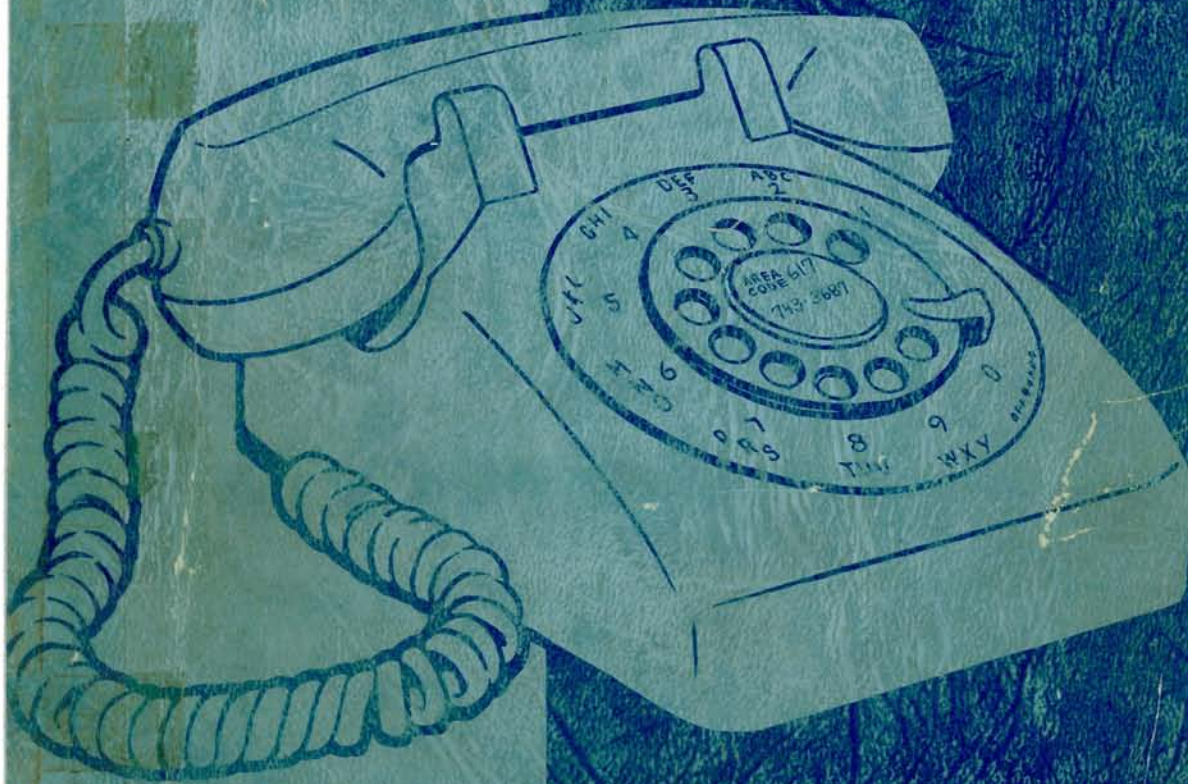


# STATION INSTALLATION HANDBOOK



**GENERAL INFORMATION**  
Includes Safety and First Aid

**I.W. AND PROTECTIONS**  
Includes Connecting Systems, Jacks and Plugs

**TELEPHONE SETS**  
Includes Ringers, Dials, and Handsets

**OUTSIDE PLANT**  
Includes Drop Wire, Terminals,  
Pole Climbing



**New England Telephone**

June 1969



# **NEW ENGLAND TELEPHONE STATION INSTALLATION HANDBOOK**

## **FOREWORD**

This handbook has been assembled for a field trial. It is intended to be used by installation craftsmen in their daily job.

The objective of the field trial is to determine the minimum number of Bell System Practices needed for the station installation job.

It is anticipated that this handbook will be replaced as required in order to keep it updated.

### **PART 1**

GENERAL INFORMATION (Includes Safety and First Aid)

### **PART 2**

I.W. AND PROTECTION (Includes Connecting Blocks, Jacks and Plugs)

### **PART 3**

TELEPHONE SETS (Includes Ringers, Dials, and Handsets)

### **PART 4**

OUTSIDE PLANT (Includes Drop Wire, Terminals, Pole Climbing)

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**FIRST AID**

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**1. GENERAL**

1.01 This section is reissued to include Rescue Breathing as the Bell System preferred choice of artificial respiration methods.

1.02 It conforms to the latest procedures recommended in the American Red Cross First Aid Textbook which is standard for Bell System first aid instruction.

1.03 **KNOW YOUR FIRST AID.** Do not attempt to save time and effort by using second-best methods of First Aid. It is just as important to know the "don'ts" of First Aid as it is to know the "do's."

1.04 Report all injuries to your supervisor as soon as possible.

**2. THE WHY AND HOW OF FIRST AID**

2.01 First Aid is defined as the immediate and temporary care given to the victim of an accident or illness until the services of a physician can be obtained.

2.02 First Aid training also shows how injuries occur, and helps to reduce accidents by sharpening the desire to prevent injuries.

2.03 In case of serious injury, act quickly as each second of delay is important. Be reluctant to make statements to the victim and to bystanders about the injuries. It is not the First Aider's province to diagnose, evaluate, or predict.

**2.04 General Directions**

- (a) Keep the victim lying down. Do not transport a seriously injured person unless it is necessary to do so.
- (b) Treat in order listed:
  - (1) Severe bleeding (Part 4.)
  - (2) Stoppage of breathing (Part 7.)
  - (3) Poisoning by mouth (Part 8.)
  - (4) Shock (Part 6.)
- (c) Check for other injuries and plan what to do.
- (d) Obtain the services of a physician. (See next part.)

**3. GETTING THE DOCTOR OR AMBULANCE**

3.01 If possible, stay with the victim and ask someone else to call a doctor. If necessary, call the police for this purpose. (Consult your List of Physicians and Hospitals, if available.)

3.02 When the doctor is called, give him the following information:

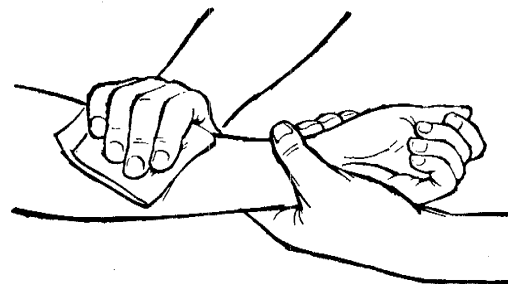
- (a) Cause and probable extent of the injury
- (b) Location of the victim
- (c) What First Aid is being given
- (d) What First Aid supplies are available
- (e) Whether an ambulance is needed

**4. WOUNDS AND BLEEDING**

4.01 A wound is a break in the skin or mucous membrane. It is caused by force and usually extends into the underlying tissue. Control bleeding and protect wounds from contamination. The danger of tetanus (lockjaw) should be considered in ALL WOUNDS. Guard against infection. (If it occurs, see Paragraph 13.12.)

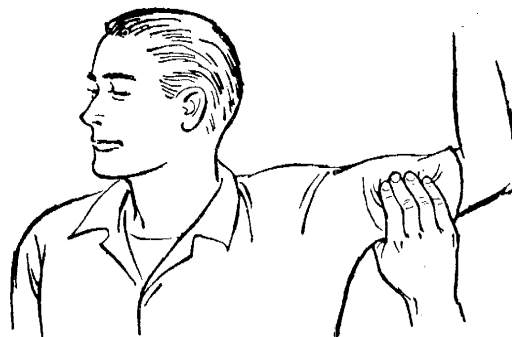
**4.02 Wounds with Severe Bleeding**

- (a) Severe bleeding must be stopped without delay. Apply direct pressure on the wound, using a cloth pad or even bare hand, if necessary. (Fig. 1)



**Fig. 1—Direct Pressure on the Wound**

- (b) Elevate the bleeding part, if possible.
- (c) If an arm or leg is involved, and direct pressure must be delayed or is not entirely effective, apply digital pressure at pressure points. (Figs. 2 and 3)



**Fig. 2—Finger Pressure on Brachial Artery**

Pressure on the inner half of the arm, midway between the elbow and the armpit, compresses the brachial artery against the bone there, causing bleeding in the arm, beyond the point of pressure, to be controlled.



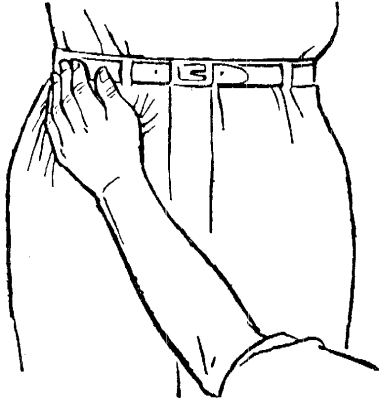


Fig. 3—Hand Pressure on Femoral Artery

Pressure applied just below the groin on the front inner half of the thigh compresses the femoral artery against the underlying pelvic bone. If considerable force is applied, bleeding below the point of pressure will be controlled.

(d) Bandage the pad firmly into place on the wound. Do not remove it once it is in place. If blood saturates the dressing, bandage additional layers of cloth on top of original dressing.

(e) **THE TOURNIQUET SHOULD BE USED ONLY IN EXTREME CASES, WHERE IT IS NECESSARY TO RISK LOSING THE VICTIM'S LIMB IN ORDER TO SAVE HIS LIFE.** If it is to be used:

- (1) Place it close above the wound, between the body and the wound.
- (2) Make sure that it is applied tightly enough to stop bleeding.
- (3) Wrap the material tightly twice around the limb if possible and tie a half knot. (See A, Fig. 4.)
- (4) Place a short stick on the half knot and tie a full knot. (See B, Fig. 4.)
- (5) Twist the stick to tighten the tourniquet until the flow of blood ceases. (See C, Fig. 4.)
- (6) Secure the stick in place with the loose ends of the tourniquet or another strip of cloth. (See D, Fig. 4.)
- (7) A notation should always be made and attached to the victim, giving the time of application and location of the tourniquet.
- (8) **DO NOT RELEASE THE TOURNIQUET ONCE IT HAS BEEN APPLIED. IT IS URGENT THAT SUCH CASES HAVE MEDICAL ATTENTION AS SOON AS POSSIBLE.**

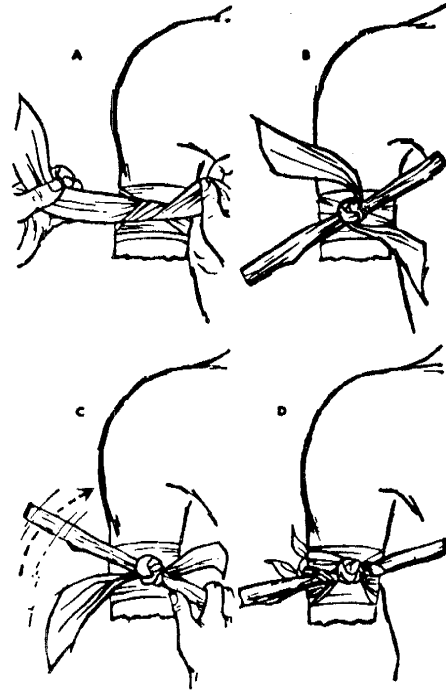


Fig. 4—Application of Tourniquet

**4.03 Neck Wounds:** These are most frequently made by knives, razors, and windshield glass. The large artery, vein, or both, may be cut.

(a) **First Aid**

(1) Apply hand pressure both above and below the cut and continue to hold until a doctor directs that pressure be released. One need not worry about getting the hand in the wound in such severe cases.

(2) A bulky compress of the cleanest material immediately available to maintain pressure may be a great help.

**4.04 Minor Wounds in Which Bleeding Is Not Severe**

(a) **First Aid**

(1) Wash your hands thoroughly with clean water and soap.

(2) Cleanse the injury thoroughly, using plain soap and boiled water or if not available, use first aid antiseptic on a sterile compress.



- (3) Apply first aid antiseptic from first aid kit if available. If not, cover with sterile or clean dressing and bandage snugly.
- (4) Arrange to see a doctor promptly if evidence of infection appears.

#### 4.05 Wounds with Internal Bleeding

- (a) Caused by head injury—see Paragraph 9.02.
- (b) Caused by other than head injury—may be indicated by appearance of blood at uninjured mouth or nose.
  - (1) **First Aid**
    - (a) Keep the victim lying on his back. Turn the head to one side.
    - (b) Raise the head and shoulders if breathing is difficult.
    - (c) If the patient is in shock or unconscious, turn him on his side with head and chest lower than hips to prevent blood from being drawn into the lungs.
    - (d) Give no stimulants.

#### 4.06 Gunshot Wounds and Other Deep Wounds

- (a) **First Aid**
  - (1) Keep victim as quiet as possible. Moving may aggravate fractures or the existing damage to internal organs.
  - (2) Do not give stimulants. If wound is abdominal, do not give any food or water.
  - (3) If air passes through a chest wound as the victim breathes, cover wound firmly with dressing material.
  - (4) If intestines protrude, do not force them back into the abdomen; cover with cloths wet with water at body temperature. Water and dressings should be as sterile as possible under the circumstances.

## 5. BITES AND STINGS

### 5.01 Animal Bites

- (a) **First Aid**
  - (1) Wash the wound thoroughly to remove all saliva. Use a gauze compress and a solution of soap and water to scrub the wound; kitchen or laundry soap is best, but any soap will do. Thorough washing of bite wound should be continued at least 10 to 15 minutes; then rinse with clean running water and apply a sterile dressing.
  - (2) If possible, steps should be taken to confine the animal so that it will be available for examination to determine whether its bite may have transmitted rabies or tetanus.
  - (3) Always consult a physician promptly.

### 5.02 Snake Bites (Poisonous)

- (a) **Prevention**—Most snake bites can be prevented when working in snake-infested regions by wearing high-topped boots or heavy leggings, and by being extremely careful about putting the hands in places where they might be bitten.
- (b) **Symptoms**
  - (1) Bite of a rattlesnake, copperhead, or cotton-mouth moccasin leaves one or two small puncture wounds. Since the coral snake chews rather than bites, it leaves no fang marks. Severe pain, swelling and discoloration of the poisoned part occurs rapidly.
  - (2) General weakness, shortness of breath, nausea, vomiting, weak and rapid pulse, dimness of vision, possibly unconsciousness.
- (c) **First Aid**
  - (1) Start at once. Have victim lie down and keep quiet, as muscular activity increases circulation resulting in more rapid absorption of the venom.
  - (2) If bite is on an extremity, tie a constricting band—**not a tourniquet**—firmly above the bite.

- (3) Sterilize a knife or razor blade with a match flame, first aid antiseptic or alcohol and make incisions. Try with one of them to get into the venom deposit point. Crosscuts, about one-fourth inch long, may be made at each fang mark and over the suspected deposit point. Make shallow cuts through the skin in the crossways direction; longitudinal cuts may be deeper. Muscles and nerves run in a longitudinal direction and a deep crosscut may sever them. Beware of cutting muscles and nerves of the fingers, hands or wrist, for they lie immediately below the skin, and their injury may cause much disability. Apply suction, using the mouth or suction cup. Continue suction for an hour or more.

### 5.03 Snake Bites (Non-poisonous)

- (a) **Symptoms**
  - (1) Horseshoe-shaped row of teeth marks.
  - (2) Absence of symptoms other than those usually following minor wound.
- (b) **First Aid**
  - (1) Cleanse wound thoroughly with clean water.
  - (2) Apply sterile dressing.

### 5.04 Insect Bites and Stings

- (a) **First Aid**
  - (1) Remove the "stinger" if still present.
  - (2) If possible, ice or ice water should always be applied.
  - (3) Apply a paste made of baking soda and cold cream, or a compress moistened with ammonia water.
  - (4) Avoid scratching the bite.

### 5.05 Tick Bites

Rocky Mountain spotted fever is transmitted by tick bites, and despite its name, the disease can occur in any part of the country.

- (a) **First Aid**
    - (1) First remove the tick by covering it with any kind of available oil. If the tick does not disengage at once, wait half an hour, then remove all parts of it with tweezers.
    - (2) Gently scrub the area thoroughly with soap and water.
- ### 5.06 Spider, Scorpion and Tarantula Bites
- (a) **First Aid**
    - (1) If on an extremity, apply a constricting band for **5 minutes only** just above the bite. (See Fig. 4.)
    - (2) Keep the affected part lower than the rest of the body and apply ice, ice water or any cold application locally for two hours.
    - (3) Obtain medical attention.

## 6. SHOCK (DUE TO PHYSICAL INJURY)

- 6.01 **All seriously injured persons should be given first aid for shock.**
- 6.02 **Definition:** Shock is a depressed condition of many of the body functions due to failure of enough blood to circulate through the body following serious injury. Causes low resistance, possibly death.
- 6.03 **Factors which make shock worse:** Pain, rough handling, improper transportation, continued bleeding, excessive cold or heat, stoppage of breathing, sight of blood. The effects of shock may be lessened by keeping the victim lying down and comfortable.
- 6.04 **Symptoms**
  - (a) Weakness of the victim.
  - (b) Skin: Pale, cool, moist—perspiration on forehead, lips, palms.
  - (c) Pulse: Rapid, sometimes weak or absent.

- (d) Breathing: Fast, shallow, irregular, occasional deep breaths.
- (e) Eyes: Vacant, lackluster.
- (f) General: Thirst, nausea, indifference, restlessness.

6.05 **First Aid**

- (a) Keep the victim lying down.
- (b) Do not add heat; simply prevent a large loss of body heat by covering, if necessary, with blanket, overcoat, newspapers, etc. Do not cause sweating.
- (c) Fluids: Water in small amounts, if victim is conscious, is helpful.

7. **ARTIFICIAL RESPIRATION**

7.01 Rescue is usually the first step. Electric shock, inhalation of gas, and drowning are the commonest causes of stoppage of breathing. Every Plant man should be thoroughly familiar with the rescue techniques where electricity or gas is involved, including rescues from manholes, poles and power wires, as covered in Sections 010-100-011, 010-100-012, and 010-100-013, respectively.

Some of the important points to remember in effecting rescues are listed below:

- (a) **Electricity**
  - (1) Cut off current supply, if possible.
  - (2) Break the contact by separating the victim from the source of the electrical power, making sure that in the process you don't expose yourself to contact with the victim or the source of electricity. Use rubber gloves, long dry sticks, dry rope, dry folded cloths and stand on insulating material, if possible.
- (b) **Gas**
  - (1) Recognize the danger of explosion.
  - (2) If in a building, shut off both gas and electric supply.
  - (3) Ventilate the space thoroughly before attempting rescue.
- (c) **Drowning**

Unless you are an expert swimmer and trained in life saving, keep out of the water when rescuing a drowning person. Instead, "Row or throw." (Learn American Red Cross life saving and water safety techniques.)

7.02 **General Directions**

- (a) **START AT ONCE AND DON'T GIVE UP.** There are many cases on record wherein a person apparently dead has been revived after several hours of continuous artificial respiration.
- (b) The purpose is to restore natural respiration by maintaining an alternating decrease and increase in the expansion of the chest and thereby an adequate air exchange.
- (c) The mouth-to-mouth rescue breathing method is the Bell System Standard for general use. However, in the rare case where it is impracticable to use this method, another means of ventilating the lungs should be used.
- (d) The only equipment necessary to perform rescue breathing is carried with you at all times—your hands, your mouth and your repetitive breathing.

7.03 **Additional Related Directions** (Regardless of method used.)

- (a) Begin artificial respiration immediately.
- (b) A mechanical resuscitator operated by a trained person should be used when available.
- (c) If assistance is available, have blankets or other suitable material placed over and under victim.
- (d) When breathing starts, keep the victim lying down and treat for shock (Part 6).

7.04 **Mouth-to-Mouth (Rescue Breathing)**

If there is foreign matter visible in the mouth, wipe it out quickly with your fingers or a cloth wrapped around your fingers.

- (a) Tilt the head back so the chin is pointing upward (Fig. 5). Pull or push the jaw into a jutting-out position (Fig. 6 and Fig. 7).



Fig. 5



Fig. 6



Fig. 7

These maneuvers should relieve obstruction of the airway by moving the base of the tongue away from the back of the throat.

- (b) Open your mouth wide and place it tightly over the victim's mouth. At the same time pinch the victim's nostrils shut (Fig. 8) or close the nostrils with your cheek (Fig. 9). An alternative is to close the victim's mouth and place your mouth over his nose (Fig. 10). Blow into the victim's mouth or nose. (Air may be blown through the victim's teeth, even though they may be clenched.)

The first blowing efforts should determine whether or not obstruction exists. This will be apparent if there is resistance to your blowing effort and if the victim's chest fails to rise.

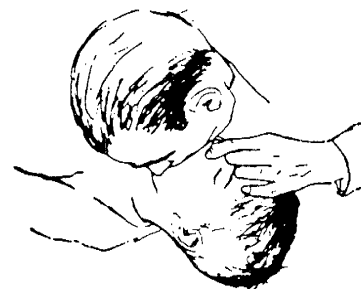


Fig. 8



Fig. 9



Fig. 10

(c) Remove your mouth, turn your head to the side, and listen for the return rush of air that indicates air exchange. Repeat the blowing effort.

For an adult, blow vigorously at the rate of about 12 breaths per minute. For a child, take relatively shallow breaths appropriate for the child's size, at the rate of about 20 per minute.

(d) The rise and fall of the victim's chest wall is the best indication that you are correctly administering Rescue Breathing. "Keep your eye on the chest wall."

(e) If you are not getting air exchange, recheck the head and jaw position (Figs. 5, 6 and 7). If you still do not get air exchange, quickly turn the victim on his side and administer several sharp blows between the shoulder blades for the purpose of dislodging any obstructing matter (Fig. 11). Again sweep your fingers through the victim's mouth to remove foreign matter.

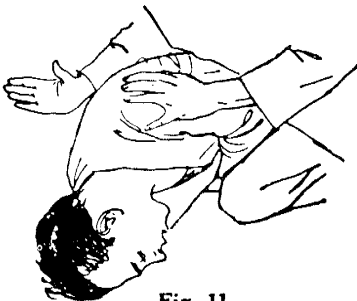


Fig. 11

Those who do not wish to come in contact with the person may hold a cloth over the victim's mouth or nose and breathe through it. The cloth does not greatly affect the exchange of air.

7.05 **Mouth-to-Mouth** (Rescue Breathing) Technique for Infants and Small Children

If foreign matter is visible in the mouth, clean it out quickly as described previously.

(a) Place the child on his back and use the fingers of both hands to lift the lower jaw from beneath and behind, so that it juts out (Fig. 12).

(b) Place your mouth over the child's mouth AND nose (Fig. 13), making a relatively leakproof seal. Breathe into the child, using **shallow puffs of air** in order to prevent damage to the child's lungs. The breathing rate should be about 20 per minute. "Keep your eye on the chest wall."



Fig. 12

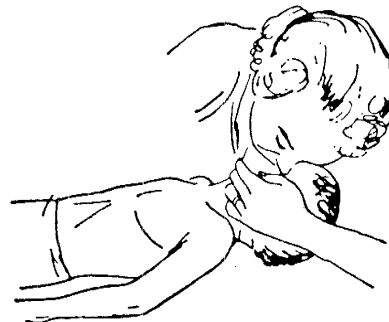


Fig. 13

If you meet resistance in your blowing efforts, recheck the position of the jaw. If the air passages are still blocked, the child should be suspended momentarily by the ankles (Fig. 14) or inverted over one arm (Fig. 15) and given two or three sharp pats between the shoulder blades, for the purpose of dislodging any obstructing matter. Check the mouth for foreign matter and remove it quickly.

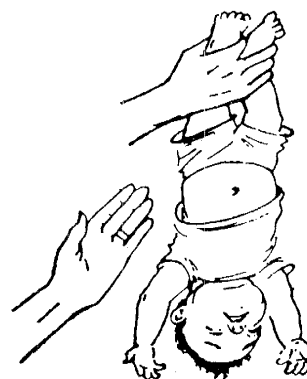


Fig. 14





Fig. 15

**7.06 Back Pressure-Arm Lift Method**

It is possible that because of the nature of the injury or other circumstances, the manual method of artificial respiration should be used. It is re-emphasized that mouth-to-mouth (Rescue Breathing) is the preferred method because of: effectiveness, practicality, speed of application and simplicity. ↴

- (a) Place the victim in the face-down, prone position. Bend his elbows and place his hands one upon the other. Turn his face to one side, placing the cheek upon the hands. (Fig. 16.)

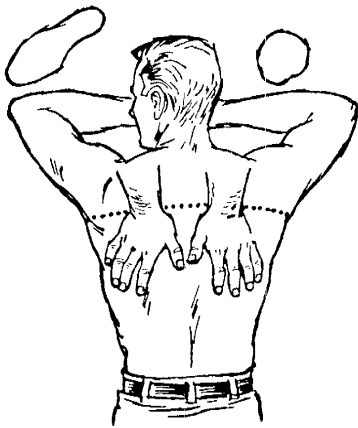


Fig. 16—Position of Victim

- (b) Position of the operator—Kneel on either the right or left knee at the head of the victim, facing him. Place your knee at the side of the victim's head close to his forearm. Place your other foot near his elbow. If it is more comfortable, kneel on both knees, one on either side of the victim's head. Place your hands upon the flat of the victim's back in such a way that the palms lie just below an imaginary line running between the armpits. With the tips of your thumbs just touching, spread your fingers downward and outward. (Fig. 17.)



Fig. 17—Position of Operator

- (c) Take it easy! Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert slow, steady, even pressure downward upon the hands. This forces air out of the lungs. Your elbows should be kept straight and the pressure exerted almost directly downward on the back. You do not need much pressure. (Fig. 18.)

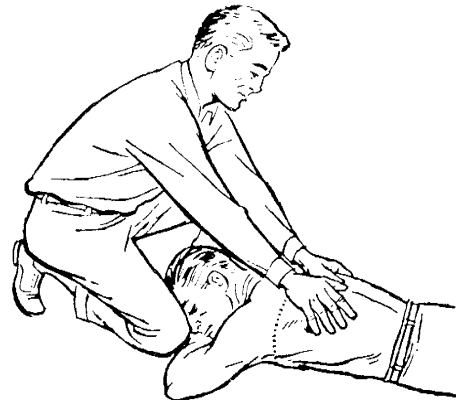


Fig. 18—Compression Phase

- (d) Release the pressure, avoiding a final thrust, and commence to rock slowly backward. Place your hands upon the victim's arm just above his elbows. (Fig. 19.)



Fig. 19—Position for Expansion Phase

(e) Draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders. Do not bend your elbows, and as you rock backward the victim's arms will be drawn toward you. Then lower the arms to the ground. This completes the full cycle. The arm lift expands the chest by pulling on the chest muscles, arching the back, and relieving the weight on the chest. The cycle should be repeated 12 times per minute at a steady rate. The compression and expansion phases should occupy about equal time with the release periods being of minimum duration. (Fig. 20.)

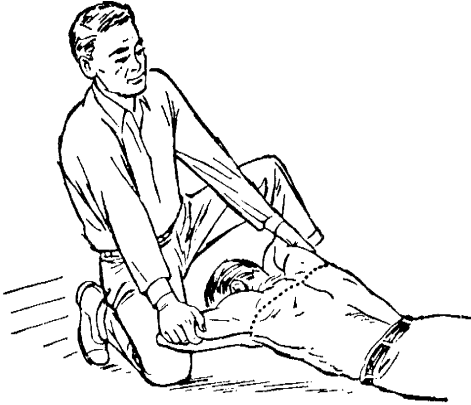


Fig. 20—Expansion Phase

## 8. POISONING BY MOUTH

8.01 "Hurry" is the word to associate with poisoning by mouth. Give First Aid without delay. If possible, have someone call a doctor, poison control center or hospital while you give First Aid.

8.02 **Symptoms**—These vary greatly according to the kind and amount of poison taken and the time elapsed. Many poisons cause no symptoms until absorbed into the system. Others cause burns in the mouth or abdominal pain. There may be nausea, vomiting, visual disturbances, convulsions, headache, or deep sleep.

### 8.03 First Aid

#### (a) When the poison is not an acid, alkali, strychnine, or kerosene:

- (1) Dilute the poison. Quickly administer fluid (milk and/or water) in large amounts.
- (2) Induce vomiting—Strong baking soda solution or milk of magnesia. Repeat the dilution and induction of vomiting until fluid is returned clear. If fluid can not be administered, use fingers or spoon in the mouth to induce gagging and vomiting.
- (3) If the antidote is given on the label, administer it as directed. If no specific antidote is known, administer a universal antidote of two parts by volume of crumbled burnt toast, one part strong tea, and one part milk of magnesia.

#### (b) When the poison is an acid:

- (1) Dilute the poison. Quickly administer fluid (milk and/or water).
- (2) **Do not induce vomiting.** Neutralize with weak alkali (baking soda in water, or milk of magnesia); then give milk, olive oil, or egg white to protect the digestive tract lining.
- (3) If the antidote is given on the label, administer it as directed.

#### (c) When the poison is an alkali:

- (1) Dilute the poison. Quickly administer fluid (milk and/or water).
- (2) **Do not induce vomiting.** Neutralize with weak acid (vinegar, lemon juice). Follow with milk, olive oil or egg white.
- (3) If the antidote is given on the label, administer it as directed.

#### (d) When the poison is a petroleum product such as kerosene, solvents or insecticides:

- (1) Dilute the poison. Quickly administer fluid (milk and/or water).
- (2) Vomiting should not be induced.

## 9. INJURIES TO BONES, JOINTS, AND MUSCLES

### 9.01 Fractures

#### (a) Definition—A break in a bone.

- (1) Simple—closed fracture not associated with an open wound.
- (2) Compound—open fracture has wound extending from the skin to the fracture area.
- (3) Comminuted—bone is broken into small pieces. May be closed or open.

#### (b) Symptoms—Swelling, tenderness to touch, deformity, pain on motion, discoloration, bleeding.

#### (c) First Aid

- (1) For all fractures:
  - (a) Keep broken ends quiet.
  - (b) Keep joints on each side quiet.
  - (c) Treat for shock. (Paragraph 6.05)
  - (d) When in doubt, handle as fracture.
  - (e) If possible, apply ice bag over painful area.
  - (f) Do not move before immobilizing. Use splints, arm sling, newspapers, magazines, etc.
  - (g) Provide transportation if needed.
  - (h) Call a doctor.
- (2) Additional measures for compound fracture:
  - (a) Control bleeding.
  - (b) Apply clean dressing to wound.

### 9.02 Head Injuries: Concussion and Fracture of Skull

(a) **Important:** A concussion is an injury to the brain caused by a blow to the head and may or may not involve a skull fracture. Concussion must be expected in **any** accident due to force. Whether or not the skull is fractured is not important compared to the possible injury to the brain. The primary treatment for both is the same, and **in both cases it is essential to keep the victim as quiet as possible.**

#### (b) Symptoms—Some or all of the following may be present:

- (1) Evidence of a blow, head wound, or swelling.
- (2) Unconsciousness—total or partial—even if only for a few seconds after an accident.
- (3) Eye pupils unequal in size.
- (4) Headache—dizziness.
- (5) Paralysis of extremities.
- (6) Bleeding from the nose, an ear canal, or the mouth.

#### (c) First Aid

- (1) **EXTREMELY IMPORTANT: KEEP THE VICTIM LYING DOWN AND QUIET!**
- (2) **DO NOT GIVE STIMULANTS.**
- (3) If his face is flushed, elevate his head slightly.
- (4) If the victim is unconscious, turn his head to one side.

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- (5) Loosen clothing about his neck.
- (6) Merely lay a dressing on the wound.
- (7) Reassure the victim, if conscious.

### 9.03 Fracture of Neck or Spine

- (a) If at all possible, do not move the victim; summon a physician to the scene.
- (b) Keep the victim flat on his back.
- (c) Do not allow his head to tilt forward or sideways.
- (d) If transportation is absolutely essential, even for a few feet, use a firm support such as a shutter, board, or door.

### 9.04 Dislocations

- (a) **Definitions**—A dislocation is a displacement of a bone end from the joint. The surrounding ligaments and other soft tissue always suffer some injury.
- (b) **Symptoms**—Swelling, tenderness to touch, deformity, pain on motion, discoloration.
- (c) **First Aid**
  - (1) Keep the affected part quiet.
  - (2) Do not attempt to reposition the dislocated bone.
  - (3) Obtain medical attention.
  - (4) Treat for shock. (Paragraph 6.05)

### 9.05 Strains and Sprains

- (a) **Definitions**
  - (1) **Strain**—A strain is an injury to a tendon or muscle.
  - (2) **Sprain**—A sprain may be described as a stretching or tearing of the ligaments around a joint.
- (b) **Symptoms**
  - (1) **Strain**—Pain and stiffness.
  - (2) **Sprain**—Pain, swelling, lack of use, discoloration.
- (c) **First Aid**
  - (1) **Strain**
    - (a) Rest and apply heat.
    - (b) Rubbing may help.
    - (c) In severe cases call a doctor.
  - (2) **Sprain**
    - (a) Elevate the injured member and apply cold applications.
    - (b) If ankle is sprained apply bandage over shoe. Immobilize if transported.
    - (c) If lower extremities are involved, avoid weight bearing.
    - (d) In severe cases see a doctor.
    - (e) Always have sprains X-rayed.

## 10. BURNS

10.01 **Causes:** Dry heat, flame, hot metal, hot liquid, steam, electricity, sunburn, and chemicals.

10.02 **Effects:** Shock, infection, permanent damage, death.

### 10.03 Degrees of Burns

- (a) Skin merely reddened—(1st Degree).
- (b) Skin blistered—(2nd Degree).
- (c) Deeper tissue destroyed—(3rd Degree).

### 10.04 First Aid

#### (a) Thermal Burns

- (1) Extensive area burns, such as those covering the back or chest area or a large portion of one or more extremities.
  - (a) Treat for shock.
  - (b) Exclude air from the burn by the application of a thick dressing; if the dressing is sterile it will assist in the prevention of further contamination. Use lint-free material.
  - (c) The dressing should be kept dry.
  - (d) Do not break blisters.
  - (e) Transport at once to a doctor or the hospital.

(2) Small area burns—apply medicated ointment and a sterile dressing.

(3) **Thermal burn of the eye.** If pain can be tolerated, irrigate the eye gently to remove foreign material. Cover the eye with a dry sterile dressing or clean cloth, and immediately seek medical aid. Do not apply oil or ointments unless necessary to relieve pain pending medical care.

#### (b) Chemical Burns

(1) Wash away the chemical with large amounts of water. Then, if specific chemicals for treatment are indicated on the label, apply them, if available. For creosote burns, wash with hot water and soap; apply Creosote Burn Wash. (See Section 010-100-010.)

(2) **Acid or alkali burn of the eye.** Quickly irrigate the eye thoroughly with plain tap water for several minutes. Remove any particles of the chemical, have the patient close his eye, place a dressing over the lid and snugly bandage. Obtain immediate medical attention.

#### (c) Sunburn

- (1) Mild sunburn—medicated ointment, cold cream, salad oil or shortening may be applied. Do not use butter or oleomargarine.
- (2) Severe sunburn—obtain medical advice.

## 11. ILL EFFECTS OF EXCESSIVE HEAT

11.01 Exposure to excessive heat may result in heat exhaustion, heat stroke, and heat cramps, the first-named being most common. In exhaustion cases, the temperature is approximately normal; in stroke, it is high. Most likely to be affected are the aged, the obese, the very young, alcohol addicts, and those suffering from any disease that impairs the strength of the entire body.

### 11.02 Heat Exhaustion

(a) **Symptoms**—Fatigue, headache, vomiting, nausea. Temperature remains near normal, and unconsciousness is rare. In severe cases, perspiration is profuse, weakness is extreme, and the skin is pale and clammy. Heat cramps may be present. (See Paragraph 11.04.)

#### (b) First Aid

- (1) Provide bed rest.
- (2) Every 15 or 20 minutes give a half glass of water in which a half teaspoonful of salt has been dissolved.

### 11.03 Heat Stroke

#### (a) Symptoms

- (1) Usually begins with a sharp pain in the head and dizziness, followed almost immediately by unconsciousness.
- (2) Skin is dry and very hot, face flushed, breathing difficult.
- (3) Temperature is very high. Pulse is rapid and full.

#### (b) First Aid

- (1) Arrange for medical care without delay.
- (2) Move victim to a cool place—indoors if possible—and provide bed rest.
- (3) Remove clothing and sponge the body with alcohol or lukewarm water to reduce the body temperature to a more tolerable level, as indicated by a pulse rate of 110 per minute or less. Resume sponging if temperature rises again.

(4) When victim is fully conscious give a half glass of water in which a half teaspoonful of salt has been dissolved. Provide covering according to victim's comfort.

### 11.04 Heat Cramps

(a) **Symptoms**—Pain in abdominal muscles or limbs following profuse perspiration.

#### (b) First Aid

- (1) Apply firm, steady pressure to painful part.



- (2) Apply warm wet towels to painful part.
- (3) Give a half glass of water in which a half teaspoonful of salt has been dissolved. Repeat several times at 15-minute intervals.

## 12. ILL EFFECTS OF EXCESSIVE COLD

12.01 **Frostbite:** The freezing of a part of the body, usually the nose, ears, cheeks, fingers, or toes.

### (a) Symptoms

- (1) Condition may not be evident to victim.
- (2) Feeling of intense coldness or numbness. Pain in early stages, later subsiding.
- (3) Dead white, glossy skin, later changing to yellow.
- (4) Blisters may appear.

### (b) First Aid

- (1) Handle a frozen or frostbitten part with the greatest care.
- (2) Firm pressure against the part with the warm hand is helpful, but **RUBBING IT WITH THE HAND OR SNOW IS DEFINITELY HARMFUL.**
- (3) If out of doors, cover the frozen part with woolen material.
- (4) Make the victim warm and remove him to a warm room as soon as possible.
- (5) If the frozen part is still cold or numb, rewarm it by immersing it in **lukewarm** water, or by wrapping in blankets. Do not rub or expose to extreme heat, such as a hot stove, hot water bottle, heat lamp, etc., because excessive heat may increase the damage.
- (6) Once fingers or toes are rewarmed, encourage the victim to exercise them. Do not disturb blisters.

12.02 **Prolonged Exposure to Cold**

### (a) Symptoms

- (1) General numbness.
- (2) Difficulty of movement or staggering.
- (3) Drowsiness or failing eyesight.
- (4) Unconsciousness in advanced cases.

### (b) First Aid

- (1) Give artificial respiration if breathing has stopped.
- (2) Move the victim to warm room as soon as possible.
- (3) Rewarm the victim as rapidly as possible by wrapping him in warm blankets or by immersing him in a tub of warm, but not hot, water.
- (4) When the victim reacts to above First Aid, give him a hot drink and dry his body thoroughly if water was used to rewarm him.

## 13. COMMON EMERGENCIES (Listed alphabetically)

13.01 **Apoplexy (Stroke)**

### (a) Symptoms

- (1) Unconsciousness usually occurs.
- (2) Loud, heavy breathing.
- (3) Slow, strong pulse.
- (4) Partial paralysis, indicated in an unconscious person by lack of muscular tension if one of the extremities is moved.

### (b) First Aid

- (1) Obtain medical care immediately.
- (2) Place the victim on his back, or if breathing is difficult, place him on his side to allow saliva to drool from his mouth.
- (3) Cover the victim sufficiently to prevent chill.

13.02 **Appendicitis**

- (a) **Symptoms**—Abdominal pain, usually generalized in the beginning, later localized especially in lower right region; nausea, vomiting, mild fever, and constipation or diarrhea may be present.

### (b) First Aid

- (1) Obtain medical attention without delay.
- (2) Do not administer laxatives, food, or water.
- (3) An ice bag placed over the painful area may help relieve discomfort, but it should be understood that this merely removes a symptom, and does not correct the condition.

13.03 **Blisters**

This paragraph applies only to blood blisters and water blisters caused by pinching and chafing; see Paragraphs 10.04 and 12.01 for blisters due to burns and frostbite, respectively.

### (a) First Aid

- (1) Wash thoroughly with soap and warm water, dry, and apply a small amount of first aid antiseptic to edge of blister, puncture at this point with a sterilized needle, or other sharp sterile object and press out the fluid.
- (2) Apply a sterile dressing held in place with a light bandage.
- (3) If the blister has already burst, wash with soap and water and apply sterile dressing.
- (4) Consult a doctor if the blister is very extensive, or if there is evidence of infection.

13.04 **Boils and Sties**

### (a) First Aid

- (1) Sties and boils in the facial region should be kept as free as possible of all pressure. Boils in other regions may be covered lightly with compresses saturated with the following solution:

1 tablespoonful of Epsom salts  
1 pint of warm water

- (2) Never squeeze a boil. If it breaks, however, wipe away the pus with a sterile pad wet with rubbing alcohol.

13.05 **Bruises and Contusions**

### (a) First Aid

- (1) Usually no special care is required. Apply cold packs, use ice when available, and elevate the injured member to reduce swelling and relieve pain.

13.06 **Convulsions in Young Children**

### (a) Symptoms

- (1) Muscle spasms and twitching of various degrees.
- (2) Stupor or sleep may follow spasms.

### (b) First Aid

- (1) Provide bed rest and quiet. Maintain calm demeanor in child's presence.
- (2) Call a doctor.
- (3) Unless directed by a doctor, do not give an enema, bath, or warm packs.

13.07 **Epileptic Fits**

### (a) Symptoms

- (1) An attack of epilepsy is generally preceded by a loud cry, and the victim generally falls. This is followed by unconsciousness accompanied by convulsive, jerking movements of the muscles.

### (b) First Aid

- (1) Prevent victim from harming himself by placing pillow, coat or blanket under his head.
- (2) Place folded compress, clean handkerchief, piece of wood or pleated bandage between his teeth at one side of his mouth to prevent him from biting his tongue. Do not obstruct breathing.
- (3) Do not restrain convulsive movements or give stimulant.
- (4) When jerking has ceased, loosen clothing about the neck, and keep the victim quiet.

## SECTION 010-100-001

### 13.08 Eye Injuries

- (a) **Types**—Eye injuries are divided into three groups for first aid purposes:

- (1) Group 1 cases—injury to the eyelids and soft tissue around the eye.
- (2) Group 2 cases—injury to the surface of the eyeball.
- (3) Group 3 cases—injury that extends through the surface of the eye into deeper tissue.

(b) **First Aid**

- (1) **Group 1 cases**—Open wound should be covered with a sterile dressing and snug bandage. Bruises or “black eyes” may be given cold applications immediately after injury, followed by warm applications after swelling has been controlled.

(2) **Group 2 cases**—

- (a) If injury is due to entry of a chemical, flush the eye thoroughly and repeatedly with clean water. Obtain medical attention at once.

- (b) If injury is due to entry of a foreign body:

- (1) Pull down the lower lid and see if the body lies on the surface of the lid's lining. If so, it can be lifted off gently with the corner of a clean handkerchief or a piece of moist cotton wrapped around a clean toothpick. (Never use dry cotton around the eye.)

- (2) Grasp the lashes of the upper lid gently between the thumb and forefinger while the victim looks upward. Pull the upper lid forward and down over the lower eyelid. A foreign body on the lining of the upper lid can be dislodged and swept away with the tears.

- (3) Flush the eye with a cool solution. This can be done with an eyedropper or small bulb syringe, if available.

- (3) **Group 3 cases**—Lay a sterile compress or clean cloth over eye, and make no attempt at further first aid. Obtain medical care as quickly as possible. If necessary to transport victim, keep him **flat**, using stretcher or substitute.

### 13.09 Fainting

(a) **First Aid**

- (1) Often a person feels faint and can prevent fainting by lowering his head as though to tie his shoe. If further care is necessary, treat for shock. (Paragraph 6.05)

### 13.10 Heart Attack

(a) **Symptoms**

- (1) Chest pain.
- (2) Shortness of breath.
- (3) Bluish color of lips and fingernails.

(b) **First Aid**

- (1) Keep the victim quiet and as comfortable as possible.
- (2) Obtain medical care at once.

### 13.11 Hernia (Rupture)

- (a) **Symptoms**—A protrusion or bulge in any region of the abdomen from the navel to the crotch.

(b) **First Aid**

- (1) Have the victim lie down and refrain from physical activity.
- (2) If the bulge does not subside, apply cloths saturated with cold water.
- (3) If the above measures fail, have the victim lie on his abdomen and bring his knees up under his chest.
- (4) Do not attempt to reduce the bulge by pressure.
- (5) Send for a doctor.

### 13.12 Infection

- (a) **Symptoms**—Pain, swelling, redness, heat, pus, red streaks, tenderness.

(b) **First Aid**

- (1) Apply hot solutions (2 level teaspoonfuls of salt per quart of boiled water). Be sure applications do not burn the victim.

- (2) Keep the victim at rest. Keep the affected part quiet. **Get medical care as soon as possible.**

### 13.13 Insulin Reaction

- (a) **Symptoms**—Confused, stuporous, mentally disturbed, or unconscious condition, with no other apparent reason for the condition. Diabetics should wear a tag or carry a readily accessible card to identify them; however, the first aider should search for such identification only in the presence of a witness.

(b) **First Aid**

- (1) Administer any food or drink containing sugar.
- (2) Send for a doctor.

### 13.14 Nosebleed

(a) **First Aid**

- (1) Have the victim sit up with his head thrown slightly back, breathing through his mouth. Loosen his collar and anything tight around his neck.

- (2) Apply cold packs over his nose.

- (3) Pressing the nostrils together firmly for 4 or 5 minutes often stops the bleeding and gives opportunity for a clot to form.

- (4) Have the victim avoid blowing his nose for a few hours. If these measures do not stop the bleeding, a physician is needed at once.

### 13.15 Plant Poisoning

- (a) **Types**—Ivy, oak, and sumac. (See Figs. 21, 22, and 23.)

- (b) **Prevention**—Learn to recognize these plants in their various forms at all seasons of the year and avoid contact with them at all times. Even the smoke from burning plants may be harmful; avoid it wherever possible.

- (c) **Symptoms**—After contact with these plants, the skin becomes red and swollen and itches violently. Soon small blisters begin to form, which may unite into large blisters. Frequently these become infected. Fever and general discomfort may result.

(d) **First Aid**

- (1) As soon as possible, wash the exposed part with soap and water, then sponge it with rubbing alcohol and apply calamine lotion.

- (2) If discomfort continues, one part of Burow's solution diluted with 25 parts of water may be applied with a compress for 20-minute periods.

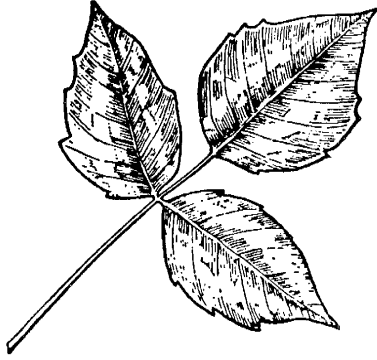


Fig. 21—Poison Ivy

Grows as a climbing plant and is found on fences, poles and trees. Also, grows as a crawling plant and a low shrub. Leaves are green in spring and summer but turn to brown in fall. All of the plant, including the roots, is poisonous. The berries, when present, are white.

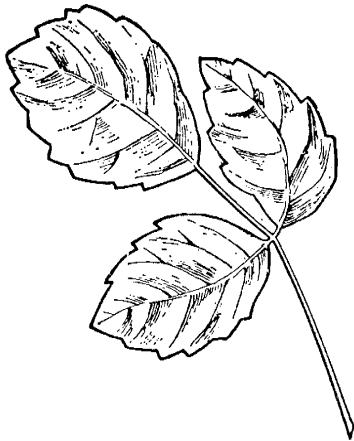


Fig. 22—Poison Oak

Closely related to the ivy plant, similar in appearance and habits of growth, but with the edges of the leaves more deeply notched. It is not a tree and is in no way related to the oak family.

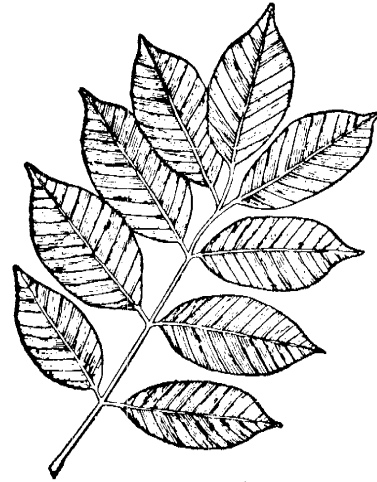


Fig. 23—Poison Sumac

A shrub or small tree which may grow 20 feet high. Distinguished from the nonpoisonous sumac by its loose, drooping clusters of berries, which are always white. Leaves are orange colored in spring, green in summer and orange or russet in the fall.

### 13.16 Splinters

#### (a) First Aid

- (1) If the splinter is near the surface, it may be picked out. Apply first aid antiseptic to the skin and remove the splinter with a knife point, needle, or tweezers that have been sterilized. Induce bleeding.
- (2) Apply first aid antiseptic to the wound and cover with clean compress.
- (3) If the foreign body is buried deeply, or if the wound is of considerable size, apply first aid antiseptic and a proper dressing. Always see a doctor.

### 13.17 Unconsciousness—Cause Unknown

#### (a) Possible Causes

- (1) Asphyxia (See Part 7.)
- (2) Shock (See Part 6.)
- (3) Poisoning, including sleeping pills (See Part 8.)
- (4) Head Injury (See Paragraph 9.02.)
- (5) Heat Stroke (See Paragraph 11.03.)
- (6) Heart Attack (See Paragraph 13.10.)
- (7) Apoplexy (Stroke) (See Paragraph 13.01.)
- (8) Epilepsy (See Paragraph 13.07.)
- (9) Insulin Reaction (See Paragraph 13.13.)



(b) **First Aid**

- (1) Give artificial respiration if the victim is not breathing.
- (2) Move the victim as little as possible until the cause of unconsciousness can be determined.
- (3) If necessary to prevent the victim from choking on vomitus, blood, etc., place him on his abdomen, with his head turned to one side.
- (4) Send for a doctor without delay.

**14. TRANSPORTATION**

14.01 In rendering emergency assistance in serious accident or illness, there is no greater need for calmness than in the procedures associated with transportation.

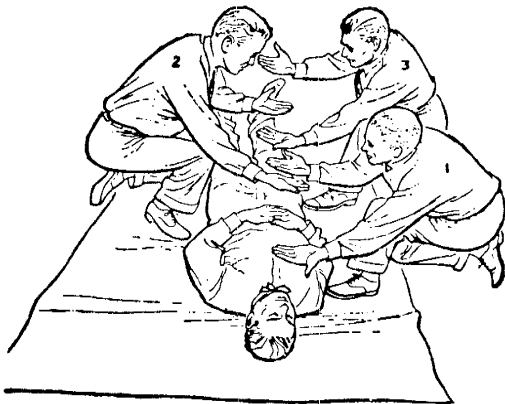
14.02 The objective is to avoid subjecting the patient to unnecessary disturbance during planning, preparation, and transfer, to prevent injured body parts from twisting, bending, and shaking. **TAKE THE NECESSARY TIME AND EFFORT TO PROVIDE GOOD TRANSPORTATION.** (More harm is done through improper transportation than through any other measure associated with emergency assistance.)

14.03 If a person must be lifted to safety before a check for injuries can be made, the body should not be jackknifed. An attempt should be made to give adequate support to each extremity, the head and the back, keeping the entire body in a straight line and maintaining it immobile. One method for accomplishing this is:

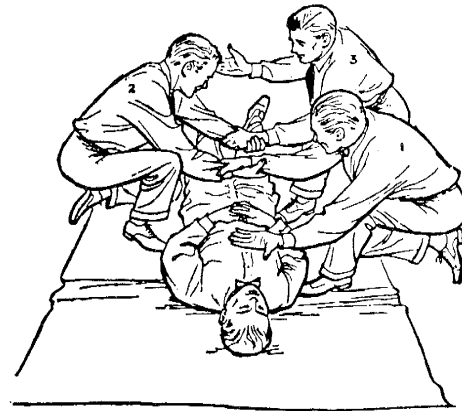
(a) **3-Man Hammock Carry—Victim Lying Face Up—Supine**

- Step 1. All carriers kneel on the knee towards the victim's feet. (See Figs. 24 and 25.)
- Step 2. No. 1 cradles the victim's head and shoulders with his top arm. His other arm is placed under the victim's lower back.
- Step 3. No. 2 slides his top arm under the victim's back above No. 1's bottom arm, and his other arm just below the buttocks.
- Step 4. No. 3 slides his top arm under the victim's thighs above No. 2's bottom arm. His other arm is placed under the victim's legs below the knees.

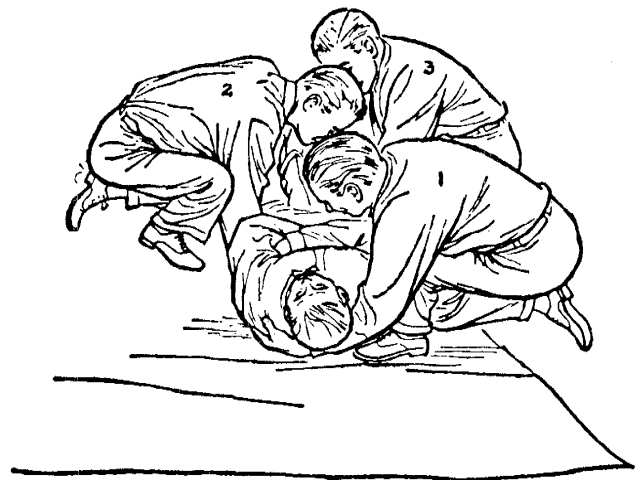
**Note:** The hands of carriers No. 1 and No. 2 should be placed about halfway under the victim's body at this stage. (See Fig. 26.)



**Fig. 24—Hammock Carry Step 1—Position of Bearers**



**Fig. 25—Hammock Carry—Showing Interlocking Grip**



**Fig. 26—Position of Bearers—Ready to Lift**

Step 5. At a signal, the victim is lifted to the carriers' knees and rested there while the hands are slid far enough under the victim to allow rotation of the hands inward to secure an interlocking grip. (See Fig. 27.)



Fig. 27—Position of Bearers—Lifting Victim to Knees

- Step 6. At the next signal, all carriers stand erect with the victim. (See Fig. 28.)
- Step 7. To lower the victim to the ground, merely reverse the procedure.

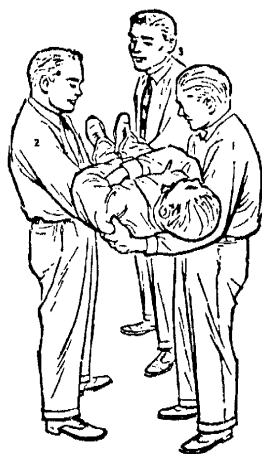


Fig. 28—Ready to Carry

14.04 If the victim must be pulled to safety, he should be pulled in the direction of the long axis of his body, not sideways. If available, a blanket or similar object placed beneath the victim will serve as a drag and lessen the danger of aggravating any injuries.

(a) **Blanket Drag**

- (1) Place the blanket diagonally beneath the victim.
- (2) Cross the arms of the victim over his chest, then fold the lower end and sides of the blanket over the victim.
- (3) Drag the victim by grasping the end of the blanket near the victim's head. (See Fig. 29.)

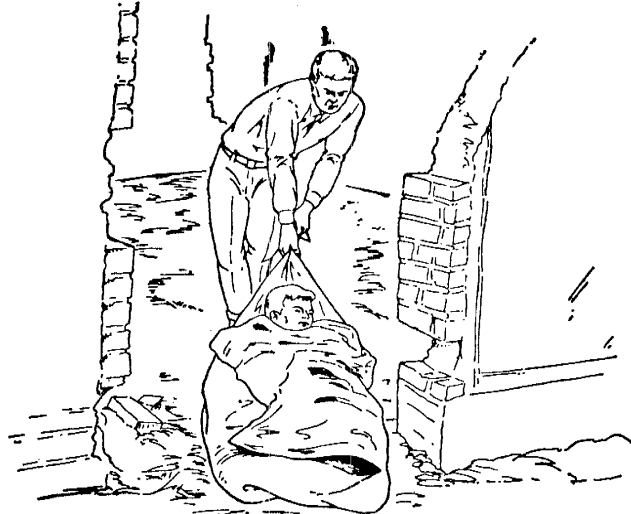


Fig. 29—The Blanket Drag

14.05 Persons who may have head injuries, fractures of such bones as those of the thigh, leg, arm, and pelvis, or possible back injuries should not be transported in a sitting position.

14.06 **Methods of Transportation**

(a) **Litter (Stretcher)**

- (1) If no litter is available, one may be improvised. Use a cot or door, or use two poles with a blanket as shown in Fig. 30; a strong sheet, rugs, or coats may be substituted for the blanket.

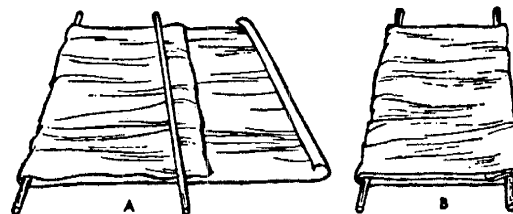


Fig. 30—Improvised Litter

(b) **Traction Blanket Lift (5 Men and Victim)**

Position of victim—supine

- Step 1. Pleat a standard army blanket in folds about 1 ft. long and place on the floor just above the victim's head so that the pleated blanket will "feed out" from the bottom.
- Step 2. Fold back the top pleat so that the man at the head and the two men at the shoulders can kneel on the fold.
- Step 3. No. 1 takes the position on one or both of his knees and grasps the victim's head in the standard manner for applying traction. (See Fig. 31.)

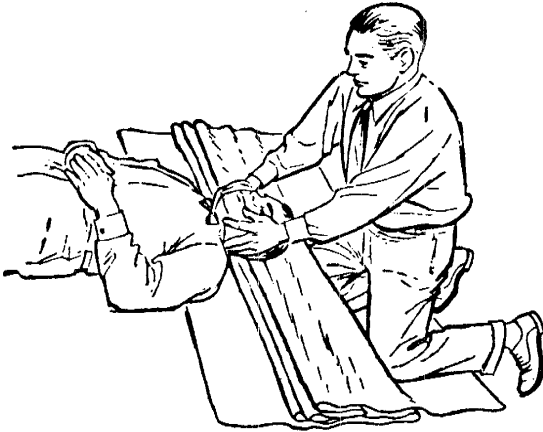


Fig. 31—Placing the Blanket under the Victim

Step 4. Nos. 2 and 3 kneel on one or both knees at the victim's shoulders, placing one hand flat under his shoulder blade and the other in his armpit. (See Fig. 32.)

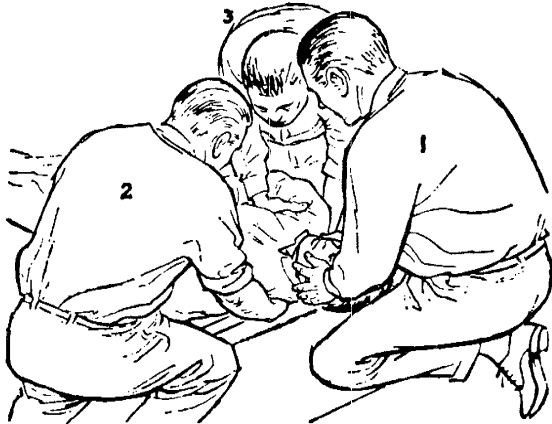


Fig. 32—Holding Victim against the Pull of the Blanket

Step 5. Nos. 4 and 5 grasp the bottom pleat of the blanket and pull the blanket under the victim while Nos. 1, 2 and 3 hold the upper portion of the victim's body in place. (See Fig. 33.)



Fig. 33—Pulling the Blanket Through

Step 6. Roll the blanket tightly at the sides until it fits the contour of the victim's body. (See Fig. 34.)



Fig. 34—Rolling Edges Tightly for Firm Grip

Step 7. Nos. 2 and 3 (on opposite sides) grasp the blanket with the top hands at the victim's shoulder and the bottom hands at his lower back. Nos. 4 and 5 grasp blanket with top hands at his hips and lower hands at his legs (below knees). No. 1 remains at his head, holding slight traction. (See Fig. 35.)





Fig. 35—Blanket Fits Contour of Body

Step 8. At a signal, Nos. 2, 3, 4 and 5 lean back in opposite directions, using the back muscles and body weight. This will lift the victim 6 to 8 inches from the floor so that a litter can be slid underneath him. Use same procedure for victim in prone position. (See Fig. 36.)

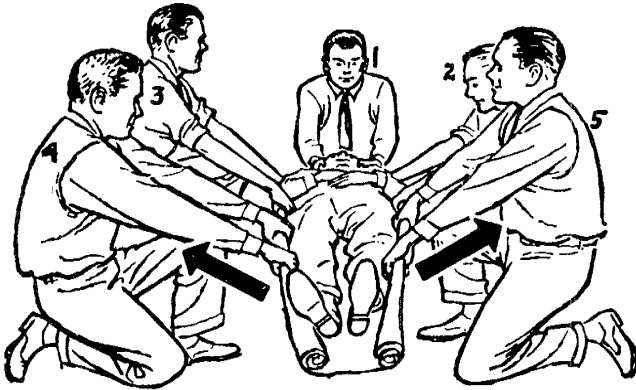


Fig. 36—Bearers Lean Backward and Litter Is Placed under Victim



Fig. 37—Lowering Victim to Litter

(c) Suspension Lift

Step 1. The victim lies in a prone position with his hands under his chin, similar to the position assumed in artificial respiration. (See Fig. 38.)

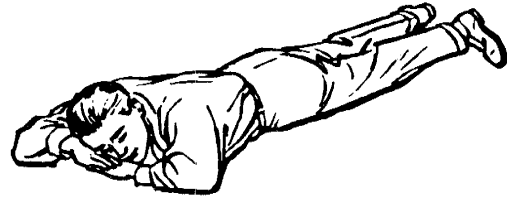


Fig. 38—Position of Victim

Step 2. Carrier 1 kneels on one or both knees at the victim's head. He carefully slides his hands under the mid-forearms of the victim until the upturned palms of his hands rest under the victim's armpits. (See Fig. 39.)

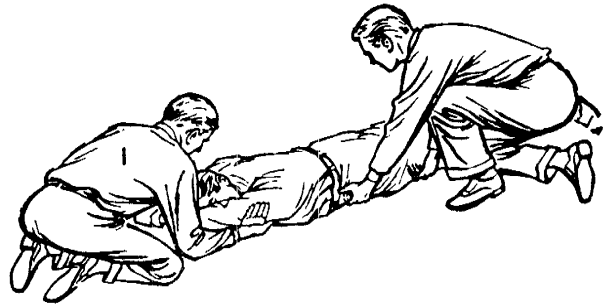


Fig. 39—Position of Carrier No. 1

Step 3. Carriers 2 and 3 grasp the victim's hipbone with their top hands and his knee cap with their lower hands. (See Fig. 40.)



Fig. 40—Position of Carriers

Step 4. On signal, all lift together so that the victim is raised 5 or 6 inches from the floor (just high enough to slide a litter underneath). (See Fig. 41.)

**Note:** Care should be taken so that the body is lifted as a unit. Also, carriers 2 and 3 should shift the weight toward carrier 1 when raising the victim.

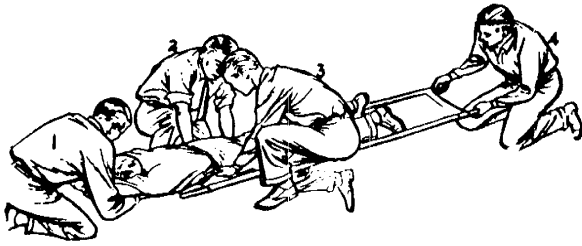


Fig. 41—Lifting and Placing of Litter

(d) MANY OTHER METHODS OF TRANSPORTATION ARE USEFUL. LEARN FIRST AID AND KNOW THEM ALL.

**14.07 Methods of Transfer**

(a) These include special methods for short-distance transfers, the walking assist, manual carries, transfer by supporting devices such as stretchers and cots, and transfer by vehicles.

It is difficult for inexperienced people to lift and carry a person gently. Their efforts may not be well coordinated. They need careful explanations.

(b) The best device for short-distance transfers is the stretcher or cot.

It is important to remember that the short-distance transfer is harmful unless the injured parts are immobilized. "Splint them where they lie" unless there is urgent danger in delay.

(c) Unless there is unusual urgency, it is best to wait until an ambulance is available.

Aside from rare exceptions, the drive should be at moderate speeds, with gentle stops and starts, and with observance of all safety rules.

**15. BELL SYSTEM FIRST AID KITS**

**15.01 Maintenance.** The Bell System First Aid Kits contain standard materials with which first aid work is to be done on the job. It is, therefore, necessary to become familiar with their contents, to know where each article should be found, and to learn the best method of using it. The list of contents inside each kit shows the proper location of each article. It is very necessary that a complete supply be kept in the kit at all times and each article located where it can be found without delay or confusion. A used article should be replaced as soon as possible so that a supply will be available for the next emergency.

**15.02 General Precautions.** Use of the first aid kit should be in accordance with the precautions given during first aid instruction.

**15.03 Use of Contents.** Most of the articles included in the first aid kits are placed in individual packages. These packages have illustrated instructions on them which explain briefly the uses and methods of handling the articles they contain.

## FIRST AID PREVENTION OF AND FIRST AID FOR SKIN IRRITATION FROM CREOSOTE

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2. CAUSE OF THE IRRITATION.....	1
3. PREVENTIVE MEASURES .....	1
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### 1. GENERAL

1.01 With the increasing use of creosote treated poles and other creosote treated wood products in the telephone business, it is desirable and necessary that those who have occasion to handle these materials and may be susceptible to creosote irritation know and follow simple precautions to prevent skin irritations which may result from contact of the skin with the creosote, together with the first aid practices to follow if irritation does occur.

### 2. CAUSE OF THE IRRITATION

2.01 In creosote used for treating poles and crossarms for the Bell System, the amount of tar acids is limited to 10 per cent. or less. In these tar acids there may be present a small fraction of creosols, phenols and other ethereal bodies with acid radicals which have a tendency, when brought directly into contact with the skin of those who are susceptible, to produce skin irritations, unless preventive measures are adopted.

### 3. PREVENTIVE MEASURES

3.01 Employees climbing or handling creosoted poles or handling or working on creosoted crossarms where some of the creosote may be transferred to the skin, as, for example, while the poles or arms are new or during hot weather, should observe the following precautions:

- (a) Do not roll up the shirt sleeves.
- (b) Wear gloves and keep the neck well covered with collar or handkerchief.
- (c) As far as practicable, keep the legs of the pants or overalls well down over the ankles.
- (d) When direct contact of the skin with creosote is likely, rub the arms and face well, before starting the work, with the petroleum jelly supplied for this purpose or with vaseline purchased at a nearby drug store. The carbolated petrolatum of the standard first aid kits is not suitable for this purpose and should NOT be used because of its carbolic acid constituent. As soon as practicable after completing the work upon which the coating of the skin with petroleum jelly or vaseline was required, wipe off the grease with a clean, dry cloth and then wash well with plenty of soap and hot water.

- (e) Never rub the eye or wipe perspiration from it with the hand or shirt sleeve if they have been exposed to creosote. This is an IMPORTANT precaution and should be borne in mind whenever working on or with creosoted wood products.
- (f) When there has been direct contact of the skin with free creosote, wash the part with abundant hot water and soap, then pour the standard "Creosote Burn Wash" freely over the exposed skin area. This wash should NOT BE APPLIED in or near the eye.
- (g) If practicable, before lunch and always after the day's work, when exposure to creosote has occurred, wash the hands, arms, face and neck with plenty of soap and hot water. In washing the face, keep the hands away from the eyes.
- (h) Overalls and other articles of clothing which have been in contact with creosote should be soaked in soapy hot water and washed as soon as practicable.

### 4. FIRST AID PRACTICES

4.01 The following are first aid practices to be followed should there be indications of skin irritation or an eye burn from creosote.

- (a) Skin Irritations:
  - (1) Apply the "Creosote Burn Wash" as suggested as a precautionary measure in Paragraph 3.01-(f), above.
  - (2) If the irritation continues for 24 hours or if a large skin area is affected, obtain a doctor's services.
- (b) Eye Burns:
  - (1) Flush the eye with water. To do this, submerge the eye in a basin of water and open and close the eyelids.
  - (2) Follow (1) by dropping two or three drops of castor oil into the eye, using a clean eye-dropper, or by applying castor oil to the eye with an eye-cup.
  - (3) Apply an eye bandage and obtain a doctor's services.



## FIRST AID RESCUE OF EMPLOYEE FROM POLE

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6. Removing Employee from Contact with Wires and Lowering Him .....	2
7. Artificial Respiration and Other First Aid.....	2

### 1. GENERAL

1.01 This section specifies methods of rescuing an employee working aloft when, on account of electric shock or for any other reason, help is required to lower him to the ground.

1.02 In an electric shock accident, quick rescue and the prompt application of artificial respiration, if normal breathing has stopped, are extremely important. In some cases, the injured person may remain in contact with the wire because of his inability to let go of the live conductor or due to his being unconscious.

1.03 Unless it is definitely known that the cause of the disability is not electric shock or that the contact with the electric supply conductors has been broken, it should be assumed that all of the wires on the pole are energized with dangerous voltages. In this event the rescuer should take precautions as specified in these instructions to protect himself and his assistants from injury due to electric shock.

1.04 In all cases where the employee has received a severe electric shock or is unconscious, have someone call a physician to the location as soon as practicable without delaying the rescue. If the victim is conscious and, after receiving first aid can safely be moved, he should be taken where he may receive the services of a physician. In administering first aid and transporting the victim, follow the recommendations covered in the American Red Cross First Aid Text Book and outlined in Section 010-100-001.

1.05 Send someone to get the truck, as soon as practicable if it is not near the scene of the accident, as it may contain useful equipment or it may be needed as an insulated platform to effect the rescue and to transport the injured employee.

1.06 In electric shock cases, notify as soon as practicable, the power company which operates the equipment involved in the accident.

1.07 If the cause of the disability is not electric shock, the rescue work may be conducted more deliberately and without the speed which is essential in electric shock cases.

1.08 Review this practice and also the Red Cross First Aid Text Book at intervals so that if an accident on a pole should occur, the rescue work will be handled effectively.

### 2. PLANNING THE RESCUE

2.01 Before starting the rescue, plan quickly, but carefully, how the operation can best be carried out. The most important details to be considered are the following:

(a) Probable cause of the disability (electric shock, sickness, fainting, etc.). In an electric shock case determine, if possible, the source of the shock and whether or not the contact has been cleared. If the source is not apparent or if the nature of the disability cannot be determined from the ground, assume that the injured person has been shocked and that the contact still exists, and use the protective measures applying to such cases.

(b) Rescue materials available such as rope, rubber gloves, pliers, tree pruner, climbers, body belt, safety strap, ladder. (An extension ladder may be used, under some conditions, to facilitate the removal of the victim.)

(c) Assistants to help handle rope in lowering him from pole.

(d) Position of victim with respect to wires and other attachments on pole.

(e) Method to be used in clearing contact between victim and source of shock. (Lifting him clear, opening switch, cutting wires, etc. If wires are to be cut, consider possibility of unsound pole falling due to unbalanced load effect on the pole.)

(f) Side of pole to be climbed and position from which rescue work will be done.

(g) Point of attachment for rope to be used in lowering the employee.

(h) Need for cutting wires below victim which might interfere with rescue work and the lowering operations.

(i) Protection of rescuer from electric shock (if pole, rope or other equipment is wet).

(j) Availability of truck to be used (with necessary precautions) as an insulated platform, particularly under wet conditions.

2.02 Employees should become generally familiar with the types of construction used by the electric companies that operate in the localities where rescue work may be necessary so that they may be able to estimate the voltages of different types of circuits.

### 3. REMOVING EMPLOYEE FROM CONTACT WITH LIVE CIRCUIT OF LESS THAN 15,000 VOLTS

3.01 In electric shock cases the rescuer should wear rubber gloves throughout the operations when he will be exposed to possible shock. If rubber gloves are not available, rescue work may be undertaken only if the contact can first be cleared by available safe means, such as by the use of a dry rope, dry board, dry tree pruner, dry ladder, or opening a switch. Men handling the rescue must keep cool, think clearly, and avoid impulsive and unsafe operations. Keep in mind the fact that wet ropes, wet wood and wet clothing are not safe insulators, and severe shock can be transmitted by them.

3.02 When handling wires that may be "hot," use only one hand, in so far as practicable, and keep the other hand and other parts of the body clear of wires, guys, suspension strand, cable terminals or other grounded structures.

3.03 If the reason for the high voltage being on the plant is evident, this contact should be removed, where practicable to do so, without handling the supply conductors. In some cases it may be possible to clear the contact by throwing a dry hand line over the telephone or supply wires and pulling them apart or by pushing them apart with a ladder, or long dry stick, such as a tree pruner handle or pike pole. Do not use green wood or damp sticks in attempting to separate the wires and avoid standing on wet ground and in water.

3.04 If methods mentioned above cannot be employed and if rubber gloves are worn, the contact between the supply wires and telephone conductors may be opened by cutting the telephone wires with pliers. A tree pruner with a dry pull rope may also be used, preferably with rubber gloves, for this purpose.

3.05 Under extreme conditions, secondary electric circuits may be cut, provided that rubber gloves are worn while the wires are being cut. Do not attempt to cut a primary wire.

3.06 In cutting supply wires or telephone wires that are crossed with electric supply wires, take a position so that the cut wires will not fly back or fall and injure the rescuer or other person. Turn the face away or close your eyes while cutting the wire to protect the eyes from the flash that may follow.

**4. REMOVING EMPLOYEE FROM CONTACT WITH LIVE CIRCUIT OF MORE THAN 15,000 VOLTS**

4.01 If, in electric shock cases, the injured employee remains in contact with either charged telephone or power wires and, in the best judgment of the rescuer, the voltage involved is greater than 15,000 volts, the rescuer should, for his own protection, secure the assistance of a qualified employee of the power company to break the contact or open the switch, before proceeding with the rescue. This precaution is necessary since the rubber gloves are not designed to withstand these higher voltages and the rescuer cannot be sure that ropes, tree pruner handles, ladders and such equipment that might be used with rubber gloves are always dry enough to provide the degree of protection required.

**5. ASCENDING THE POLE**

5.01 Keeping in mind the plan of rescue as developed in accordance with Part 2, proceed with the work.

5.02 The rescue rope should be a rope in good condition, not less than 3/8 inch in size, and long enough to permit any available assistants on the ground to lower the victim. (A larger rope is preferable.)

5.03 Push a loop formed near the end of the rescue rope under the body belt at the back so that it can conveniently be carried up the pole and removed when needed.

5.04 Climb the pole on the selected side and get into proper position to work.

5.05 While aloft, exercise every precaution to avoid contact with telephone wires, suspension strand, cable guys and other equipment, as well as contact with the body of the victim, unless it is clearly evident that the contact with the "hot" wire has been broken.

5.06 If necessary, in order to facilitate lowering the victim, cut those telephone wires which would interfere. It is assumed, of course, that no wires will be cut which, in the planning of the rescue, it was concluded would be likely to cause the pole to fall. In cutting the telephone wires, exercise care to avoid dropping them on persons below. Be careful also that no projecting ends are left which might injure the victim while he is being lowered.

**6. REMOVING EMPLOYEE FROM CONTACT WITH WIRES AND LOWERING HIM**

6.01 Pass the rescue rope over a crossarm or other attachment of suitable strength located above the employee. If working alone, take one complete turn of the rope around the crossarm or other fixture, so as to provide some snubbing action to assist in holding the victim's weight.

6.02 Avoid direct contact with the victim until he is clear of the wires or other equipment that may be charged. When practicable double back the end of the rope on itself and place the double rope end around the victim's body under the arms, and tie it either at the front or back with a bowline knot. (See Section 081-510-201.) However, time should not be taken to double the end of the rope if it delays the rescue.

6.03 If it will facilitate the rescue, pass the rope through the D rings of the victim's body belt and tie the rope securely, preferably in front. If the rope is attached to his belt, exercise care in handling him so that the belt will not slip over his shoulders or down over his hips and cause him to fall. If necessary to move the employee to facilitate attaching the rope, this may be done by pulling on his safety strap.

6.04 After the rope has been secured to the victim by either of the methods described in Paragraphs 6.02 and 6.03, pull him toward the pole by means of the rope or both the rope and the safety strap. If help is available on the ground, these assistants should be guided by the rescuer on the pole.

6.05 When the preparations for lowering have been completed, unsnap or cut the employee's safety strap and lower him to the ground, guiding him when necessary, so that he will clear attachments on the way down.

**7. ARTIFICIAL RESPIRATION AND OTHER FIRST AID**

7.01 Immediately upon the victim's reaching the ground, remove the rope or body belt from his chest, so that it will not interfere with his breathing.

7.02 If normal breathing has stopped, apply artificial respiration immediately and such other first aid as may be necessary, in accordance with the recommendations of the American Red Cross First Aid Text Book.

## FIRST AID RESCUE OF PERSON FROM LIVE WIRE ON GROUND

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### 1. GENERAL

1.01 This section specifies methods of rescuing a person who is in contact with a live wire that is on the ground or at any location other than on a pole.

1.02 In an electric shock accident, quick rescue and the prompt application of artificial respiration, if normal breathing has stopped, are extremely important. In some cases the injured person may remain in contact with the wire because of his inability to let go of the live conductor or due to his being unconscious.

1.03 An attempt to rescue a person from contact with a live wire is dangerous for anyone who does not understand how to proceed, because of the fact that the electric current may be carried through the body of the victim to the rescuer, or the live wire may come in contact with the rescuer or other person and shock him, unless proper precautions are taken.

1.04 If an unconscious person is in contact with a wire and it is not definitely known that the wire has been de-energized, assume that it is a live circuit, in proceeding to clear him from contact with the wire.

1.05 In all cases where the victim is unconscious, call a physician to the location as soon as practicable, without delaying the rescue. After the victim has been removed from the contact, apply such first aid treatment as may be necessary in accordance with the recommendations of the American Red Cross First Aid Text Book and outlined in Section 010-100-001.

1.06 Notify as soon as practicable the power company which operates the equipment involved in the accident.

1.07 Review this practice and also the Red Cross First Aid Text Book at intervals, so that if it should become necessary to rescue a person in contact with a live wire on the ground, the rescue work will be handled promptly and safely.

### 2. PLANNING THE RESCUE

2.01 Before starting the rescue, consider quickly but carefully, how the operation can best be carried out. The most important details to be considered are as follows:

(a) Position of the injured person with respect to the conductor. His position will influence the method to be employed in clearing the contact, that is, whether to cut the wire, pull the wire clear of the victim, roll him off the wire or lift him clear of the wire.

(b) Presence of a nearby switch by means of which the wire may be deenergized.

(c) Rescue equipment available, such as rubber gloves, rubber footwear, pliers, dry rope, tree pruner, long-handled shovel, dry board, dry ladder, triangular bandage, or other non-conducting material that could be used for cutting or moving the wire or moving the victim.

(d) Dependable assistants.

(e) Probable voltage of circuit. (See Paragraph 4.01)

(f) Presence of bystanders. It may be necessary to modify the rescue methods so that bystanders will not be injured by the energized wire while it is being handled.

2.02 Men handling the rescue must keep cool, think clearly and avoid impulsive and unsafe operations. Keep in mind the fact that wet ropes, wet wood and wet clothing are not good insulators and severe shocks can be transmitted by them. Avoid standing on wet ground and in water.

2.03 Employees should become generally familiar with the types of construction used by the electric companies that operate in the localities where rescue work may be necessary, so that they may be able to estimate the voltages of different types of circuits.



**2. FREEING PERSON FROM CONTACT WITH LIVE WIRE OF LESS THAN 15000 VOLTS**

3.01 In rescuing a person who is in contact with a live wire, always wear rubber gloves, if available. If rubber footwear is available, wear it, also.

3.02 If rubber gloves are available, with or without rubber footwear, proceed in accordance with one of the following methods which are listed in their order of preference:

- (1) Pull the wire clear of the victim by means of a rope, or push it clear with a tree pruner, board or ladder.
- (2) Cut the live wire on both sides of the victim by means of pliers or a tree pruner, or on the remaining side if it is broken. In cutting the wire, close the eyes or turn the head away so that the eyes will not be exposed to the flash. Warn bystanders to keep clear so that they will not be injured by the ends of the wire after it has been cut. In many kinds of electric circuits, such as series street lighting circuits, voltage may remain on the wires after they have been cut at one place. If practicable, and if it will not delay the rescue operations, hold the wire down by means of a board or tool handle before it is cut so that the wire ends will be under control.
- (3) Roll the victim off the wire. Observe the wire closely so as to avoid accidental contacts with it and prevent the ends from hitting bystanders.
- (4) Lift the victim off the wire.

3.03 If rubber gloves are not available, extreme care must be exercised to avoid direct contact with the body of the person or with the live circuit. Use one of the following methods which are listed in their order of preference:

- (1) Pull the wire clear of the victim by means of a dry rope, provided that it appears that the wire can easily be freed. A dry tree pruner may also be used in pulling the wire or cutting it clear. Do not under any circumstances use a wet rope or other wet materials that may come in contact with the live wire or the body of the victim.

(2) If the live wire cannot be freed readily by pulling it clear, slip a dry rope or other dry material under the shoulder or other part of the victim's body and roll him or lift him off the wire. A dry board, ladder, or dry stick may be used to assist in pushing the rope under his body.

(3) If the victim's clothing is wet, do not touch it under any circumstances unless rubber gloves are being worn. If his clothing is dry, it may be touched only if other dry insulating material is not available. Before grasping any portion of the victim's clothing, touch it lightly to make sure there is no voltage in it. Preferably stand on a dry board or other insulating material while in contact with the clothing. Remember that under wet weather conditions extreme care must be used to avoid shocks unless rubber gloves and rubber footwear or the equivalent are used.

**4. FREEING PERSON FROM CONTACT WITH LIVE WIRE OF MORE THAN 15000 VOLTS**

4.01 If the victim is in contact with a live wire and in the best judgment of the rescuer, the voltage is in excess of 15000 volts, the rescuer should, for his own protection, secure the assistance of a qualified employee of the power company to break the contact before proceeding with the rescue. This precaution is necessary since the rubber gloves are not designed to withstand these higher voltages and the rescuer cannot be sure that ropes, tree pruner handles, ladders and such equipment that might be used with rubber gloves are always dry enough to provide the degree of protection required.

**5. ARTIFICIAL RESPIRATION AND OTHER FIRST AID**

5.01 If normal breathing has stopped, apply artificial respiration immediately after the rescue. Follow the methods of applying artificial respiration, treating burns, treating physical shock, or giving other first aid recommended in the American Red Cross First Aid Text Book.

## SCREWDRIVERS

### SELECTION, USE AND MAINTENANCE

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#### 1. GENERAL

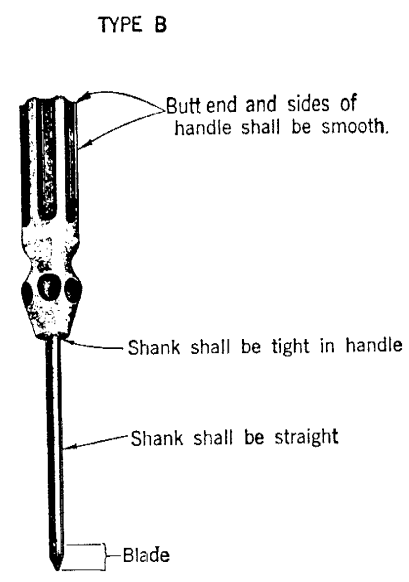
- 1.01** This section covers the use, general handling precautions, care and maintenance of standard Bell System screwdrivers and the screwdriver bit.
- 1.02** This section is reissued to cover the plastic-handled Phillips Type B screwdriver and the C, D and E screwdrivers with tougher and longer life blades and plastic handles. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.
- 1.03** The C, D and E screwdrivers replace the previous standard 3- and 6-inch cabinet, H cabinet, and 4- and 5-inch regular wood-handled screwdrivers. The use and maintenance of the wood-handled screwdrivers still used in the field are the same as covered herein.
- 1.04** Screwdrivers that are designed for special purposes such as offset screwdrivers, cord repair, etc, should be replaced when they become worn or defective.

**1.05** The screwdrivers provided for use in the Bell System are high-grade tools. The blade tips are specially ground to fit the screws ordinarily used in telephone work. The B, C, D and E screwdrivers consist of fluted transparent amber-colored plastic handles pressed on the tangs which are forged in one piece with the heat-treated alloy steel blades. These screwdrivers may be furnished with a 4- or 6-fluted plastic handle.

**1.06** *Screwdrivers are intended for use in turning screws and not for use as drills, chisels or pinch bars.*

#### 2. B SCREWDRIVER

**2.01** Fig. 1 illustrates the B screwdriver and indicates the condition in which screwdrivers of this type shall be maintained for safe and satisfactory service. This screwdriver is furnished in three sizes as shown in the table in Paragraph 2.02. It is for general use with cross-recessed head screws of the Phillips type.



**Fig. 1**

**2.02** The following is a table of the sizes of B screwdrivers, their over-all lengths, and the sizes of screws that are accommodated by each screwdriver. Select the proper size of screwdriver for each type of screw.

SIZE No.	OVER-ALL LENGTH In.	SIZE OF SCREW No.
1	7	4 and smaller
2	8	5 to 9
3	11	10 to 16

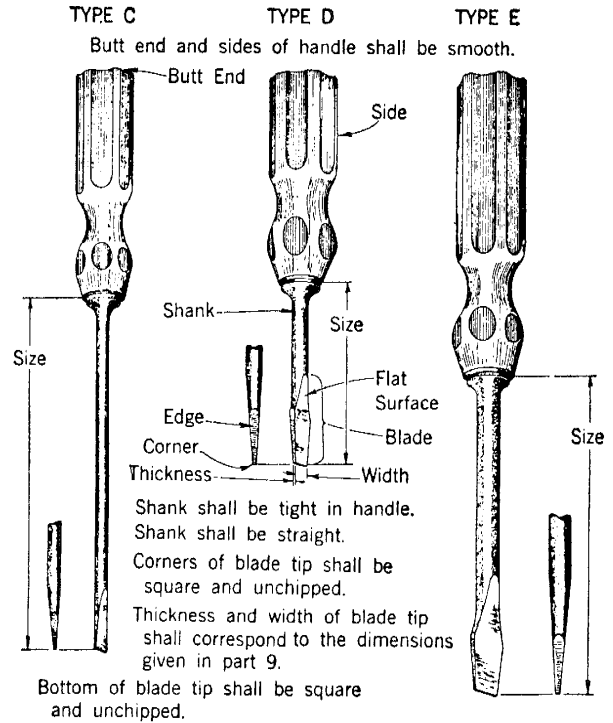
**2.03** It is not feasible to repoint the blade tip of the B screwdriver in the field since it is formed of curved surfaces which cannot be restored readily by filing. Careful storage and use of this screwdriver by squaring the blade tip in the cross-recessed slots of the proper size screws will result in its maximum safe and efficient usage. When the blade tip becomes inefficient or hazardous by wear or defect, it should be marked defective and exchanged for one in good condition.

**3. C, D AND E SCREWDRIVERS**

**3.01** Fig. 2 illustrates the C, D and E screwdrivers and indicates the condition in which screwdrivers of these types should be maintained for safe and satisfactory service. These screwdrivers are furnished in three types designated C, D and E in the sizes as shown in the table in Paragraph 3.02. The two C screwdrivers are for light duty on small screws used principally in apparatus assemblies. The two E screwdrivers are for general use on the larger wood and machine screws used in making plant attachments. The D screwdriver is a combination of features of the C and E types for use on an intermediate range of screw sizes.

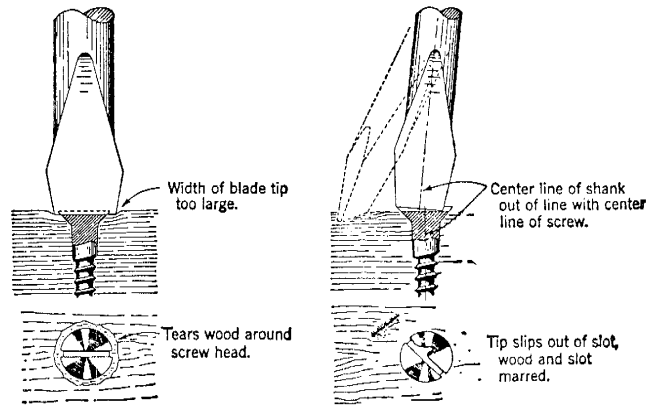
**3.02** The following is a table of the sizes of C, D and E screwdrivers, their over-all lengths, and the range of sizes of screws that are accommodated by each screwdriver. Select the proper size of screwdriver for each size of screw. Wherever practicable, select the D or E type screwdriver for turning in wood screws.

TYPE	SIZE In.	OVER-ALL LENGTHS In.	SIZE OF SCREW No.
C	3	6-7/8	4 to 6
C	6	9-7/8	5 to 8
D	3	6-1/2	5 to 10
E	4	8-5/16	5 to 12
E	5	10-1/2	14 to 18



**Fig. 2**

**3.03** Figs. 3 through 7 illustrate what is likely to occur if a screwdriver is not maintained in good condition, is of the wrong size, or is improperly used. These conditions promote neither safety nor satisfactory workmanship. Also, screws with damaged slots are difficult to remove.



**Fig. 3**

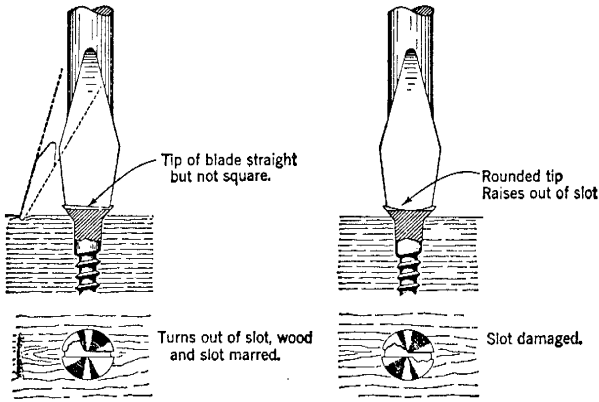


Fig. 4

Bent shank throws screw out of line, causing point to break out of hole.

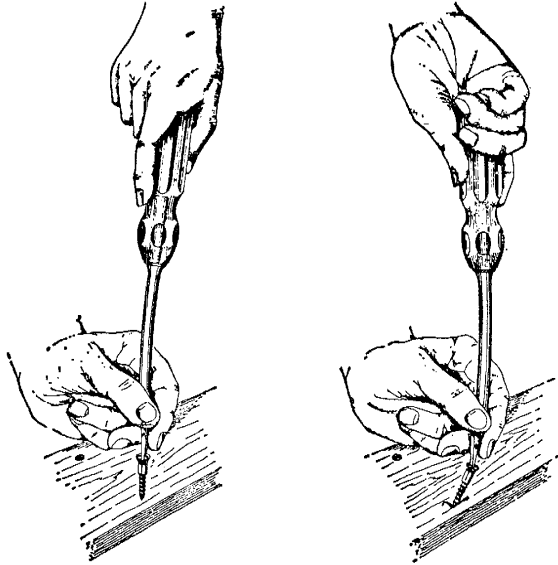


Fig. 7

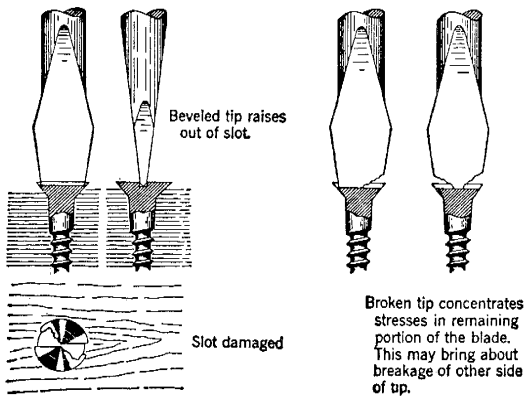


Fig. 5

**4. SCREWDRIVER BIT**

**4.01** The screwdriver bit, illustrated in Fig. 8, is provided for use where a considerable number of the larger screws are to be placed or removed and a brace is available.

**4.02** The sizes of screws recommended for use with the screwdriver bit range from No. 14 through No. 18.

**4.03** The blade tip of this screwdriver shall be repointed, when required, in accordance with Part 9 of this Section.

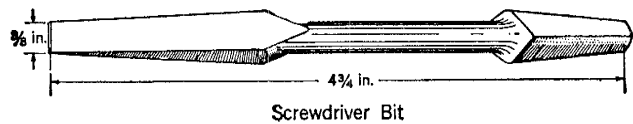


Fig. 8

**5. OFFSET SCREWDRIVER**

**5.01** The offset screwdriver, illustrated in Fig. 9, has either one or two blades which project at a right angle to the handle or shank. The angles, however, that are listed in the Bell System Practices for the various types of offset

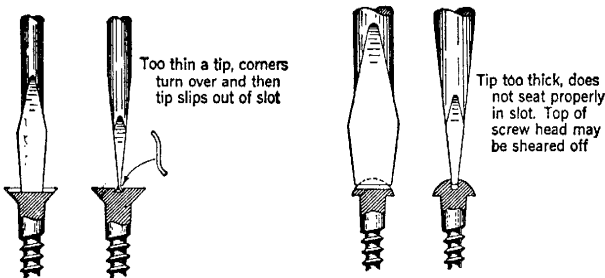
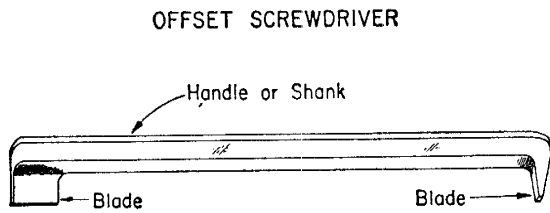


Fig. 6

screwdrivers are determined by the angle formed by the face of the blade and the handle (Fig. 9 illustrates a 90° offset screwdriver).



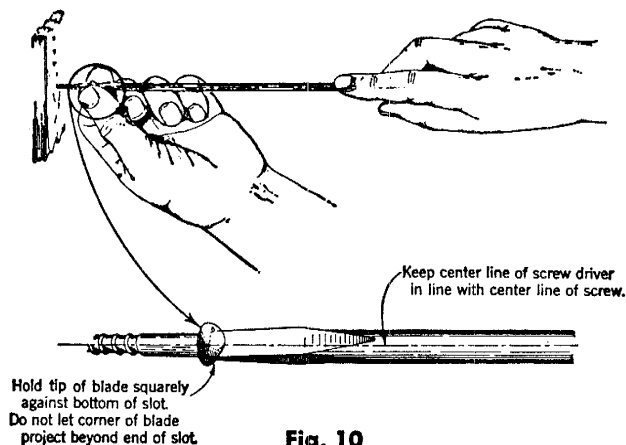
## 6. USING SCREWDRIVERS

**6.01** In general, a lead hole will not be required for starting the smaller sizes of screws in soft wood. Lead holes of the following sizes shall be made for the larger sizes of screws where such holes are not already available. An automatic drill or a hand drill equipped with twist drills has been found satisfactory for this work.

SIZE OF WOOD SCREW		SIZE OF DRILL POINT
HARD WOOD	*SOFT WOOD	
No. 6	No. 6	1/16 Inch
No. 8 to No. 10	No. 8 to No. 10	3/32 Inch
No. 12 to No. 18	No. 12 to No. 14	1/8 Inch
	No. 18	11/64 Inch

\* Use this table for outside attachments.

**6.02** After lead hole has been drilled insert the screw and start it by holding it and the screwdriver in position as shown in Fig. 10.



**6.03** Turn the screw, keeping the center line of the screwdriver in line with the center line of the screw. Hold the tip of the blade squarely against the bottom of the screw slot in order to prevent damaging the screw. Use two hands when starting screws, one on the handle of the screwdriver to do the turning and the other on the blade to steady it on the screw. Avoid injury by keeping the head and arms in such a position that they will not be struck with the tip should the screwdriver slip. Remember that the tip of the blade will have the greatest tendency to slip out of the screw slot just before each turn is completed, especially the last turn.

**6.04** When turning screws in hard wood, lubricate the threads with a small amount of soap or beeswax, taking care, particularly in hot weather, that the lubricant does not enter the slot of the screw or coat the screwdriver tip. It is difficult to keep the tip of the screwdriver engaged with the screw slot if either the blade or the slot is lubricated. Such a condition may be the cause of an accident and, therefore, if lubricant is found at these points it shall be removed before turning the screw.

**6.05** When using an offset screwdriver, the tip of the blade should rest flush with the bottom of the slot in the screw. If room permits, apply pressure on the shank or handle directly above the screw in order to hold the tip of the blade firmly in place while the pressure is applied for the swinging motion. If there is not enough space to apply the pressure directly over the screw it should be applied to the handle as near as possible to the screw head.

**6.06** When the swinging space of the offset screwdriver is limited, it may be necessary to reverse the ends of the screwdriver after each swing. If the screw cannot be turned in this manner, two offset screwdrivers with blades at different angles may be used.

**Caution:** Care should be taken while using offset screwdrivers so as not to injure the fingers or hand or burr the head of the screw by the blade slipping out of the slot of the screw.

## 7. INSPECTION OF SCREWDRIVERS

**7.01** Each employee, on receipt of and at frequent intervals thereafter, shall make an inspection of the screwdriver in accordance with Paragraph 7.04, in order to determine whether any fault has developed.

**7.02** Each employee shall at all times assume the responsibility of determining that the screwdriver is in good condition and that its appearance does not indicate injury or defects sufficient to impair its usefulness.

**7.03** Screwdrivers shall be checked periodically and the employee performing this work shall see that all instructions contained herein are complied with.

**7.04** Screwdrivers should be examined to determine their condition as suggested below. In connection with the inspection of screwdrivers the important conditions to look for are:

- (a) \*Handle broken, split, cracked or rough on sides or butt end.
- (b) Blade loose in handle.
- (c) Blade broken.
- (d) Soft tip (temper destroyed).
- (e) \*\*Blade bent. (See Part 10.)
- (f) \*\*Point of tip chipped, worn or improperly shaped. (See Part 9.)

\*The plastic handles are tough and resistant to breakage, splitting and cracking. However, any roughness on the handle may be made smooth by sanding so as to avoid irritation to the hand.

\*\*When conditions (e) and (f) are found they shall be corrected in accordance with Parts 9 and 10. A screwdriver with an improperly shaped tip that cannot be readily sharpened in the field, or one with the blade excessively bent, shall be exchanged for one in good condition.

**7.05** If any of the conditions under (a), (b), (c) or (d) are found to exist or if the condition of the screwdriver is such that there is any doubt

as to its serviceability, it should be marked defective and exchanged at once for one in good condition in accordance with the established routine.

## 8. STORING SCREWDRIVERS

**8.01** New screwdrivers shall be left in the original package until required. Screwdrivers which have been issued should be placed in a locker or container provided for the purpose when not in use. Never place a screwdriver in such a position on shelves that persons passing by are likely to scratch themselves on the protruding tip or, in such a way that the screwdriver may roll off and create a hazardous condition or strike someone. Screwdrivers shall be kept in tool rolls or other approved carrying cases or suspended from brackets provided in the compartments of a truck for this purpose when not in use. When suspended from brackets, screwdrivers shall be stored with blade downward.

## 9. REPOINTING C, D AND E SCREWDRIVER BLADES

**9.01** The screwdriver blade tip shall be kept properly shaped at all times. The following method has been found satisfactory for repointing the tip:

(a) Select one of the types of files provided for sharpening tools. If the teeth of the file are clogged, clean them before using the file. This can be readily done with the standard carding brush or by pushing the end of a copper strip (a small piece of copper strip of the ground wire clamp is suitable) across the file in line with the cutting edges of the teeth.

(b) Select such a location for performing the work that the elbows will be level with the object to be filed. A flat surface should be sought as this can be used as a guide in determining whether the file is being pushed straight across the object.

(c) For squaring the tip of the blade, hold the screwdriver blade at a right angle to a flat surface (floor of truck, top of box or workbench) using index finger to steady it, as shown in Fig. 11.

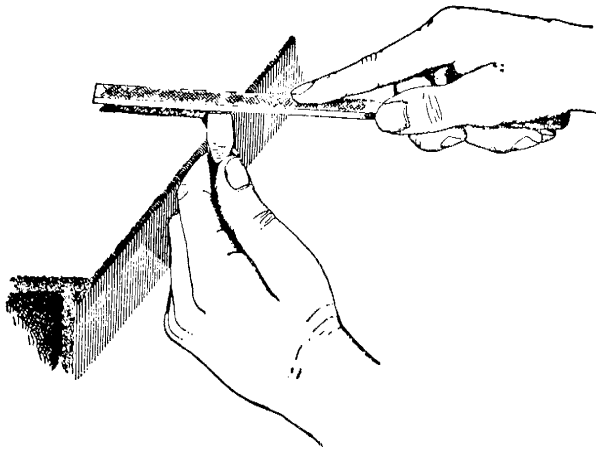


Fig. 11

Place the file parallel with the flat surface and at a slight angle (approximately 20 to 30 degrees) to the center line of the surface to be filed. Grasp the file securely so that it can be easily steadied and its movement controlled at all times. Move the file forward and parallel to the flat surface, applying sufficient pressure for the teeth to grasp the metal. The pressure should be evenly distributed and maintained throughout the forward stroke. On the return stroke, the file should be held slightly above the surface being filed in order not to dull the cutting teeth. Continue filing until broken, chipped or rounded edges have been removed.

(d) With the screwdriver and file held in a position similar to that illustrated in Fig. 12, dress down the edges of the tip, restoring the width of the point to its original size as closely as practicable.

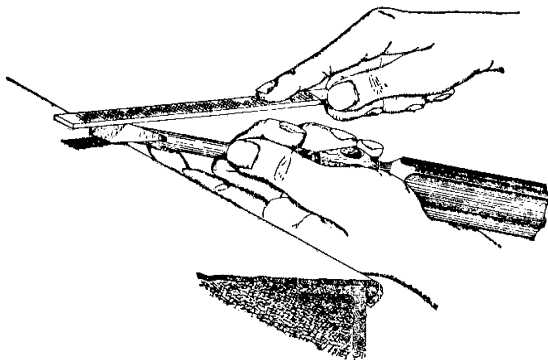


Fig. 12

(e) With the screwdriver and file held as shown in Fig. 13, file the entire broad flat face of the tip until the following dimensions, with regard to thickness of point, are obtained. The slots of the screws listed in the following table may be used as gauges for determining the thickness of the point desired. This method of gauging is only an approximation of the dimensions given, so that when screws having smaller slots than those used for gauging are encountered they shall be adopted as the gauges.

SCREWDRIVER		POINT DIMENSIONS		SIZE OF FLAT HEAD SCREW
TYPE	SIZE	THICKNESS	WIDTH	SLOT TO BE USED AS GAUGE
C	3 in.	.025 in.	3/16 in.	No. 4 Wood Screw
C	6 in.	.028 in.	3/16 in.	No. 5 Machine Screw
D	3 in.	.029 in.	1/4 in.	No. 5 Wood Screw
E	4 in.	.031 in.	1/4 in.	No. 6 Wood Screw
E	5 in.	.043 in.	7/16 in.	No. 14 Galv. Wood Screw
Screwdriver Bit		.043 in.	3/8 in.	No. 14 Galv. Wood Screw

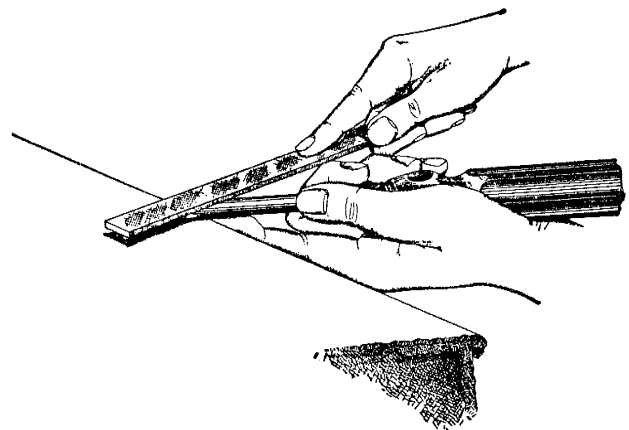


Fig. 13

**9.02** *Never use an emery wheel for repointing a screwdriver blade. Heat generated by its use may destroy the blade temper.*



## 10. STRAIGHTENING SCREWDRIVER SHANK AND BLADE

**10.01** The shank and tip of a screwdriver blade shall be kept straight. If the blade is bent and a vise is not available, straighten it by placing the bent portion on a solid flat surface with the tip and the portion of the shank near the handle resting on the flat surface. With the screwdriver in this position, strike the curved section near the handle lightly with a hammer. Repeat, striking a little ahead of the last blow until the tip is reached. These operations should be followed until the shank is flush with the flat surface. Blades bent excessively shall not be straightened.

**10.02** To straighten a bent shank and blade with a vise available, place the shank of the screwdriver in the vise in a horizontal position. The point where the bend starts should be just outside the jaws of the vise. The shank should be parallel with the top of the workbench on which the vise is mounted. Apply pressure at the handle or shank in a direction that will tend to straighten out the bent portion. If the bent portion is such that one operation does not entirely straighten the shank, reposition the screwdriver in the vise as the portion nearest the vise becomes straight. Continue in this manner until the entire shank is straight.

## 11. PRECAUTIONS

**11.01** Do not use a screwdriver as a drill, chisel or pinch bar.

**11.02** Do not stick a screwdriver in either the flame of a furnace or torch, or a pot of hot solder, as this will destroy the temper of the tool. Never use a screwdriver as a substitute for a soldering copper.

**11.03** Use the size of screwdriver with the sizes of screws for which it is intended.

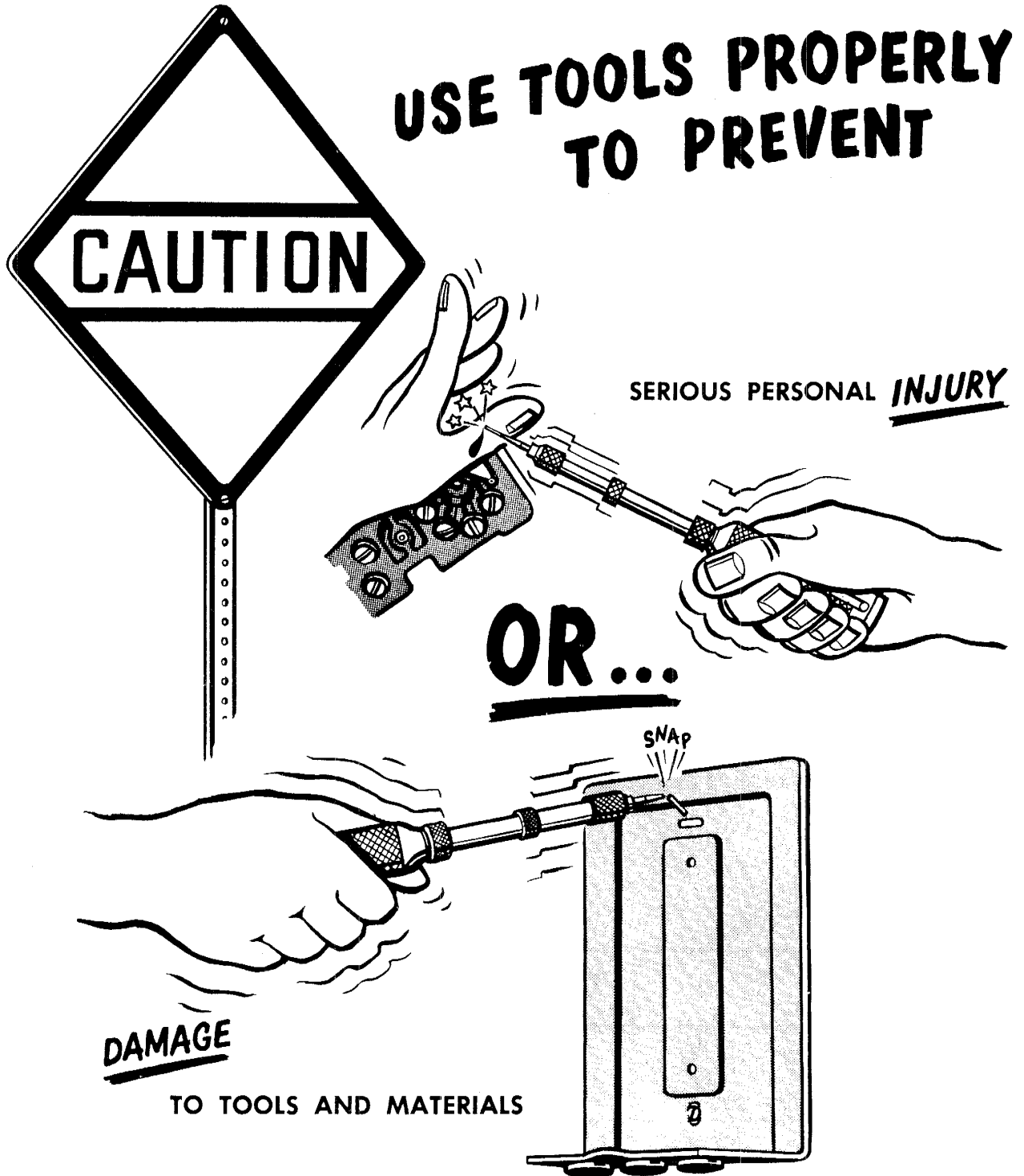
**11.04** Do not use a screwdriver with broken, chipped or rounded tip.

**11.05** Do not carry screwdrivers in pocket where injury may result through exposure of the tip of the blade.

**11.06** Do not use screws with damaged slots. Burred screw slots often cause the screwdriver to slip, resulting in accidents.

**11.07** Do not work with the screwdriver in such a position that if it slips it will cause injury, particularly in the area of the hands, face or eyes. If it is necessary to hold small objects in which screws are to be placed or from which they are to be removed, the hand should be kept away from the back of the object so that it will not be struck if the screwdriver slips. This can usually be accomplished by placing the object against some supporting surface—*avoid holding small objects in the palm of the hand.*





**B AUTOMATIC DRILL**

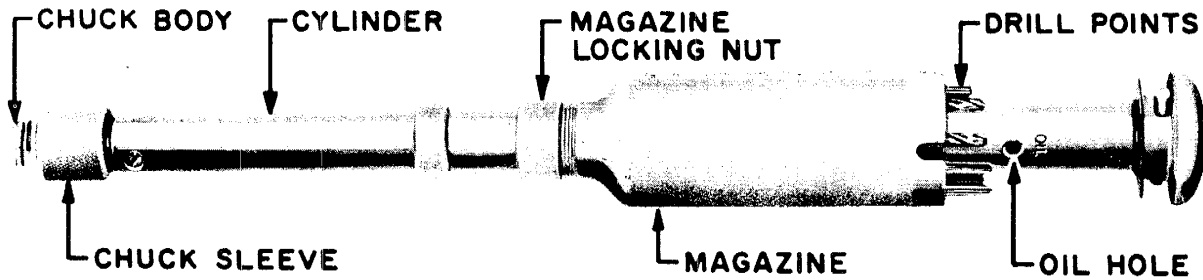


Fig. 1 -- B Automatic Drill

**1.00 INTRODUCTION**

This section tells how to use and take care of B Automatic Drill, Specification AT-7137 (Fig. 1).

**2.00 GENERAL**

**2.01** The B Automatic Drill is a push-type drill. It is used with drill points suitable for drilling small holes in light metal or wood. The handle serves as a magazine for ten drill points.

**2.02** Drill points furnished with the B Automatic Drill are listed in Table A.

**2.03** Drill points of other sizes may be ordered separately.

**3.00 OPERATION**

**3.01** To remove a drill point from magazine:

1. Loosen magazine locking nut, allowing magazines to slide down cylinder.
2. Remove desired drill point.
3. Slide magazine to its original position and tighten locking nut.

**3.02** To insert drill point:

1. Grasp cylinder of the drill in palm of hand with thumb against back of chuck sleeve.
2. Slide chuck sleeve forward past end of chuck body.

**TABLE A**

**DRILL POINTS**

Quantity	Size	Intended Use	Remarks
2	1/16"	Wood	Straight-fluted carbon steel drills, suitable for drilling wood.
2	3/32"	Wood	
2	11/64"	Wood	
2	No. 33	Metal	Carbon or alloy steel twist drills suitable for light metal drilling.
2	No. 30	Metal	

3. Insert drill point in chuck and release chuck body.

**3.03** Rotary action of the drill is created by the forward stroke, or push, of the handle.

#### **4.00 PRECAUTIONARY MEASURES**



*Observe the following precautions to prevent accidents, and damage to tools or materials.*

- Keep both hands behind the drill point during operation.
- Use suitable eye protection when drill is used above eye level.
- Remove drill point from the chuck when not in use.
- Do not use drill points that are bent.

- Mark the location to be drilled and remove apparatus before drilling holes.

- Start guide holes with a center punch when metal is being drilled.

- Use only enough pressure to operate the drill. (This is particularly important when using the small 1/16-inch drill point.)

- Hold drill at right angle to surface being drilled.

#### **5.00 MAINTENANCE**

**5.01** Keep the automatic drill well lubricated with light-weight lubricating oil, applied through the cylinder oil hole.

**5.02** The automatic drill should operate freely without bind or excessive play in parts.



## GROUNDING PORTABLE ELECTRIC POWER TOOLS

### 1.00 INTRODUCTION

This section describes the proper grounding of portable electric power tools and methods of obtaining effective grounds.

### 2.00 GENERAL

**2.01** The grounding of portable electric tools protects the operator from electric shock caused by insulation breakdown on current-carrying parts within the tool housing. Grounding prevents the appearance of voltage on the frame of the tool.

**Note:** Tools operated from ungrounded portable electric generators (circuit isolated from ground) do not require grounding.

**2.02** Grounding, as described in this section, is accomplished by a third conductor used to connect the tool housing to the local power ground-

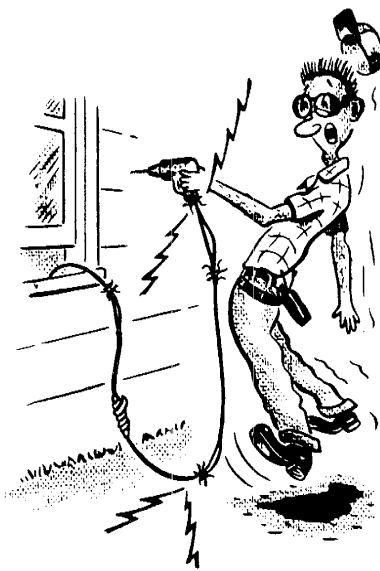
ing system or to other equivalent grounds such as a cold water pipe.

**2.03** Permission should be obtained from the property owner or an authorized person before connecting power tool to outlet receptacles on a customer's premises.

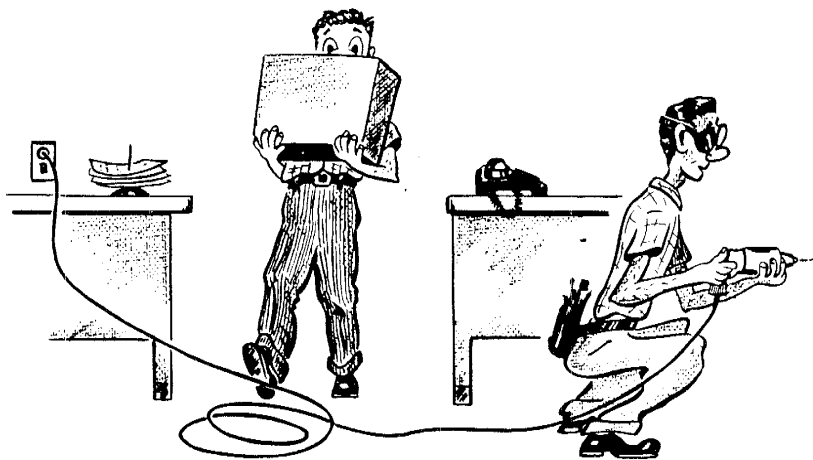
### 3.00 CAUTIONS

**3.01** Use only electric tools provided by the telephone company.

**3.02** Electric power tools should always be grounded except as noted in 2.01. Take special care to ensure that this grounding is adequate (see Parts 4 and 5).







**3.03** Before connecting a tool to a power supply, check the apparatus plate on the tool to be certain that the proper voltage and type of current (ac or dc) is available.

**3.04** Replacement cords should have equal or larger gauge wire than the original cord.

**3.05** All cords assembled or repaired locally should be tested for continuity of the grounding conductor before connecting the tool to a power supply. Periodic testing of the grounding conductor should be followed in accordance with local procedures.

**3.06** Make certain that the grounding connections do not become disengaged during the operation of the tool.

**4.00 PROVISIONS FOR GROUNDING**

**4.01** The adapters shown in Fig. 1 permit connections when the outlet receptacle is not the same type as the plug.

**4.02** All electric power tools except lamps and soldering coppers should be equipped with a 3-conductor cord which terminates in a 3-blade plug (see Fig. 2). Lamps and soldering coppers do not require grounding.

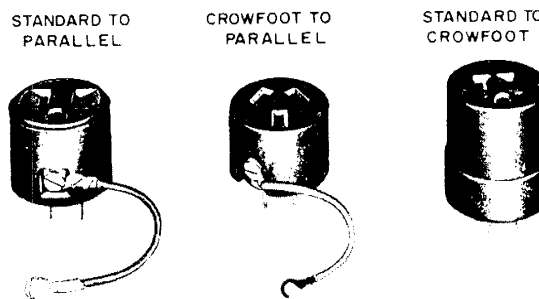
**4.03** The 3-blade standard plug supersedes two other types of plugs: 3-blade crowfoot and the 2-blade parallel with an external attached pigtail grounding wire.

**Note:** The earlier-type plugs may continue to be used until replacement is necessary at which time the standard plug should be used. See Fig. 3 for typical cord make-up.

**4.04** Extension cords are required for connecting power tools to outlet receptacles located away from the work area. This is a 30-foot cord, with 18-gauge conductors, having a standard plug at one end and a standard connector at the other.

*Caution: The C extension cord (Fig. 3) should not be used with portable electric tools where conductors of a larger size are required, such as 1/2-inch electric drills and electric soldering pots.*

**4.05** The pigtail grounding terminal on adapters or attachment plugs should be connected to a suitable conductor. As shown in Fig. 4, 14-gauge ground wire or the B or C grounding cord will be satisfactory.



**Fig. 1 — Adapters**

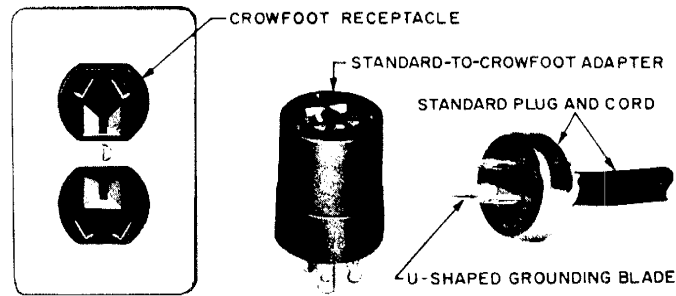


Fig. 2 — Standard-to-crowfoot Adapter

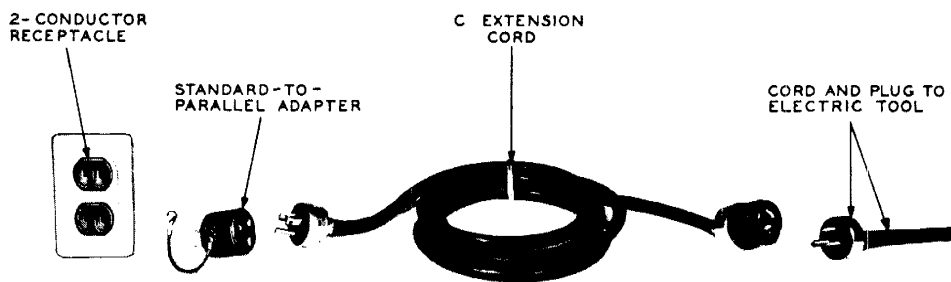


Fig. 3 — Typical Cord Make-up

**5.00 METHOD OF GROUNDING**

**3-wire Grounding-type Receptacles**

**5.01** The most satisfactory method of providing an effective ground is through the connection of a 3-blade plug to a comparable 3-wire receptacle. (see Fig. 5).

**Note:** The standard-to-crowfoot adapter must be used when the receptacle is a crowfoot type and the plug is standard (see Fig. 2).

**2-wire Receptacles (Ungrounded Outlet Box)**

**5.02** Where electrical connections are to be made at 2-wire parallel receptacles, proceed as follows:

- Locate a nearby grounded object, such as a cold water pipe, to which the ground wire or grounding cord may be attached.

- Attach ground wire to ground terminal on plug or adapter and to the grounded object selected, making certain a good metallic connection at both ends is accomplished (see Fig. 4).
- Insert the adapter or plug into the receptacle for operation of the tool.

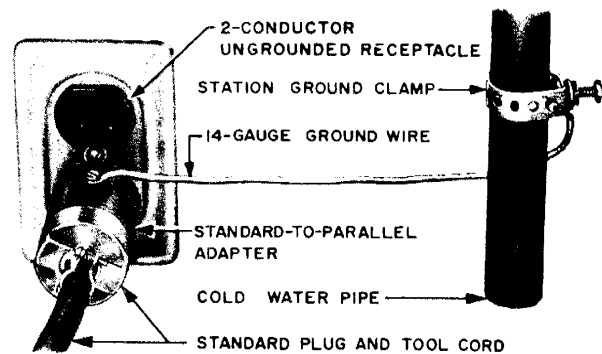


Fig. 4 — Ungrounded 2-conductor Receptacle

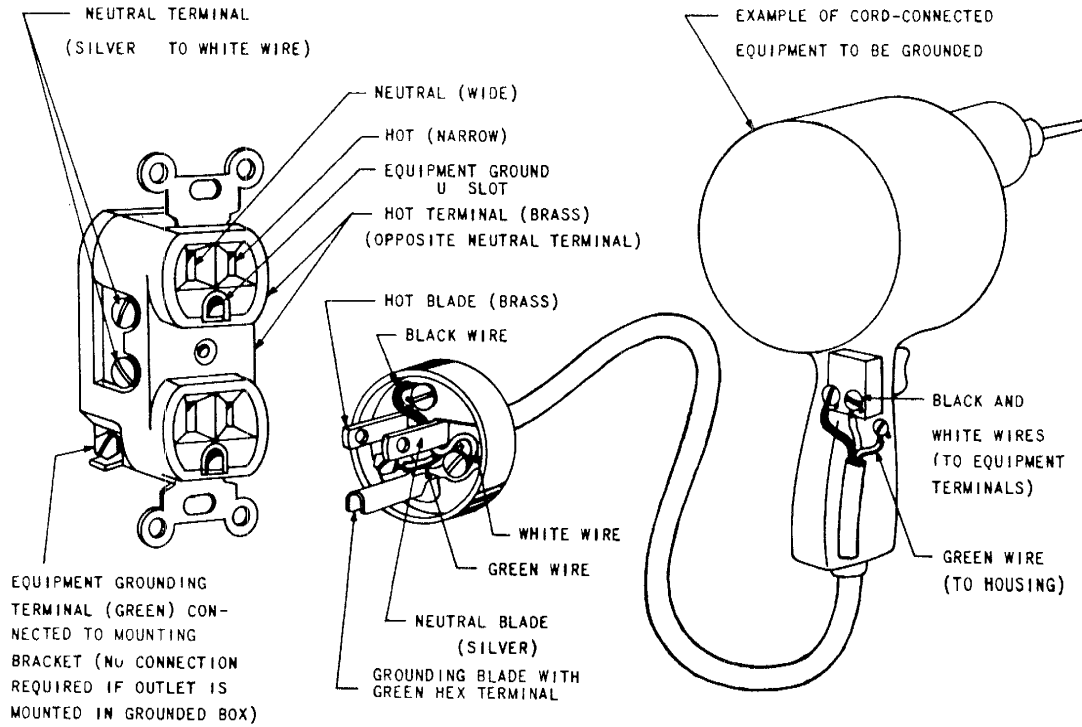


Fig. 5 — Wiring of 125-volt Standard Plug and Receptacle

5.03 The B and C grounding cords are used to ground power tools at 2-wire receptacles.

- The B grounding cord is a 15-foot, 18-gauge, single-conductor cord with clips at both ends (see Fig. 6).
- The C grounding cord is similar to the B except that it has a clip on one end and a standard-to-parallel adapter on the other (see Fig. 7).

**2-wire Receptacles — (Grounded Outlet Box)**

5.04 Where it is known that a building is wired with metallic conduit, armored cable, or nonmetallic sheath cable with a grounding conductor, the outlet boxes may be grounded. Under these conditions and only after it has been found that the boxes are grounded, the grounding pigtail terminal on the adapter or plug may be fastened under the coverplate screw of the receptacle. (See Fig. 8.)

5.05 In grounding to a 2-conductor receptacle (Fig. 8), connect pigtail to coverplate screw before inserting adapter into the receptacle.

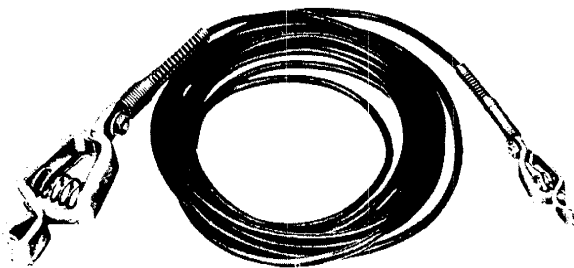


Fig. 6 — B Grounding Cord

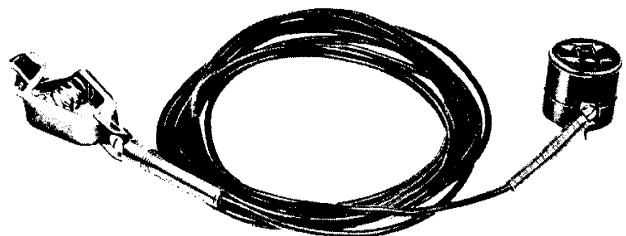
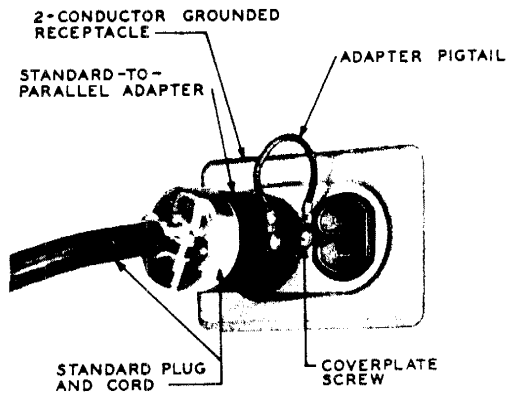
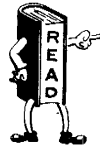


Fig. 7 — C Grounding Cord



**Fig. 8 — Grounded 2-conductor Receptacle**



*If grounding cannot be accomplished as outlined in this section, the electric tool must not be operated. Nonelectric tools should be used to complete the job.*



## INSULATING GLOVES

### LEATHER PROTECTORS, FABRIC LINERS AND GLOVE BAG

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**1. GENERAL**

**1.01** This section covers the description, care and maintenance of insulating gloves provided for the protection of workmen against electric shock, and the precautions to be followed in their use. Information on Leather Protector Gloves, Fabric Liner Gloves and the B Glove Bag is also included.

**1.02** This section has been reissued to include the D and E Insulating Gloves.

**2. TYPES OF INSULATING GLOVES**

**2.01** All types of insulating gloves are of the gauntlet type and are made in four sizes: 9-1/2, 10, 11, and 12. The size indicates the approximate number of inches around the glove, measured midway between the thumb and finger crotches. The length of each glove, measured from the tip of the second finger to the outer edge of the gauntlet, is approximately 14 inches (Fig. 1).

**2.02** *Insulating Gloves*, are thick enough to eliminate the need for protector gloves and are intended for use without them. These Gloves have been superseded by the D Insulating Gloves.

**2.03** *B Insulating Gloves*, have been superseded by C and E Insulating Gloves, but will continue to be used until the supply has been exhausted. Protector gloves are required to be worn over these gloves to prevent mechanical damage.

**2.04** *C Insulating Gloves*, formerly called C Rubber Gloves, are the same as B Insulating Gloves except that they are made of rubber of minimum thickness, consistent with desired dielectric strength, to permit maximum flexibility. Leather protector gloves are required to be worn over these gloves to prevent mechanical damage. These Gloves have been superseded by the E Insulating Gloves.

**2.05** *D Insulating Gloves*, while electrically identical to the Insulating Gloves which they supersede, are made of two plies of rubber: the outer ply black and the inner ply red. This change provides a more positive basis for determining the physical condition of the gloves. D Insulating Gloves are of sufficient thickness to eliminate the need for protector gloves. They are primarily intended for central office use.

**2.06** *E Insulating Gloves*, while electrically identical to the B and C Insulating Gloves

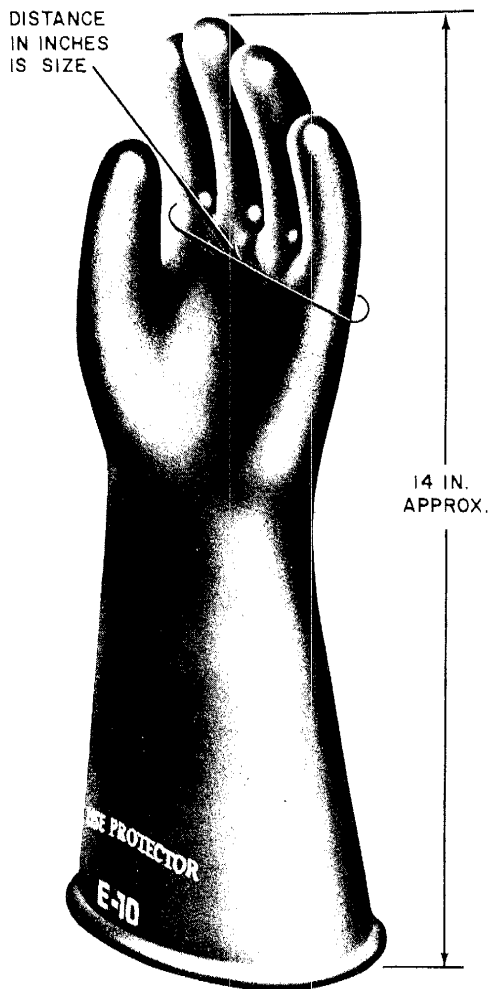


Fig. 1—E Insulating Glove

which they supersede, are made of two plies of rubber: the outer ply black and the inner ply red. These lightweight gloves must be used only with protector gloves and are intended for outside plant use. ♦

**3. LEATHER PROTECTOR GLOVES**

**3.01** B or C Leather Protector Gloves shall always be worn over B, C, or E Insulating Gloves to prevent mechanical damage to the insulating gloves. Leather protector gloves do not provide protection from electrical shock by themselves and shall never be worn except over insulating gloves. Neither shall they be worn as a substitute for work gloves.

**3.02** B and C Leather Protector Gloves are of the gauntlet type. The over-all length is about 13 inches and the cuff is about 4-1/2 inches wide. Fig. 2, a C Leather Protector Glove, illustrates these dimensions.

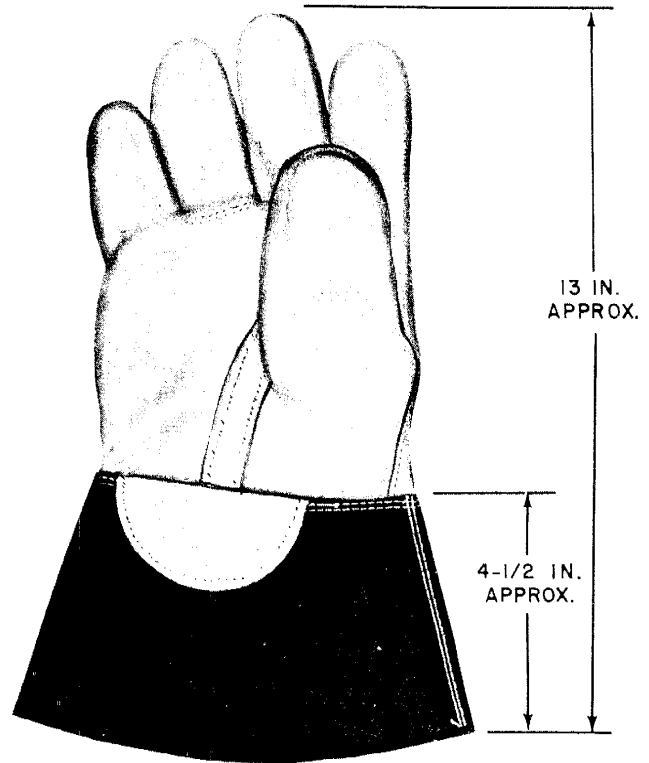


Fig. 2—Leather Protector Glove

**3.03** *B Leather Protector Gloves* are made of 3 to 3-1/2 ounce horsehide with inseam construction (seams sewn inside at the back of the fingers and thumb). They are available in two sizes. Size 11 is for use over sizes 9-1/2 and 10, B, C, or E Insulating Gloves. Size 12 is for use over sizes 11 and 12, B, C, or E Insulating Gloves.

**3.04** *C Leather Protector Gloves* are made of deerskin using the moccasin style outseam construction (seams sewn outside at back of the fingers and thumb). These gloves are somewhat more flexible and less bulky than the B type and are available in four sizes for use over B, C, or E Insulating Gloves of similar size designations.

**3.05** Leather protector gloves shall be given reasonable care in their use. Oil, grease,

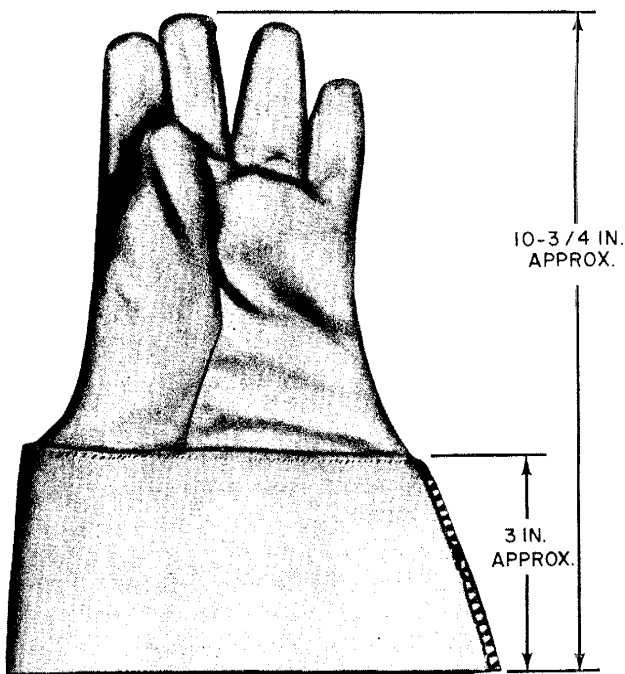


paint, etc, on the palm and finger surfaces of the gloves will impair their usefulness for work operations. Such foreign matter should be immediately wiped off the gloves with a soft, dry cloth.

**3.06** Inspect leather protector gloves before and after using them. Remove all foreign particles imbedded in the surface, especially splinters of wood or metal, since they may damage the insulating gloves.

#### 4. C FABRIC LINER GLOVES

**4.01** C Fabric Liner Gloves are formfitting gloves made of lightweight interlock knit cotton cloth. They are equipped with 3-inch wide rubberized fabric gauntlets. The over-all length of the gloves is about 10-3/4 inches (Fig. 3).



**Fig. 3—Fabric Liner Glove**

**4.02** C Fabric Liner Gloves are available in size 7 for insulating glove sizes 9-1/2 and 10, and in size 8 for insulating glove sizes 11 and 12.

**4.03** C Fabric Liner Gloves may be worn inside all types of insulating gloves for warmth in

cold weather and for absorbing perspiration in warm weather.

#### 5. B GLOVE BAG

**5.01** The B Glove Bag is provided for carrying and storing insulating gloves and associated leather protector and fabric liner gloves.

**5.02** The B Glove Bag, Fig. 4, is made of cotton duck with a liner of polyethylene. A zipper is provided for opening the top of the bag. A web strap, terminated in a snap hook and a Dee ring and reinforced with leather at the point of maximum wear, is provided for suspending the bag from the body belt.

**5.03** Dead air space is provided within the bag by the polyethylene liner and by the use of a zipper instead of a flap closure. The bag should be tightly zippered when gloves are stored in them. This is essential to minimize ozone deterioration of the insulating glove while in storage.

#### 6. PRECAUTIONS

**6.01** Except in emergencies such as to prevent serious injury or loss of life, telephone employees shall not handle electric light, power wires, or associated switches, and shall, therefore, arrange to have the necessary work required on these circuits performed by properly qualified employees of the electric company. Similarly, telephone employees shall not handle telephone wires that are known or suspected to be energized until the contact conditions have been cleared by the electric company.

**6.02** In general, conditions under which insulating gloves should be worn are covered in the Bell System Practices on various field operations. However, on account of the complicated nature of the conditions encountered under which insulated gloves should be worn, it is impractical to provide a complete set of rules covering all of the specific cases in which they shall be used. Therefore, where workmen must handle wires or other objects on which there is any probability of an abnormal voltage being introduced, insulating gloves shall be worn. Workmen wearing insulating gloves must avoid body contact with wires, poles, vehicles, and any other objects which might be energized.

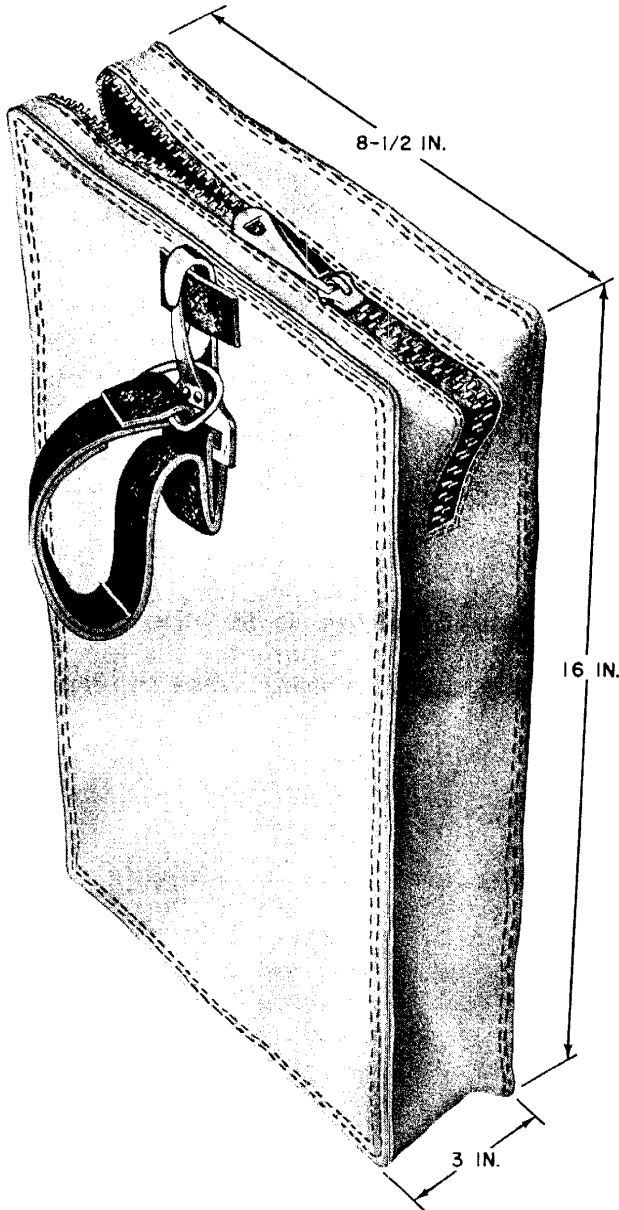


Fig. 4—B Glove Bag

**6.03** Insulating gloves are inspected and subjected to an electrical test to ensure their insulating value when purchased from the manufacturer and periodically thereafter under the company's established routine. *Workmen and storekeepers shall see that insulating gloves are returned for periodic electrical tests in accordance with the company's established routine.*

**6.04** Insulating gloves shall be inspected and tested in accordance with Parts 7 and 8 of this section.

**6.05** Insulating gloves shall never be worn inside out as this stresses the curved portions of the gloves. Attack by ozone is more pronounced at points where rubber is stressed. Therefore, these points would be more susceptible to deterioration.

## 7. INSPECTION OF INSULATING GLOVES

**7.01** Each employee shall at all times assume the responsibility for determining that his insulating gloves are in good condition. He shall see that their appearance indicates neither deterioration nor injury from an electrical or a mechanical standpoint. He shall see that they are being used within the specified electrical test period as indicated by the "Return for Test" date stamped on the back side of the gauntlet.

**7.02** Each employee shall inspect his insulating gloves in accordance with Part 7 and 8 as follows:

- (a) At the time he receives the gloves
- (b) Each time before using them
- (c) Each time after using them
- (d) A minimum of once each month

**7.03** The supervisor shall inspect the insulating gloves periodically and shall see that all instructions are followed.

**7.04** A visual inspection of insulating gloves shall be made to determine their condition. If any of the following conditions are found to exist or if the condition of the gloves is such that there is any doubt as to their safety, they shall be exchanged at once for a pair in good condition in accordance with the locally established routine. Inspections under (a) and (b) shall be made on both the inner and outer surfaces of the insulating gloves.

- (a) Cracks, cuts, or nicks that would tend to cause the glove to tear. Such injuries within

one inch of the open end of the gauntlet may be disregarded if of a minor nature.

(b) Deterioration or ozone cracking. This is caused by a reaction between the gloves and ozone in the atmosphere. This reaction causes fine surface cracks in the glove and these are best detected by rolling the surface to be inspected between the thumb and forefinger. Such cracking within one inch of the open end of the gauntlet may be disregarded if of a minor nature.

(c) Glove worn sufficiently to affect its mechanical strength. This is best detected by stretching the glove. Grasp gauntlet end of glove with one hand and pull on each finger of glove with the other hand. Pull glove by grasping at both sides. Pull between fingers of glove. Worn spots will be indicated by undue stretching or, in severe cases, by tearing of the glove.

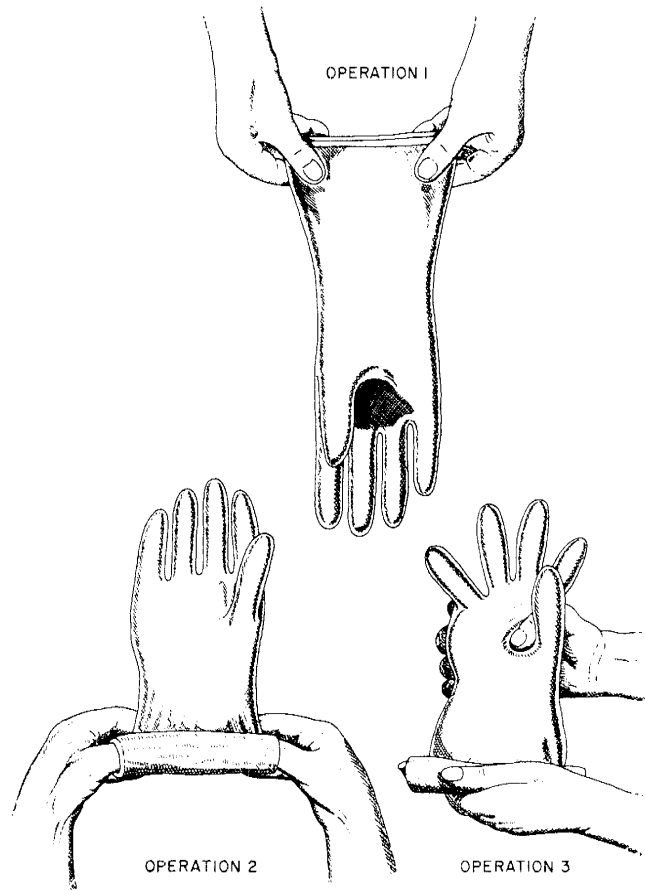
(d) Date (imprint of a rubber stamp) of next periodic electrical test to determine that the specified date has not been passed.

**7.05** When performing the above tests with the two color D or E Insulating Gloves, the appearance of one color showing through the other means that the glove is defective and not safe to use. It shall be discarded in accordance with local routine.

## 8. AIR TEST OF INSULATING GLOVES

**8.01** This test shall be made on insulating gloves only when the conditions listed under 7.04 are satisfactory. Make this test as follows: (See Fig. 5.)

- Hold the glove at each side of the edge of the gauntlet.
- Revolve it about the edge of the gauntlet as an axis, thus rolling it toward the palm and confining the air in the palm and fingers.
- Hold the rolled-up gauntlet tightly in one hand.
- Squeeze the palm of the glove with the other hand to put the confined air under pressure.



**Fig. 5—Air Test Operations 1-2-3**

**8.02** If any puncture exists, it will be indicated by escaping air and the hole in the glove should be evident.

**8.03** If a puncture is found or if the condition of the gloves is such that there is any doubt as to their safety, they shall be exchanged at once for a pair in good condition in accordance with the company's established routine.

## 9. CLEANING OF INSULATING GLOVES

**9.01** Insulating gloves shall be cleaned when they become wet from perspiration or when the gloves are subjected to contact with dirt, mud, paint, creosote, or other foreign matter. Perspiration, mud, dirt, and other foreign matter that does not adhere firmly to the glove shall be removed with clear water. Paint and creosote shall be removed as soon as practical, as some oils, if allowed to remain on the glove, will have an injurious effect.

## SECTION 081-710-200

**9.02** The following method has been found satisfactory for removing paint or creosote from the glove:

- (a) Wipe off gloves with a dry cloth to remove as much wet paint or creosote as practical.
- (b) Clean the entire glove thoroughly with a cloth moistened with KS-14356 Cleaner (dry cleaning fluid), KS-7860 Petroleum Spirits, or KS-19578 L1 Cleaner (Trichloroethane). Do not use an excessive amount of the cleaning fluid and do not wipe over "Return for Test" date. ***This cleaning shall be done in a well-ventilated location, as these materials are either flammable or their vapors constitute a health hazard. As soon as each glove has been cleaned, it should be wiped thoroughly dry with a dry, clean cloth. Do not use gasoline.*** Gasoline has a very low flash point and hence its use presents a much more serious fire hazard than does the use of the cleaning fluid or petroleum spirits, which have a much higher flash point. KS-19578 L1 Cleaner is nonexplosive.

**9.03** After insulating gloves are used, they should be thoroughly dried so the moisture from the hands will not become entrapped and cause the glove to deteriorate. Each time after use, gloves should be turned inside out and placed flat to dry. After the gloves have been dried, they shall be turned right side out and placed in the containers ready for use.

### 10. STORAGE

**10.01** Fabric liner gloves and leather protector gloves, where required, shall be stored with the insulating gloves so that they are available for use. Each of these gloves shall be dry before being stored.

**10.02** Fabric liner gloves and leather protector gloves shall be separated from the insulating gloves before being stored.

**10.03** Insulating gloves deteriorate even when not in use. This deterioration is caused by ozone in the atmosphere reacting with the glove material to produce fine surface cracks. Ozone deterioration will be materially reduced if the gloves are laid out flat without bends or folds, right side out, and protected from light, from edged tools, and from pressure due to heavy objects. Do not

store insulating gloves in unventilated rooms containing ozone-producing apparatus or equipment such as commutator-type electric motors and generators. Never place insulating gloves near steam pipes, radiators, or in places where they will be subject to heat, as heat will impair the strength of the glove material. For maximum protection of the gloves, one of the following methods of storage shall be employed:

(a) On motor vehicles, insulating gloves and associated leather protector and fabric liner gloves shall be kept in the glove bag, tightly zippered and stored in locations suitable for that purpose.

(b) With tool bags, insulating gloves and associated leather protector and fabric liner gloves shall be kept tightly zippered in the glove bag, which should be attached to the tool bag.

**Note:** Care should be taken to attach the glove bag so it will be flat against that side of the tool bag which is away from the body when the tool bag is carried in the usual way.

(c) When kept in cable splicing trailers, insulating gloves and associated leather protector and fabric liner gloves shall be kept in the glove bag, tightly zippered and stored to avoid contact with edged tools and pressure from heavy objects.

(d) When the insulating gloves and associated leather protector and fabric liner gloves are being carried for use intermittently they shall be kept tightly zippered in the glove bag, attached to the body belt.

(e) If they are stored in lockers, desks, or offices, insulating gloves shall be kept in the chipboard container in which they are supplied by the manufacturer, or in which they are returned from the routine electrical test. This container affords reasonable protection against ozone deterioration because of restricted air circulation and the fact that a reaction between ozone and cellulose decomposes the former into a less active oxygen.

**11. DISPOSITION OF INSULATING GLOVES REQUIRING ELECTRICAL TEST**

**11.01** Storekeepers are responsible for insulating gloves in the storerooms and workmen are responsible for insulating gloves which they have in the field. The dates of return for tests are stamped upon the backs of the gloves and in the space on the boxes provided for that purpose.

**11.02** Workmen shall see that gloves in the field are returned to the storeroom or office prior to the "Return for Test" date. Replacement gloves shall be available before returning the gloves to be tested.

**11.03** Storekeepers shall see that all gloves in their possession are returned for inspection on the dates indicated to the Western Electric

Branch House or other authorized inspection agency. If, however, gloves are held beyond this date, they shall not be used or issued until retested.

**11.04** All insulating gloves, before being returned to the Western Electric Company or other authorized agent, shall be given a careful inspection in accordance with Part 7 and a careful test in accordance with Part 8. Gloves with obvious defects shall be junked in accordance with Part 12.

**12. DISPOSITION OF DEFECTIVE INSULATING GLOVES**

**12.01** Gloves with obvious defects should have the front cut open from the fingers to the top of the gauntlet and should be disposed of as junk in accordance with the locally established routine.



## LEATHER BODY BELTS

### DESCRIPTION AND MAINTENANCE

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**1. GENERAL**

**1.01** This section covers the description, maintenance, and inspection of B Body Belts and Cushion Body Belts. It also covers the safety precautions to be observed when using these body belts.

**1.02** This section is issued to consolidate the information previously contained in Sections 081-720-010, 081-720-011, 081-720-105, 081-720-305, and 081-720-600 which are canceled.

**1.03** The use and care of leather safety straps are covered in Section 081-720-200.

**1.04** Fabric body belts and safety straps are covered in Section 081-721-101.

**1.05** Tool holsters used in conjunction with body belts are covered in Section 081-720-111.

**2. PRECAUTIONS**

- 2.01** Body belts and safety straps must be worn when working aloft on:
- (a) Poles (including stepped poles)
  - (b) Ladders placed on suspension strand
  - (c) Truck ladder platforms
  - (d) Ladder platforms
  - (e) Aerial platforms
  - (f) Pole platforms
  - (g) Aerial lift baskets
  - (h) Cable car.

**2.02** When climbing or working aloft, never fasten an uncoiled handline directly to a belt or to tools hanging from a belt. Use either the B Handline Carrier (Section 081-720-111) or the method described in 2.03. Both of these methods allow the handline to pull free of the workman if it is caught on an obstruction or by a passing vehicle.

**2.03** If the body belt is not equipped with a B Handline Carrier, an uncoiled handline can be safely carried aloft by forming the free end of the line into a bight and tucking the bight under the body belt.

**2.04** Never punch extra holes in a body belt. If a belt does not fit properly, replace it with one of the correct size.

**2.05** *Never use the D-rings of a body belt for anything other than their intended purpose, engaging the snap hooks of the safety strap. Foreign objects attached to D-rings may*

*prevent proper engagement of the snap hooks or give the wearer a false indication of snap hook engagement.*

**2.06** Do not rely upon the feel or sound of a snap hook engaging. Always check visually for proper engagement of both snap hooks.

**2.07** Do not use a body belt as a pike pole support when piking poles.

**2.08** Body belts should never be stored with edged tools. When body belts, safety straps, and climbers are kept in the same container, the climbers should be fitted with gaff guards to prevent damage to the leather by the climber gaffs.

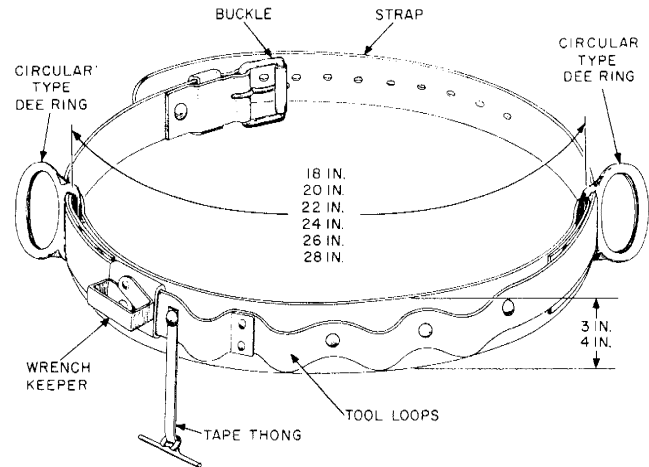
**2.09** Never place or store body belts near sources of extreme heat such as:

- (a) Steam pipes
- (b) Radiators
- (c) Heaters
- (d) Solder pots
- (e) Soldering coppers
- (f) Furnaces.

### 3. DESCRIPTION

#### B BODY BELT

**3.01** The B Body Belt (Fig. 1) is made of harness leather and is equipped with drop-forged, circular-type D-rings and buckle, a metal wrench keeper, a tape thong, and leather tool loops. The portion of the strap between the D-ring and the tool loop which is farthest from the wrench keeper will accommodate the holster. The belt is furnished in both a 3-inch and 4-inch width in six sizes ranging from 18 to 28 inches in 2-inch increments. The B Body Belt may be used as either a right-hand or left-hand belt as described in 3.04. Sizes are designated by a three-digit number such as 318 for a 3-inch wide belt in size 18. The size of the belt is the distance between D-rings measured in inches as shown in Fig. 1. The weight of the belt ranges from about 2-1/2 pounds for size 318 to about 3-1/4 pounds for size 428.



**Fig. 1—B Body Belt (Right)**

**3.02** The circular-type D-ring minimizes the possibility of the safety strap snap hook riding back to the body belt, twisting, and bringing pressure to bear on the snap hook keeper. This feature appreciably reduces the possibility of accidental disengagement of the snap hook.

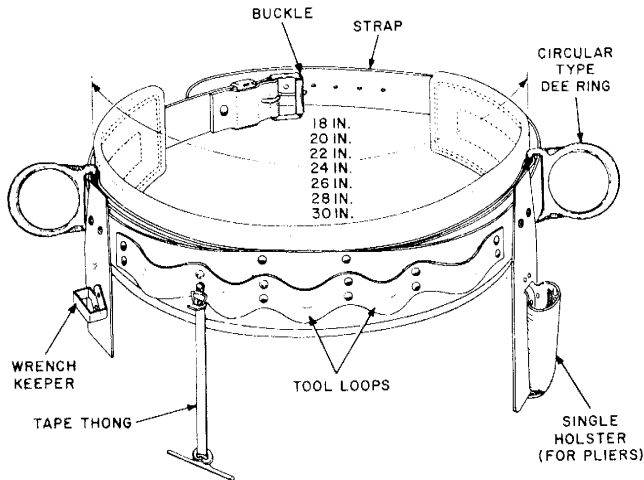
**3.03** The B Body Belt equipped with the former standard D-rings is no longer supplied. However the use, care, and maintenance of these belts still in use in the field are the same as covered in Part 4 of this section.

**3.04** Fig. 1 shows a RIGHT B Body Belt as supplied. The belt can be made into a LEFT belt by swinging the tape thong through 180 degrees on its rivet and inverting the belt so that the belt buckle is to the wearer's right. In such case, if an offset double holster is used, it should be the LEFT type.

#### CUSHION BODY BELT

**3.05** The Cushion Body Belt (Fig. 2) is intended for the use of workmen who require a cushion-type belt. The Cushion Body Belt is made of leather and is equipped with drop-forged, circular-type D-rings and buckle, a metal wrench keeper, a tool holster, a tape thong, and leather tool loops. The 5-inch wide body section is made of a single piece of leather, folded to form a cushion with rolled edges and no exposed inside rivets. The D-ring strap is free to slide over a range of about 4 inches. The belt is always put on with the





**Fig. 2—Cushion Body Belt**

buckle toward the wearer's left. Belts are furnished either as RIGHT or LEFT belts. A RIGHT belt is shown in Fig. 2. In a LEFT belt, the positions of the holster and wrench keeper are reversed. Belts are furnished equipped with either a single holster (for pliers) or an offset double holster with scissors pocket (for pliers, rule, and scissors). Screw-type rivets are used for fastening the holster and wrench keeper to the buckle strap, thus permitting replacement of these attachments as well as conversion of belts from RIGHT to LEFT and vice versa.

**3.06** The Cushion Body Belt equipped with the former standard D-rings is no longer supplied. However the use, care, and maintenance of these belts still in use in the field are the same as covered in Part 4 of this section.

**3.07** The Cushion Body Belt is available in seven sizes designated D-18, D-20, D-22, D-24, D-26, D-28, and D-30. The size of the belt is the distance between D-rings measured in inches as shown in Fig. 1. The weight of the belt ranges from about 4-1/2 pounds for the D-18 size to about 6 pounds for the D-30 size.

## 4. MAINTENANCE

### CLEANING

**4.01** Leather body belts should be cleaned and dressed at three-month intervals or more often if the belt has frequently been wet from

rain or perspiration, or has been in contact with wet paint.

**4.02** Paint ingredients have a harmful effect on leather. Therefore wet paint must be promptly removed from body belts with a dry cloth.

**4.03** Creosote is not harmful to leather but to avoid clothing stains, it should be removed from the body belt as soon as possible.

**4.04** Leather body belts may be cleaned as follows:

- (a) Remove surface dirt with a sponge dampened, but not wet, with water. Do not use gasoline or petroleum products because they will cause the leather to become dry.
- (b) Rinse the sponge in clear water and squeeze partly dry. Work up a thick lather using a neutral soap, such as castile or white toilet soap (free from alkali).
- (c) Thoroughly wash the entire length of the belt with the lathered sponge to remove embedded dirt and perspiration, and wipe with a cloth to remove excessive moisture.
- (d) Repeat (b) using a good grade of saddle soap.
- (e) Work the saddle soap lather well into all parts of the belt and place it in the shade to dry.
- (f) When the leather has practically dried, rub vigorously with a soft cloth.

### OILING

**4.05** Treating the leather in body belts with saddle soap (4.04) will normally keep the belt soft and pliable. However, to keep the leather from drying out and becoming brittle, leather body belts should be oiled approximately every six months as follows:

- (a) Clean the leather with a neutral soap as described in 4.04, (a), (b), and (c). Oil applied to dry or dirty leather has a harmful effect on the leather.

## SECTION 081-720-101

(b) While the leather is still damp, use on each belt about 1/4 ounce (two teaspoonsful) of neat's-foot oil and apply the oil gradually with the hands using long light strokes to work it into the leather. A light, even distribution of the oil is desired.

(c) After oiling, the belt should be set aside in a dry shady place for about 24 hours in order to permit the leather to dry slowly. Then rub vigorously with a soft cloth to remove excess oil.

**Note:** Do not use mineral oils or greases such as machine oil or vaseline. Leather should never look or feel greasy as this is an indication that too much oil is being used. Leather with too much oil will stretch and is likely to pick up sand or grit which may injure the leather.

### STORING

**4.06** Leather body belts not in use should be treated as follows:

(a) If a body belt is received with insufficient oil, it should be oiled as described in 4.05.

(b) When not in use body belts should be oiled at least once every six months. The belt should be oiled three months after it has been received for stock and at intervals not longer than six months thereafter as long as it remains in stock.

(c) Never store or place body belts near radiators, stoves, steam pipes, or in places where the leather would be subjected to excessive heat or dampness. Either of these conditions is likely to impair the strength of the leather. Belts that have become wet should be oiled and then set aside in a dry, shady place and allowed to dry slowly.

### 5. INSPECTION

**5.01** Each workman must be responsible for the condition of his body belt. Body belts should be inspected upon receipt and at least once a week thereafter to ensure that the belt is in a safe condition.

**5.02** Supervisors should make periodic inspections of body belts to make certain the belts are being properly maintained and are in safe condition.

**5.03** Body belts that do not pass either the visual inspection (5.04) or the bending test (5.05) must be exchanged at once for a belt in good condition. ***If there is any doubt whatsoever of the safe condition of a body belt, it should be removed from service.***

### VISUAL INSPECTION

**5.04** If any of the following conditions exist, a belt must be replaced in accordance with 5.03:

(a) Broken steel reinforcement plates holding D-rings.

(b) Leather of loop over reinforcing plates worn or crushed by the D-ring at the edges sufficiently to affect its strength or to cause the leather to tear.

(c) Loose or broken rivets (particularly those in the loops holding the D-rings).

(d) Broken or rotted threads in the stitching of the loops holding the D-rings.

(e) Cracks, cuts, etc, that would tend to cause the leather to tear or would be likely to affect the strength of the belt.

(f) Leather hard and dry. (If the leather requires only oil, it should be treated as outlined in 4.05.)

(g) Broken wrench keeper.

(h) Broken or defective buckle.

(i) Burnt leather. (See Note.)

**Note:** Visual indications that a body belt has been subjected to excessive heat are: burn marks, hard spots, crystallized or brittle leather, a curved set to the belt, or an indistinct portion of the ironed crease along the belt edge.

**BENDING TEST**

**5.05** The bending test should be made on body belts only when the leather is clean and well oiled. The leather should show no cracks other than slight surface cracks when the test is applied. If well defined cracks appear, the belt must not be used, but should be taken out of service. The test should not be made if the temperature of the leather is below 32°F since at low temperatures the leather may be damaged by bending it around the test mandrel. The bending test should be made as follows:

(a) Leather should be bent with the grain (smooth) side out, over a mandrel that is not less than 3/4 inch in diameter. (A 3/4-inch guy rod may be used.) In making this test, pull the leather taut, and wrap it halfway around the mandrel, keeping the leather under tension while the bend is being made. This procedure brings the leather into firm contact with the mandrel while the bend is being made, and thus avoids bending the leather too sharply. ***Do not loop the leather first and then pull it over the mandrel. Do not make the bend test at a buckle hole.***

(b) Body belts shall be subjected to the bending test at points where it is possible to bend them, such as under the leather tool loops and at the tongue strap.

**5.06** If leather of the thickness used in Bell System standard body belts is subjected to an excessively severe test, such as bending it too sharply (without a mandrel or over too small a mandrel) with the grain side out, even good leather may crack because of the excessive strain placed on the grain layer.

**6. FITTING BODY BELTS**

**6.01** The degree of comfort and satisfactory service a workman obtains from a body belt depends to a large extent on the location of the D-rings with respect to the prominent portions of the hip bones. Most workmen prefer to have the D-rings located slightly in front of the prominent portions of the hip bones. To obtain a properly fitting belt, measure the distance across the back to the desired locations of the D-rings and order a belt of the size that comes nearest to this dimension.



## FABRIC BODY BELTS AND SAFETY STRAPS

### DESCRIPTION AND USE

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#### 1. GENERAL

**1.01** This section describes the standard fabric body belts and safety straps and covers instructions and precautions pertaining to their use and care.

**1.02** This section is issued to include information on the D, E, and F Body Belts and to consolidate information relating to fabric body belts and safety straps. The following practices are replaced by this section:

SECTION	TITLE
081-721-011	C Body Belt—Description
081-721-200	Fabric Safety Straps—Use
081-721-300	Nylon Body Belts—Inspection and Maintenance

**1.03** The degree of comfort and satisfactory service a workman obtains from a body belt depends to a large extent on the locations of the Dee rings with respect to the prominent portions of the hip bones. The Dee rings should be slightly in front of the prominent portions of the hip bones. To obtain a properly fitting belt, measure the distance across the back to the desired locations of the Dee rings and order a belt of the size that comes nearest to this dimension. Body belt sizes are in inches

and are determined by measuring the distance between Dee rings with the belt lying flat.

**1.04** Information on tool holsters and the handline carrier for use with body belt is given in Section 081-720-111.

#### 2. DESCRIPTION

##### C BODY BELT

**2.01** The C Body Belt is a lightweight belt intended primarily for use by workmen who have only occasional need for a belt.

**2.02** The C Body Belt is equipped with drop forged circular type Dee rings and buckle, and three or four tool loops depending on belt size. The 3-inch wide body section of the belt is made of three-ply neoprene impregnated nylon cloth and the buckle strap and tool loops of four-ply neoprene impregnated nylon cloth. The belt is furnished in four sizes designated 20, 22, 24, and 26. The belt weighs about 1-3/4 pounds for the sizes 20 through 24 and about 2 pounds for size 26.

**2.03** Fig. 1 shows a C Body Belt as a "Left" belt. To be worn as a "Right" belt, the belt is turned over so that the belt buckle is on the left side of the wearer. When ordering combination holsters for use with the belt, specify either "Left" or "Right" type.

##### D BODY BELT

**2.04** The D Body Belt includes a six-ply neoprene impregnated nylon fabric strap and buckle section that is permanently riveted to a 4-1/2 inch three-ply, neoprene impregnated nylon backing which incorporates two standard Dee rings. The backing is cushioned with chrome tanned leather for the comfort of the wearer. Leather tool loops, a wrench keeper, a tape thong, and accommodations for a combination holster are provided.

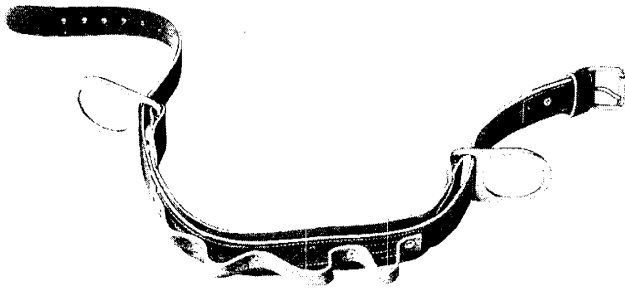


Fig. 1—C Body Belt

2.05 The six-ply strap has adequate strength to permit the wearer to secure himself with a safety strap attached to only one Dee ring. The D Body Belt is available as a "Left" or "Right" belt in sizes 18, 20, 22, 24, 26, and 28. The D Body Belt (Right) is illustrated in Fig. 2.

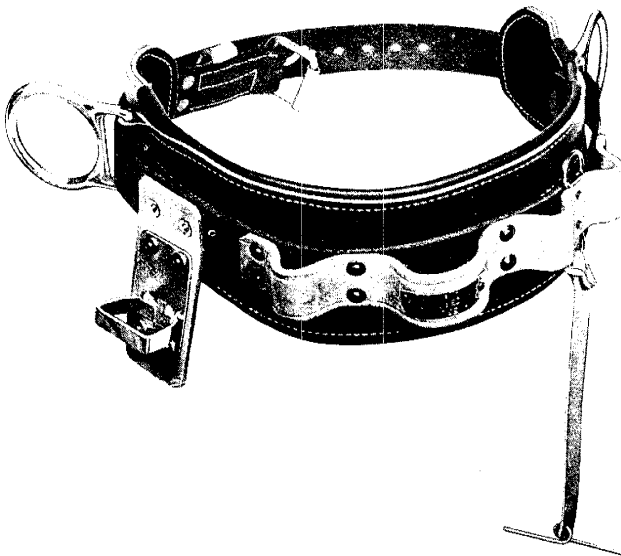


Fig. 2—D Body Belt

**E BODY BELT**

2.06 The E Body Belt is identical to the D Body Belt except that it is equipped with four

small Dee rings for use with suspenders or waist belt. The E Body Belt is illustrated in Fig. 3.



Fig. 3—E Body Belt

**F BODY BELT**

2.07 The F Body Belt is identical to the C Body Belt except that the strap portion is of six-ply construction, instead of four-ply construction, which provides adequate strength to permit the wearer to secure himself with a safety strap attached to only one Dee ring. The F Body Belt is illustrated in Fig. 4.

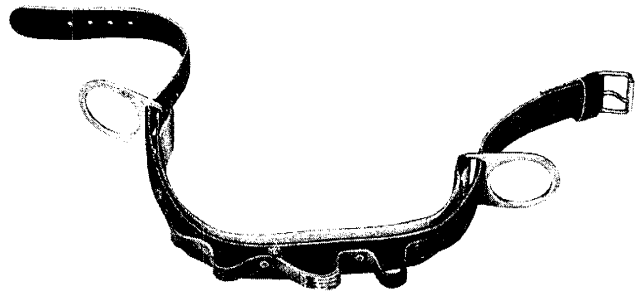


Fig. 4—F Body Belt

**D SAFETY STRAP**

**2.08** The D Safety Strap is a six-ply neoprene impregnated, nylon fabric strap. The center plies are of a contrasting color (red) from that of the outer plies. Exposure of the center plies by wear indicates that the strap should be removed from service.

**2.09** The D Strap (Fig. 5) is available in one size only. It is adjustable in length in increments of 1-1/2" from 36" to 61-1/2".

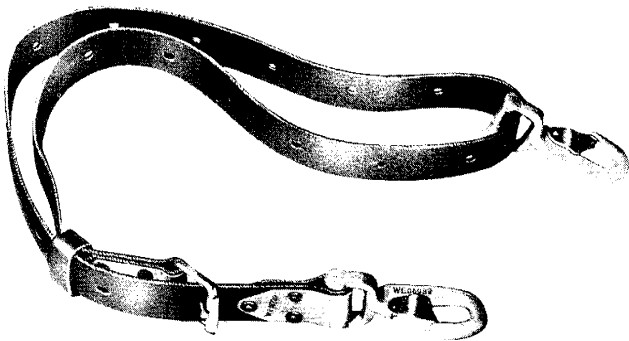


Fig. 5—D Safety Strap

**3. PRECAUTIONS**

**3.01** The safety strap, when in use, should be as short as practicable to minimize the potential falling distance.

**3.02** Before climbing a pole, see that the tongue of the buckle is properly seated in the desired hole in the safety strap.

**3.03** Do not allow a fabric body belt or safety strap to be run over by trucks, trailers, reels, or other heavy equipment or be subjected to damage caused by heavy objects falling or being dropped on the body belt or safety strap.

**3.04** *Never attach two or more safety straps together for additional length.* If one safety strap cannot be lengthened sufficiently, the method of doing the work shall be changed. If tree pruning operations are involved, only a rope sling shall be used.

**3.05** Do not use the body belt to assist in piking poles. If the pike pole should slip down between the belt and workman's body, serious injury could result.

**3.06** A workman may improve his security by placing the strap around the pole at a point directly above a crossarm, strand, pole step, or other secure attachment which is to remain in place while he is on the pole, provided the attachment is one foot or more from the top of the pole. Do not place a strap around an insulator pin, a bolt, or other insecure attachment.

**3.07** Never use electric light, power, or foreign signal circuit attachments as supports for the safety strap.

**3.08** Where either the snap hook or buckle of the safety strap is likely to contact the cable sheath, provision should be made to protect the sheath from damage. This protection may be provided by slipping a B Cable Guard over the cable or by wrapping the cable with muslin or friction tape at the place of contact.

**3.09** *See that the snap hook and Dee ring are properly engaged. Do not rely on feel or on the click of the keeper* in the snap hook when attaching a safety strap as an indication that the fastening is secure. The workman shall **look** and **know** that the snap hook is properly engaged before placing his weight on the strap. Always have keeper of snap hook on safety strap away from the body when engaged in the Dee ring.

**3.10** Never place or carry tools or materials in the Dee rings of the body belt. These items should be carried in holsters or other approved carriers. Foreign materials in Dee rings may prevent proper engagement of the snap hooks or give false indication of snap hook engagement.

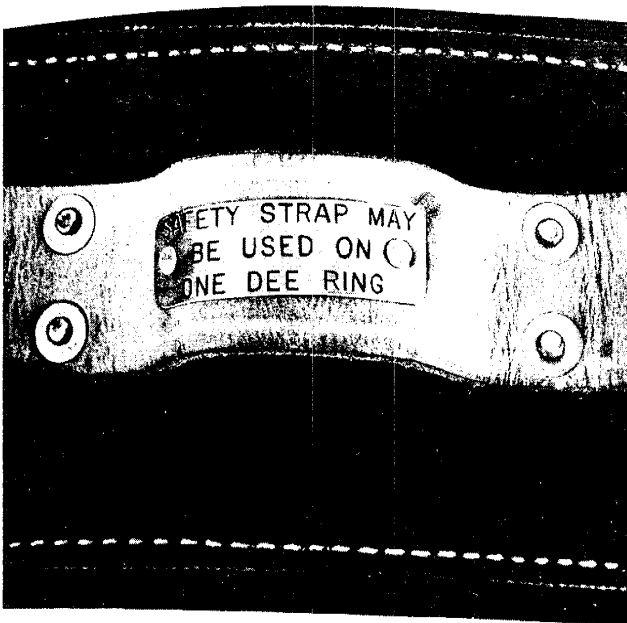
**3.11** When climbing or working on a pole, do not fasten an uncoiled handline directly to the body belt or to tools carried in the belt. With the handline fastened to the belt, the workman could be pulled off the pole if the handline should be caught either on an obstruction or a passing vehicle. To allow the handline to pull free of the

## SECTION 081-721-101

belt if it should be caught, use one of the following methods to carry or support a handline aloft:

- (1) Form the end of the handline into a loop and place the loop in the handline carrier.
- (2) Form the end of the handline into a bight and tuck the bight up under the body belt.

**3.12** *A workman shall never secure himself with a safety strap that is placed around a pole, strand, or other support in such a manner that both snap hooks are engaged in the same Dee ring of the body belt except in specific instances covered in this practice and then only when using the D, E, or F Body Belts. The D, E, and F belts may be readily identified by a metal instruction plate as shown in Fig. 6.*



**Fig. 6—Instruction Plate for D, E, and F Body Belts**

**3.13** The following are additional precautions:

- (a) Exercise care when working aloft so the keeper of the snap hook is not depressed accidentally by contact with wires, strand, crossarm braces, guys, and other attachments, or by crossarms, guard arms, cable cars, etc. that may be supported on the safety strap in the course of performing certain work operations.

- (b) A safety strap should never be used as a means of riding suspension strand.
- (c) Never use an improvised substitute of rope, wire, etc. for a safety strap or body belt.
- (d) Do not punch extra holes in a safety strap.
- (e) While wearing a safety strap which is not in use, both ends of the safety strap should be snapped into the same Dee ring. Care should be exercised to see that the safety strap does not catch on pole steps, and other attachments when climbing poles.
- (f) When climbing past another workman who has his safety strap in place around the pole, exercise care to avoid dragging the climber gaffs over his strap.
- (g) Avoid swinging rapidly around a pole in a safety strap.
- (h) Do not throw or drop a safety strap or body belt.
- (i) Exercise care to prevent damage to a safety strap and body belt from heat by contact with, or placing it near, a furnace, pot of hot solder, torch, or hot soldering copper.
- (j) Do not stand near a fire while wearing a safety strap or body belt.

**3.14** The following precautions should be observed when storing the safety strap and body belt when not in use:

- (a) Keep strap and belt away from radiators, stoves, steam pipes, fires, and other places where the fabric would be subjected to excessive heat.
- (b) A damp or wet strap or belt should not be packed in a locker, box, tool case, grip, or other container until it has been wiped with a dry cloth and allowed to dry completely by ventilation.
- (c) Straps and belts should never be stored with tools unless such tools are equipped with



satisfactory guards. When body belts, safety straps, and climbers are kept in the same container, the climbers should be fitted with gaff guards to avoid cutting or puncturing the strap or belt with the climber gaffs.

- (d) Store straps and belt in a location free from excessive humidity to prevent mildew.

#### 4. USE

**4.01** A man working on a pole shall secure himself with a body belt and safety strap. To accomplish this, attach one snap hook to a Dee ring and pass the free end of the safety strap around the pole. The strap should be flat against the pole without turns or twists. Engage the snap hook in the other Dee ring.

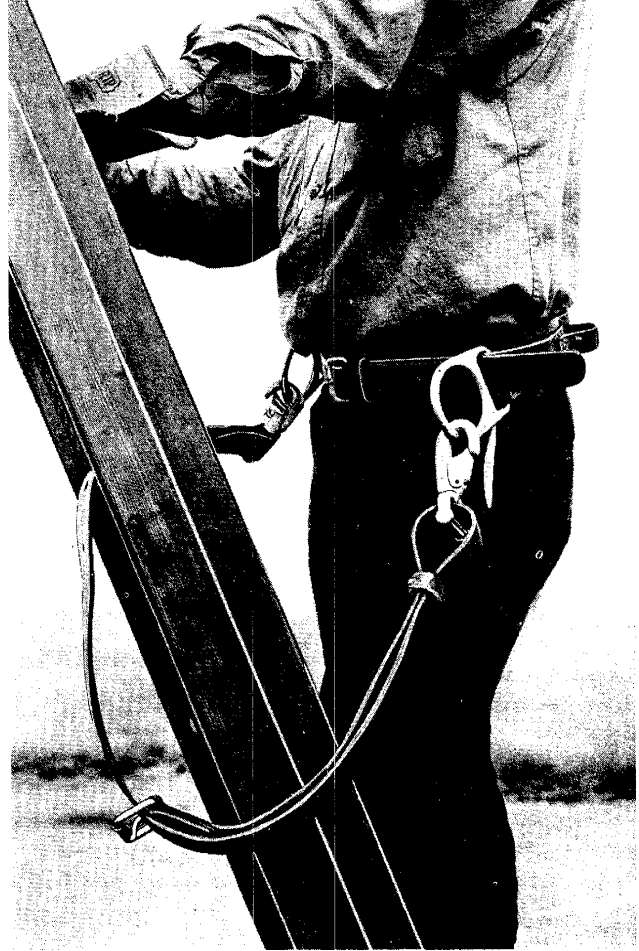
#### 4.02 Working from an extension ladder

(a) A man working from an extension ladder that is securely lashed to a suspension strand or other support shall use one of the following methods to secure himself with his body belt and safety strap. Attach one snap hook to a Dee ring, and either:

- (1) Pass the free end of the safety strap between two rungs and around one side rail, and engage the snap hook in the other Dee ring (Fig. 7) or
- (2) Pass the free end of the safety strap around a rung and engage the snap hook in the other Dee ring, or
- (3) Pass the free end of the safety strap over the suspension strand so as to loop the strand and engage the snap hook in the other Dee ring.

(b) A man working from an extension ladder which is properly placed on the strand but **not lashed** shall use the following method to secure himself with his body belt and safety strap. Attach one snap hook to a Dee ring and pass the free end of the safety strap around the strand and side rail, between two rungs, and engage the snap hook in the other Dee ring.

(c) When working from an extension ladder under conditions not covered above, a safety strap should not be used.



**Fig. 7—Method of Using Safety Strap When Working From Ladder**

**4.03** A man working from an aerial platform that is supported by a suspension strand or other support shall secure himself with his body belt and safety strap using one of the following methods:

- (a) Attach one snap hook to a Dee ring and pass the free end across the front of the body, through the other Dee ring, and engage the other snap hook on the suspension strand. Use this method with belts other than the D, E, or F Body Belt. Fig. 8 shows this method used by a workman on an aerial platform.
- (b) The straps of the D, E, and F Body Belts are constructed of material that is of sufficient strength to allow the belt to loop the strand with both ends of the safety strap attached to the same Dee ring as shown in Fig. 9. *The*



**Fig. 8—Method of Using Safety Strap When Working From Aerial Platform**

*method shown is not to be used with any body belt other than the D, E, or F body belts.*

**4.04** A person working from a truck platform ladder shall loop his safety strap through the platform framework unless the platform is equipped with safety chains. If safety chains are provided, the chains shall be attached to the Dee rings of the body belt.

**4.05** A person working from the basket of an aerial lift shall secure himself in the basket. When working from a SERVI-LIFT or SKYWORKER aerial lift, the workman shall secure himself by attaching his safety strap to the eye (Fig. 10) provided in the basket. When working from a TELSTA aerial lift, use the method shown in Fig. 11.

**4.06** The D, E, or F Body Belt should be used at B-type cross-connecting terminals as shown in Fig. 12.

**5. INSPECTION AND MAINTENANCE**

**5.01** Each employee, when receiving a safety strap or body belt and at least once a week



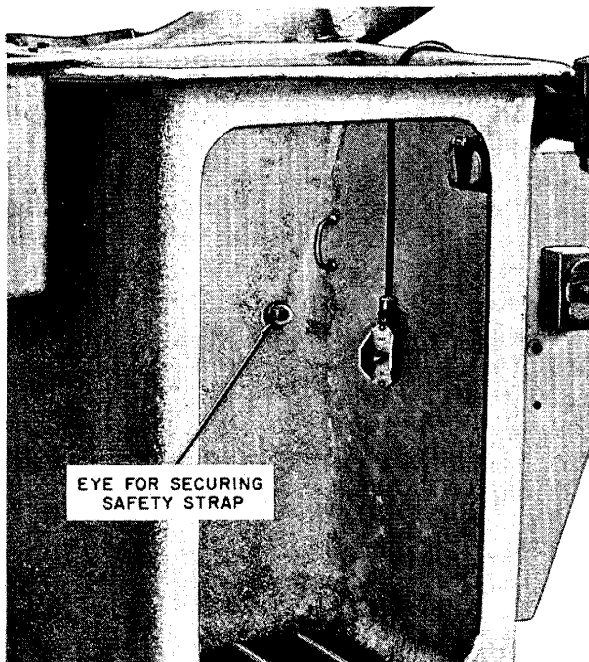
**Fig. 9—Method of Using D, E, or F Body Belt With Safety Strap on Self-Supporting Cable**

thereafter, should inspect the strap so he may detect any fault that may have developed.

**5.02** Each employee should at all times assume the responsibility for determining that his safety strap and body belt are in good condition.

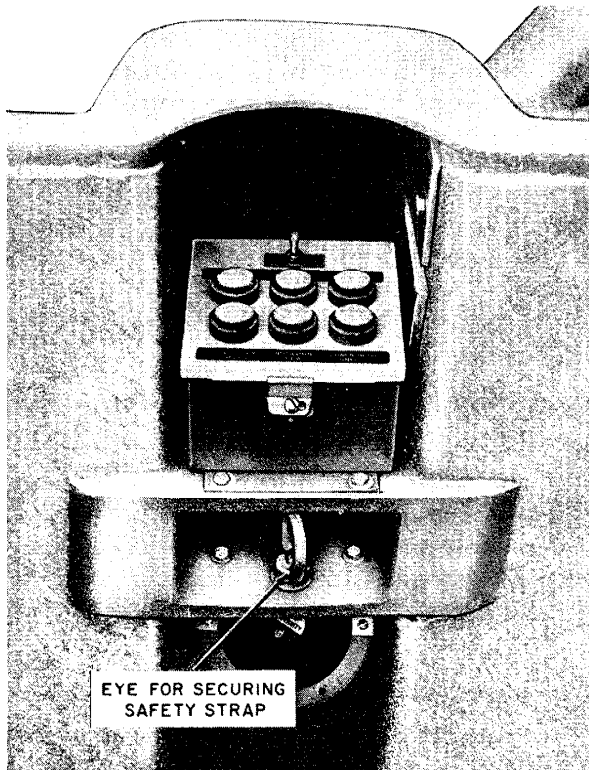
**5.03** The supervisor should inspect each safety strap and body belt periodically.

**5.04** The safety strap and body belt should be examined visually to determine their condition. If a condition exists that raises any doubt as to their safety, they should be exchanged at once for one in good condition, in accordance with established routine. A fabric safety strap or body belt should never be subjected to proof load tests.



EYE FOR SECURING SAFETY STRAP

SKYWORKER BASKET



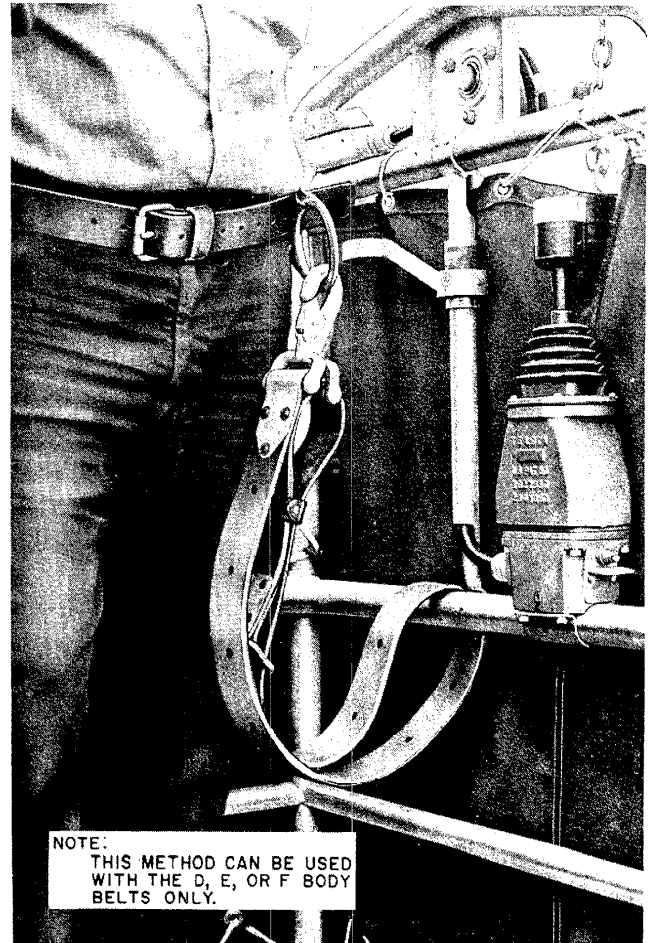
EYE FOR SECURING SAFETY STRAP

SERVI-LIFT BASKET

Fig. 10—Location of Eyes for Securing Safety Strap in Baskets of SKYWORKER and SERVI-LIFT Aerial Lifts

**5.05 Visual Inspection of Safety Strap:** The important conditions to look for are:

(a) Worn fabric, as indicated by the colored ply. When two outer layers of fabric are worn through, the red ply can be seen. The strap should be removed from service as soon as a red ply becomes visible.



NOTE:  
THIS METHOD CAN BE USED WITH THE D, E, OR F BODY BELTS ONLY.

Fig. 11—Method of Using D, E, or F Body Belt With Safety Strap in TELSTA Aerial Lift

- (b) Broken, cut, or torn outer fibers or nicks, punctures, etc, that would affect the strength of the strap. The edges of the strap should be inspected carefully.
- (c) Loose, broken, or missing rivets, or rivets with excessive wear.
- (d) Broken or badly worn steel guard on ends of safety strap.

(e) Defective buckle, or defective snap hook, and poor action of the keeper on the snap hook. The keeper should work freely without excessive side play, and should close securely under the spring tension.

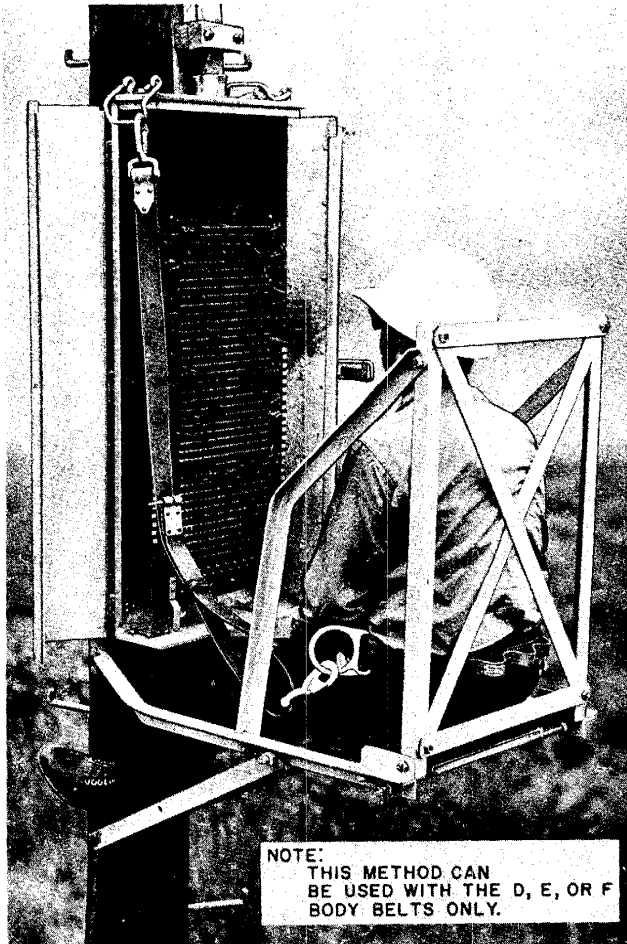


Fig. 12—Method of Using D, E, or F Body Belt With Safety Strap on B-Type Cross-Connecting Terminal

(f) Charred spots on the surface of the fabric, such as might have been caused by flames, contacts with hot solder pots, furnaces, hot soldering coppers, heated ducts, and pipes. If burns are on the flat surfaces, remove strap from service if two or more outer layers are burned through, or if the colored ply is visible. If these burns are on the edges of the strap and are more than 1/8 inch deep remove strap from service.

(g) Acid burns. A strap that has been in contact with acid shall be removed from service.

(h) Holes for tongue of buckle excessively enlarged.

(i) Broken inner fibers. Defects are usually found in the section at which an injury occurred. Breakage of the inner fibers is indicated by limpness and flexibility of the strap. The strap should be examined in short sections and if a soft, flexible section is found the strap should not be used.

**5.06 Visual Inspection of Body Belt:** The important conditions to look for are:

(a) The condition of the steel reinforcing plates holding the Dee rings.

(b) The condition of the nylon, especially at the reinforcing plates, to determine whether the nylon is worn or crushed sufficiently to affect its strength.

(c) Loose or broken rivets (particularly those in the loops holding the Dee rings).

(d) Broken or rotted threads in the stitching.

(e) Cuts that would tend to cause the nylon to tear or affect its strength.

(f) Broken or defective buckle.

**5.07 Cleaning:** Tests indicate that creosote is not injurious to nylon. However, because the creosote may stain clothing of the workman, it should be removed as soon as practicable using a cloth moistened with petroleum spirits or other approved cleaner.

**5.08 Disposition:** A strap or body belt with major defects shall be withdrawn from service immediately and returned to the storeroom for handling in accordance with established routine. Such a strap or belt shall be tagged "DANGEROUS, DO NOT USE." If practicable, it shall be marked to show the location of any defects that cannot be seen readily.

CLIMBERS

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1. GENERAL

1.01 This section describes climbers and associated items such as pads, straps and gaff guards. Information on the care and maintenance of these items is included.

1.02 Information formerly contained in Sections 081-720-300, 081-730-010, 081-730-100, 081-730-300 and 081-730-600 is also included and these sections are canceled.

1.03 A new method of testing the effectiveness of climber gaffs is included. The pole cut-out test replaces both the plane test and the cut-out test. This method is more critical of the proper shape and sharpness of the gaff. It also simulates actual climbing conditions and is more convenient since it can be made just prior to climbing a pole.

2. DESCRIPTION

CLIMBERS

2.01 Adjustable climbers have replaced fixed length climbers. The first adjustable climber was known as the C Climber. This was

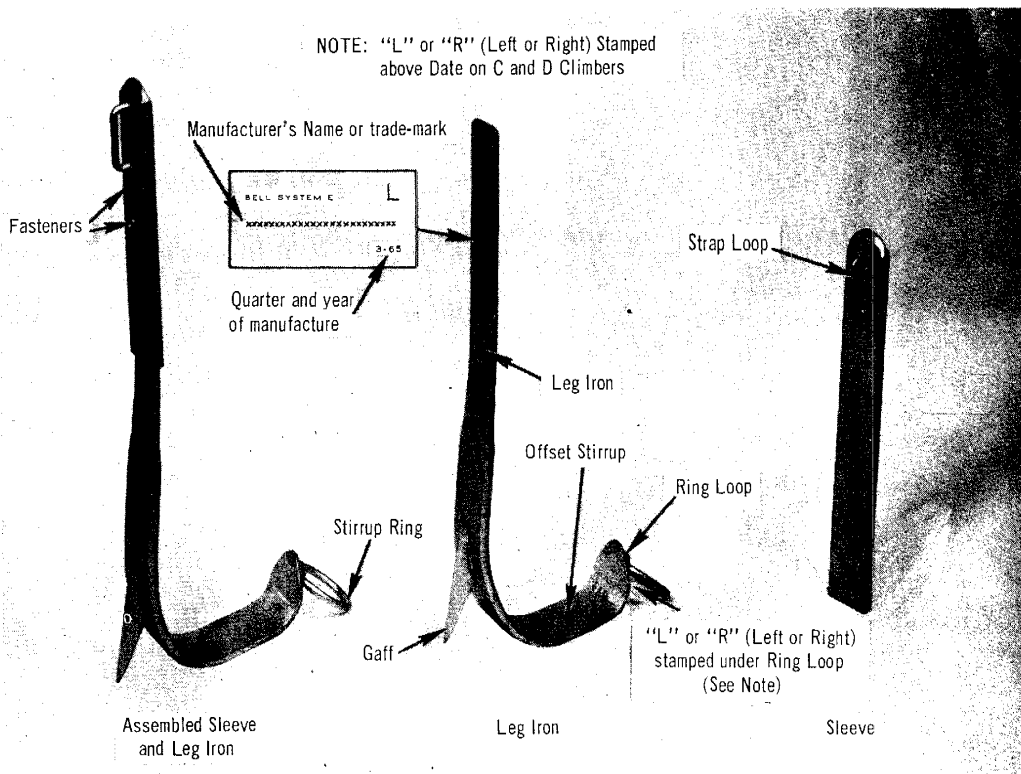


Fig. 1 - E Climber

superseded by the D Climber in which the stirrup was widened 1/4 inch to give more room for overshoes and the gaff raised 1/8 inch for better ground clearance when stepping off a pole. The E Climber, Fig. 1, which supersedes the D

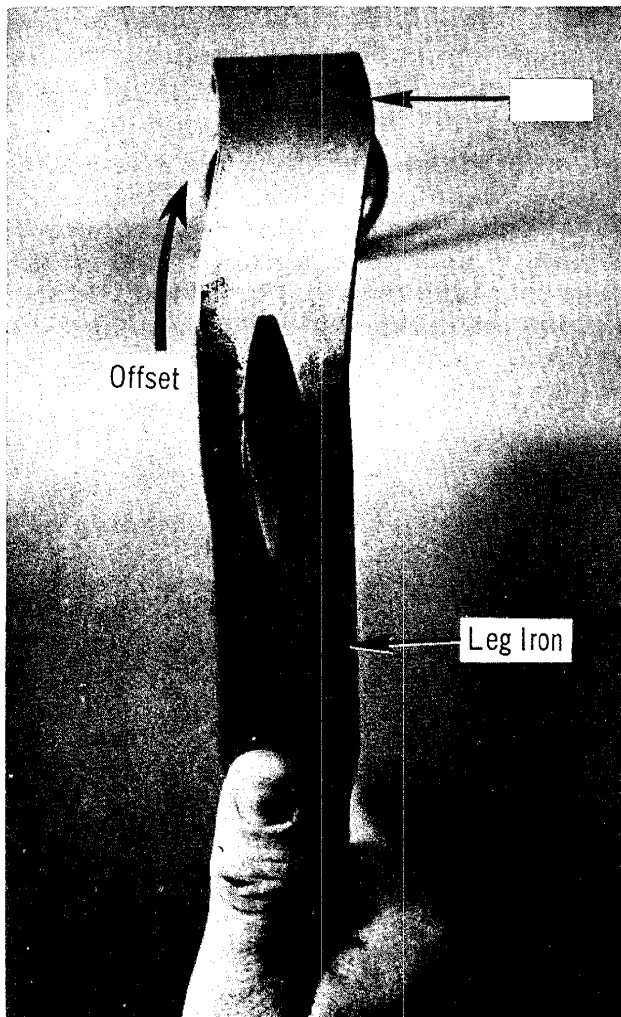


Fig. 2 — Stirrup Offset "Right"

Climber is changed to use two set screws instead of one set screw and a rivet for attaching the sleeve to the leg iron. This will allow the craftsman to remove the sleeves, pads and straps for reuse when returning climbers to be sharpened. As C and D Climbers are returned for sharpening, the rivet holes in the leg irons will be tapped so that two set screws can be used to attach the sleeves. A fully machine shaped and sharpened gaff is used on the E Climber. No filing is required at time of manufacture or when resharpened. The gaff has been designed so that it can be machine sharpened without any filing to reshape the outer rounded surfaces shown in Figs. 10 and 11. **Do not use a file on these surfaces at any time.** This will disturb the design of the gaff so that it can not be machine sharpened satisfactorily. Climbers may be ordered with or without sleeves. Sleeves including Fasteners or Fasteners only can be ordered separately. Pads and straps must be ordered separately. Gaff guards may also be ordered separately, however, all new and resharpened climbers are packaged with gaff guards installed.

**2.02** Adjustable climbers have offset stirrups, therefore, they are made for the right and left foot and are marked "R" or "L" on the appropriate climber as indicated in Fig. 1. These climbers can be identified as right or left by remembering that the offset of the stirrup is toward the front of foot. Another method is to hold the climber with gaff toward you and pointing up, then noting which direction the stirrup is offset. If the offset is to right, it is a right climber as in Fig. 2; if the offset is to left, it is a left climber.

#### SLEEVES

**2.03** Sleeves used with adjustable climbers can be adjusted in increments of 1/4 inch. They are available in two lengths. The longer sleeve used with the C and D Climbers has been

superseded by one that can be adjusted to 21-1/2 inches. Fig. 3 illustrates these sleeves and the range of adjustments. Sleeves are attached to climbers by two set screws known as Fasteners except on the shorter sleeves from 14-3/4 to

15-1/2 inches and on the longer sleeves from 17-3/4 to 18-1/2 inches. On these adjustments, only one set screw is used for attachment. For these lengths, the wedging of the sleeve and leg iron provides a sufficiently tight fit of these parts.

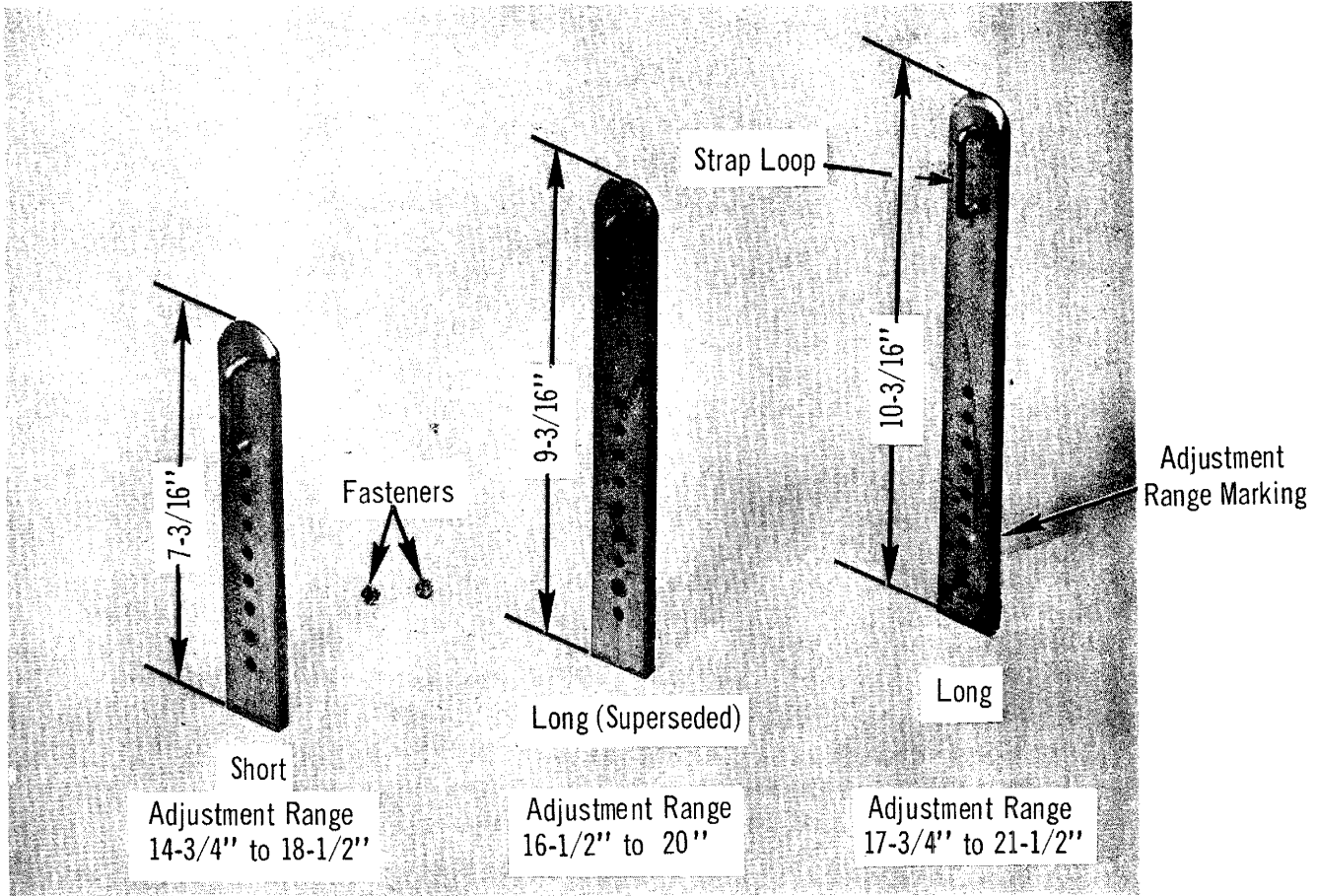


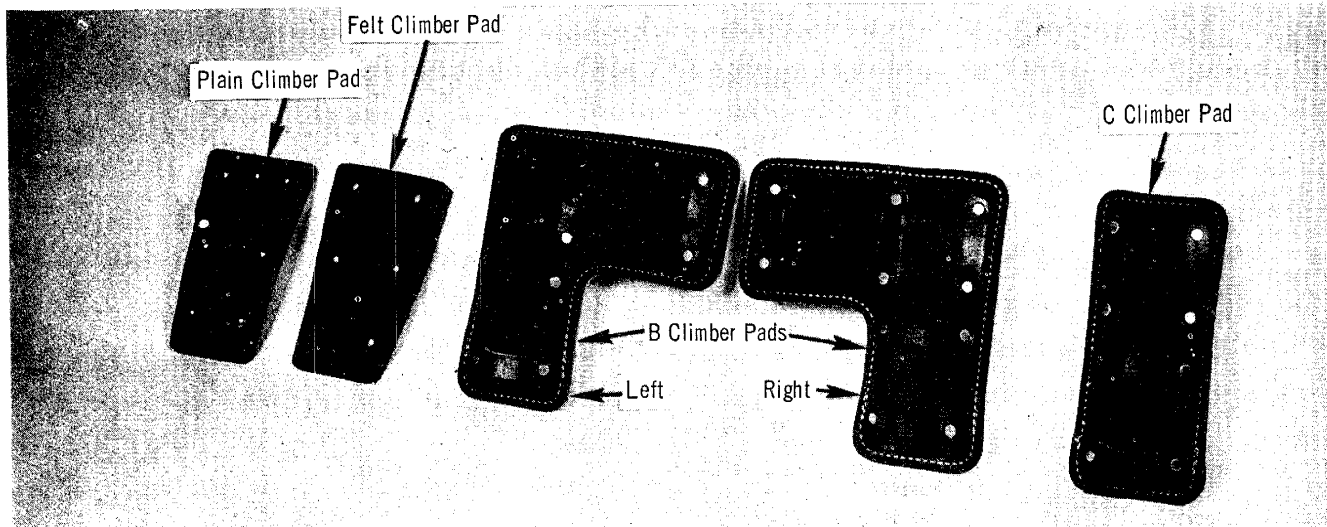
Fig. 3 – Sleeves for Adjustable Climbers



**PADS**

2.04 Plain, felt lined and cushion pads, Fig. 4, are available for use with climbers. Cushion pads are coded B Climber Pads (angle) and C Climber Pads (straight). Plain and felt lined

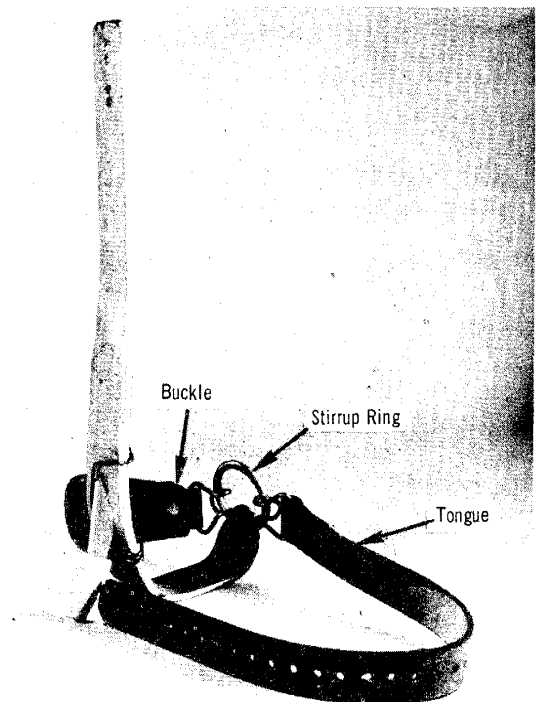
pads are generally used when wearing boots that cover the calf of the leg. Cushion pads give added comfort, especially at the calf of the leg. B Climber Pads also furnish additional padding at the shins.



**Fig. 4 – Pads**

**STRAPS**

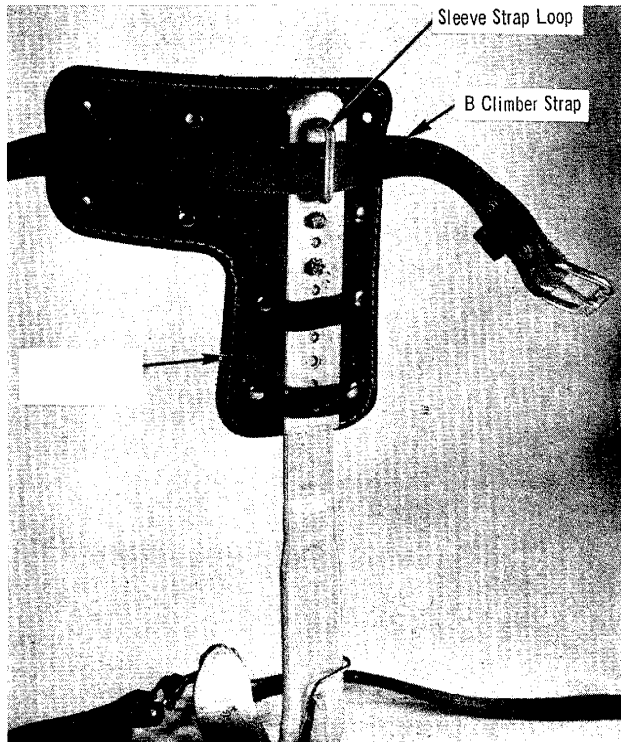
2.05 C Climber Foot Straps, Fig. 5, are used on the stirrup rings of adjustable climbers to fasten the climber to the foot. A C Climber Foot Strap consisting of a tongue and buckle that can be clipped to the climber stirrup ring is placed on the climber so that the buckle will be across the foot instep when fastened.



**Fig. 5 – C Climber Foot Strap Installed on Right Climber**



**2.06** The 22- or 26-inch B Climber Strap, Fig. 6, is used to hold the pad on the leg iron and to fasten both to a craftsman's leg when the climber is worn.



**Fig. 6—B Climber Pad (Right) Installed**

### GAFF GUARDS

**2.07** Gaff guards are used to protect gaffs and workmen when climbers are not being used. They also protect other tools from damage that are stored in vicinity of climbers. Fig. 7 illustrates a gaff guard installed.

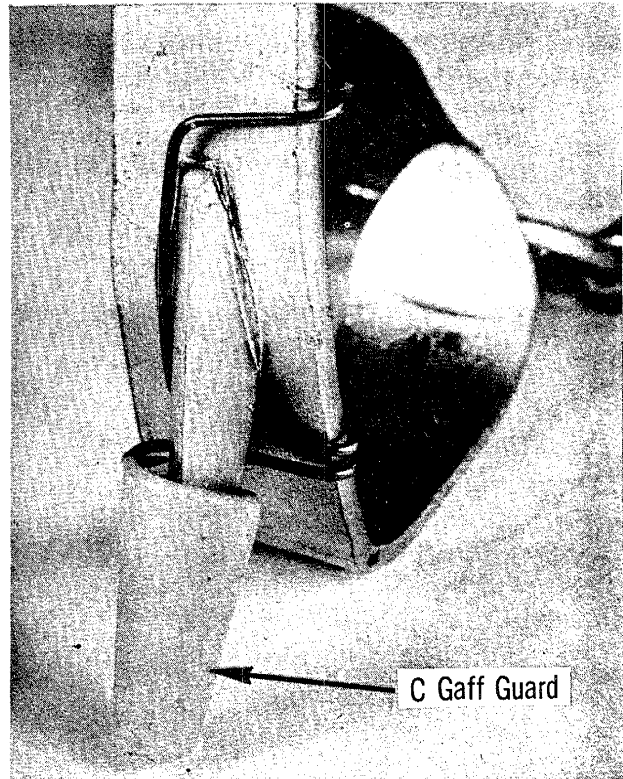
### 3. PRECAUTIONS

**3.01** Observe the following precautions when storing, transporting, and using climbers:

- (a) Equip climbers with gaff guards, when not in use. Gaff guards protect craftsmen as well as the gaff tips and cutting edges when climbers are carried by craftsmen or are stored in tool boxes or other storage spaces. They also prevent damage to safety straps and

body belts when stored in the same compartments with climbers.

- (b) Use climbers adjusted to correct size, Part 4.
- (c) Do not bend leg irons. If discomfort exists, use cushion type pads.



**Fig. 7—C Gaff Guard Installed**

(d) NEVER WEAR CLIMBERS ON WORK WHERE THEY ARE NOT REQUIRED as, for example, when walking between poles, when working on ground, a ladder, a stepped pole where the work can be performed safely from the steps, or while traveling in a motor vehicle or any other type of conveyance.

(e) When climbing past another employee who has his safety strap in place around the pole, special care should be taken to avoid gaffing the other employee, his safety strap or other equipment.

(f) When climbing past attachments on poles, care should be taken to avoid dragging climbers or foot against these attachments.

- (g) Do not use the gaff as a pry.
- (h) When climbing, avoid placing the gaff in or near a crack, knot, nail, or tack, etc.
- (i) Inspect climbers in accordance with Part 5.

**4. FITTING AND ASSEMBLING CLIMBERS**

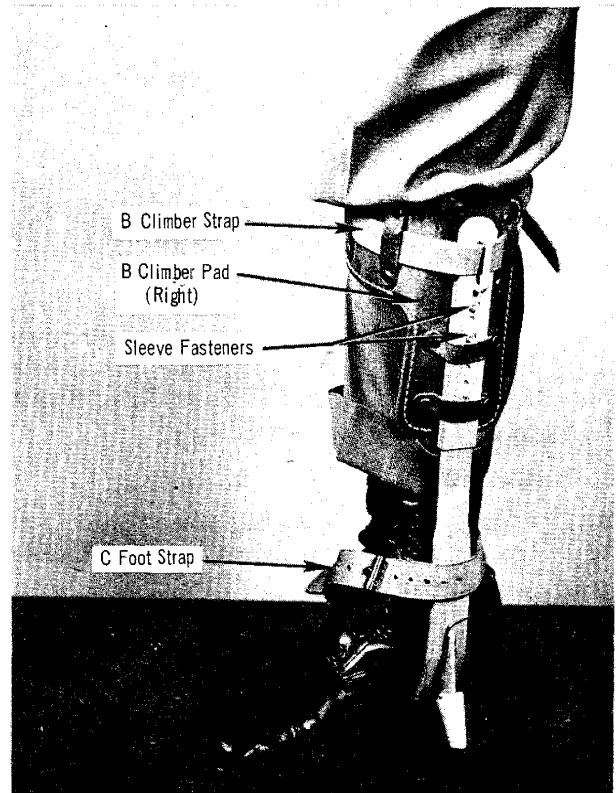
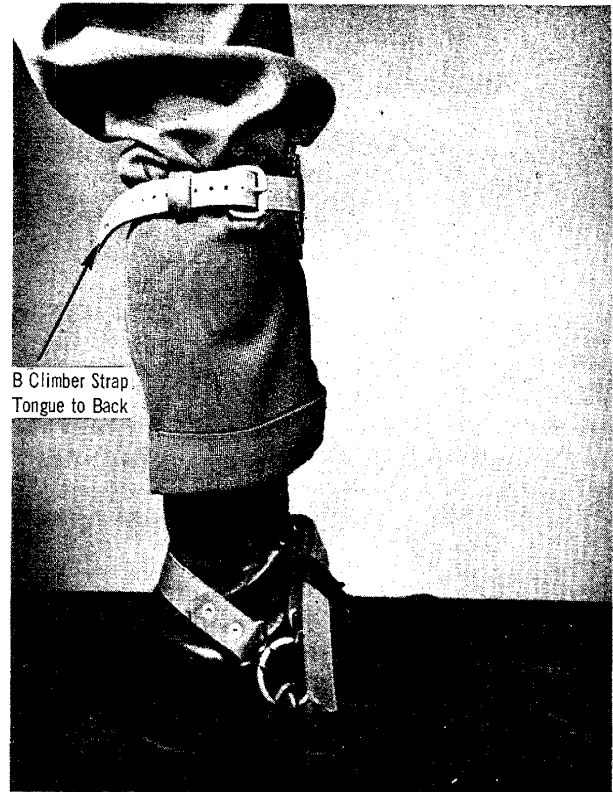
**4.01** Determine the correct sleeve to use by measuring the distance from the lower edge of the projecting kneebone to the underside of the shoe at the arch, Fig. 8, and subtract 1/2 inch. Select the sleeve (see 2.03), that covers this range. When ready to assemble the climber for use, first place the C Foot Straps as indicated in 2.05.



**Fig. 8 – Measuring for Climber Length**

Next, place a B Climber Strap and pad on sleeve as shown in Fig. 6. Place the strap so the tongue will point toward back of leg when buckled. Place sleeve on climber, step on stirrup and adjust sleeve to position that is most comfortable. Place one of the set screws to hold the sleeve in

place and put climber on to see if it feels comfortable; if so remove climber and add second set screw to hold sleeve in place (see 2.03). The same procedure can be used for the other climber.



**Fig. 9 – Right Climber on Leg**

Climbers should be adjusted to the maximum length which is comfortable. Fig. 9 illustrates assembled climber strapped to leg.

## 5. INSPECTION OF CLIMBERS

**5.01** Each employee shall assume the responsibility for determining that his climbers, sleeves, pads, straps and gaff guards are in good condition and shall inspect the gaffs to detect nicks or dulled cutting edges daily, or more often, if he has any reason to think they are not in good condition such as after accidentally hitting a nail or tack while climbing a pole. If there is any question that the gaffs are in good condition, check them with the pole cutout test, see Part 6. Furthermore, upon receipt of the climbers and at least once a week thereafter, he shall inspect the climbers and associated items in accordance with 5.03 to detect any flaw that may have developed. In addition, climbers shall pass the pole cutout test.

**5.02** The employee's supervisor shall make an inspection of the climbers at intervals of not more than three months.

**5.03** The important conditions to look for when inspecting climbers are as follows:

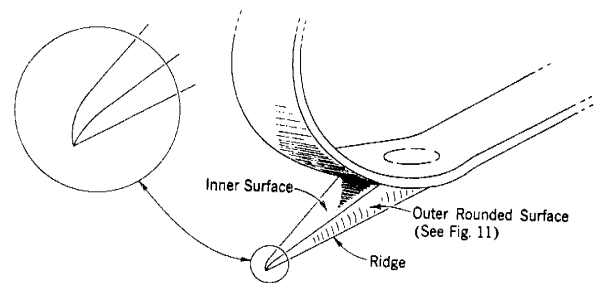
- (a) Fractured gaff or hairline crack.
- (b) Loose gaff.
- (c) Broken stirrup ring or broken or loose ring loop.
- (d) Fractured leg iron or start of fracture.
- (e) Nicks and depression in gaff due to impact with a hard object.
- (f) Ridge of gaff not straight.
- (g) Dull gaff beyond restoration by means of honing.
- (h) Broken or distorted gaff point.
- (i) Fractured sleeve or start of fracture.
- (j) Broken or loose sleeve strap loop.
- (k) Straps worn through one layer of fabric or with cuts or enlarged buckle holes that would affect the strength.
- (l) Broken or otherwise defective strap buckle.

- (m) Broken or otherwise defective clip on foot strap.
- (n) Broken or loose rivets on straps or pads.
- (o) Broken or torn loop on strap or pad.
- (p) Plastic missing from gaff guard.
- (q) Loose screw or rivet on sleeve.

**5.04** If any of the conditions, 5.03 (a) to (h) inclusive, are found, or if the condition of the climbers is such that there is good cause to doubt their safety, they shall not be used but shall be exchanged for a pair in good condition. If any of the conditions (i) to (p) inclusive are found, the item shall be replaced. If condition (q) is found, the screw or rivet shall be tightened or replaced.

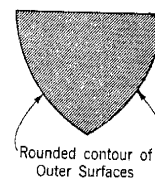
**5.05** The following illustrate the surfaces and ridge of a properly-shaped gaff. The ridge is straight.

- (a) Profile of gaff at point.



**Fig. 10 – Gaff Profile and Point**

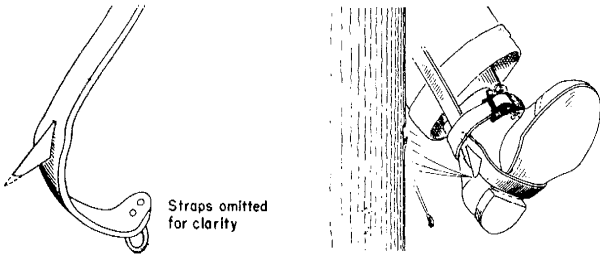
- (b) Rounded contour of outer surfaces.



**Fig. 11 – Outer Surfaces**

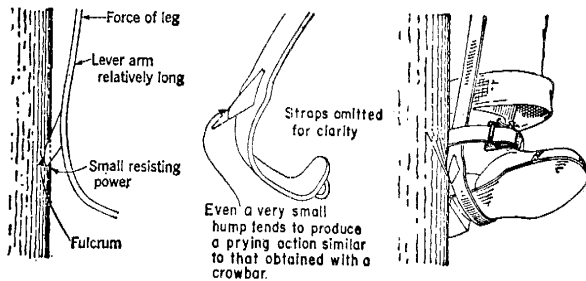
**5.06** The following illustrations show two principal causes of climber cutouts due to unsatisfactory gaff conditions.

- (a) Insufficient penetration resulting from a dull gaff.



**Fig. 12 -- Dull Gaff**

- (b) Ineffective penetration due to ridge not being straight.



**Fig. 13 -- Ridge Not Straight**

**6. TESTING CLIMBER GAFFS**

**6.01** Climber gaffs shall be tested when received and thereafter anytime there is any doubt as to their sharpness but at least once a week. They shall be tested by making the pole cutout test as follows:

1. Place the climber on the leg and fasten the foot strap in the usual manner. Do not fasten the leg strap.
2. Remove the gaff guard and put on your gloves. Place your hand between your leg and the climber pad, palm facing the pole. Place the other hand around the pole to balance yourself. With your leg at about a 30 degree angle, the normal climbing

angle, aim the gaff toward the center of the pole about one foot above the ground line. Lightly jab the gaff in the pole, so that it penetrates the wood about 1/4 inch see Fig. 14. Do this at a location where the pole surface is free of cuts.



**Fig. 14 -- Jabbing Gaff in Pole**

3. Keeping just enough pressure on the stirrup to keep the gaff in the pole, but not so much as to cause the gaff to penetrate any deeper, push the climber and your hand toward the pole by moving your knee until the strap loop of sleeve is against the pole as shown in Fig. 15.



Fig. 15 – Climber Holding

4. Making certain the strap loop is held against the pole with pressure from your leg, *gradually* exert full pressure straight down on the stirrup without raising your other foot off the ground, so as to maintain balance if the gaff does not hold.
5. A gaff, which is correctly shaped and is sharp, will cut into the pole and hold in a distance of 2 inches or less. Measure the cut from point the gaff enters the pole to bottom of cut at surface of pole as indicated in Fig. 16.

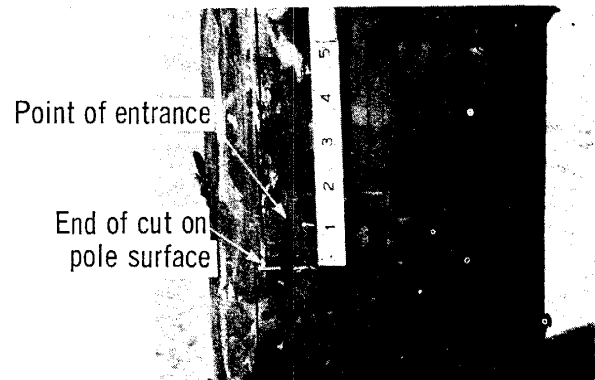


Fig. 16 – Measuring Gaff Cut

A gaff that is correctly shaped but dull or burred will cut in and hold but the length of the cut will be more than 2 inches. A gaff, which is very dull or deformed in some way, will cut out of the pole or plow through the wood for a distance greater than 2 inches. ***Do not use climbers that cut out or plow through the wood for a distance greater than 2 inches.*** If the climber gaff is dull, sharpen with a hone, as described in Part 7 and repeat cutout test.

7. FIELD MAINTENANCE

CLIMBER GAFFS

7.01 During normal use of climbers the edges along the inner surface (cutting edges), Fig. 17, may become dull. The honing stone should be used to maintain sharp edges. Remember that even a dull gaff can cut your finger so hone carefully.

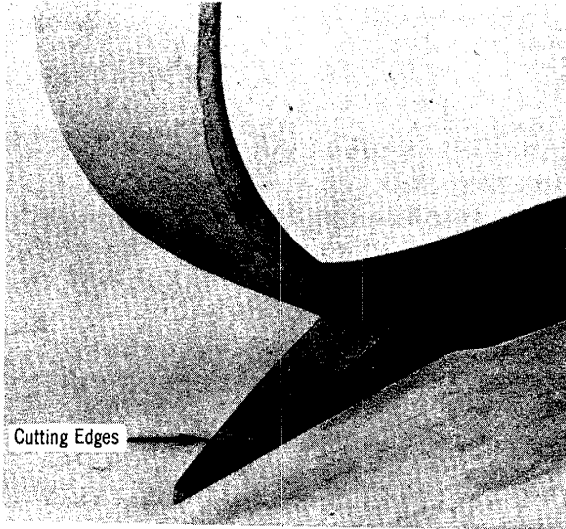


Fig. 17 — Gaff Cutting Edges

7.02 In honing, use a standard honing stone. Keep the stone well oiled with light machine oil while honing to prevent clogging the stone.

7.03 First, if there are any small burrs along the cutting edges, remove them by holding the hone against the side of the gaff and *carefully following the edge around to the tip* as indicated in Figs. 18 and 19.

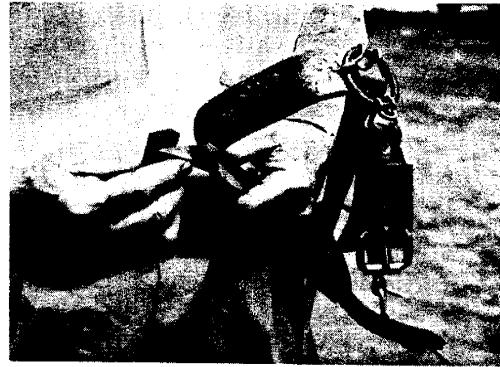


Fig. 18 — Removing Burrs from Top Cutting Edge



Fig. 19 — Removing Burrs from Bottom Cutting Edge

7.04 Hone the inner surface of the gaff by starting the stroke near the leg iron and continue over rounded curve of tip as indicated in Fig. 20. Stop the honing stroke before the stone slides off the end of the gaff to prevent dulling the tip. About 20 to 25 strokes of the honing stone should be enough. *Do not attempt to reshape the tip of the gaff.*

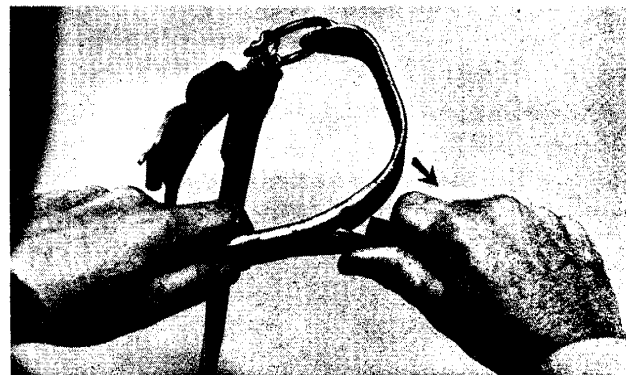
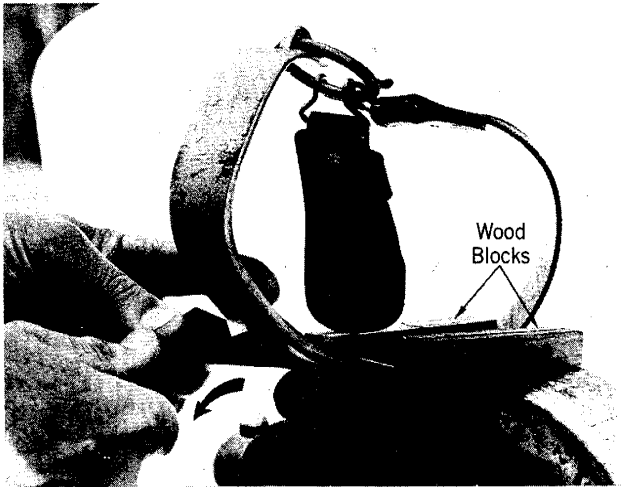


Fig. 20 — Honing Inner Surface

**7.05** When using a vise to hold a climber, always protect the leg iron by placing wood blocks between the vise jaws and the leg irons as indicated in Fig. 21. This prevents scoring the leg iron which may weaken it.



**Fig. 21 – Honing Using Vise**

#### **PADS**

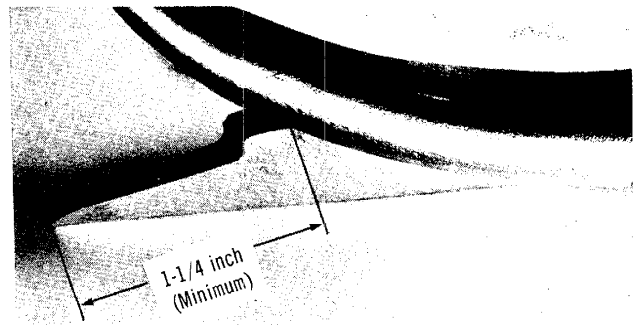
**7.06** Pads should be maintained clean and pliable for maximum comfort. Maintain this condition by using saddle soap or neatsfoot oil about every three months as follows:

- (a) Clean with a damp sponge using a neutral hand soap.
- (b) With sponge and clean water, work up a lather using a good grade of saddle soap. Work lather well into pad and put in shade to dry. When lather is almost dry, rub the leather vigorously with a soft cloth.

(c) About every six months instead of dressing with saddle soap as in (b), clean as in (a), then while leather is still damp apply about 1/2 teaspoon of neatsfoot oil on the loop side of the pad, apply oil gradually with hands using long light strokes to work into leather. After oiling, allow pads to dry overnight then rub vigorously with a soft cloth to remove excess oil.

#### **8. RETURNING CLIMBERS FOR MACHINE SHARPENING**

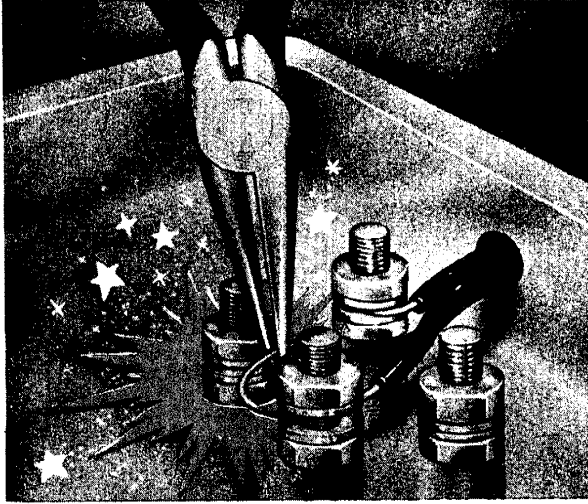
**8.01** When climber gaffs need sharpening and the desired sharpness cannot be obtained by honing as described in Part 7, the craftsman shall exchange them for a pair in good condition. Remove the straps and pads, also the sleeves unless they are riveted, for reuse on good climbers. Equip the climbers to be returned with gaff guards and tape or otherwise tie them together. Fig. 22 illustrates a gaff that has been machine sharpened a number of times, to the minimum length that shall be used.



**Fig. 22 – Gaff Sharpened to Minimum Length**







●  
**DON'T BE A  
SHORT CIRCUIT  
ALARMIST**  
●

**KNOW YOUR**

**SPECIAL SAFEGUARDING MEASURES (SSM)  
And SPECIAL SERVICE PROTECTION (SSP)**

1. GENERAL

1.01 This section provides information about protective devices used on special service circuits requiring special service protection or special safeguarding measures.

1.02 This section is reissued to add:

- C clip terminal insulator
- D clip terminal insulator
- Warning Marker, Form E-5190
- Protection for 300-type connectors
  - (a) KS-16576, List 5 designation plate
  - (b) KS-16576, List 6 designation plate
  - (c) P-16E564 heat coil cap (red)

2. SPECIAL SERVICE PROTECTION

2.01 Special service circuits require special protection to insure that plant functions do not interfere with their operations. These circuits are of a nature that momentary shorts, opens, or accidental contact may cause serious reaction in customer relations.

2.02 Binding post insulators and caps, pair indicators, and PBX frame guards are provided for field forces to place in terminals, PBX frames, and bridging locations where special service circuits appear. In addition to physical protection, these markings and protective devices are an indication that *approval from the Serving Service Center is necessary before doing any work on these circuits.*

3. SPECIAL SAFEGUARDING MEASURES

3.01 The same protection used for Special Service Protection (SSP) is required for Special Safeguarding Measures (SSM) and in addition locked terminals, unbridged pairs, wire in conduit, and cable in lieu of drop wire are required. Engineering authorization is required to establish SSM.

3.02 Special Safeguarding Measures are primarily used on services involving National Security.

4. WORK ORDERS

4.01 The special service order and/or the toll circuit layout order is noted "SSP" or "SSM" alongside the circuit number. In addition, Form E-4106 (Fig. 1) is used to notify the field forces where to place or remove protection when SSP or SSM is involved.

BSP #25 82		SPECIAL SERVICE PROTECTION				E-4106 (6.53)			
BINDING POST INSULATORS TERMINALS				PROTECTOR GUARD DEVICES DISTRIBUTING FRAMES					
CENTRAL OFFICE	SHERWOOD	DUE DATE	8-15-60		SERVICE ORD. NO.	4073			
DATE ISSUED	8/12	BY	LR	WORK ORD. NO.	✓	TRANS. NO.	✓		
COPY FOR				FIELD		FOR INFORMATION CALL 742-8163			
PLACE AND OR REMOVE SPECIAL SERVICE PROTECTION AT LOCATIONS LISTED									
CABLE	PAIR	BP	TERMINAL LOCATIONS				PROTECTION		
							PLACE	REMOVE	
21	228		F 310 STYLES				X		
			F 437 HARMON AV.				X		
		13	R	42 CAROL RD.				X	
		9	R	48 " "				X	
		5	R	54 " "				X	
		14	R	76 " "				X	
WORK COMPLETED BY _____ DATE _____ O.K. NO. _____									

Fig. 1 — Facsimile of Form E-4106

4.02 Typical circuits requiring SSP and/or SSM are:

- (a) Program transmission and television circuits.
- (b) Telephotograph, telautograph, and facsimile transmission facilities.
- (c) Private line signal channel or radiotelephone circuits.
- (d) Telegraph and teletypewriter leased lines.
- (e) TWX lines.
- (f) Clock or ADT lines that operate on closed or series circuits.

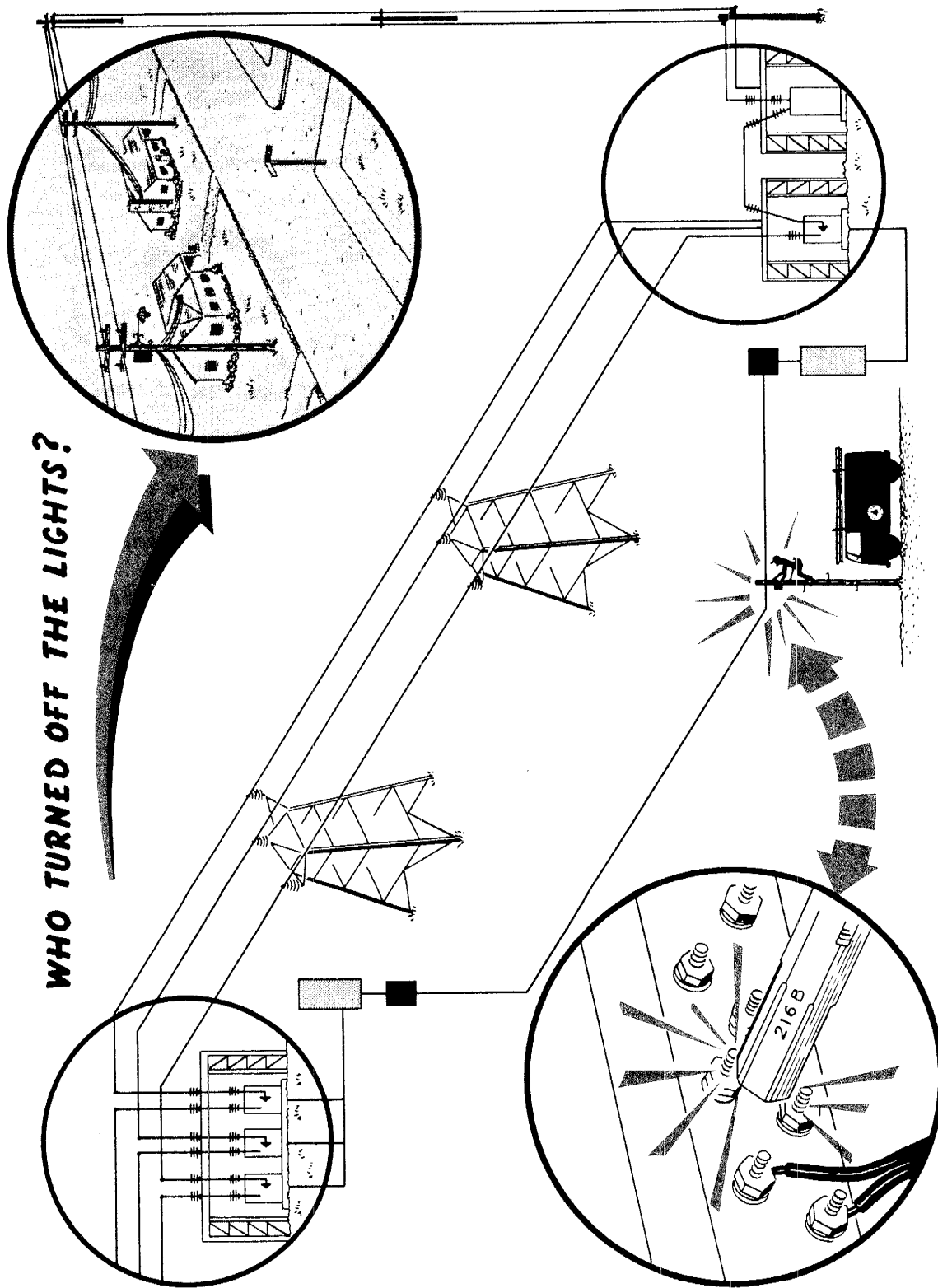


Fig. 2 — Who Turned Off the Lights

- Γ (g) Remote control, signaling, metering, data circuits, and alarm circuits for fire, police, burglar, and watchman.
- (h) Special facilities for defense or major disaster.
- (i) Civil air defense warning network.
- (j) Power company remote control circuits.
- (k) Airway communication circuits.
- (l) PBX battery and generator supply for hospitals, police, and fire department or agencies who perform emergency service for the general public.

**5. HOW TO AVOID DIFFICULTIES!**

- Obtain authorization *before working* on a special circuit.
- Use SSP and/or SSM when required.
- Use hand test set with capacitor in line (monitor) when first going across a pair.
- Do not short terminals when trying to locate a pair (Fig. 2).
- Exercise care to avoid accidental contact with other lines.
- Obtain authorization before removing any SSP and/or SSM.

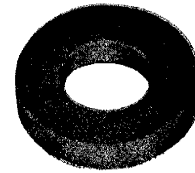
L

**6. PROTECTIVE DEVICES**

**6.01** Common protective devices used on special service circuits are shown in Fig. 3 through 18.

**6.02** Indicator KS-6660 is a red plastic ring, 1/2-inch in diameter. This indicator must be placed on wires before they are terminated. It is used to identify special service circuits. A KS-6660 indicator is shown in Fig. 3

**6.03** Indicator KS-16847 is a red cellulose-acetate spiral ring, 3/8-inch in diameter. This indicator is also used to identify circuits. The split-ring feature of this indicator permits placing or removing indicator on terminated wires (see Fig. 4).



**Fig. 3 — Indicator KS-6660**



**Fig. 4 — Indicator KS-16847**

**6.04** Binding post caps, Fig. 5 through 11, are neoprene caps for use on cable and wire terminals as protection against accidental contacts on special service lines, and as a means of minimizing faceplate leakage in distribution cable terminals. Binding post caps are supplied in red and black. Red caps are intended for use on special service lines and the black caps are for general use.

- The B binding post caps, Fig. 5, are for use on nonworking posts of N, T, and 61-type cable terminals.



**Fig. 5 — Binding Post Cap B**

- The C binding post caps, Fig. 6, are for use on working posts of N, T, and 61-type cable terminals.
- The D binding post caps, Fig. 7, are for use on 7A fuses installed in L-type fuse chambers.
- The E binding post caps, Fig. 8, are for use on 49-type cable terminals.

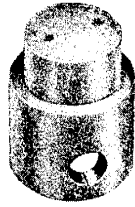


Fig. 6 — Binding Post Cap C



Fig. 7 — Binding Post Cap D

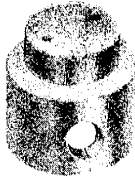


Fig. 8 — Binding Post Cap E

- The F binding post caps, Fig. 9, are for use on terminals equipped with insulation crushing washers such as B buried cable terminals, and 30-2, 57B, and 59A-type connecting blocks.



Fig. 9 — Binding Post Cap F

- The G binding post caps, Fig. 10, are for use on 30-type connecting blocks.



Fig. 10 — Binding Post Cap G

- The H binding post caps, Fig. 11, are for use on 31-type connecting blocks.



Fig. 11 — Binding Post Cap H

6.05 The KS-14539 guard protector, Fig. 12, is a red plastic hood designed to cover the heat coils and springs on C50 protected-type frames.



Fig. 12 — Guard Protector KS-14539

6.06 Binding post insulators are open-ended fiber insulators for use on binding posts to prevent accidental contacts. These insulators are designated No. 1, 2, 3, and 6, and are shown in Fig. 13. Binding post insulators have a red enamel finish.

- No. 1 insulators, Fig. 13, are for use on binding posts having 3/8-inch hexagonal nuts, and on 7T fuses.
- No. 2 insulators, Fig. 13, are for use on binding posts having 7/16-inch hexagonal nuts, and on 7A fuses.

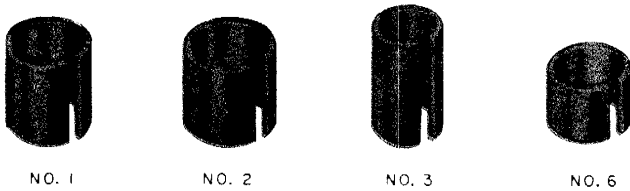


Fig. 13 — Binding Post Insulators

- No. 3 insulators, Fig. 13, fit the screw binding posts of BD, BE, BF, and BG cable terminals.
- No. 6 insulators, Fig. 13, are for use on terminations of the alarm and contactor circuits in T pressure contactor-terminals and 3-pair gas-tight terminals.

6.07 Terminal punching insulators are opened fiber insulators for use on terminal punchings to prevent accidental contacts. These insulators are designated No. 4, 5, and 7 and are shown in Fig. 14. Terminal punching insulators have a red enamel finish.

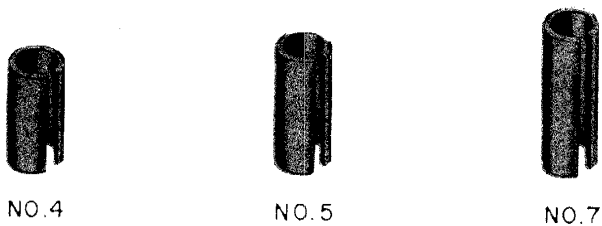


Fig. 14 — Terminal Punching Insulators

- No. 4 insulators, Fig. 14, are 1/2 inch in length and are used on terminal strips.
- No. 5 insulators, Fig. 14, are 5/8 inch in length and are also used on terminal strips.
- No. 7 insulators, Fig. 14, are for use on cable conductor terminating lugs of the C- and E-type protector mountings.

6.08 The B coil spring insulator (MD) is a fiber insulator designed for use on the 70-type connecting block (Fig. 15). When installed, one B insulator will protect two coil springs, "Tip and Ring," that are mounted on the face or station side of this block. This insulator has a red enamel finish.



Fig. 15 — B Coil Spring Insulator (MD)

6.09 The B clip terminal insulator is a red plastic insulator, Fig. 16, designed to protect one row of terminals on the 66-type connecting block. This insulator may be cut with diagonal pliers to fit all clip-type connecting blocks.



Fig. 16 — B Clip Terminal Insulator

6.10 The C clip terminal insulator is red plastic, Fig. 17, and is designed for identification and mechanical protection of two terminals on 66G-type connecting blocks. The insulator is approximately 1/2-inch long with closed ends.

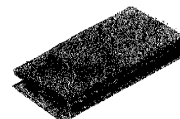


Fig. 17 — C Clip Terminal Insulator

6.11 The D clip terminal insulator is red plastic, Fig. 18, and is designed for identification and mechanical protection of two terminals on 66H-type connecting blocks. This insulator is approximately 7/8-inch long with closed ends.



Fig. 18 — D Clip Terminal Insulator

6.12 The 12A guard is shown in Fig. 19. It is designed to protect special service lines appearing on frames that are equipped with 444A test jacks.

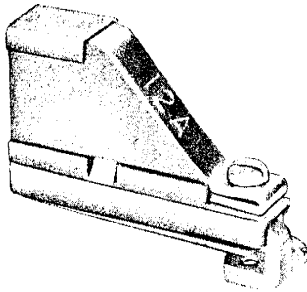


Fig. 19 — 12A Guard

6.13 The 12B guard, Fig. 20, is the same as 12A guard with-addition of a locking screw for maximum security.

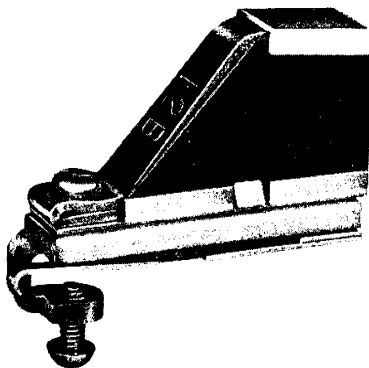


Fig. 20 — 12B Guard

6.14 The Warning Marker Form E-5190 is red waterproof plastic cloth, Fig. 21, with a pressure sensitive backing. The tapes are 1/4 inch wide by 1-1/2 inches long and are supplied on a dispenser card with 36 tapes to a card. This wiring marker is designed for identification of special service lines joined by B wire connectors.

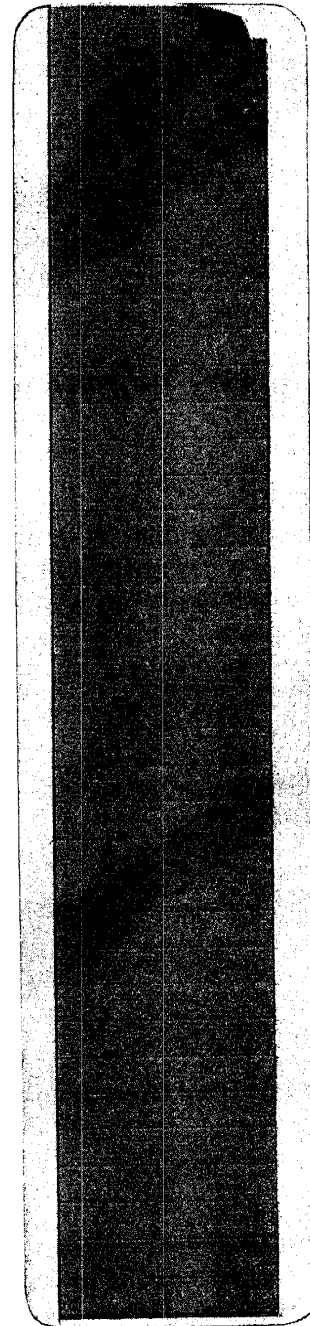


Fig. 21 — Warning Marker Form E-5190

→ 6.15 The KS-16576, List 5 designation plate, Fig. 22, is a red plastic hood designed to cover the wire-wrap terminals on the jumper wire side of 300-type connectors.

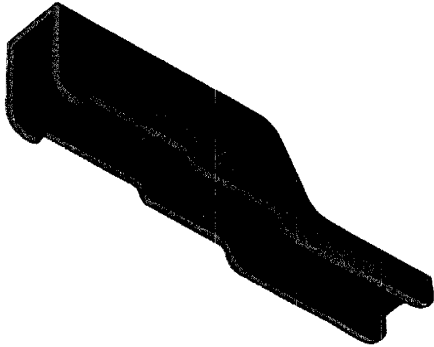


Fig. 22 — KS-16576, List 5 Designation Plate

6.16 The KS-16576, List 6 designation plate, Fig. 23, is a red plastic hood designed to cover the test-terminals on the cable side of 300-type connectors.

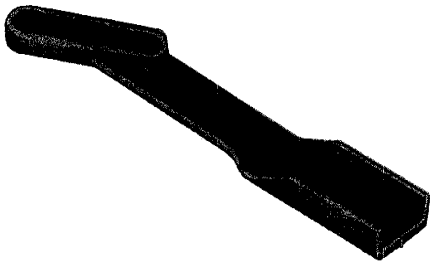


Fig. 23 — KS-16576, List 6 Designation Plate

6.17 The P-16E564 heat coil cap (red), Fig. 24, is used in place of the black heat coil caps on protected 300-type frames.

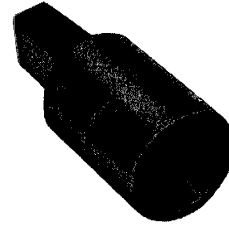


Fig. 24 — P-16E564 Heat Coil Cap

## 7. INSTALLING AND REMOVING SSP

7.01 Special service protection may be installed or removed upon receipt of Form E-4106 (Fig. 1). Install SSP as shown in the following figures.

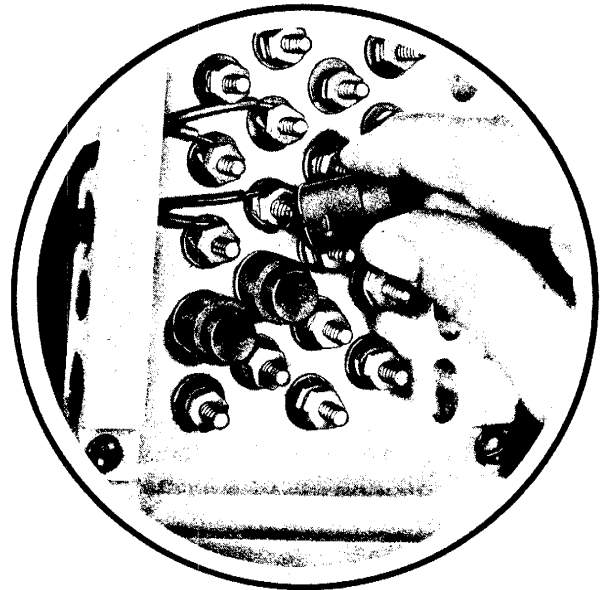


Fig. 25

Install binding post caps as follows:

- (1) Clean faceplate.
- (2) Place cap over binding post and push until seated against faceplate.



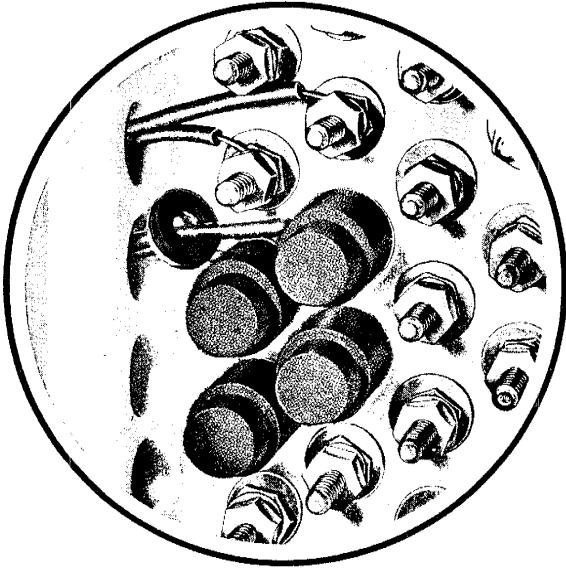


Fig. 26

Slip the KS-6660 indicator over end of wire, as shown in Fig. 26. Split-ring feature of KS-16847 indicator permits placing or removing indicator on terminated wires.

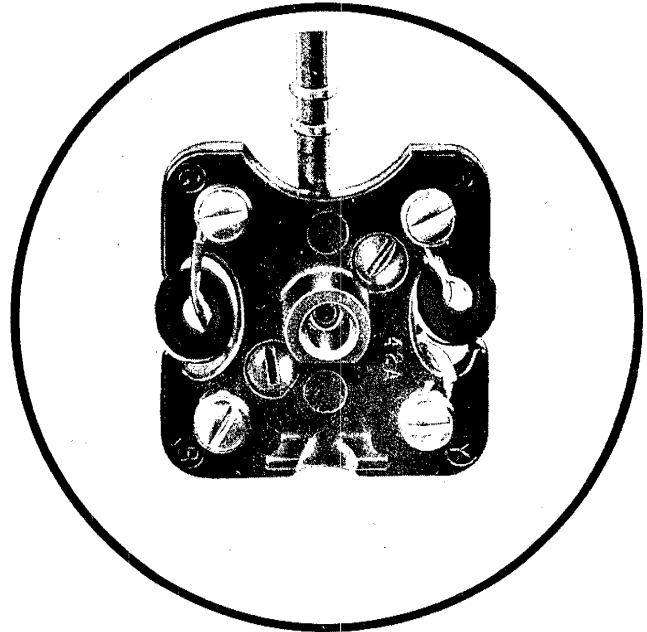


Fig. 28

SSP used with 42A connecting block.

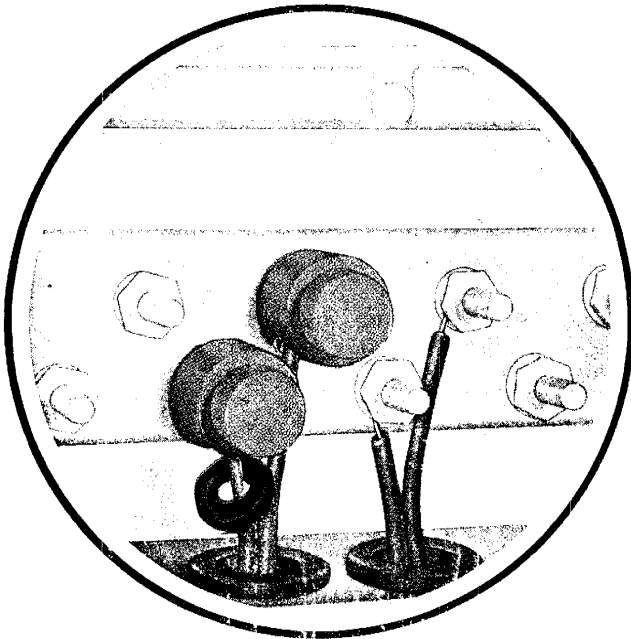


Fig. 27

SSP used in N-type cable terminals, wiring terminals, or fuseless protected terminal blocks.

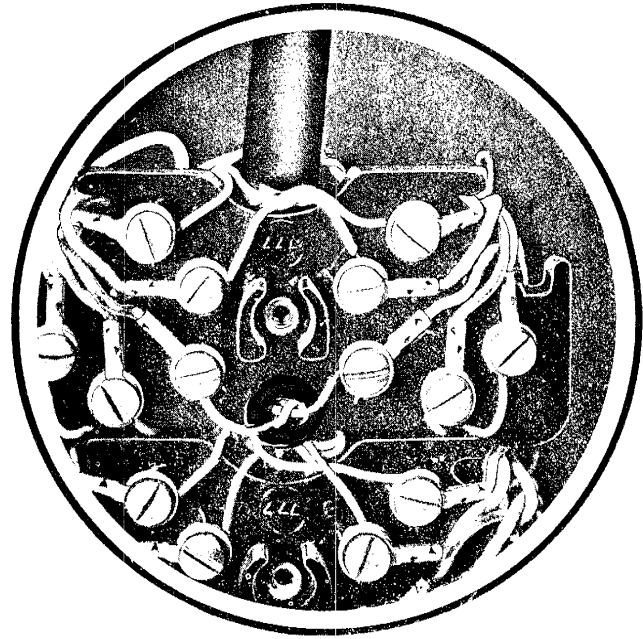


Fig. 29

SSP used with 44A connecting block.

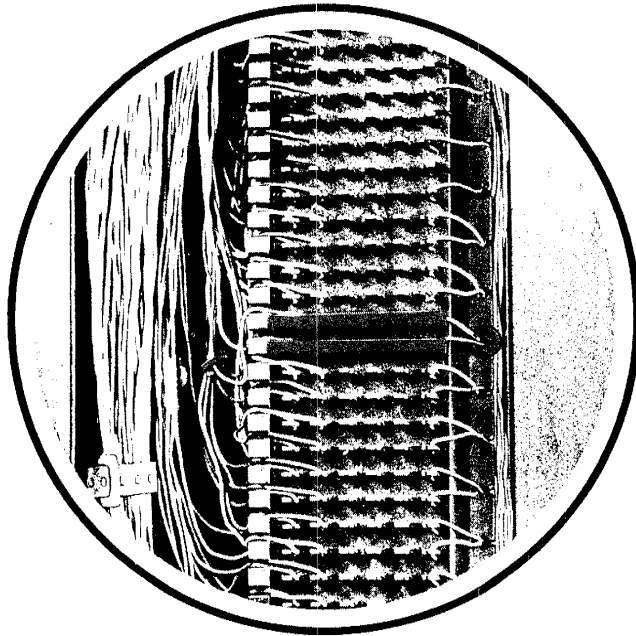


Fig. 30

B clip terminal insulators installed on 66-type connecting block.

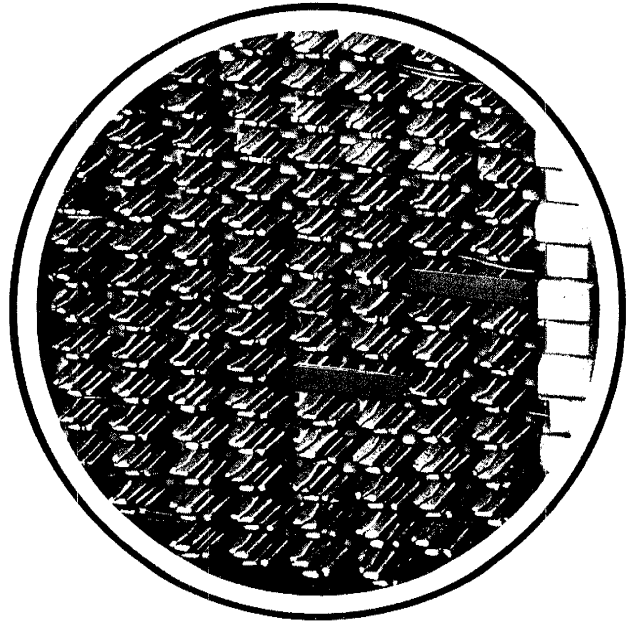


Fig. 32

D clip terminal insulators installed on 66H-type connecting block.

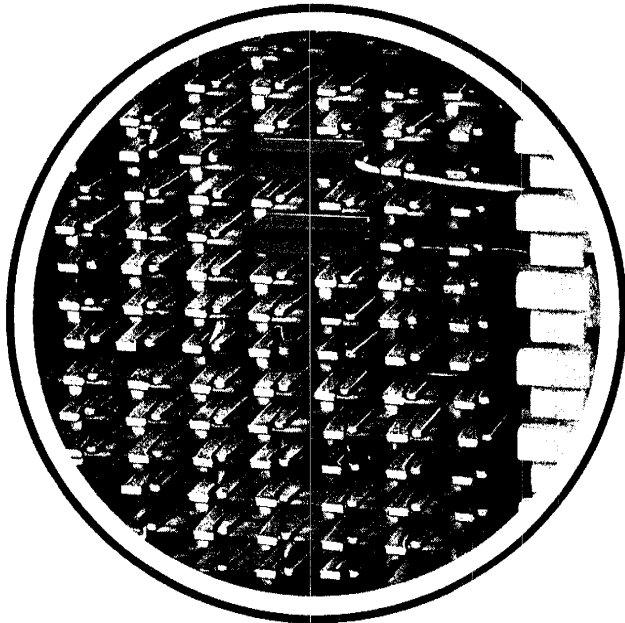


Fig. 31

C clip terminal insulators installed on 66G-type connecting block.

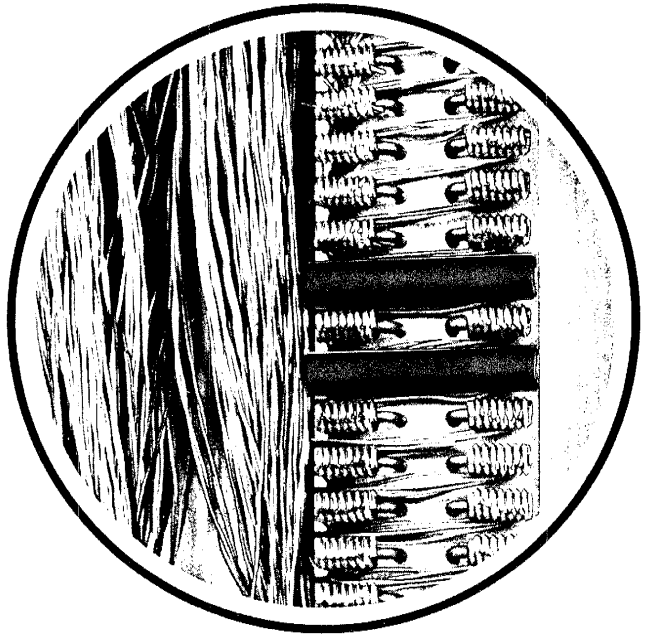


Fig. 33

B coil spring insulators (MD) installed on 70-type connecting block.

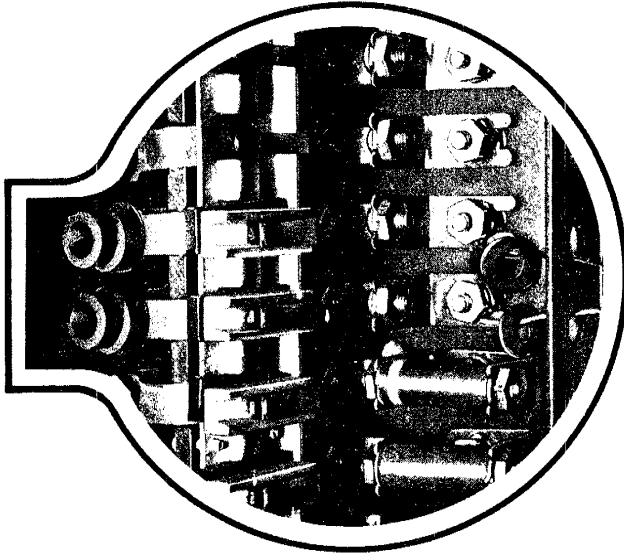


Fig. 34

D binding post caps installed in L-Type fuse chamber.

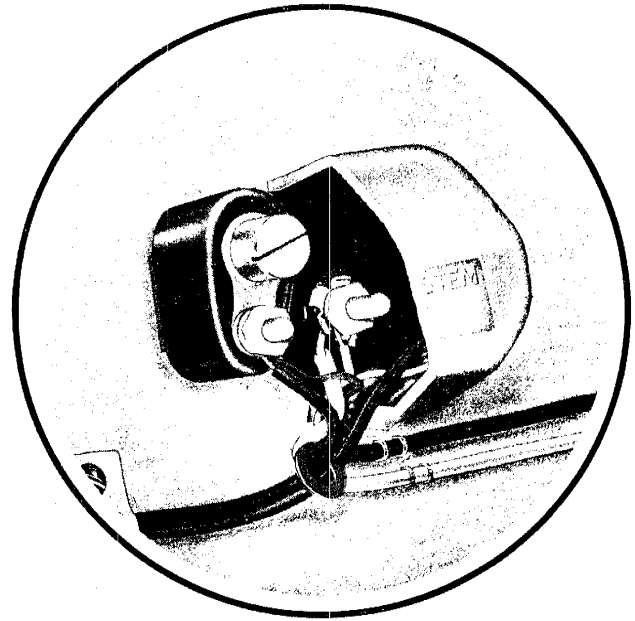


Fig. 36

Indicator used with station protector 123A1A. The 150A cover (shown cut away) gives added security.

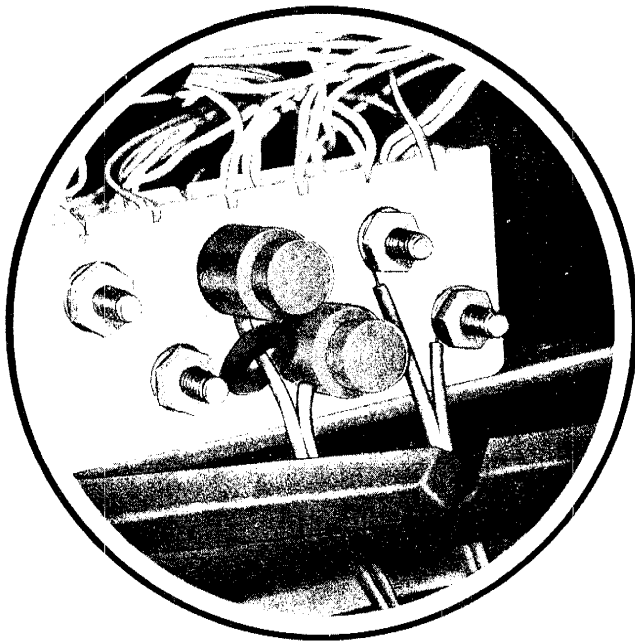


Fig. 35

E binding post caps and indicators used with 49A cable terminal.

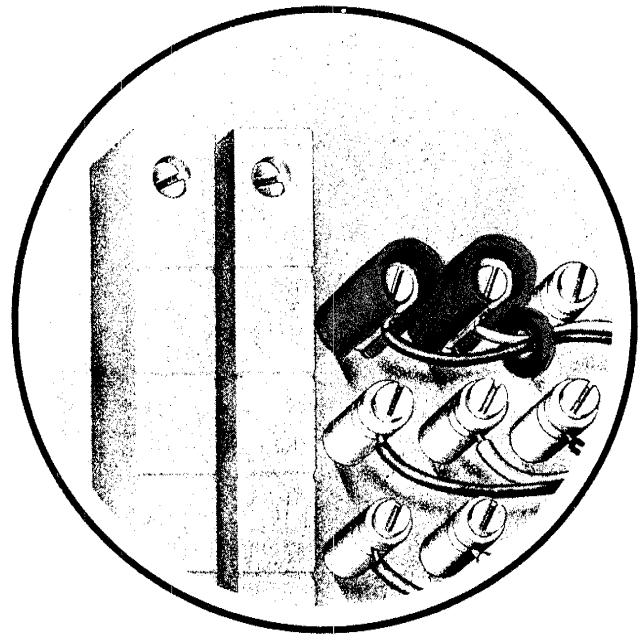


Fig. 37

No. 3 binding post insulators installed in BD-type cable terminal. **Remember** — SSP is required at both ends of cross-connecting wires.

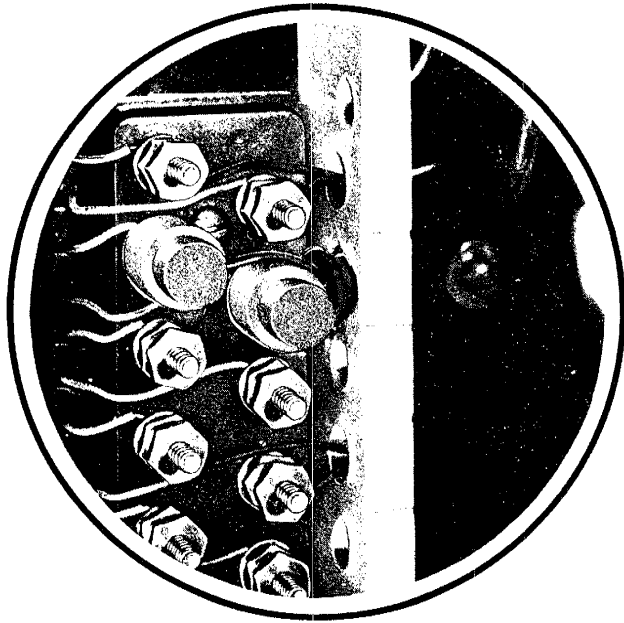


Fig. 38

A 30-type connecting block with SSP.

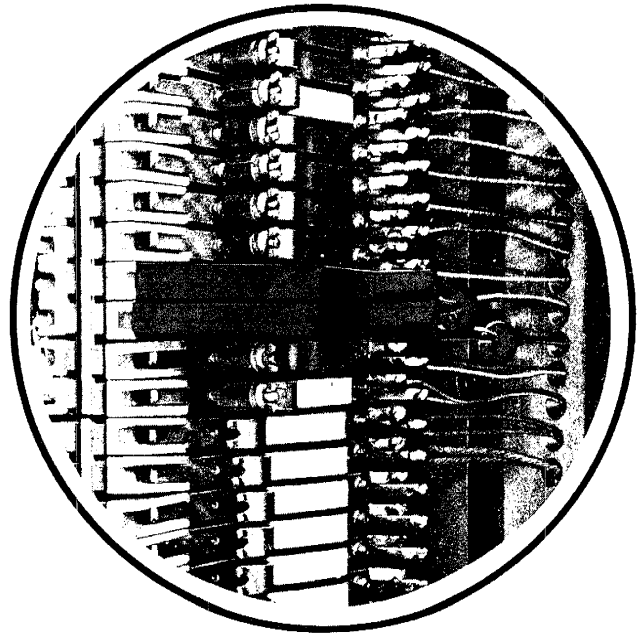


Fig. 40

C50 type frame with KS-14539 guard and terminal punching insulators. *Protect each special circuit appearing on frame. Place SSP on each end of jumper wire.*

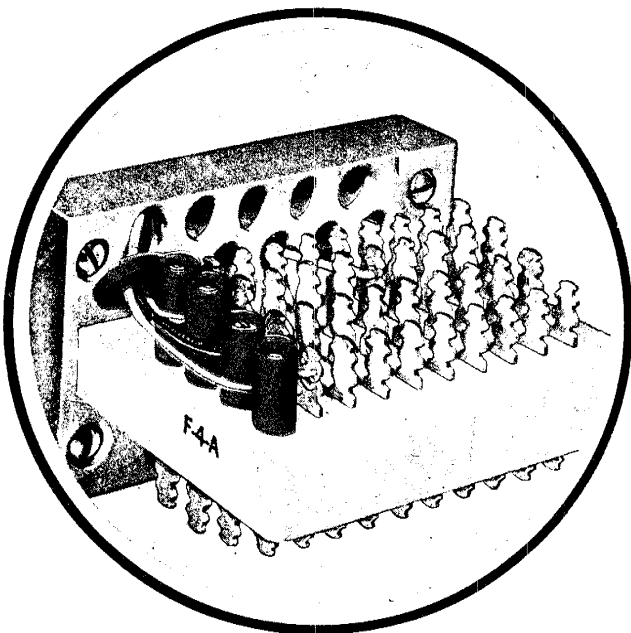


Fig. 39

Typical terminal strip with SSP. Terminal punching insulators shown here are No. 4 (short) and No. 5.

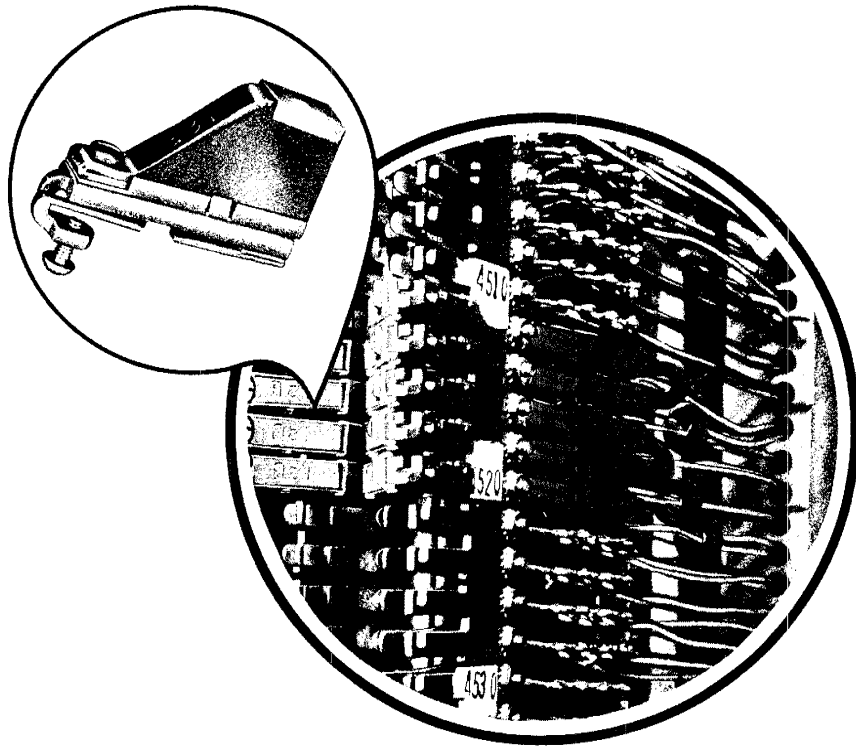


Fig. 41

SSP on frame equipped with 444A test jacks or 401 connector.

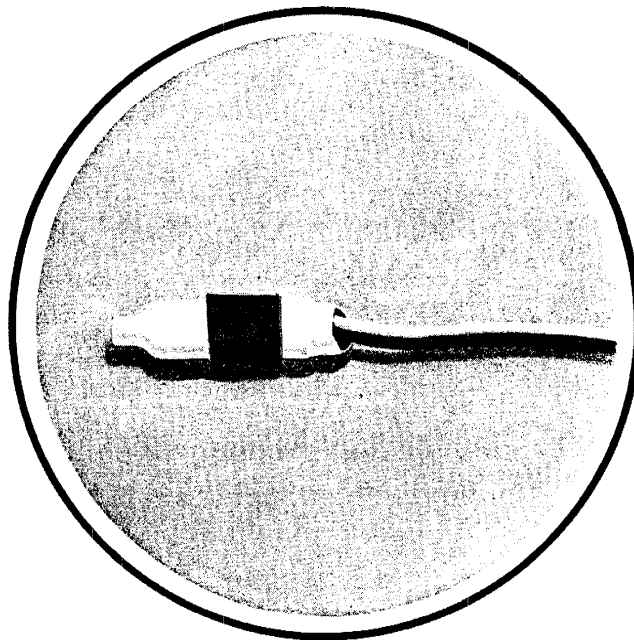


Fig. 42

Warning marker Form E-5190 installed on B wire connector.

7

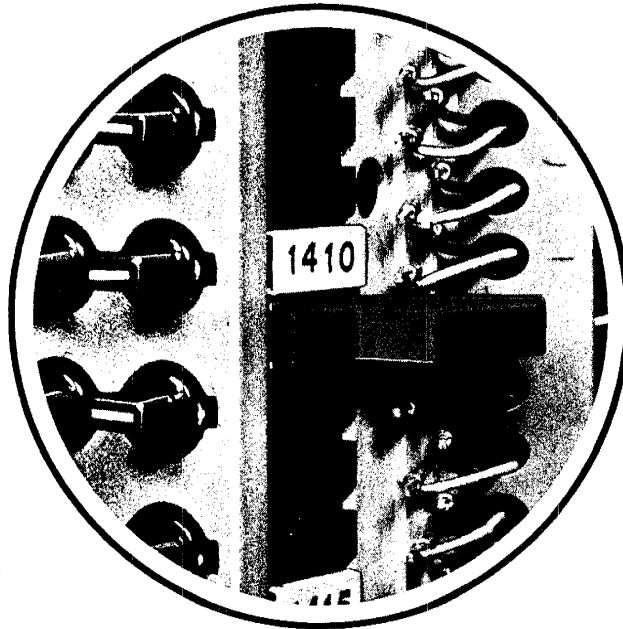


Fig. 43

Protected 300-type connector (jumper wire side) on frame protected with KS-16576, List 5 designation plate.

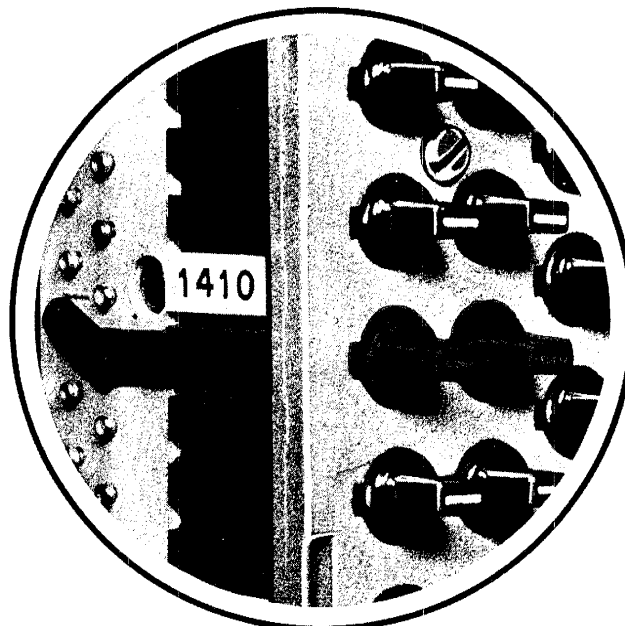
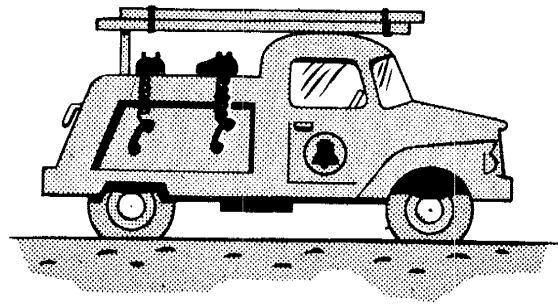
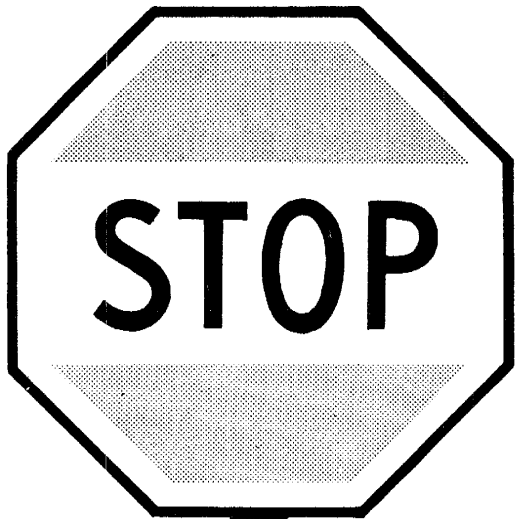


Fig. 44

Protected 300-type connector (test-terminal side) protected with KS-16576, List 6 designation plate. ↙

PACKAGING AND HANDLING  
DISCONNECTED STATION APPARATUS



UNNECESSARY...

***DAMAGE***



**SECTION 500-810-200**

**1.00 GENERAL**

**1.01** This section outlines procedures to be followed by the field forces to protect disconnected telephone station apparatus from damage during its return to telephone company storerooms or the Western Electric Company.

**1.02** The condition of returned telephone equipment determines the *cost* of repair work.

**1.03** A majority of the repair cost is built up due to damage inflicted on the set. This occurs between the time of disconnection and arrival at the repair shop.

**1.04** All disconnected station apparatus requires protective handling. Point sections covering various apparatus will be added as required.

**1.05** Cartons of disconnected apparatus left on customer's premises for pickup should be sealed.

**2.00 DISCONNECTION OF EQUIPMENT**

**2.01** All equipment when removed from service should be disconnected properly. Unnecessary repair costs result when cords are cut off and equipment is pried off wall or otherwise removed improperly.

**2.02** After apparatus has been disconnected, backboards, mounting screws, wire clippings, etc, should be separated from apparatus.

**3.00 PROTECTING TELEPHONE SETS**

**3.01** To give maximum protection to disconnected telephone sets, package them in containers similar to those in which they were delivered. Usually, corrugated cardboard cartons are available from new installations. These cartons should be held for packaging of returned apparatus instead of being discarded or otherwise destroyed.

**3.02** Cardboard cartons also may be obtained through normal supply channels. Table A gives carton and detail numbers required for different sets.

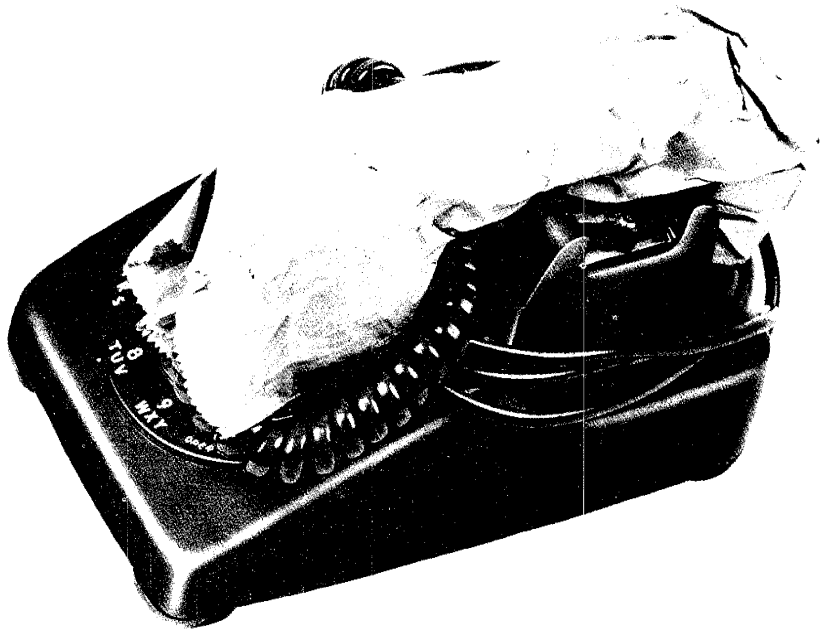
**TABLE A**

**CARTON LISTING**

<b>Carton No.</b>	<b>Detail No.</b>	<b>Type Set</b>
8499	8499A 8499B	201, 211
21800	21800A 21800B 21800C	202, 300, 5300 500 500
RM 649508	RM 649708 RM 649945	500 Wall Set
RM 649522	None reqd RM 649722	400 Key Sets 500 Key Sets
RM 649600	RM 649610 RM 649620	600 (Call Director)
RM 649601	RM 649611 RM 649621	601 (Call Director)
RM 649530	None reqd	700 (PRINCESS Set)



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NOT  
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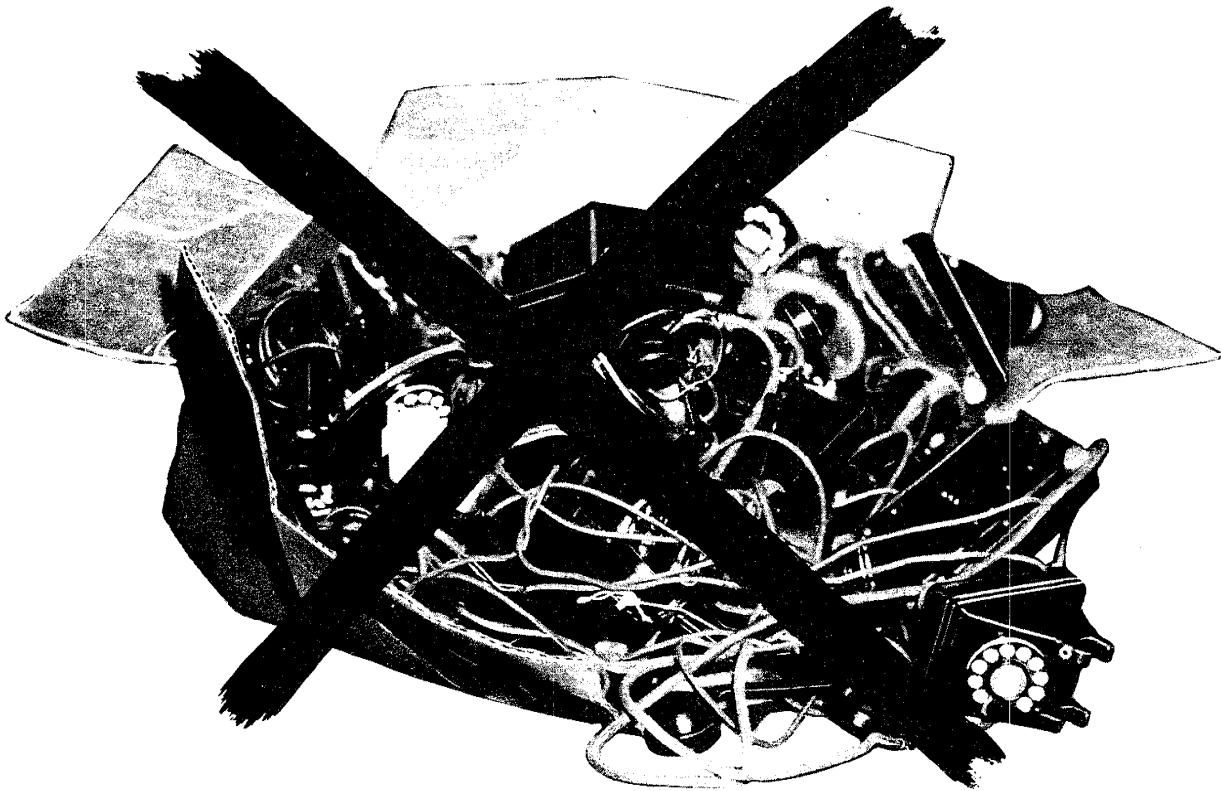


Fig. 1

**SECTION 500-810-200**

**3.03** If there are no suitable cartons available, paper or transparent plastic bags may be used for protecting telephone sets. The type bag used will depend on local supplies.

**Caution:** *Plastic bags can be dangerous due to their suffocating characteristics if handled by small children. Do not leave these bags on the customer's premises or accessible to children.*

**3.04** Particular care should be given to handling disconnected Call Directors, Princess, and other colored telephone sets.

- Considerable damage and costly repairs of Call Directors can result if they are not protected properly when disconnected. Make certain Call Directors are not handled as loose items. Protect them in such a way that handset, mounting cord, and especially the connectors cannot mar other parts of the set.

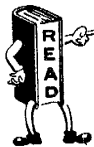
**Caution:** *Tape should not be used to tie mounting cords (particularly Call Director) in coils. Tape stains the jacket and results in costly repairs.*

- All disconnected colored telephone sets, in addition to being packed in suitable cartons, should be protected by plastic bags. These will remain on the sets until the Western Electric Company is ready to make repairs.

**3.05** When telephone sets are packed in cartons, care should be taken to use the cardboard separators and details with which each carton is equipped. This will prevent loose handset or cords from damaging fingerwheel or other parts of the set.

**3.06** When paper or plastic bags are used to package telephone sets:

- Coil mounting cord loosely around upper part of set (Fig. 1).
- Place handset in a 5-pound paper bag or equivalent.
- Place handset across the instrument in a position 90 degrees from its normal position in the cradle. (Do not stretch retractile cords out of their natural shape or wrap them around the set.)
- Spade tips and stay hooks should be so positioned that they will not mar or scratch the handset or housing during transit.
- Place telephone set in bag and fold over end of bag, securing it with a rubber band; or place in trays for return to Western Electric Company.



**Under no circumstances shall connecting blocks, plugs, jacks, screws, or other miscellaneous items be placed in cartons or bags with telephone instruments. These items should be transported separately.**

## STATION AND PBX PROTECTION REQUIRED FOR VARIOUS CONDITIONS OF PLANT

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**1. GENERAL**

- 1.01** In general, this section covers the requirements for protection of subscriber stations including coin telephones at indoor or outdoor locations and general requirements for protecting PBX circuits.
- 1.02** This section replaces Section 638-210-011, Issue 1, and 465-310-201, Issue 2, which are canceled.
- 1.03** The service order should indicate the type of fuseless or fused protector required. If it does not, consult your supervisor.
- 1.04** Station protectors ensure safety to subscribers and telephone personnel and prevent damage to station equipment from abnormally high voltage and current.
- 1.05** Isolated sections of aerial cable are considered as open wire for the purpose of determining the type of protector required unless the cable is

effectively grounded to a multigrounded neutral or to an extensive water (metallic pipe) system.

**1.06** Cable, wire, strand, etc. that is subject to disturbances by lightning or possible contact or induction from electric circuits in excess of 300 volts are called exposed cable, wire, or circuits.

**1.07** Cable, wire, strand, etc. that are not subject to disturbances by lightning or electric circuits in excess of 300 volts are called unexposed cable, wire, or circuits.

**1.08** In nonlightning areas the exposure status of cable or wire is based only on power exposure. The protection outlined in the station protection practices is primarily for protection against the effects of power contacts. In lightning areas protection is required regardless of power exposure except when the plant is effectively shielded by buildings or other structures.

**1.09** Ground rods encountered on reinstalls and reconnects shall not be used if a better grounding electrode is available.

**1.10** Section 460-100-101 describes the various types of station protectors, Section 460-100-200 outlines the methods of installing protectors, Section 460-100-201 outlines the methods for installing protector and signaling grounds, Section 462-460-200 covers the installation of station sets installed in autotrailers, and Section 502-415-100 covers the special requirements for station sets installed in explosive atmospheres.

**2. FUSELESS STATION PROTECTION AND REQUIREMENTS (AERIAL OR BLOCK CABLE)**

**2.01** Fuseless station protectors should be used at all stations served by a cable with a grounded metal sheath or shield, such as lead, alpth, stalpth, etc (1.05). When drop wire is to be joined to a cable pair, a fusible link is required as outlined in 4.01, (b).

## SECTION 460-100-100

**2.02** The fuseless protectors should be installed when single pair drop wire is used at stations served by open or multiple wire when the protector can be grounded as follows:

- (a) A metallic cold water pipe having at least 10 feet buried.
- (b) A metallic cold water pipe bonded to a multigrounded neutral system.
- (c) Service ground of a multigrounded neutral power system.
- (d) Metallic service entrance conduit (except duminum) bonded to the service entrance box of a multigrounded neutral system.

**Note:** If one of these grounds is not available a fused-type protector must be used.

**2.03** Subject to the grounding restrictions outlined in 2.02, the fuseless protector may be used as follows:

- (a) At any station served by open wire where bridling to C Drop Wire is through D or E Block Wire fusible link (bridling wire).
- (b) At stations where C Drop Wire is directly connected to urban wire.
- (c) Where C Drop Wire is connected through D or E Block Wire fusible link to rural wire.

**Note:** The bridling between drop wire and open wire or rural wire must consist of at least two feet of D or E Block Wire. Bridling requirements are outlined in Section 462-240-200.

**2.04** A fuseless protector must not be used with multiple drop wire when the stations are served by open or multiple wire.

**Note:** A fuseless protector can be used only with multiple drop wire when the stations are served by a grounded metal sheath or shielded cable.

**2.05** Drop wire from an unexposed cable terminal into an exposed area exposes both the subscriber station and the distribution cable. Fuseless protectors are required at both ends of the drop.

When drop is to be joined to a cable pair a fusible link is required as outlined in 4.01, (b).

**Note:** Section 638-200-200 covers unexposed cable at exposed wire connections.

## 3. FUSED STATION PROTECTION AND REQUIREMENTS

**3.01** When the grounding requirements or bridling requirements outlined in 2.02 or 2.03 cannot be followed, a fused-type protector must be used.

## 4. STATION PROTECTION AND REQUIREMENTS (BURIED AND UNDERGROUND)

**4.01** Fuseless station protectors may be used with buried distribution cable connected to exposed cable as follows:

- (a) When 24- or 26-gauge cable is so located that it will serve as a fusible link. Section 638-205-015 covers the requirements for placing fuse cables.
- (b) When the buried distribution cable is 19- or 22-gauge and no fuse cable has been placed, a minimum of 8 inches of either 24- or 26-gauge wire must be placed at the junction point as a fusible link between the service wire and buried cable.

**Note:** B Wire Connectors should be used to join the fine gauge wire (24- or 26-gauge conductors) used as a fusible link to the service wire and buried distribution cable.

**4.02** When the requirements outlined in 4.01 cannot be met, a fused-type protector must be used.

**4.03** For any length of buried wire, bond the aluminum shield or armored wire to the ground terminal of the protector by means of the solderless connector. The aluminum shield or armor wire is bonded to the terminal housing by means of an AT-7796X Connector.

**4.04** Service drops joined to exposed underground cable pairs will require the same type protectors as drop wire joined to exposed aerial cable pairs.

**5. PBX STATION PROTECTION (CENTRAL OFFICE TRUNKS, TIE TRUNKS, OFF-PREMISES EXTENSIONS, RINGING FEEDERS, AND BATTERY FEEDER CIRCUITS)**

**5.01** When PBX's are served by exposed metal sheath cables, the following protection is required:

- (a) The sheath of the cable must be grounded.
- (b) A fuse cable spliced between the entrance cable and the terminating facilities.
- (c) The terminating facilities shall be equipped with heat coils and carbon blocks.

**5.02** When drop or multiple drop wire is extended from exposed metal sheath cables, fuseless protectors should be used. When drop wire is to be joined to a cable pair a fusible link is required as outlined in 4.01, (b).

**5.03** Fuseless protectors may be used with open or multiple wire when the requirements of 2.02 are observed. Otherwise fused protectors must be used.

**5.04** All exposed PBX lines require 60-type fuses except as follows:

- (a) As outlined in 5.01.
- (b) Battery feeder circuits.

**5.05** Battery feeder circuits extended from exposed metal sheath cables require the following protection:

- (a) As outlined in 5.01.
- (b) Where a single battery feeder pair is extended from a metal sheath cable, the fuseless-type protector or protected terminal is all the protection required.
- (c) Where two or more cable pairs are used in multiple and these pairs are extended by a single drop wire, the arrangement may be considered as a single pair and protection provided as in (b).
- (d) When multiple drop wire is extended from a cable terminal and terminates on 116- or

117-type protectors, no other protection for a single pair battery feeder circuit is required.

(e) When two or more battery feeder pairs are extended from NH-type terminals (without metal housing) or 1A4A-type terminals, no other protection is required.

(f) When two or more cable pairs are used in multiple and these pairs are extended by two or more drop wires, fused-type protectors must be used.

**5.06** Battery feeder circuits extended from open or multiple wire require the following protection:

(a) A fuseless protector may be used with a single battery feeder pair when the protector can be grounded as outlined in 2.02. Otherwise a fused protector must be used.

(b) A fused protector must be used with two or more pairs.

**5.07** Exposed PBX lines (central office trunks, tie trunks, off-premises extensions, and ringing feeder circuits) extended from metal sheath cables must be provided with sneak current protection. The 60A or 60D Fuses are generally used with these types of circuits. The 60-type fuses are not required when pairs are extended from a protector frame equipped with heat coils and carbon blocks.

**5.08** Exposed PBX lines (central office trunks, tie trunks, off-premises extensions, and ringing feeder circuits) extended from open or multiple wire must be provided with sneak current protection. The 60A or 60D Fuses are generally used with these types of circuits. Protection can be provided as follows:

(a) Fuseless protectors equipped with 60-type fuses may be used with a single drop when the grounding requirements of 2.02 can be observed. Otherwise a fused protector equipped with 60-type fuses must be used.

(b) When two or more drops are terminated at the same location, fused protectors equipped with 60-type fuses must be provided for each drop.

**6. STATIONS REQUIRING SPECIAL PROTECTIVE MEASURES**

**6.01** Special protective measures are usually required for stations located in the following areas:

- (a) At power substations or generating stations.
- (b) In atmosphere containing explosive gas, vapor, or dust.
- (c) Where privately owned circuits are in conflict or joint use with power circuits not suitable for general joint use.
- (d) When facilities are leased for the operation of FOREIGN signaling circuits which might impress excessive voltage or current on the system's facilities.

**Note:** The protection required for the circuits listed in (a) through (d) will be on the service order. If it is not, consult your supervisor.

**6.02** Outdoor stations served by exposed conductors usually require only fuseless or fused protectors.

**6.03** There are some stations where protectors and special grounding arrangements are necessary, as follows:

- (a) **Coin Telephones:** If the drop or line wire is exposed between the cable terminal and telephone, protectors are required (2.05).
- (b) **Stations on Wood Poles:** If possible install the stations on a pole having a vertical ground wire connected to a multigrounded neutral.

When a multigrounded neutral is not available and the station is served from a metal sheath cable, the protector is grounded to a ground rod. If the station is served from open or multiple wire, ground the protector to a ground ring following local instruction.

**Caution:** Do not install a station on a pole having a power vertical ground wire for lightning protection unless the ground wire is connected to a multigrounded neutral.

(c) **Stations on Metal Poles:**

**Caution:** Do not install stations on metal poles that support power circuits (open wire or in conduit) of 300 volts or more unless the pole is grounded to a multigrounded neutral or a metallic cold water pipe.

- (1) Fuseless protectors are required on metal poles supporting power circuits of 300 volts or more.
- (2) When the conductors are exposed and the power circuits on the metal pole are 300 volts or less and the pole is bonded to a multigrounded neutral or low impedance ground, such as a metallic cold water pipe, a fuseless protector is required.
- (3) When the conductors are exposed and the power circuits on the metal pole are 300 volts or less, a fused protector is required.
- (4) When the conductors are unexposed and the power circuits on the metal pole are 300 volts or less, no protection is required.

## STATION PROTECTORS IDENTIFICATION AND SELECTION

### 1. GENERAL

1.001 This addendum supplements Section 460-100-101, Issue 1.

1.002 This addendum is issued to show design change on 90A bracket.

### 3. DESCRIPTION OF PROTECTOR MOUNTINGS AND ASSOCIATED EQUIPMENT

The following change applies to Part 3 of the section.

(a) Fig. 9—Revised

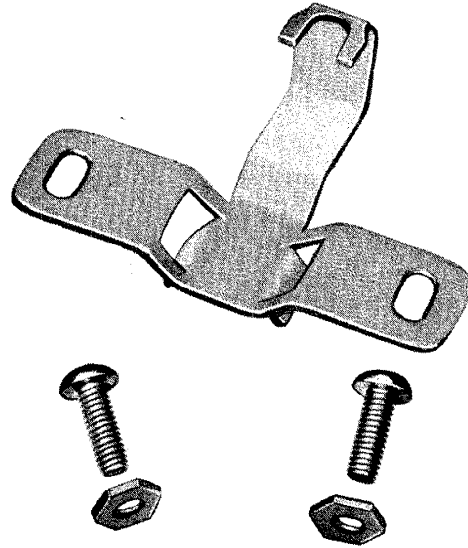


Fig. 9—90A Bracket





## STATION PROTECTORS IDENTIFICATION AND SELECTION

CONTENTS	PAGE	
1. GENERAL . . . . .	1	1.03 The station protectors covered in this section are the fuseless and fused type. The fuseless protector contains protector units having three mil air gaps.
2. DESCRIPTION OF STATION PROTECTORS . . . . .	1	
3. DESCRIPTION OF PROTECTOR MOUNTINGS AND ASSOCIATED EQUIPMENT . . . . .	4	2. DESCRIPTION OF STATION PROTECTORS
4. MANUFACTURE DISCONTINUED . . . . .	6	2.01 Table A lists the various types of protectors and their use.
1. GENERAL		2.02 The 123A1A Protector consists of a base of insulating material containing three binding posts and two 2B1A Protector Units (Fig. 1).
1.01 This section covers the description and use of station protectors.		2.03 the 123A1A Protector provides protection against high voltage and abnormal current for one pair of wires at subscriber's premises.
1.02 This section replaces Section 638-215-100 which is canceled.		

TABLE A — PROTECTORS — FUSELESS AND FUSED			
TYPE	PROTECTOR	USE	
		INDOOR	OUTDOOR
Fuseless	123A1A	X	1
	128A1A-2	X	1
	98AA	X <sup>2</sup>	
	106CA	X <sup>2</sup>	
	116C		X
	117B	X	
Fused	106C	X	
	1293C		X
	1293CA		X
<p><i>Note 1:</i> For outdoor installation, a 150A Cover or 305A2 Protector Mounting is required.</p> <p><i>Note 2:</i> Fuse type converted to fuseless operation.</p>			

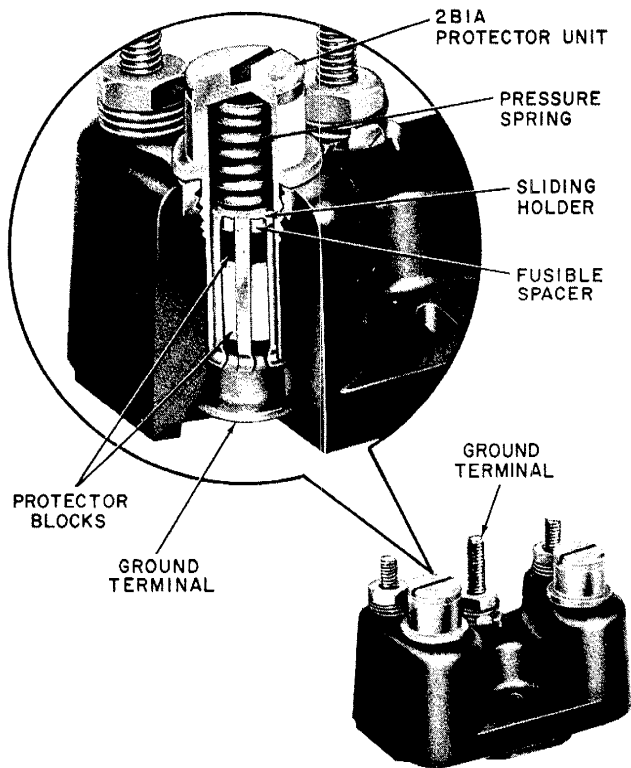


Fig. 1—123A1A Protector

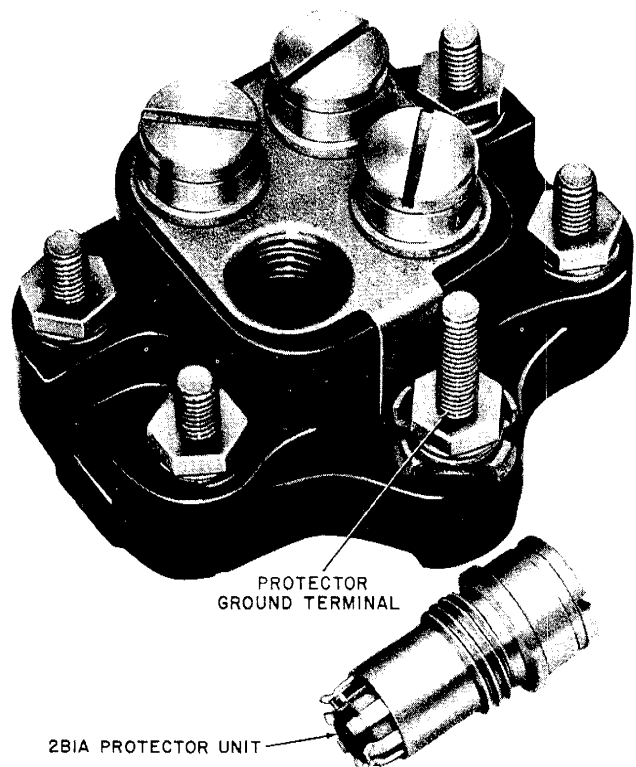


Fig. 2—128A1A-2 Protector

**2.04** The 128A1A-2 Protector consists of a base of insulating material containing five binding posts and four 2B1A Protector Units (Fig. 2).

**2.05** The 128A1A-2 Protector provides protection against voltage and abnormal current for two pairs of wires at subscriber's premises.

**2.06** The 116C Protector is a molded terminal block containing twelve binding posts, twelve 2A1A Protector Units, and two binding posts for signaling ground connections. The terminal is housed in a metal container with a hinged metal cover. The metal housing is equipped with a clamp for connecting the station ground wire (Fig. 3).

**2.07** The 116C Protector provides protection for six-pair multiple drop wire at the subscriber's premises. The 116C Protector is used only with six-pair multiple drop wire extended from metal sheath cables.

**2.08** The 117B Protector is a molded terminal block containing twelve binding posts, twelve 2A1A Protector Units, and two binding posts for

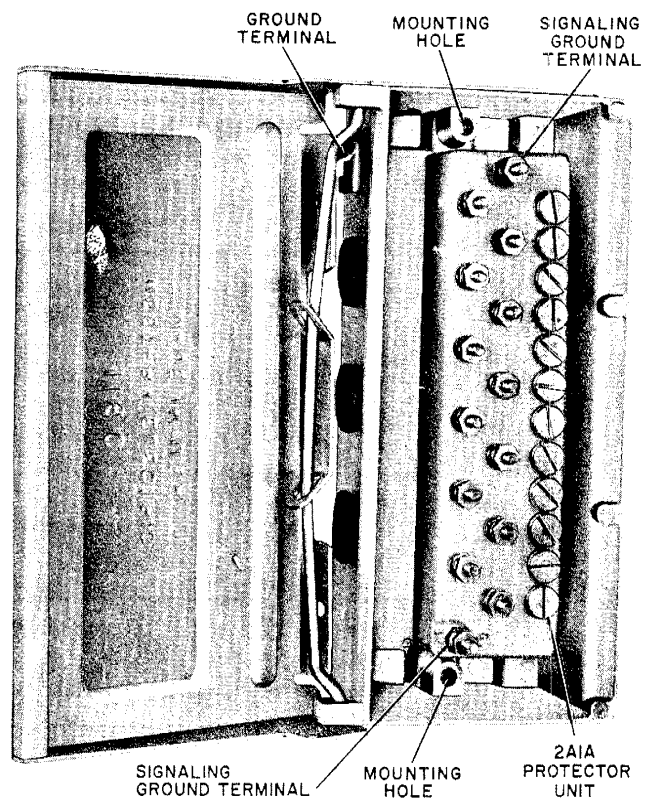


Fig. 3—116C Protector

signaling grounds (Fig. 4). The binding post with a pronged washer is for connecting No. 10 station ground wire to the protector. It is provided with wood screws for mounting on wood and self-tapping screws for mounting on metal surfaces.

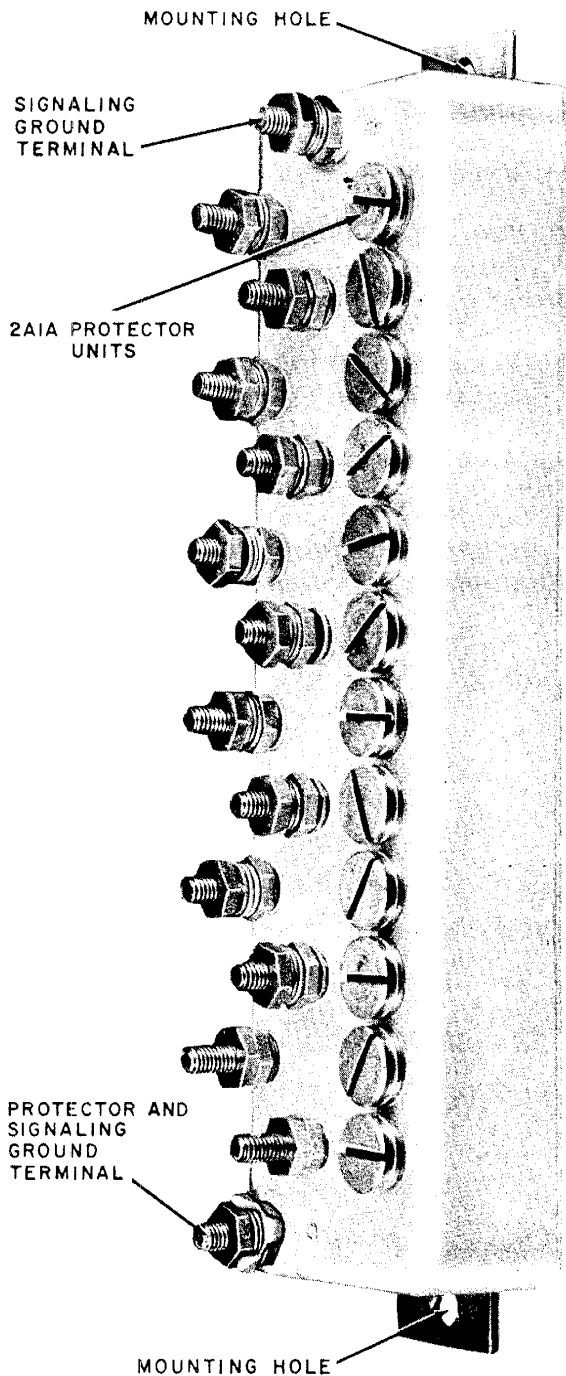


Fig. 4—117B Protector

2.09 The 117B Protector is for indoor mounting and provides protection for six-pair multiple drop wire at the subscriber's premises. Use only with six-pair multiple drop wire extended from metal sheath cables.

2.10 The 98AA Protector consists of a base of insulating material containing five binding posts, two 11CBB Fuses, two 213A Connectors inserted over the fuses with the pilot holes toward the station end of the protector, two 121A Adapters inserted in the bottom of the protector well under the carbon blocks, and two each No. 26 and 27 Protector Blocks (Fig. 5).

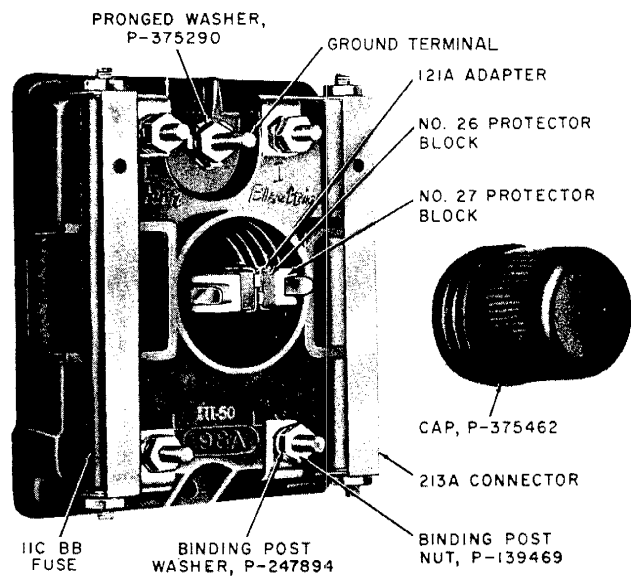


Fig. 5—98AA Protector

2.11 The 98AA Protector provides protection against abnormal voltage and current for one pair of wires served from grounded metal sheath cables. It is not to be used at stations served by open wire.

2.12 The 106C Protector consists of a base of insulating material containing five binding posts, two 11CBB Fuses, and two 2A1A Protector Units (Fig 6).

2.13 The 106C Protector provides protection against high voltage and abnormal current for one pair of wires at subscriber's premises.

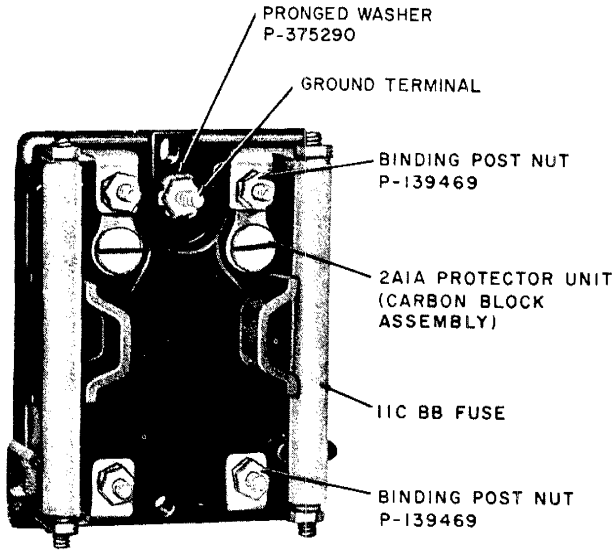


Fig. 6—106C Protector

2.14 The 106CA Protector is a 106C Protector converted for fuseless operation by strapping out the 11CBB Fuses with No. 213A Connectors (Fig. 7). The 213A Connector is placed with the pilot hole toward the station end of the protector.

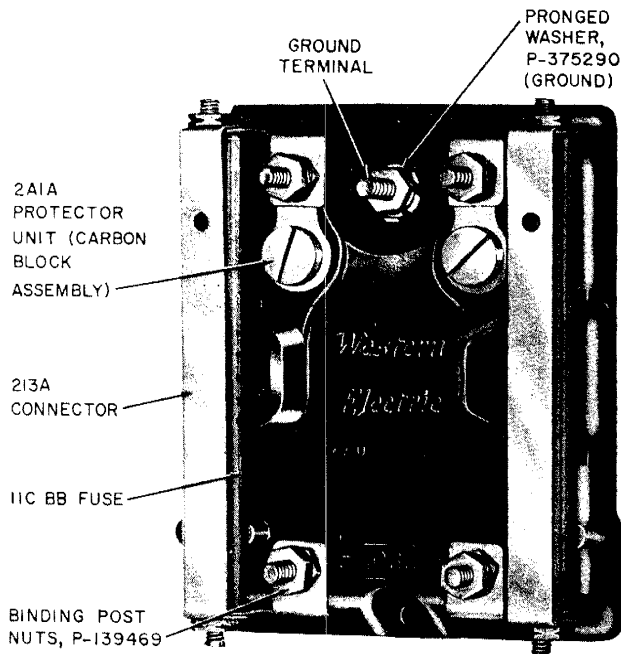


Fig. 7—106CA Protector

2.15 The 106CA Protector provides protection against high voltage and abnormal current for one pair of wires served from grounded metal sheath cables. It is not to be used at stations served by open wire.

2.16 The 1293C Protector consists of a 106C Protector mounted in a 93C Protector Mounting.

2.17 The 1293C Protector is used where fused protection for one pair of wires is required and it is necessary to install the protector outdoors.

2.18 The 1293CA Protector consists of a 106CA Protector mounted in a 93C Protector Mounting.

2.19 The 1293CA Protector is used for protection against high voltage and abnormal current for one pair of wires served from grounded sheath cables when it is necessary to install the protector outdoors.

### 3. DESCRIPTION OF PROTECTOR MOUNTINGS AND ASSOCIATED EQUIPMENT

3.01 The 72A Bracket is a formed metal bracket (Fig. 8).

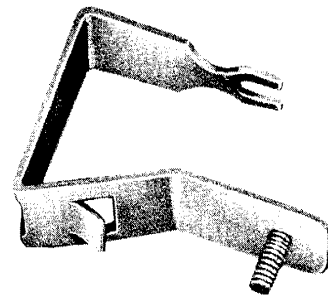


Fig. 8—72A Bracket

3.02 The 72A Bracket is used to mount a 123A1A Protector on an acceptable metallic cold water pipe by means of a station ground clamp.

3.03 The 90A Bracket is a formed metal bracket (Fig. 9).

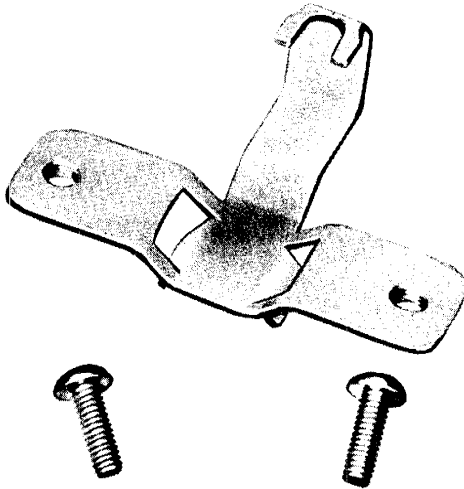


Fig. 9—90A Bracket

3.04 The 90A Bracket is used to mount a 128A1A-2 Protector on an acceptable metallic cold water pipe by means of a station ground clamp.

3.05 The 150A Cover consists of gray semiflexible insulating material (Fig. 10).

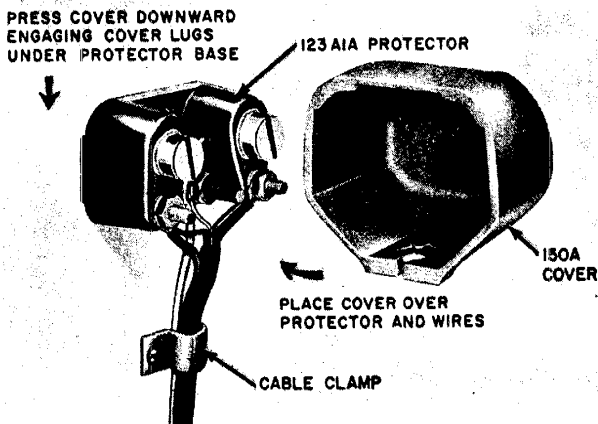


Fig. 10—150A Cover

3.06 The 150A Cover snaps over a 123A1A or 128A1A-2 Protector. It is intended as a protective covering for outdoor installation, or indoor installation when a protective covering is required.

3.07 The 305A2 Protector Mounting consists of a metal base and a removable metal cover. It is provided with two screws for fastening the protector to the metal base (Fig. 11).

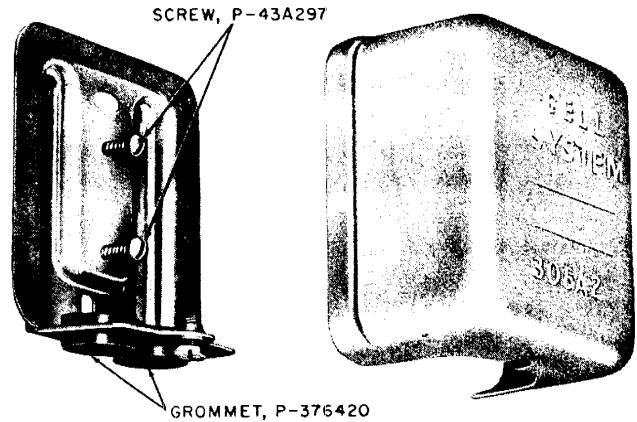


Fig. 11—305A2 Protector Mounting

3.08 The 305A2 Protector Mounting is intended to house the 123A1A or 128A1A-2 Protector for outdoor installation.

3.09 The 93C Protector Mounting consists of a metal base and removable metal cover. It is provided with two screws for fastening the protector to the metal base (Fig. 12).

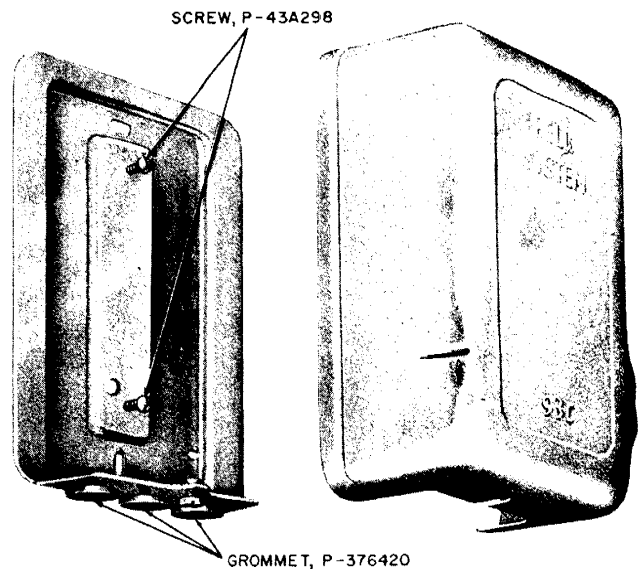


Fig. 12—93C Protector Mounting

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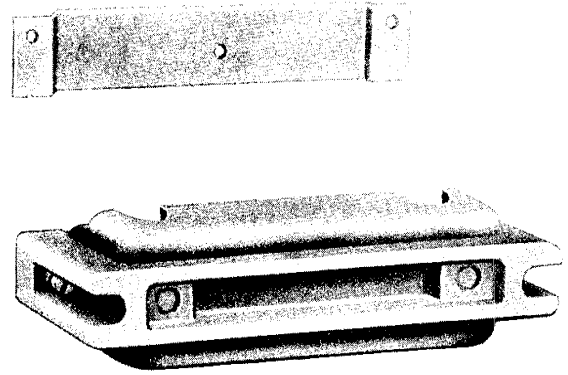
**3.10** The 93C Protector Mounting is intended to house the 98AA, 106C, and 106CA Protector for outdoor installation.

**3.11** The 46A Shield consists of a shield of insulating material containing two captive screws and a metal mounting strap (Fig. 13).

**3.12** The 46A Shield is used with the 106C Protector when mounted in commercial boxes. When the fuses blow, the shield prevents hot gases from short-circuiting or grounding the terminals of the protector.

**4. MANUFACTURE DISCONTINUED**

**4.01** The following protectors are no longer manufactured: 98A, 109A, 111A, 116A, 116B, 117A, 1093A, and 1093C.



**Fig. 13—46A Shield**

## STATION PROTECTION INSTALLATION AND INSPECTION

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7. INSTALLING PROTECTORS—PBX . . . . .	10

1.07 Fused protectors must be used when it is necessary to run more than one drop or block wire to furnish battery for a telephone system. A maximum of three drops or block wires furnishing battery for a system may be terminated on one fused protector and must be bridged on the line side of the protector.

1.08 Sneak current fuses (60-type) are not required with protectors associated with resident systems. They shall be provided on special service and leased lines when specified on the service order or by other local instructions. The 60-type fuses are listed in Table A.

TABLE A — 60-TYPE FUSES		
FUSES	CURRENT (AMPERES)	COLOR OF SHELL
60A	.500	Red
60D	.500	Red
60E	1.800	Black
60F	.267	Red
60G	.750	Grey
60H	.267	Red
60J	.300	Grey

### 1. GENERAL

1.01 This section covers the installation of station protectors. It also includes the use of 150A Covers, 46A Shields, and associated protector mountings.

1.02 This section replaces Sections 638-215-200 and 465-310-201 which are canceled.

1.03 Service orders on other local instructions will specify whether or not station protection is required.

1.04 Station protectors prevent damage to station equipment from abnormally high voltage or current.

1.05 Noninsulated building attachments should be used with fuseless protectors or with fused protectors that have been converted to fuseless type.

1.06 When installing a fuseless 123A1A or 128A1A-2 Protector, if possible, use a 72A or 90A Bracket.

### 2. LOCATION OF PROTECTORS

2.01 Before installing protectors the following should be taken into consideration:

- (a) **Fuseless Protector:** The line conductors remain grounded for the duration of a power contact, and the voltage on the wire cannot rise sufficiently to create a hazard. To ensure this safety feature, the length of ground wire from the protector should be as short as possible to provide a low-resistance path to

**SECTION 460-100-200**

ground. When possible, the 123- or 128-type protectors should be installed directly on a metallic cold water pipe by means of a 72A or 90A Bracket.

- (b) **Fused Protector:** To reduce the extent of exposure that might exist when fuses open as a result of a power contact, the line conductors on the line side of the protector should be as short as possible.
- (c) Accessibility (Avoid placing where a ladder is necessary for installation or maintenance.)
- (d) Location of telephone and power ground. (The telephone ground shall be located to facilitate common grounding.)
- (e) Appearance (Avoid locations on fronts of buildings or in living quarters.)
- (f) Dry and well ventilated locations when mounted indoors or underneath buildings.

**2.02** When it is necessary to multiple fuseless or fused protectors, there should be 1 inch separation when horizontally mounted and 2 inches separation when vertically mounted (Fig. 7, 20, and 27).

**3. INSTALLING PROTECTORS—GENERAL**

*Caution: Before connecting the protector ground wire, test the power company ground rod, ground wire, cabinet, meter box, etc, with a B Voltage Tester prescribed in Section 620-105-010. The voltage test shall be as prescribed for vertical power ground wires or metallic conduit.*

**3.01** Terminate line and inside wires on the protector so that the ring conductors (single tracer or red wires) shall be connected to the right side of the protector (on the ceiling, the right side as viewed from the inside wiring end of the protector).

**3.02** Protectors installed indoors may be mounted in any position.

**3.03** All screws and fasteners shall be of sufficient length to mount securely. The 080 Division of the Plant Series Practices contains information concerning the various types of screws, anchors, etc, required to install the protectors.

**3.04** The size ground wire required for single or multiple installation of protectors is listed in Table B.



*When the initial protector ground wire is installed, it should be of sufficient size to provide protection for any future protectors installed (Table B).*

TABLE B — GROUND WIRE CAPACITY		
GROUND WIRE SIZE	NO. OF PROTECTED CIRCUITS	
	FUSELESS	FUSED
No. 14	1	3
No. 12	2	6
No. 10	6	7
No. 6	7 or More	8 or More

*Note: The ground wire between protectors shall be the same size as the ground wire between the protector and the grounding electrode.*

**3.05** Backboards should be used only on uneven or insecure mounting surfaces.

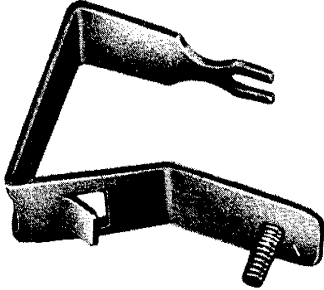
**3.06** The type and number of protectors that can be mounted on a backboard are listed in Table C.

TABLE C — PROTECTOR CAPACITY OF BACKBOARDS		
NO.	TYPE PROTECTOR	TYPE BACKBOARD
1 or 2	123 or 128	79
3 to 10	123 or 128	81
1	98 or 106	79
2 to 5	98 or 106	81



**4. INSTALLING PROTECTORS—FUUSELESS**

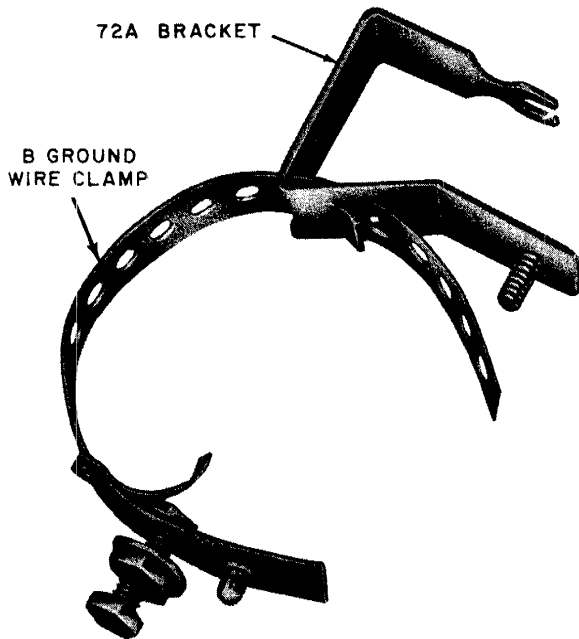
**4.01** The 123A1A Protector preferably should be installed directly on an acceptable metallic cold water pipe by means of a 72A Bracket and a B Station Ground Wire Clamp. The 72A Bracket is illustrated in Fig. 1.



**Fig. 1—72A Bracket**

**4.02** To install the 72A Bracket on the 123A1A Protector proceed as follows:

- (a) Place a B Station Ground Wire Clamp through the slots in the 72A Bracket (Fig. 2).



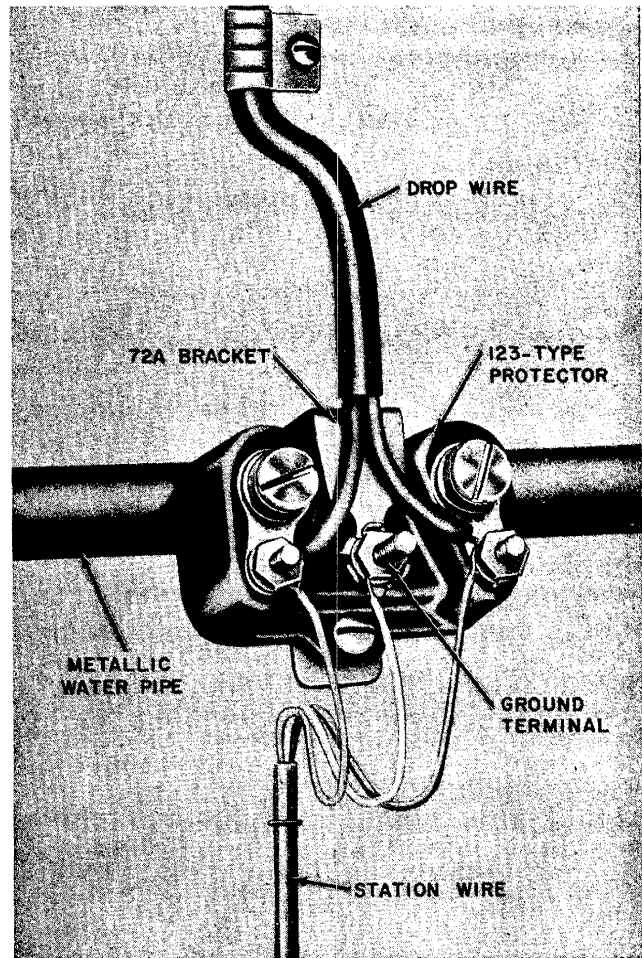
**Fig. 2—B Station Ground Wire Clamp Through Slots in 72A Bracket**

- (b) Attach the ground wire clamp to an acceptable cold water pipe in the usual manner. Remove the screw from the 72A Bracket and slide the

protector into place, making sure the notched portion of the bracket is under the pronged washer of the protector ground terminal.

- (c) Place the mounting screw furnished with the 72A Bracket in the bottom mounting hole of the 123A1A Protector and into the threaded hole of the bracket. Tighten the mounting screw, ground terminal nut, and protector ground terminal nut (Fig. 3).

*Note:* A protector installed in this manner is grounded through the 72A Bracket and eliminates the need of station ground wire. Do not use the 72A Bracket with the 128A1A-2 Protector.



**NOTE:**  
B STATION GROUND WIRE CLAMP NOT SHOWN  
FORM E-3013B OMITTED FOR CLARITY.

**Fig. 3—123A1A Protector Installed on a Metallic Water Pipe**

4.03 Fig. 4 illustrates a typical installation when the 123A1A Protector cannot be installed on a metallic cold water pipe.

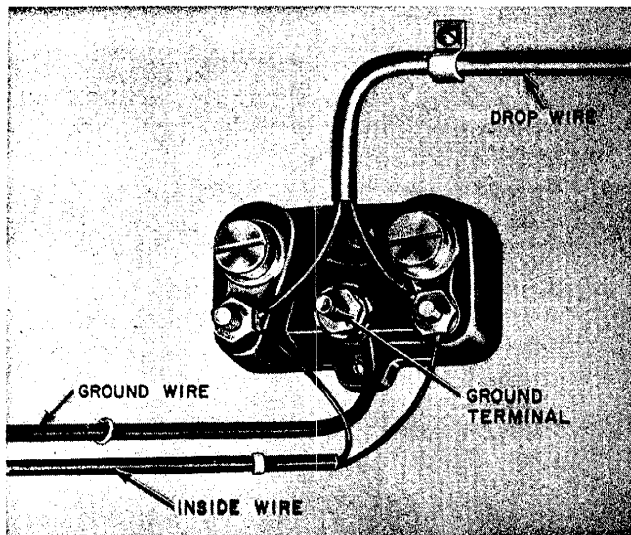


Fig. 4—123A1A Protector

4.04 The 128A1A-2 Protector preferably should be installed directly on an acceptable metallic cold water pipe by means of a 90A Bracket and a B Station Ground Wire Clamp. Fig. 5 illustrates the 90A Bracket.

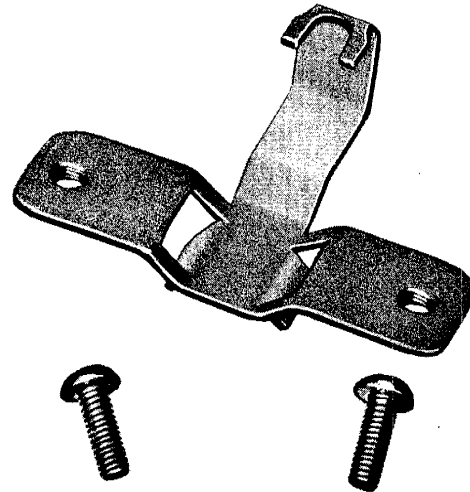


Fig. 5—90A Bracket

4.05 The 90A Bracket is installed on the 128A1A-2 Protector as outlined in 4.02. Fig. 6 illustrates a 128A1A-2 Protector installed on a metallic cold water pipe using a 90A Bracket.

4.06 Fig. 7 illustrates a typical installation when the 128A1A-2 Protector cannot be installed on an acceptable metallic cold water pipe.

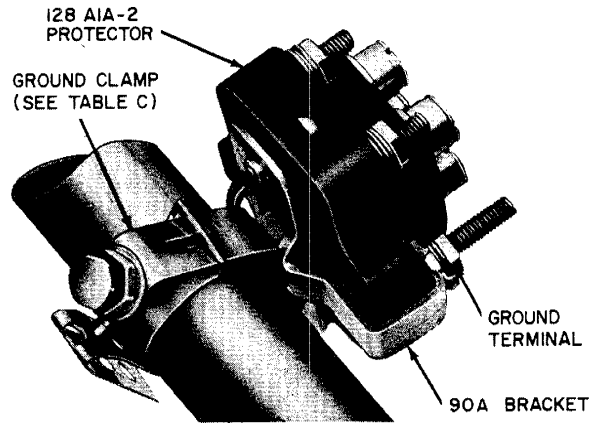


Fig. 6—128A1A-2 Protector Installed on a Metallic Water Pipe

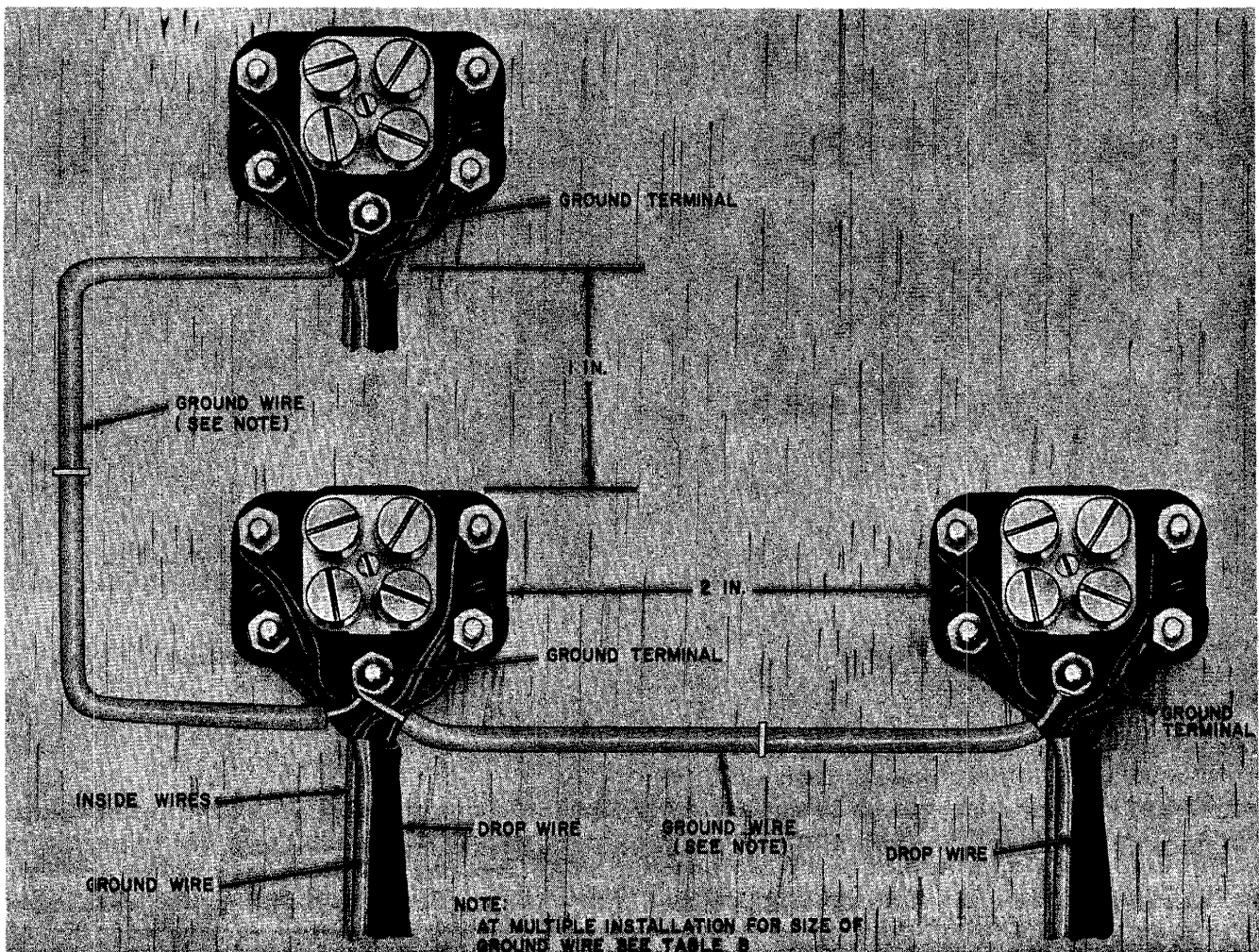
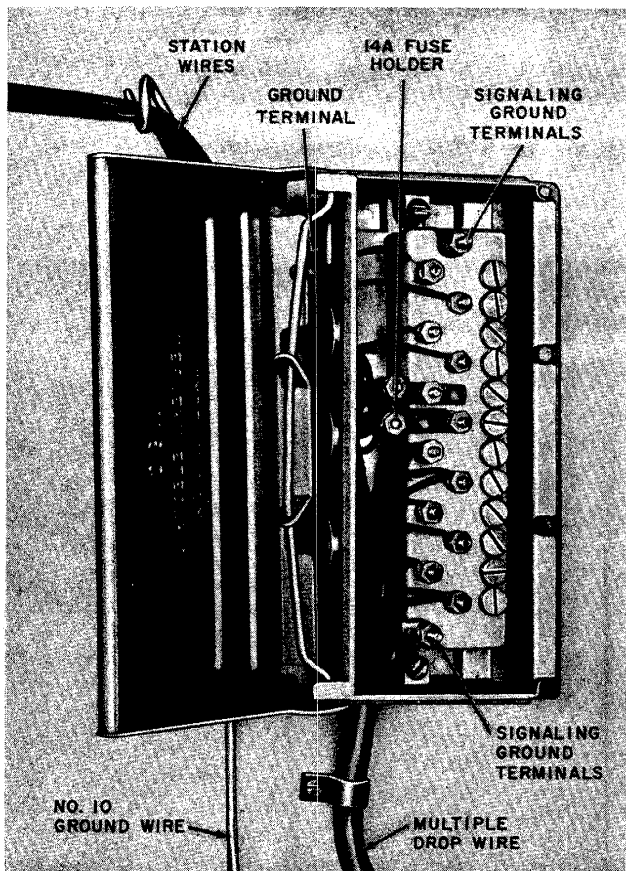
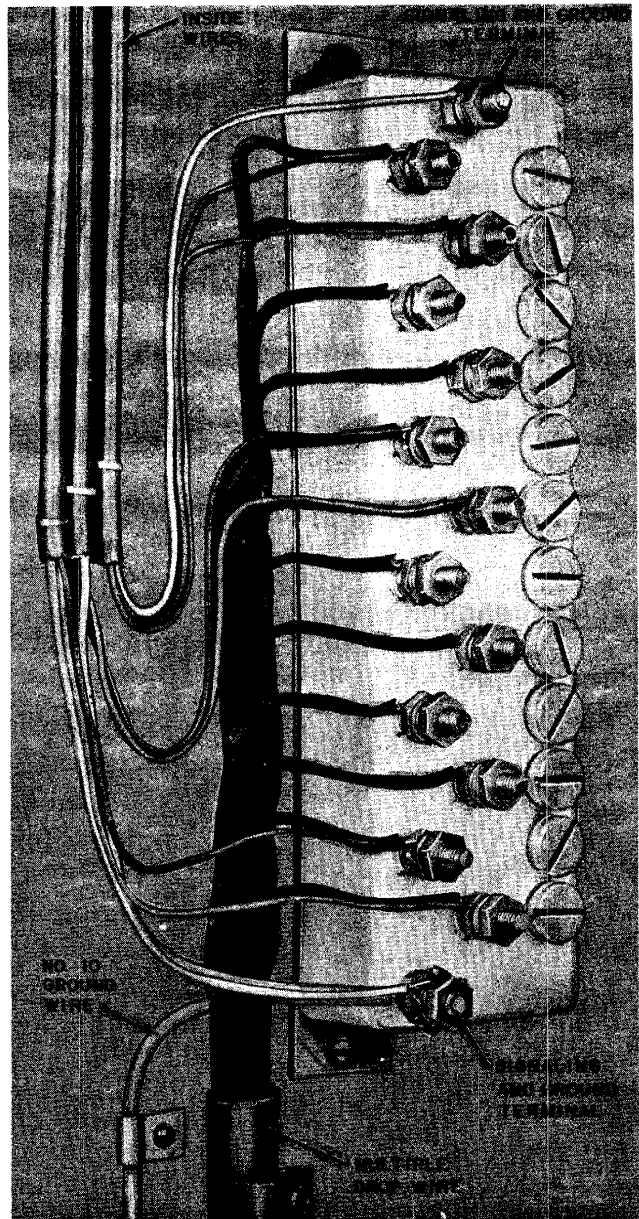


Fig. 7—128A1A-2 Protector

**4.07** The 116C Protector is for outdoor mounting. It is shown served by multiple drop wire (Fig. 8). Terminate all drop wire during the initial installation. Terminate the drop wire conductors under the bottom nuts. Terminate station wire conductors between the washers under the top nut. A ground terminal is provided on the rear of the metal housing. The signaling ground binding post is internally bonded to the ground terminal.



**Fig. 8—116C Protector**



**Fig. 9—117B Protector**

**4.08** The 117B Protector (Fig. 9) is for indoor installation. Drop wire is terminated on the protector in the same manner as outlined for the 116C Protector (4.07). The ground wire is placed under the pronged washer of the protector ground terminal (Fig. 9). The signaling ground binding post is internally bonded to the ground terminal.

**4.09** To protect the 123A1A or 128A1A-2 Protectors at outside installation, a 150A Cover or a 305A2 Protector Mounting is installed over the protectors. The 150A Cover is also used inside when a protective covering is required. Fig. 10 illustrates the installation of the 150A Cover.

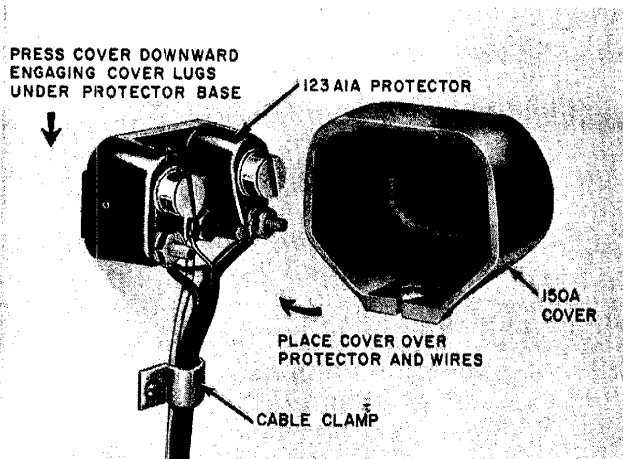


Fig. 10—Installation of 150A Cover

4.10 When using the 150A Cover bring all the wires together under a common clamp. The clamp is the last attachment and is placed about 2 inches below the protector.

4.11 To remove the 150A Cover, grasp the sides of the cover with the thumb and forefinger and at the same time apply pressure with the middle finger at the central tapered portion in an upward direction. When the cover lugs clear the base of the protector, the cover may be lifted off.

4.12 The 305A2 Protector Mounting is used to house the 123A1A or 128A1A-2 Protector at outside installations. Two screws are furnished with the protector mounting for fastening the protector to the back of the mounting. Two holes are provided in the back for attaching the protector mounting to its mounting surface. Fig. 11 illustrates a 123A1A Protector installed in a 305A2 Protector Mounting.

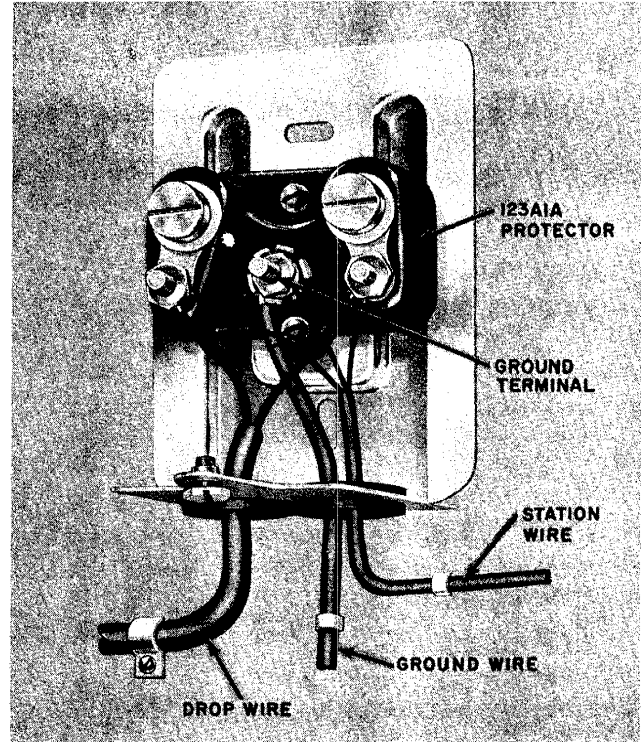


Fig. 11—305A2 Protector Mounting

## 5. INSTALLING PROTECTORS—FUSED

5.01 Typical installations of the fused 98AA, 106C, and 106CA Protectors are shown in Fig. 12, 13, and 14, respectively.



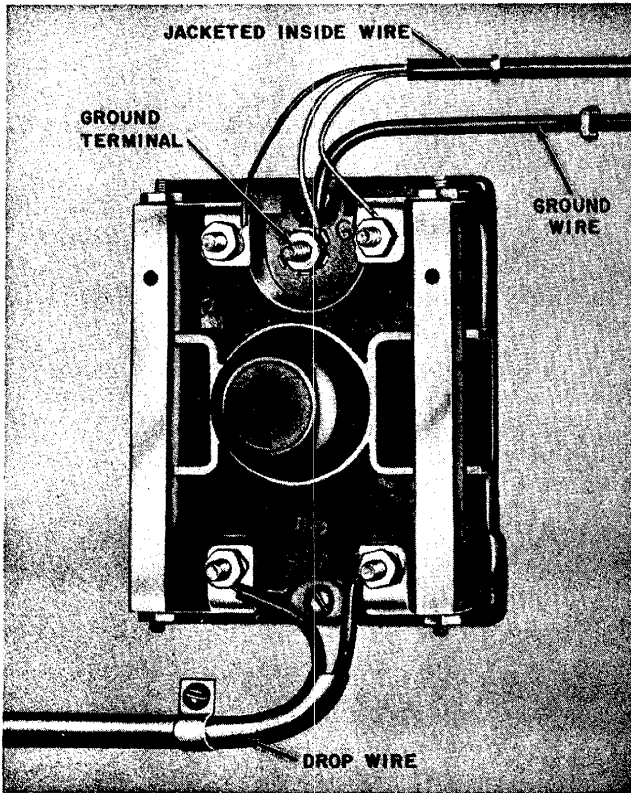


Fig. 12—98AA Protector

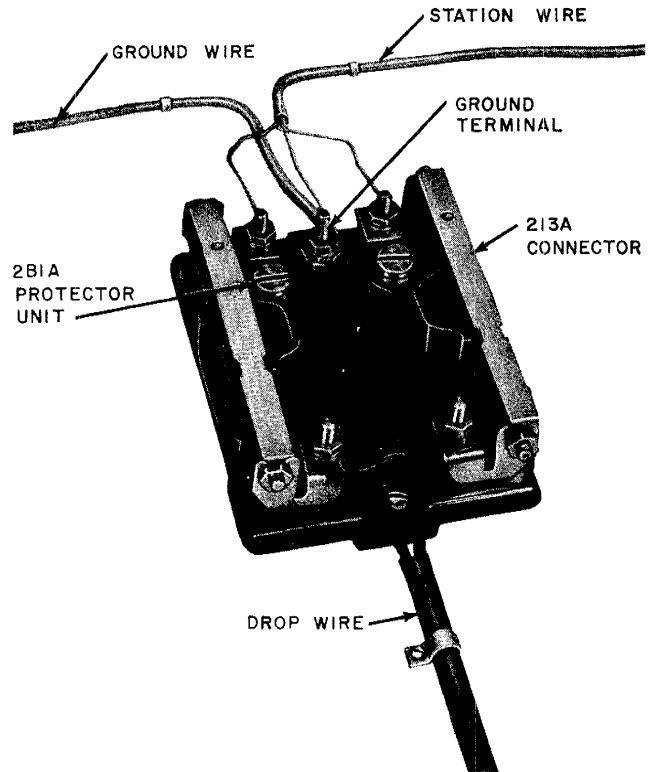


Fig. 14—106CA Protector

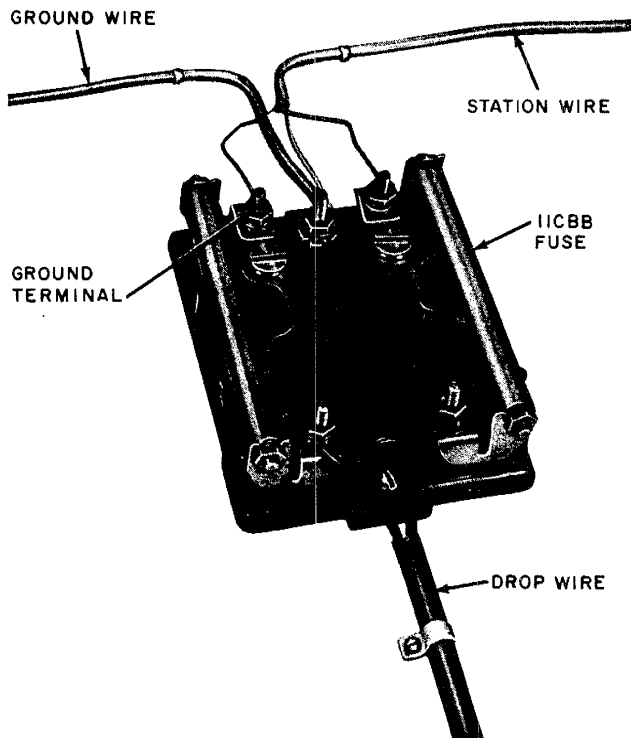


Fig. 13—106C Protector

5.02 The 93C Protector Mounting is used to house the 98- or 106-type protector at outdoor installations. Two screws are furnished with the protector mounting for fastening the protector to the back of the mounting. Two holes are provided in the back for attaching the protector mounting to its mounting surface. Fig. 15 illustrates a fused protector installed in a 93C Protector Mounting. The protector is coded 1293C Protector.

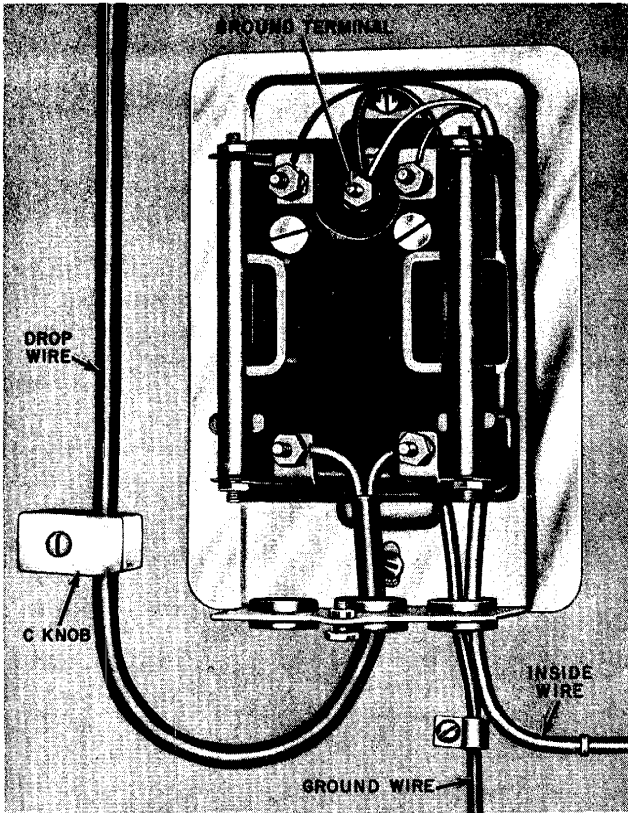
5.03 When fused protectors are installed in confined spaces such as protector cabinets provided by the customer, it is necessary to install a 46A Shield on the line side of the protector (Fig. 16). A metal detail is furnished with the shield and is placed between the protector and mounting surface. The shield is provided with two captive screws which fasten it to the metal detail. The shield is to prevent the highly ionized gases developed with the operation of a fuse from coming in contact with the line terminal of the protector.

**6. BURIED INSTALLATION**

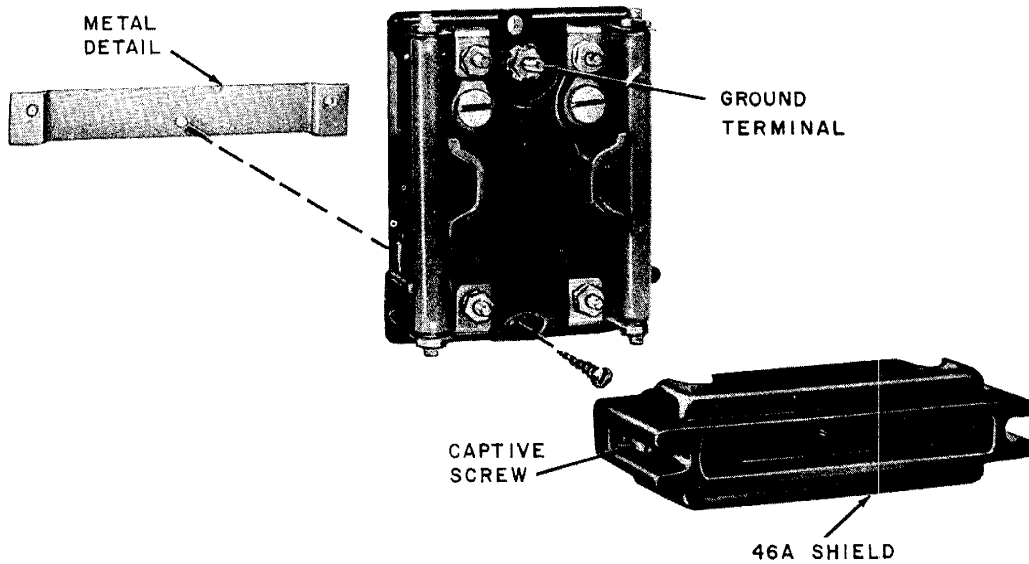
**6.01** The armor of underground wire or the aluminum tape of service wire should always be grounded at the buried closure and at the subscriber's location. The grounding is required to protect the wire from lightning damage and to minimize shock or fire hazards at the subscriber's location from sustained power contact.

**6.02** The 629 Division of the Plant Series Practices covers the installation of protectors at junctions of buried and aerial plant.

**6.03** The Thomas and Betts No. 264-30489-38 Lug-It can be used to bond the aluminum shield of service wire or the armor wire of underground wire to a 123A1A or 128A1A-2 Protector. The Lug-It has a spade-type tongue which can be placed under the washer of the protector ground terminal without removing the nut.

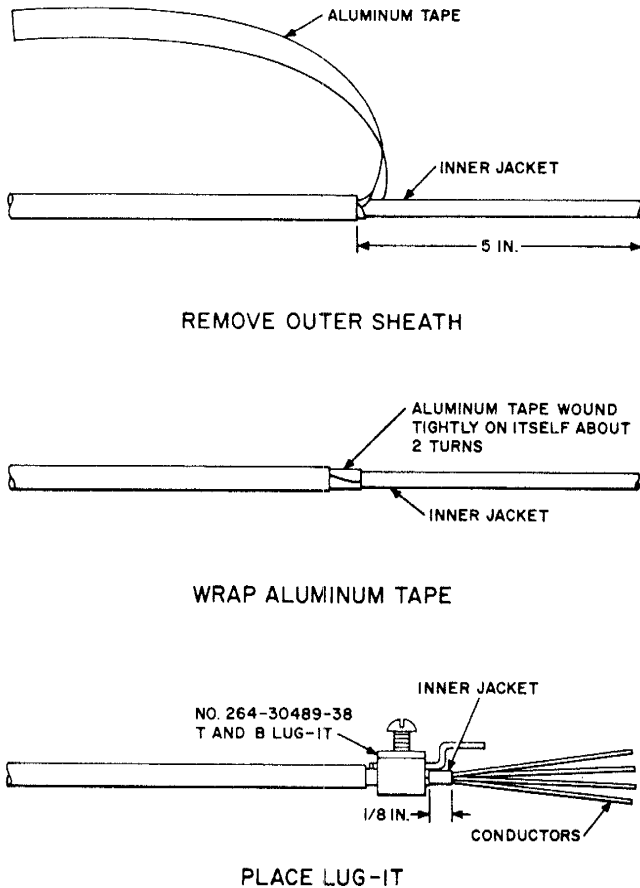


**Fig. 15—1293C Protector**



**Fig. 16—Installation of 46A Shield**

**6.04** Install the 123A1A or 128A1A-2 Protector on the wall and mark the location of the Lug-It on the service wire. Cut off the service wire about 5 inches beyond this mark. Remove the outer jacket, untwist the aluminum tape, and install the Lug-It as illustrated in Fig. 17.



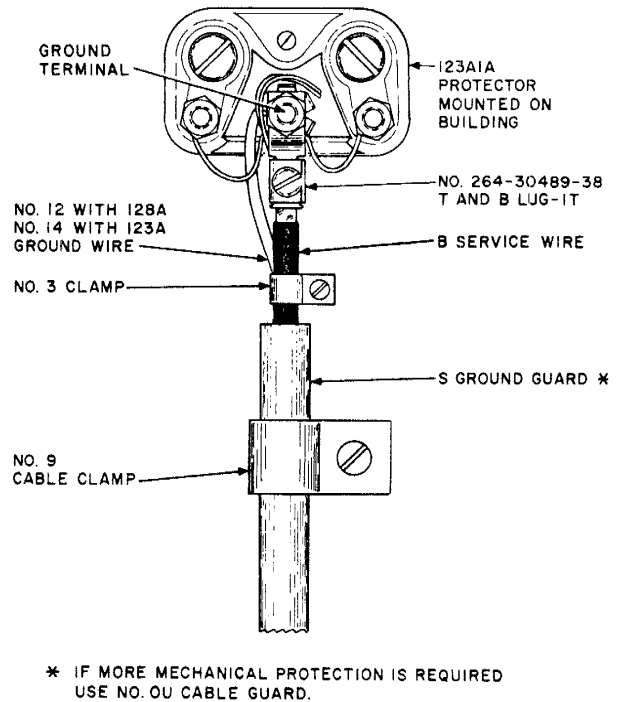
**Fig. 17—Placing Lug-It**

**6.05** The Lug-It can be installed on underground wire as outlined in 6.04 and Fig. 17.

**6.06** Fig. 18 illustrates the Lug-It installed on a 123A1A Protector.

**7. INSTALLING PROTECTORS—PBX**

**7.01** At locations where PBX circuits terminate on main frame type protectors equipped with heat coils and carbon blocks no other protection is required.



**Fig. 18—Service Wire on Protector**



7.02 At a main frame, No. 75A Heat Coils should be used for each conductor of a battery feeder group. Strap the pairs on the PBX side of the frame.

7.03 Fig. 19 illustrates the 123A1A Protector equipped with 60-type fuses by means of a 94A Protector Mounting.

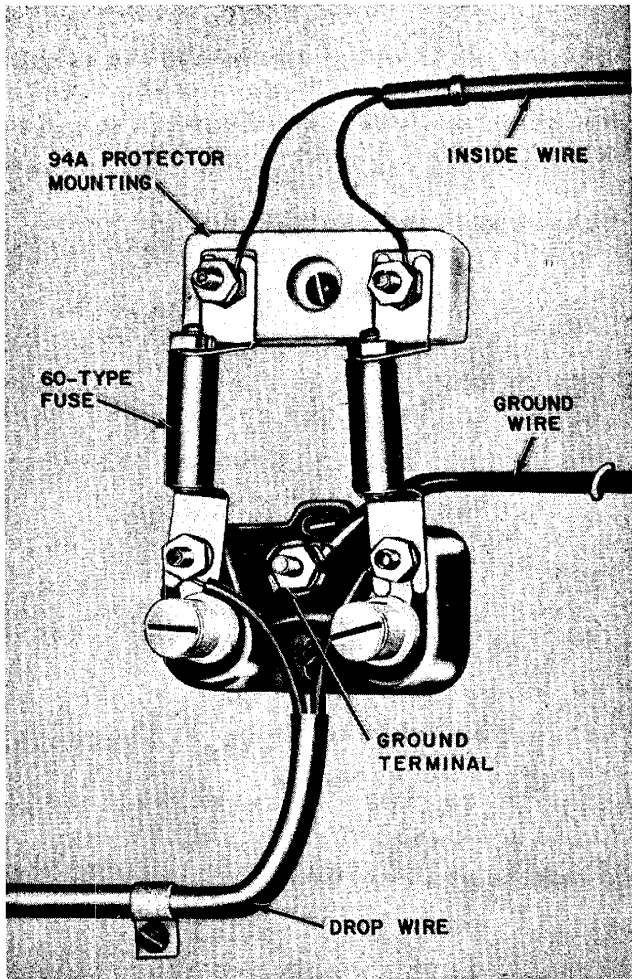


Fig. 19—94A Protector Mounting and 60-Type Fuses

7.04 Fig. 20 illustrates a method of terminating two drop wires at a fuseless protector where 60-type fuses are required. Strap the pairs on the PBX side of the protector.

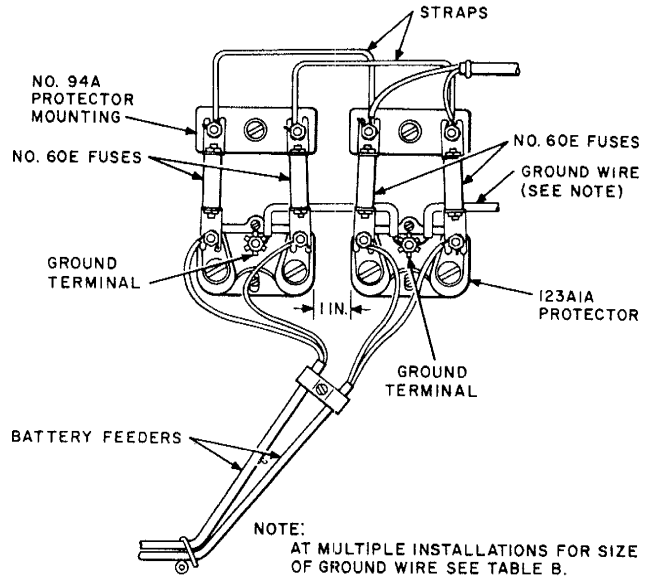


Fig. 20—Fuseless Protectors and 60-Type Fuses—Multiple Pairs

7.05 The 97A Protector Mounting is used to house the 123A1A Protector equipped with 60-type fuses at an outdoor installation. Two screws are furnished with the protector mounting for fastening the protector to the back of the mounting. Two holes are provided in the back for attaching the protector mounting to its mounting surface. Fig. 21 illustrates a typical installation.

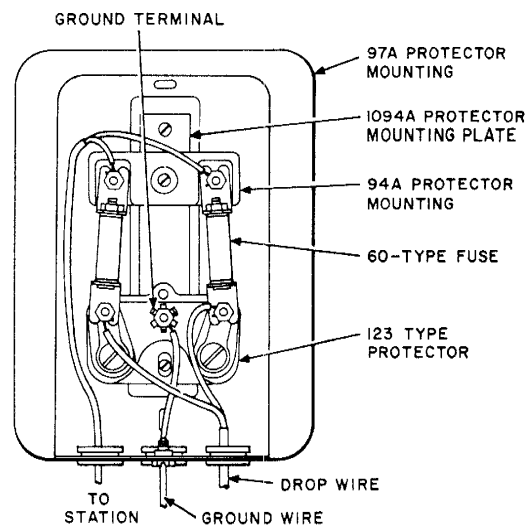
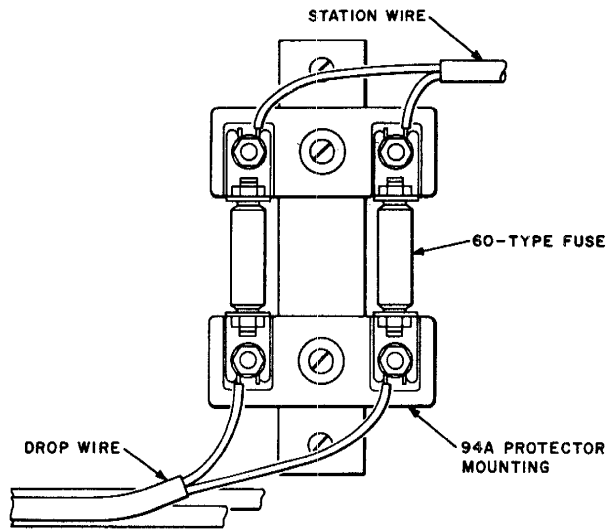


Fig. 21—Fuseless Protectors and 60-Type Fuses—Outdoor Installation

7.06 Fig. 22 illustrates a typical installation of 60-type fuses where no protector is required.



NOTE:  
1094A CONSISTS OF TWO 94A, ONE 97A MOUNTING, AND TWO 60-TYPE FUSES.

Fig. 22—1094A Protector With 60-Type Fuses

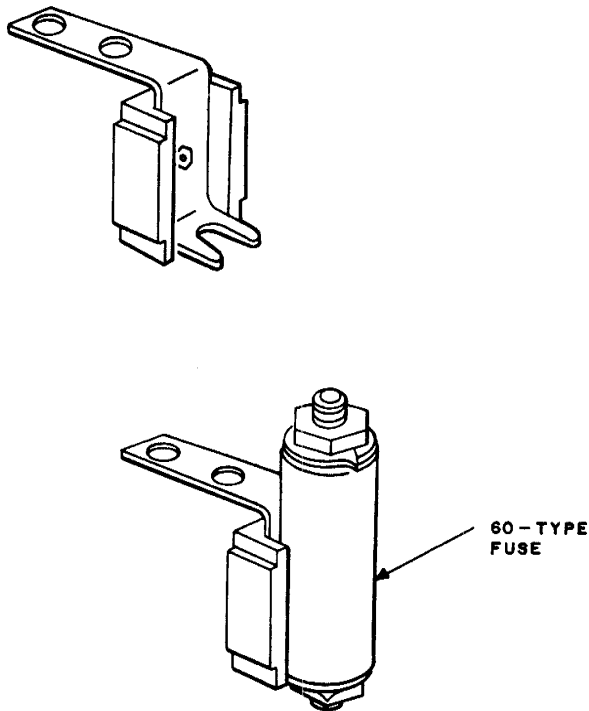


Fig. 23—14A Fuse Holder

7.07 When sneak current (60-type fuses) protection is required for pairs terminated on 1A4A-, 116-, or 117-type protectors, 14A Fuse Holders are required. Fig. 23 illustrates the 14A Fuse Holder.

*Note:* 60-type fuses cannot be installed in pole-mounted NH-type terminals.

7.08 Fig. 8 illustrates a 116C Protector equipped with 14A Fuse Holders and 60-type fuses.

7.09 Fig. 24 illustrates two battery feeder pairs terminated at a 117-type protector equipped with 14A Fuse Holders and 60-type fuses. Strap the pairs on the PBX side of the fuses.

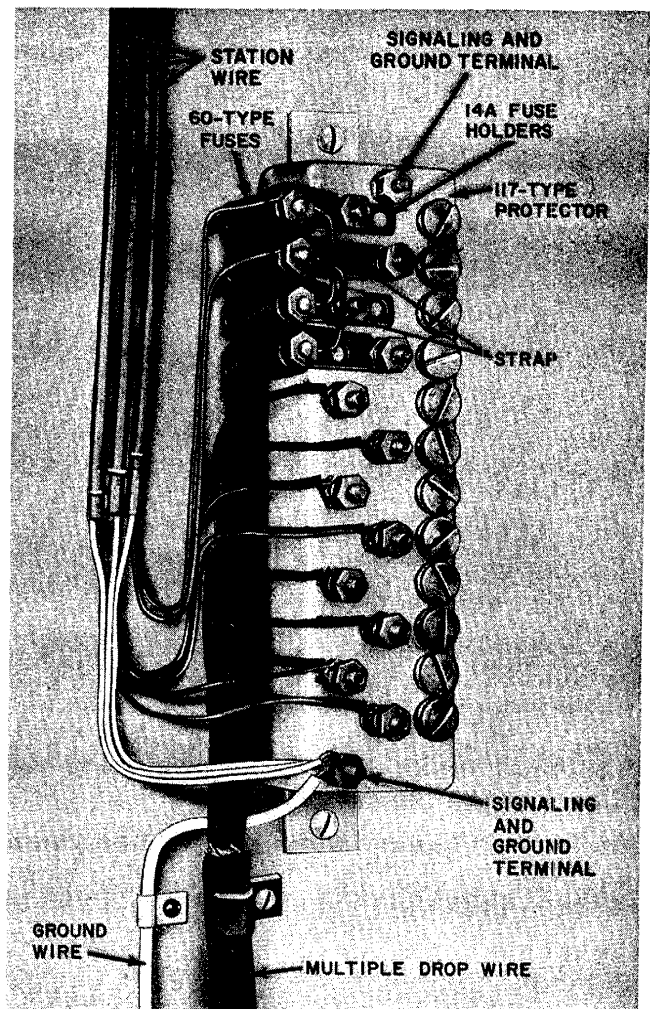


Fig. 24—117-Type Protector Strapped for Battery

7.10 If it is necessary to strap the conductors at the binding posts, remove the 2A1A Protector Units associated with each conductor and install 2A1D Protector Units (Dummy). Mount a fused-type protector and terminate the multiple

conductors on the line side of the protectors. Use two 11CBB Fuses, one for the tip and one for the ring conductors (Fig. 25 and 26). On disconnects, replace the 2A1D Protector Units with 2A1A Protector Units.

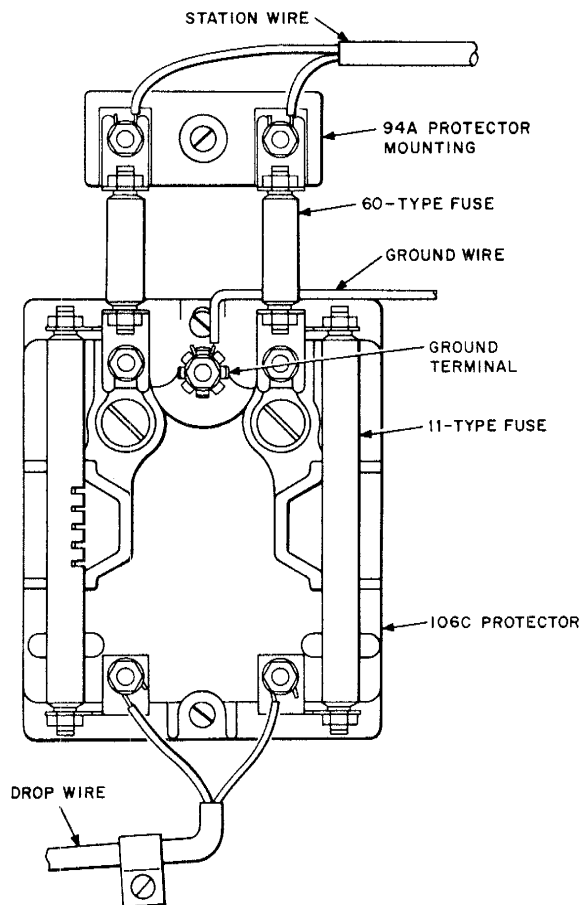


Fig. 25—94A Protector Mounting with Fused Protector

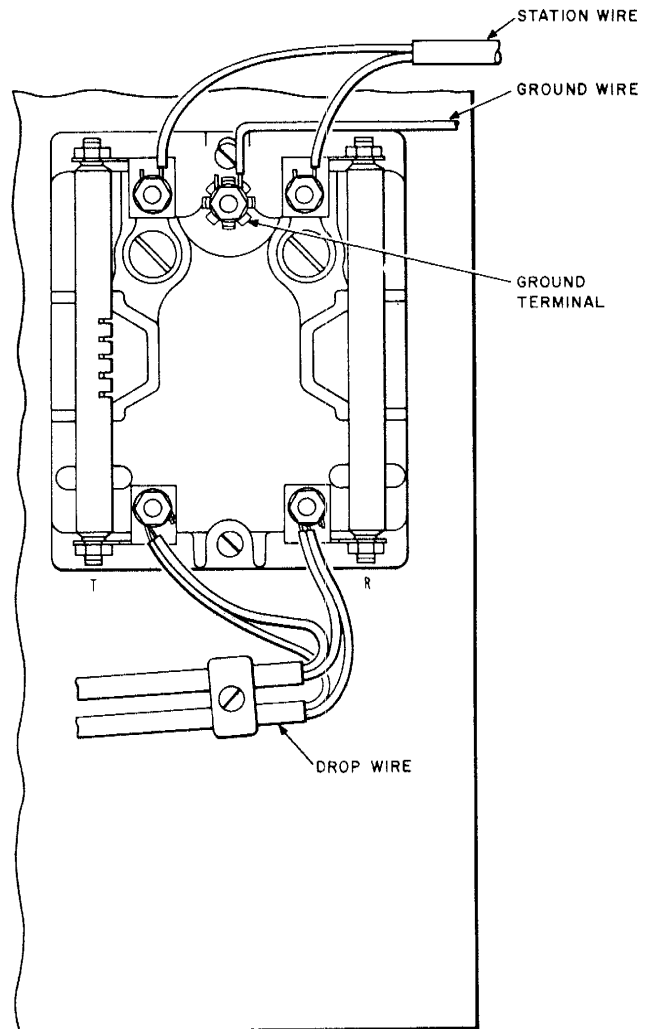


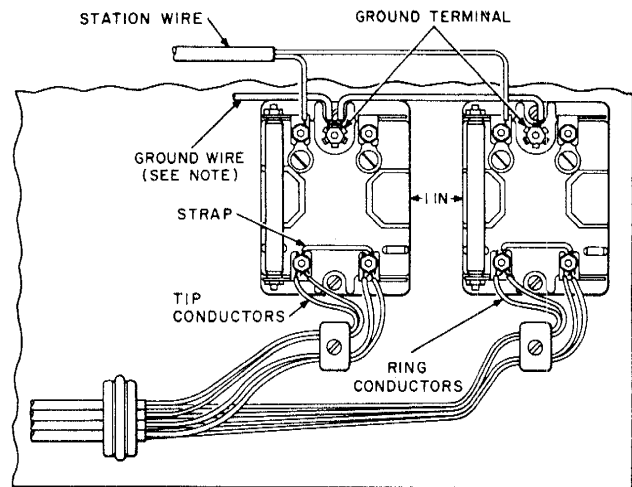
Fig. 26—Drop Wire Bridged at Protector

**SECTION 460-100-200**

**7.11** Fig. 25 illustrates a typical installation of 60-type fuses with a fused protector.

**7.12** Fig. 26 illustrates a typical installation of two multiple drop wires bridged at a fused protector. Three multiple drop wires are installed in the same manner.

**7.13** Fig. 27 illustrates a typical installation when four or more battery feeder pairs are bridged at fused protectors. Bridge the pairs on the line side of the fused protectors. One 11CBB Fuse is required for each side of the circuit.



NOTE:  
AT MULTIPLE INSTALLATIONS FOR SIZE OF GROUND WIRES SEE TABLE B.

**Fig. 27—Bridging Four Pairs at Fused Protectors**

## STATION PROTECTOR AND SIGNALING GROUNDS SELECTION AND INSTALLATION

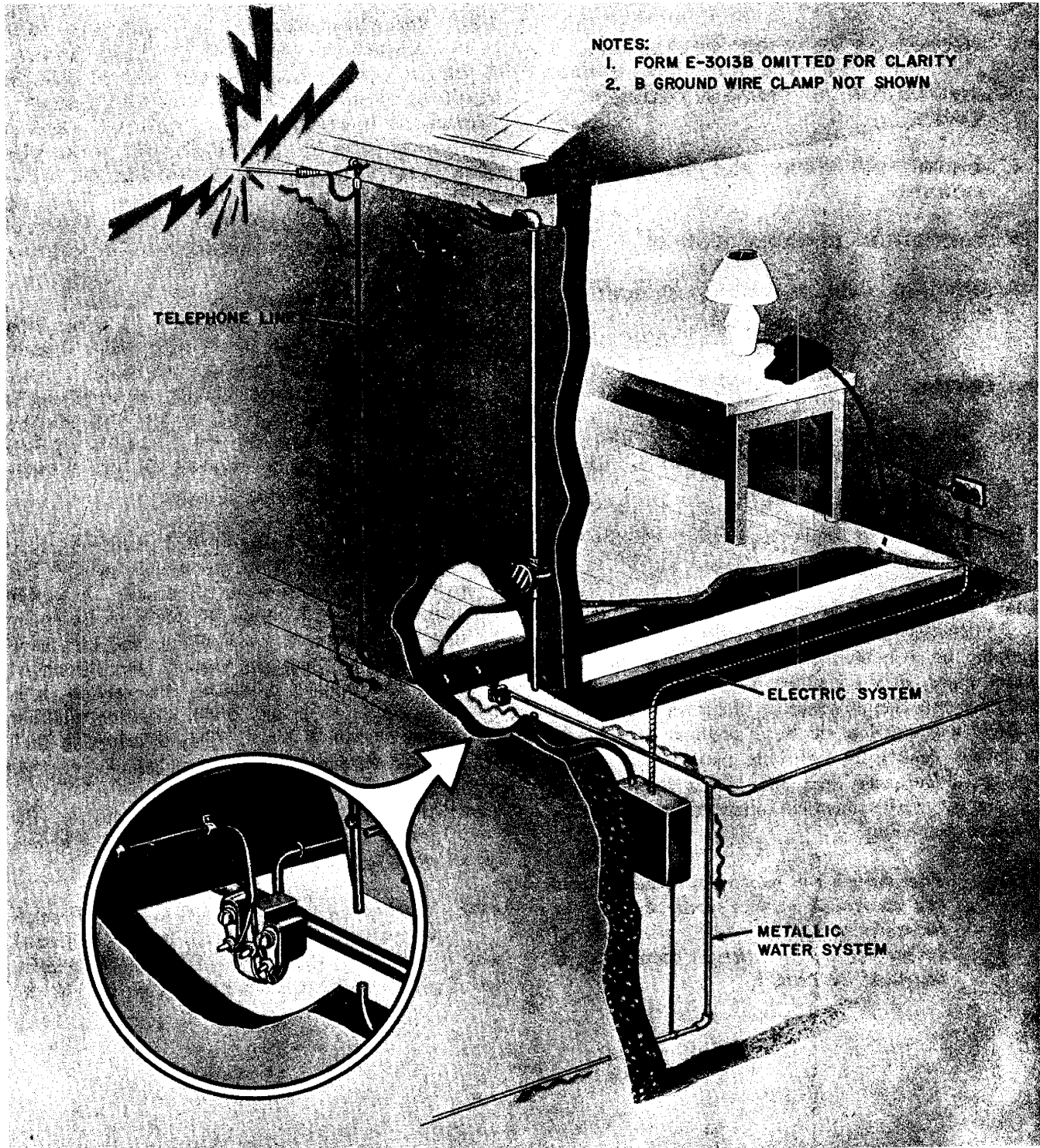


Fig. 1—Effective Ground

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4. INSTALLATION OF STATION GROUND CLAMPS . . . . .	16
5. BONDING OF POWER AND TELEPHONE GROUNDS . . . . .	18
6. SELECTION OF SIGNALING GROUND . . . . .	20
7. LOCATING AND INSTALLING GROUND RODS . . . . .	20

**1. GENERAL**

**1.01** This section covers the selection of protector and signaling grounds and the installation of ground-connecting apparatus.

**1.02** This section replaces Section 638-210-100, which is canceled.

**1.03** When telephone equipment and wiring are isolated from ground (earth) and from other metallic or grounded structures such as metallic water pipes, power conduit, power ground wiring, and foreign communication facilities, abnormal voltage may develop on these systems as a result of power contact or lightning disturbances. The voltage differences that may exist between the various structures must be equalized or limited by common grounding.



*The telephone protector ground and the electrical service ground shall be interconnected. The method of interconnecting these facilities is outlined in Part 5.*

**1.04** On visits to previously installed stations, inspect the grounding system. Systems not properly grounded must be changed to meet the current grounding and bonding requirements. The preferred effective ground is illustrated in Fig. 1.

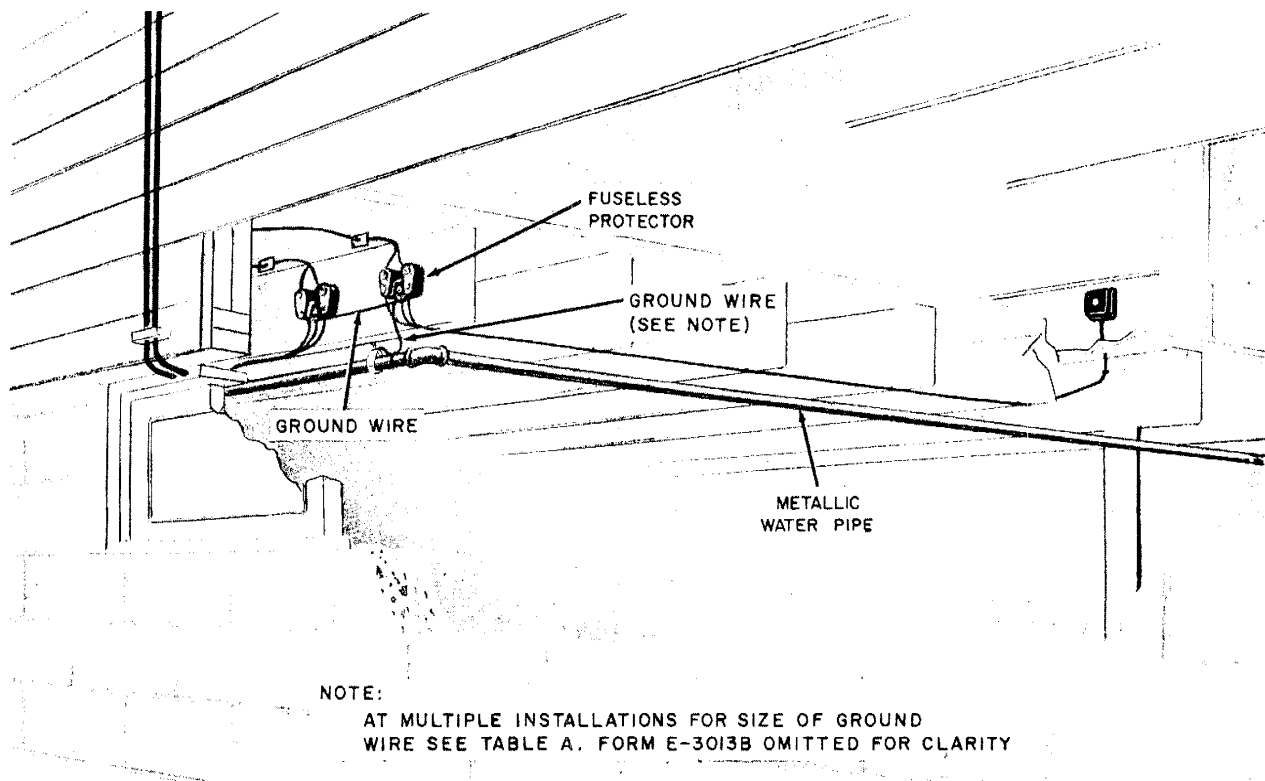
**1.05** When available, a public metallic water pipe provides the preferred grounding medium. A private metallic water system with at least 10 feet of buried metallic pipe is an acceptable grounding medium and is preferred to a ground rod. Connect the ground wire to the metallic cold water pipe at a point where normal maintenance of water meters, pumps, or the installation of insulating sections for reducing vibrations will not interrupt the circuit to ground or common bonding to power ground.

**1.06** When the interior metallic cold water pipe is insulated from the buried water system by an insulating joint or when the water system is nonmetallic, the interior metallic water piping is not an acceptable ground and an alternate method (Part 3) must be employed. The alternate selected ground shall always be bonded to the interior metallic cold water piping system.

**1.07** The MGN (multigrounded neutral) type power system is an acceptable ground but it is not in general use in all areas. A power company may have adopted the MGN as its policy on new or rearranged construction and still have a portion of its plant operating without a multigrounded neutral. To properly interpret this section, it is necessary to know in any given situation whether the power system is MGN. This information shall be obtained through supervisory channels.

**1.08** In selecting a location for a protector, the length of drop wire inside a building should be as short as possible.

**1.09** Whenever possible, use a 72A or 90A Bracket to ground a fuseless protector. If a ground wire is necessary, the run should be short, straight, and if possible a continuous piece of wire, (Fig. 2).



**Fig. 2—Ground Wire Run—Fuseless Protector**

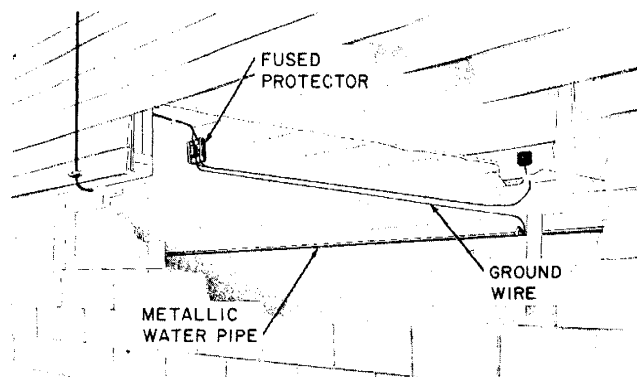
**1.10** If it is necessary to use a fused protector, the length of drop wire indoors should be as short as possible. The ground wire run should be short, straight, and if possible a continuous piece of wire, (Fig. 3).

**2.02** To prevent damage to copper pipe or tubing, place the B Ground Clamp on fittings only.

**2.03** Do not spiral the ground wire around the pipe.

**2. PRECAUTIONS**

**2.01** Before connecting the protector ground wire, test the power company ground rod, ground wire, cabinet, meter box, etc, with a B Voltage Tester as prescribed in Section 620-105-010 of the Bell System Practices. The voltage test shall be as prescribed for vertical power ground wires or metallic conduit. If the grounding mediums are energized, proceed no further with the work. Report this condition to the proper supervision so that the power company or customer owned power system may be informed of the situation.



**Fig. 3—Ground Wire Run—Fused Protector**

**SECTION 460-100-201**

**2.04** Do not attach ground wires to the interior of any service entrance box, fuse box, meter box, etc.

**2.05** Due to corrosive action, do not attach ground wire to power service aluminum ground wire, aluminum conduit, aluminum service boxes, etc.

**2.06** Do not attach ground wire to gas pipes because gas companies generally isolate the exterior piping at the meter.

**2.07** Do not splice the ground wire. The ground wire shall be a continuous wire from the protector ground lug to the grounding clamp attached to the grounding medium.

**3. SELECTION OF PROTECTOR GROUND**

**3.01** The gauge of station ground wire is dependent on the type and number of protectors as listed in Table A.

<b>TABLE A — GROUND WIRE CAPACITY <sup>1</sup></b>		
<b>SIZE</b>	<b>NO. OF PROTECTED CIRCUITS</b>	
	<b>FUSELESS</b>	<b>FUSED</b>
No. 14	1	3
No. 12	2	6
No. 10	6	7
No. 6	7 or More	8 or More

Note 1: The ground wire between protectors shall be the same size as the ground wire between the protector and the grounding electrode.

**3.02** The selection of the protector ground should be made as outlined in Table B and illustrated in Fig. 4 through 19. No exceptions other than those covered in 3.07 and 3.08 are permitted except by the approval of the supervisor or as stated in authorized instructions.

**3.03** The grounding conductor of the power system is the wire that is directly connected to the metallic cold water pipe or other grounding medium. If this wire is encased in metallic armor or metallic conduit, the armor or conduit may be considered as the grounding conductor.

**3.04** The metallic entrance conduit of the power service is that portion of conduit from the power drop attachment to the service equipment enclosure. The conduit or armoring on the branch circuits in the building must not be used as protector ground.

**3.05** Fig. 4 illustrates the 123A1A Protector attached to a metallic cold water pipe by means of a B Station Ground Clamp and a 72A Bracket. This arrangement should be the first choice of grounding to an acceptable metallic cold water pipe.

**3.06** The 128A1A-2 Protector can be grounded to a metallic cold water pipe by means of a B Station Ground Clamp and 90A Bracket. This arrangement should be the first choice of grounding to an acceptable metallic cold water pipe.

**3.07** Stations located at power company stations, or in explosive atmosphere, or connected to foreign communication circuits usually require special protection. These installations are covered in other sections of the Bell System Practices.

**3.08** At radio or television stations connect the protector ground to the radio or television station ground.

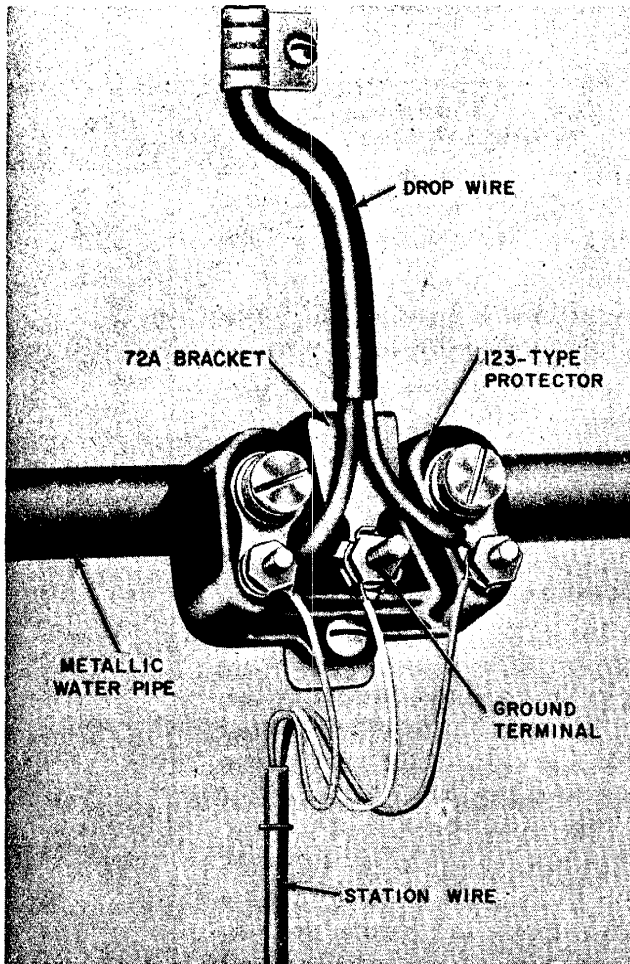
*Note:* In Fig. 4 through 19 the E-3013 Form (Caution Tag) has been omitted for clarity.



TABLE B — PROTECTOR GROUNDING

A1 — MGN System on acceptable metallic water pipe A2 — MGN System on ground rod B1 — Non-MGN System on acceptable metallic water pipe B2 — Non-MGN System on ground rod C — Power not grounded at premises D — No power			
WATER PIPE	POWER CONDITION	WHAT TO DO FOR PROPER PROTECTOR GROUNDING	FIG.
Acceptable metallic water pipe (at least 10 feet in moist soil)	A1 or B1	Ground protector to metallic water pipe or to power service conduit or ground wire	4, 5, or 6
	A2 or B2	Ground protector to metallic water pipe and bond power to water pipe	7
	C or D	Ground protector to metallic water pipe (if C, refer to 5.03)	8
Metallic interior water piping not acceptable because of plastic entrance, insulating joints, etc.	A2	Ground protector to MGN ground rod. Bond with No. 6 station ground wire to metallic water pipe. If ground rod not accessible ground to power service conduit or ground wire	9 or 10
	B2	Ground protector to best available ground or telephone ground rod. Bond to power ground rod and interior metallic water pipe with No. 6 station ground wire. If power ground rod is not accessible bond to power service conduit or ground wire.	11 or 12
	C or D	Ground protector to best available ground or ground rod, bond to interior metallic water pipe using same size station ground wire as protector ground wire (if C, refer to 5.03).	13
No metallic water pipe or not possible to connect to metallic water pipe	A2	Ground protector to MGN power ground rod, or, if ground rod is not accessible, ground protector to power service conduit or ground wire.	14 or 15
	B2	Ground protector to telephone ground rod and bond with No. 6 station ground wire to power ground rod.	16 or 17
	C or D	Ground protector to best available ground (if C, refer to 5.03).	18 or 19

**Note:** Verify existing power and telephone bonding and grounding. If they meet these requirements no further action is required.



NOTE:  
B STATION GROUND WIRE CLAMP NOT SHOWN  
FORM E-3013B OMITTED FOR CLARITY.

Fig. 4—Protector Mounting—72A Bracket

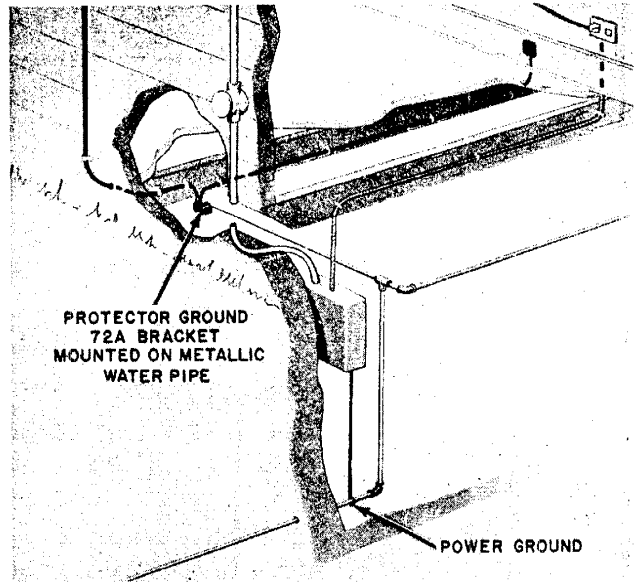


Fig. 5—Protector Ground—72A Bracket

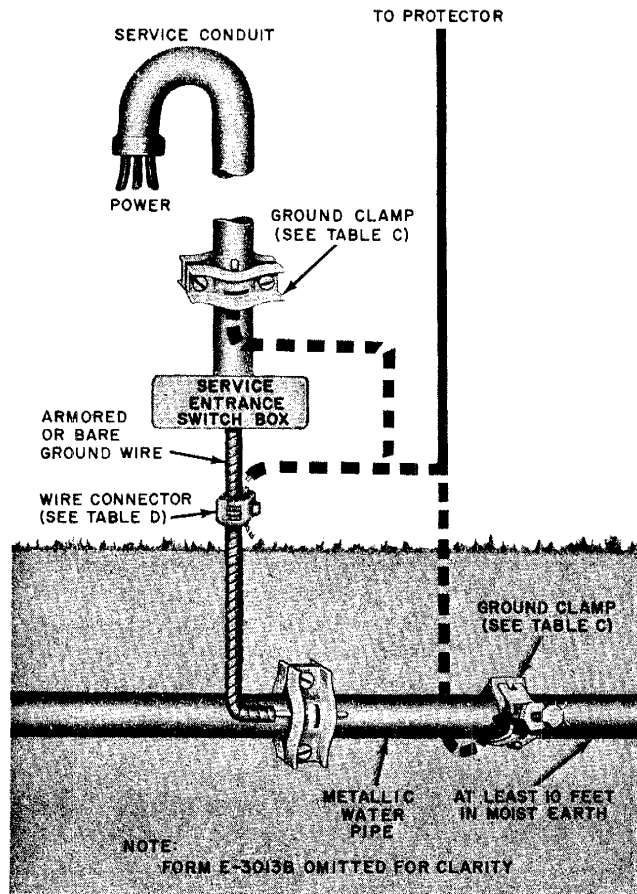


Fig. 6—Power Grounded to Acceptable Water System

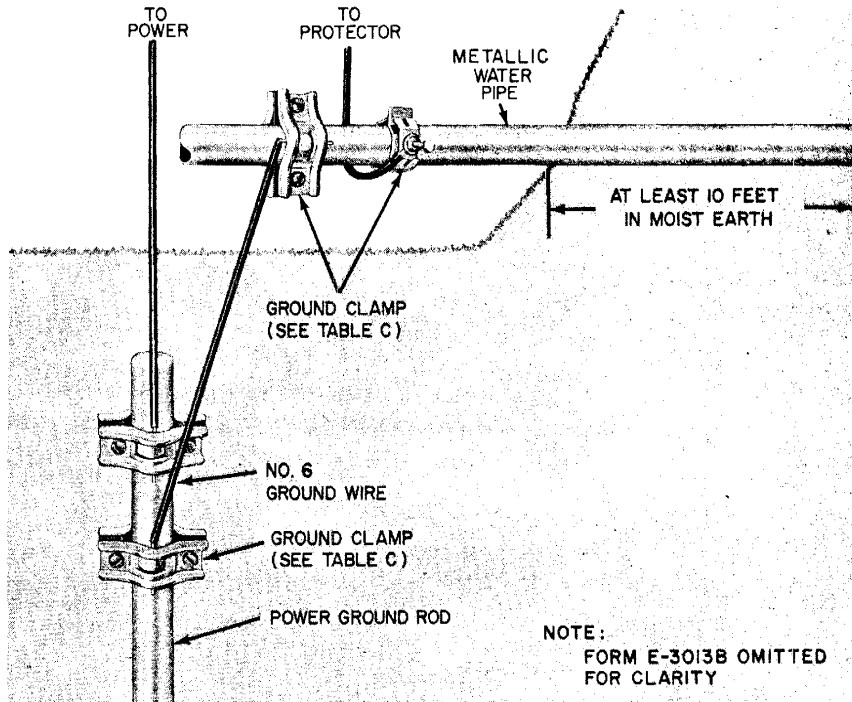


Fig. 7—Grounding to Metallic Water System—Power on Ground Rod at Premises

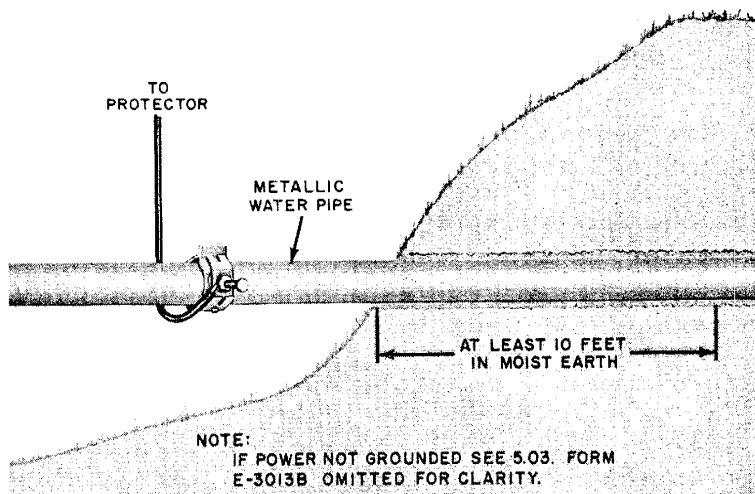
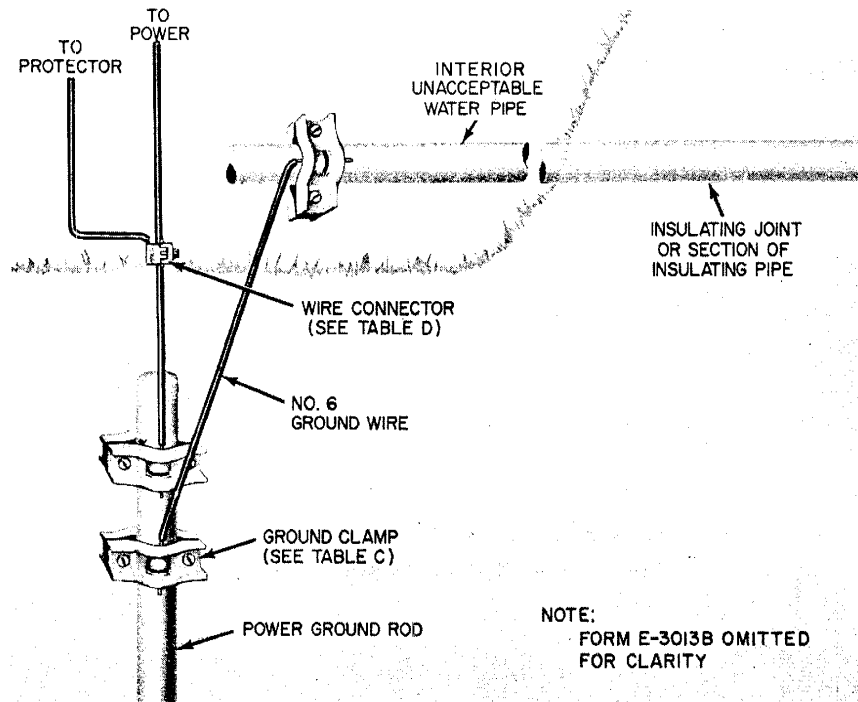
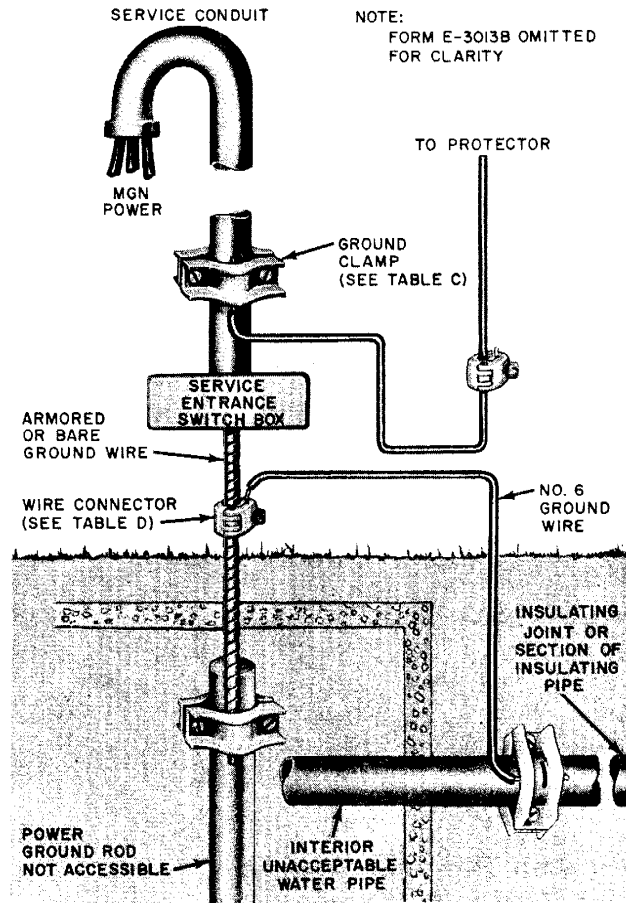


Fig. 8—Grounding to Metallic Water System—Power if Any Not Grounded at Premises



**Fig. 9—MGN Power Grounded to Ground Rod—Unacceptable Interior Water System**



**Fig. 10—MGN Power Grounded to Inaccessible Ground Rod—Unacceptable Interior Water System**

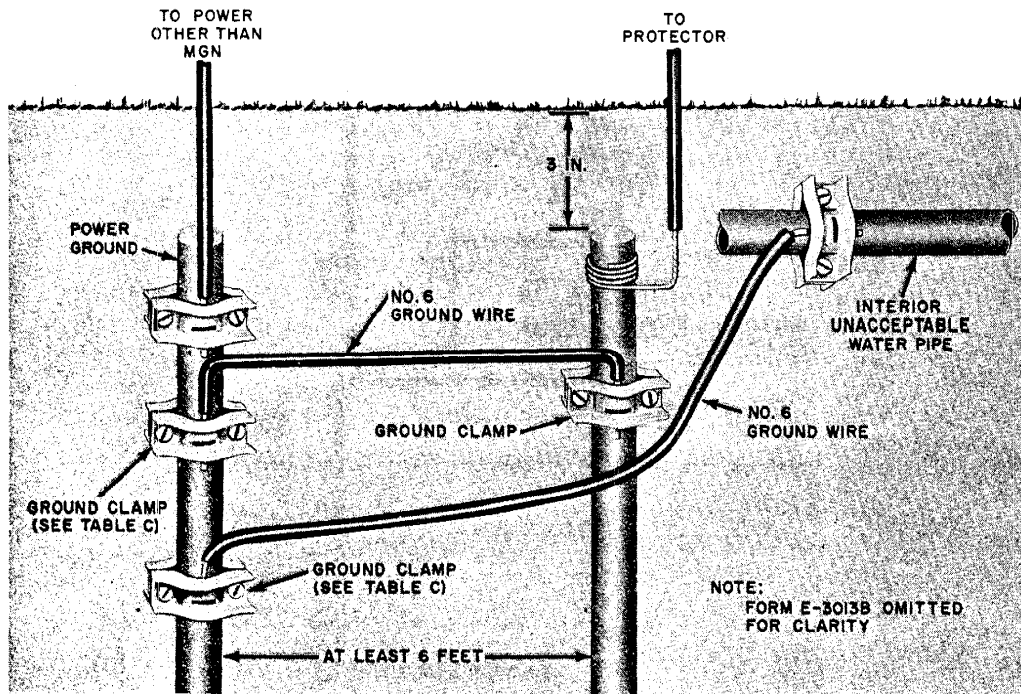
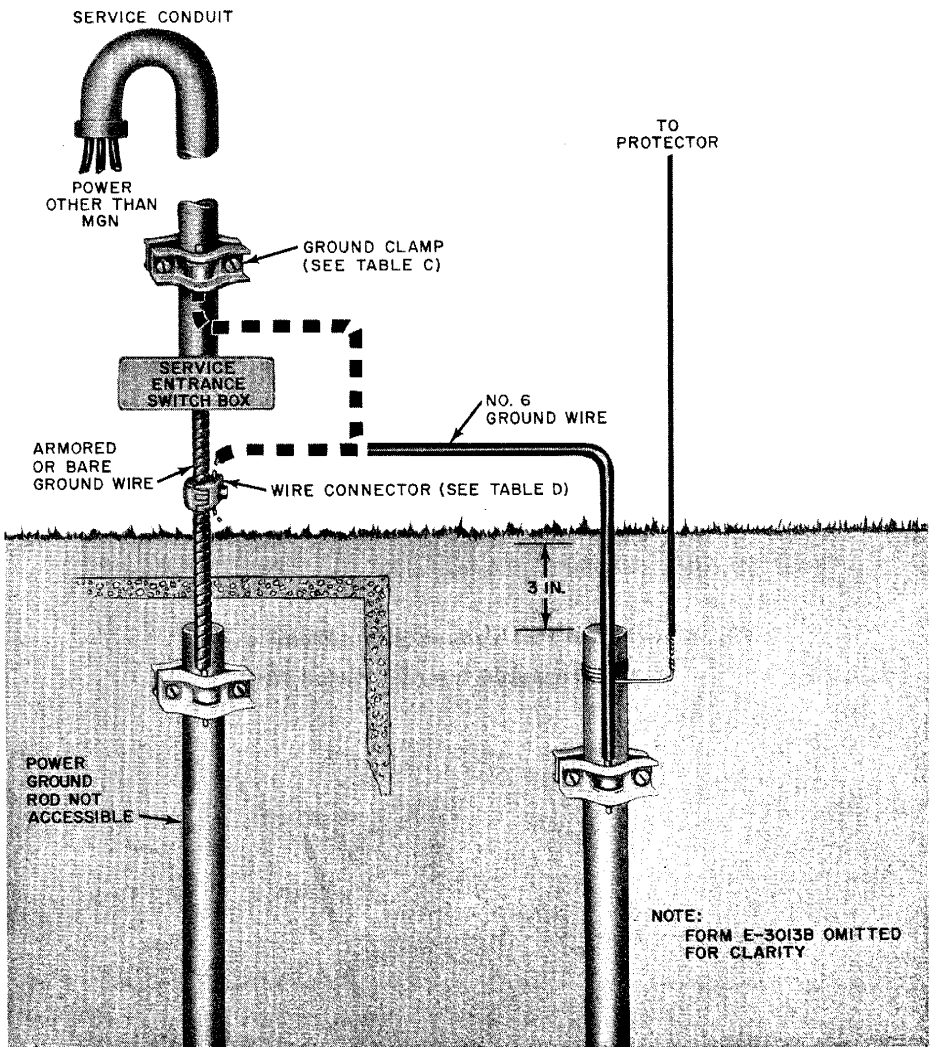
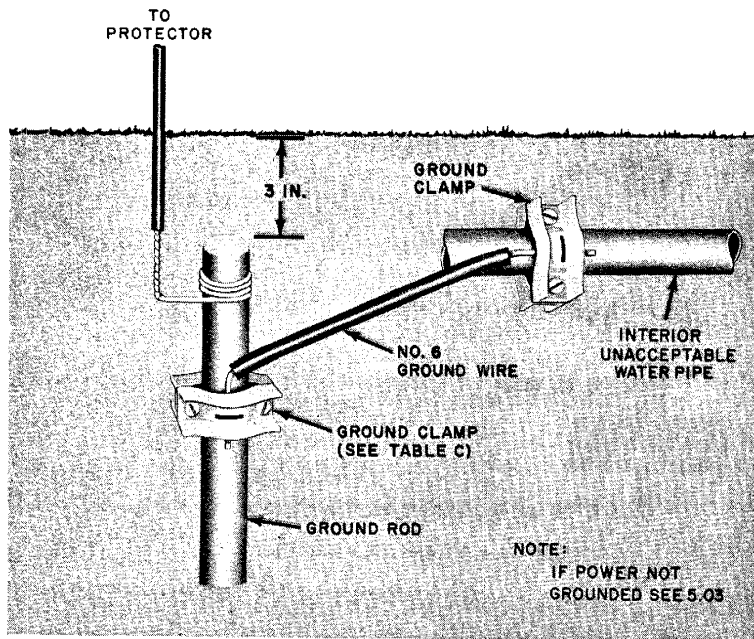


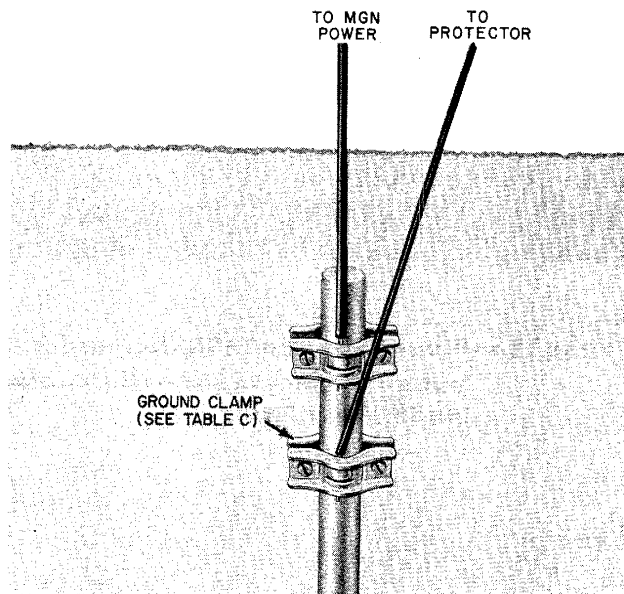
Fig. 11—Power Other Than MGN Grounded to Ground Rod—Unacceptable Interior Water Pipe



**Fig. 12 — Power Other Than MGN Grounded to Inaccessible Ground Rod — Unacceptable. Interior Water Pipe**

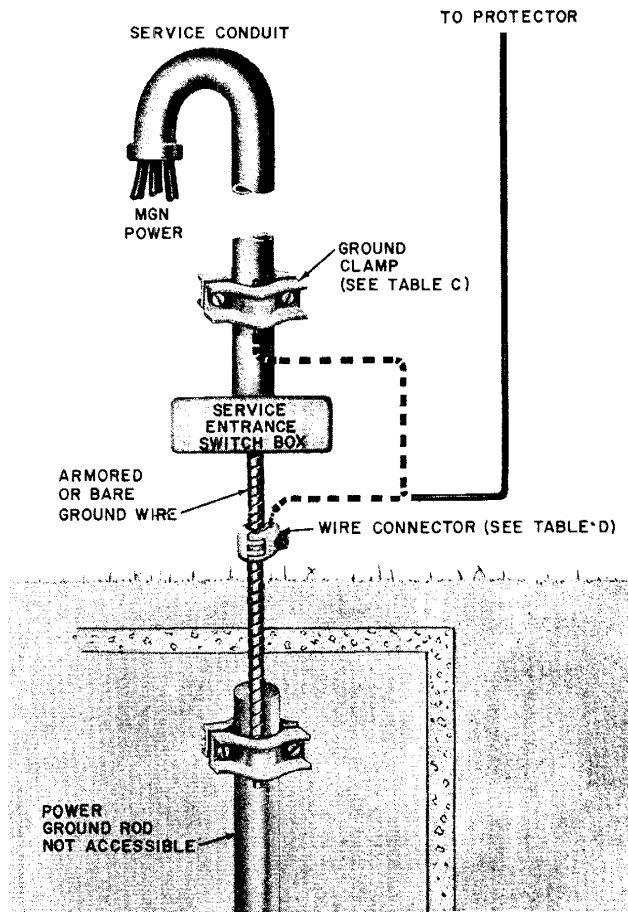


**Fig. 13—Power Not Grounded on Premises—  
Unacceptable Interior Water Pipe**



**Fig. 14 — MGN Power Grounded to Ground Rod —  
No Water Pipe — Connection to Pipe Not Possible**





**Fig. 15—MGN Power Grounded to Inaccessible Ground Rod—No Water Pipe—Connection to Pipe Not Possible**

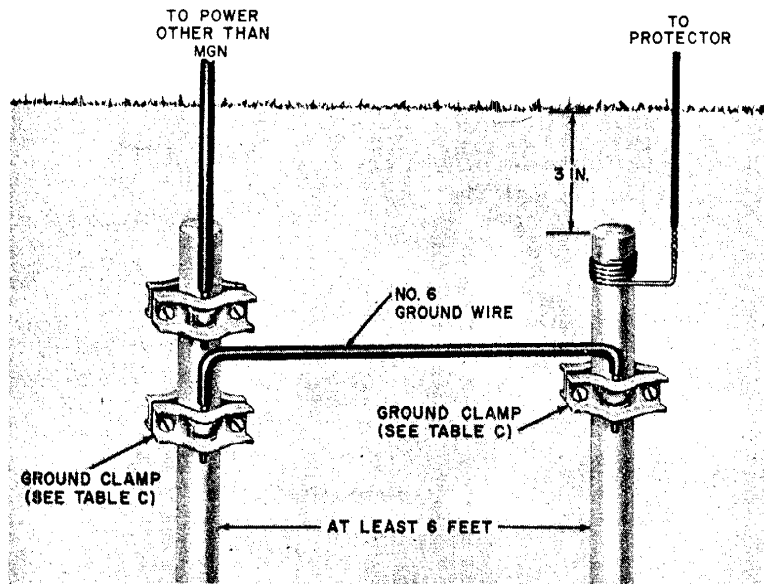


Fig. 16—Power Other Than MGN Grounded to Ground Rod—No Water Pipe—Connection to Water Pipe Not Possible

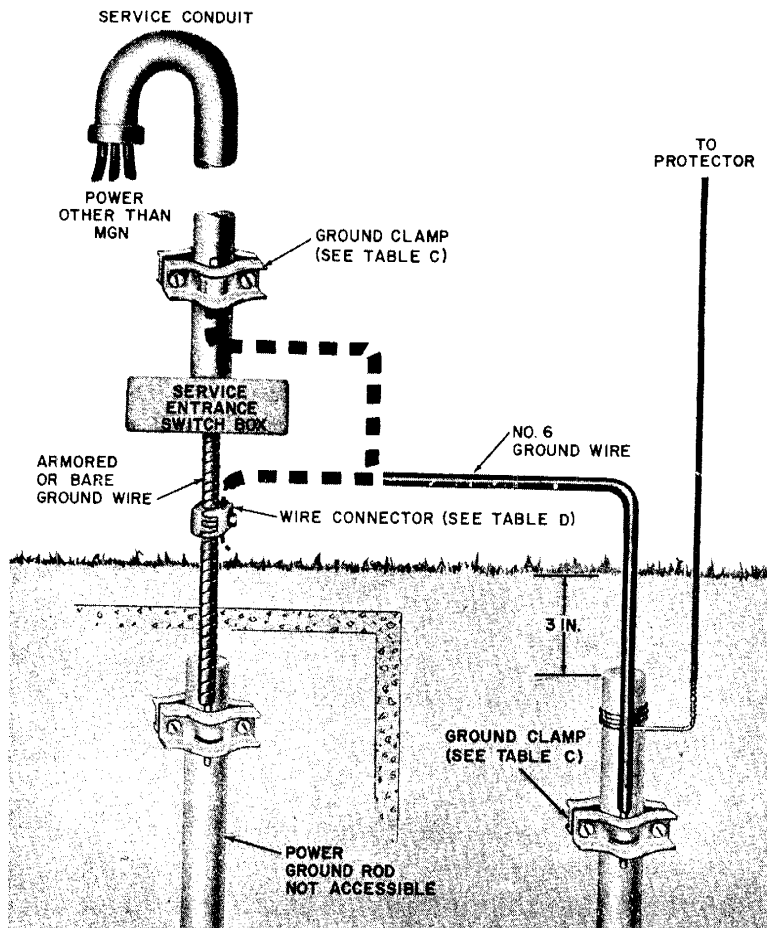
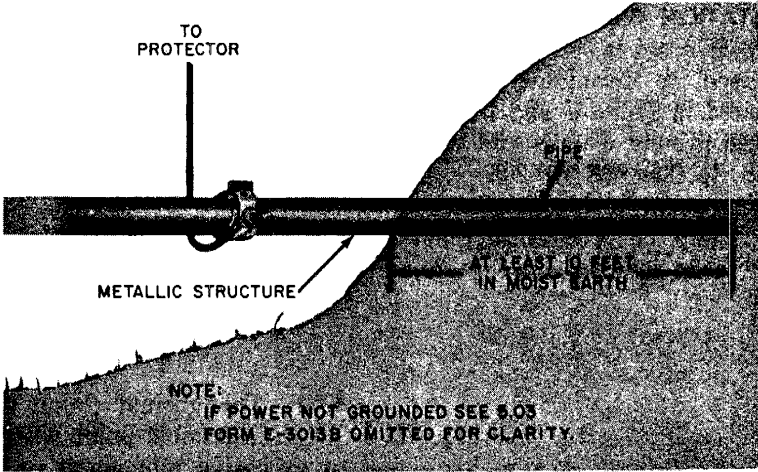
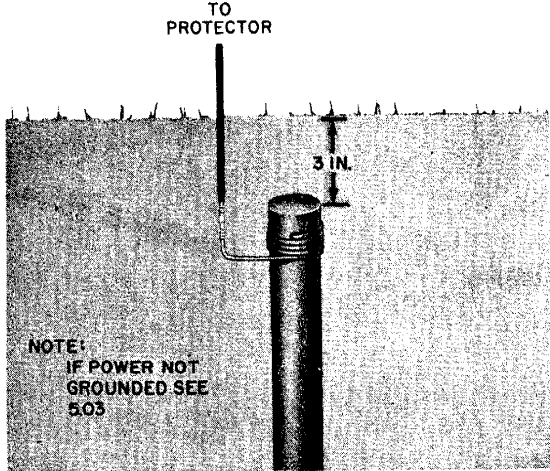


Fig. 17—Power Other Than MGN Grounded to Inaccessible Ground Rod—No Water Pipe—Connection to Pipe Not Possible



**Fig. 18—Grounding To Best Available Ground—Power Ground Rod, etc Not Available**



**Fig. 19—Grounding to Telephone Ground Rod—Water Pipe, Power Ground, or Metallic Structure Not Available**

4. INSTALLATION OF STATION GROUND CLAMPS

4.01 The hardware used to terminate station ground wire is listed in Table C and D. The method of installing these ground clamps and wire connectors is outlined in Section 638-310-205.

4.02 The B Ground Clamp, E Connector, and AT-7796X Connector are illustrated in Fig. 20, 21, and 22, respectively.

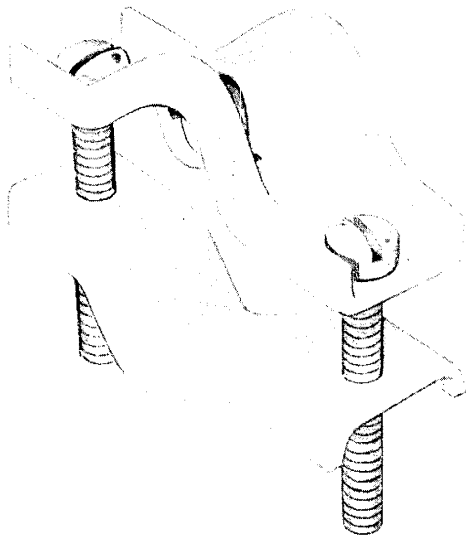


Fig. 20—B Ground Clamp

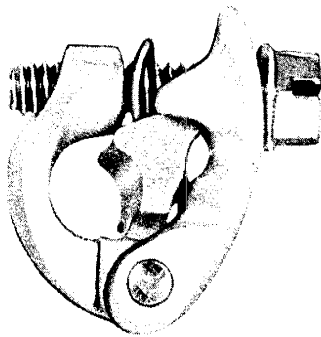


Fig. 21—E Connector

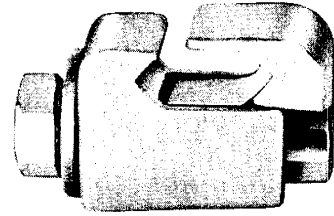


Fig. 22—AT-7796X Connector

4.03 The ground clamp should be located at an accessible point where it will not be subject to excessive movement or vibration and where it will least likely be damaged by plumbers or other workmen. If the pipe is insecure or subject to vibrations, tape the ground wire to the pipe in close proximity to the ground clamp (Fig. 23).

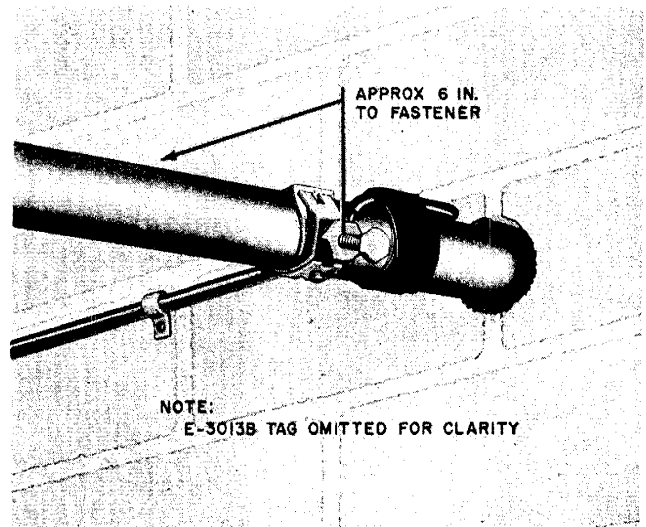


Fig. 23—Typical Ground Clamp Installation

4.04 Where insulating joints are found (usually at meters, pumps, valves, etc), the ground clamp should be installed at a point where the insulating joint will not break continuity to ground. Where pumps, meters, etc, may be removed for seasonal overhaul, the ground clamp should be installed at a point where the continuity to ground will not be broken.

TABLE C — GROUND CLAMPS AND WIRE CONNECTORS			
GROUND CLAMPS	CONDUCTOR SIZE	SERVICE PIPE INTERIOR OR ABOVEGROUND SIZE (IN.)	SERVICE PIPE OR GROUND ROD (BURIED) SIZE (IN.)
72A or 90A Bracket with B Station Ground Clamp Size 6-3/4		3/8 through 1-3/4	
72A or 90A Bracket with B Station Ground Clamp Size 12-1/2		1-7/8 through 3	
B Station Ground Clamp Size 6-3/4	No. 14, 12, or 10	3/8 through 1-3/4	3/8 through 1-3/4
B Station Ground Clamp Size 12-1/2	No. 14, 12, or 10	1-7/8 through 3	1-7/8 through 3
B Ground Clamp	No. 8, 6, or 4	1/2 through 1	1/2 through 1
L Ground Clamp	Small opening No. 6 Large opening No. 4 through 1/0	3/8 through 3	

TABLE D — WIRE CONNECTORS		
GROUND CLAMPS	WIRE CONNECTOR	CONDUCTOR SIZE
E Connector Size 1	—	No. 14 through 4
E Connector Size 2	—	No. 4 through 1/0 and 8 through 4 armored bare wire
—	AT-7796X Connector Size 6	No. 14 through 6
—	AT-7796X Connector Size 4	No. 8 through 4
—	AT-7796X Connector Size 2	No. 6 through 2

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**4.05** Make certain that the surface of the metallic pipe to which the ground clamp is being fastened is free of paint, rust, etc.

**4.06** The E-3013B Form (Fig. 24) should be placed at all ground wire terminations to warn people not to disturb the clamp or wire.

**4.07** The E-3013B Form is attached to the B Station Ground Clamp by placing the elongated slot over the hexagonal screw (Fig. 25). An alternate means of attaching the E-3013B Form is to insert the B Station Ground Clamp through the elongated slot before it is attached to a pipe (Fig. 25). The E-3013B Form is attached to other ground clamps with station wire or its equivalent.

*Note:* After the installation is complete, check the ground clamps to be sure that the E-3013B Form has been placed.

**5. BONDING OF POWER AND TELEPHONE GROUNDS**

**5.01** The selection of protector grounds listed in Table B and illustrated in Fig. 4 through 19 is intended primarily to provide the best available ground for the telephone protector. It is also intended to accomplish bonding between the power and telephone grounds where there is a choice of acceptable grounds. Fig. 26 illustrates the necessity for bonding.

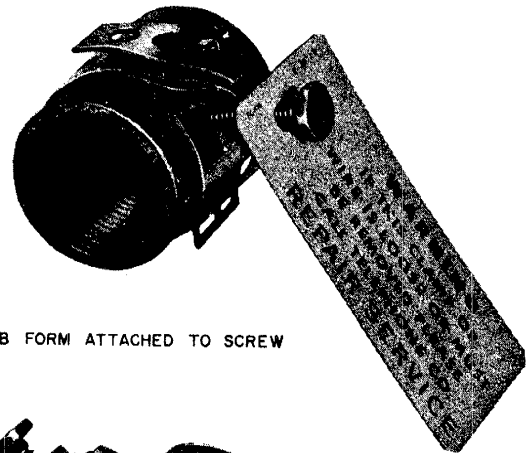
**5.02** When a situation exists where the power and telephone grounds are not common, the following corrective arrangements should be made:

(a) If an acceptable public or private water system is available and the power service is grounded to a ground rod, connect the telephone protector to the metallic water system. In addition, a No. 6 Station Ground Wire should be bonded to the interior metallic water pipe and the power ground rod.

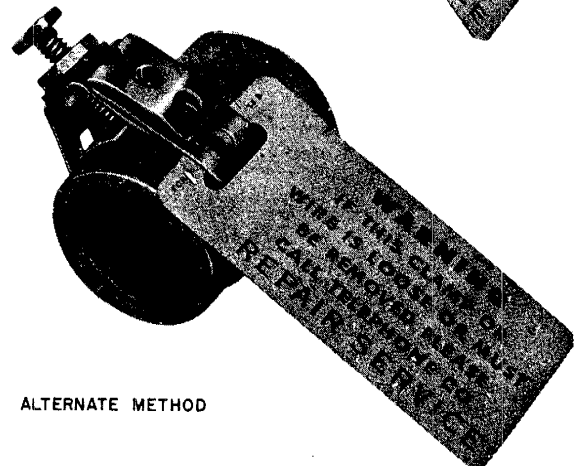
(b) If the power service and the telephone protector are connected to separate ground rods, bond the two rods together as shown in Fig. 11 and 12.



**Fig. 24—E-3013B Form**



**E-3013B FORM ATTACHED TO SCREW**



**ALTERNATE METHOD**

**Fig. 25—E-3013B Form Attached to B Station Ground Wire Clamp**

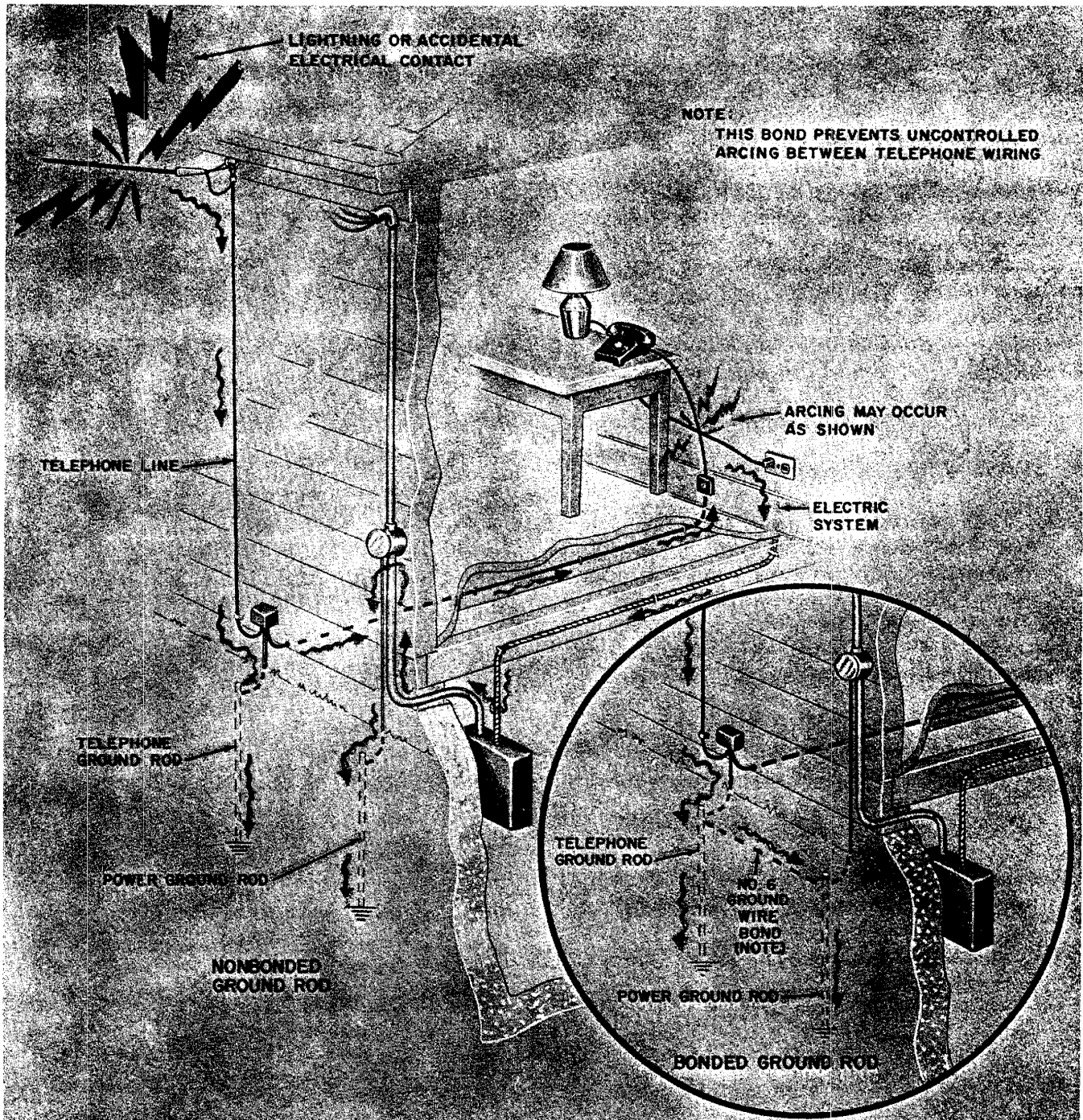


Fig. 26—Effects Of Bonding



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5.03 The customer's telephone service may be installed where a power ground is not provided. However, the customer should be informed immediately of the need for a power ground and should be requested to notify the telephone company when the ground has been provided. ***The procedure for notifying the customer shall be covered by local instructions.*** Where telephone service is already being furnished and there is no power ground, the same procedure should be followed. When installing telephones at contractor shacks, trailers, etc. and an acceptable metallic cold water pipe is not available, the telephone protector must be connected to a telephone ground rod. This ground rod must be bonded to a power ground rod as soon as the power ground rod has been installed and connected.

## 6. SELECTION OF SIGNALING GROUND

6.01 When selecting the signaling ground, the protector ground may be used. Do not use the signaling ground for protector grounding unless the station ground wire and grounding medium meet the requirements for protector grounding as covered in Part 3. Ground strips connected to grounded sheath cables are suitable for signaling grounds.

**Note:** Sections 638-310-100 and 638-310-105 cover the description and use of ground strips.

## 7. LOCATING AND INSTALLING GROUND RODS

**Caution:** *Avoid personal injury by protecting eyes and hands when driving ground rods.*

- 7.01 Locate and install ground rods as follows:
- Where least likely to be damaged or tampered with.
  - As near as practical to masonry walls in earth-floor basements.
  - Approximately 12 inches from outside wall (Fig. 27).
  - Approximately two feet from base of wooden poles or posts where conditions permit (Fig. 28).

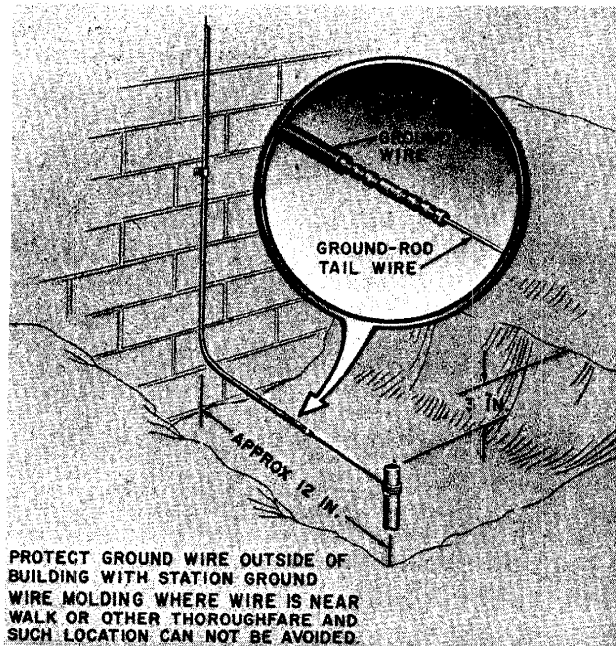


Fig. 27—Ground Rod Installation Near Wall

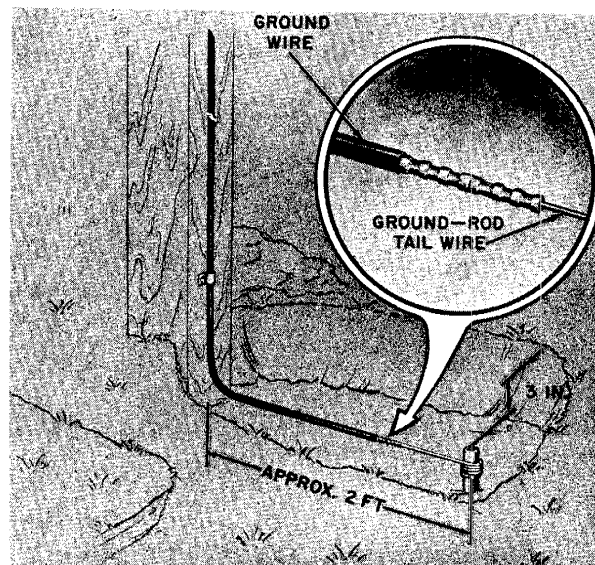


Fig. 28—Ground Rod Installation Near Pole



- (e) At least 6 feet from power service ground rod.
- (f) Do not unspiral the tail wire attached to the ground rod until the driving operation is complete.
- (g) Drive ground rods until the top of the rod is approximately 3 inches below ground level (Fig. 27 and 28). Increase depth where damage from digging is likely.
- (h) If the vertical or horizontal station ground wire run is located so it can be damaged or tampered with and such a location cannot be avoided, protect the ground wire with station ground wire molding.

**7.02** Inspect ground rods before and after driving to make certain that tail wires are not broken. If the tail wire is broken replace with another rod or use a ground clamp of the proper size as listed in Table C.

**7.03** After the ground rod is installed, No. 14 station ground wire is spliced to the tail wire with a 0.064 brass sleeve. Press the sleeve 6 times, 3 times each side of center (Fig. 27 and 28). Do not tape splice. When a larger size of ground wire must be terminated on the ground rod, select the proper size and type of ground clamp as listed in Table C.

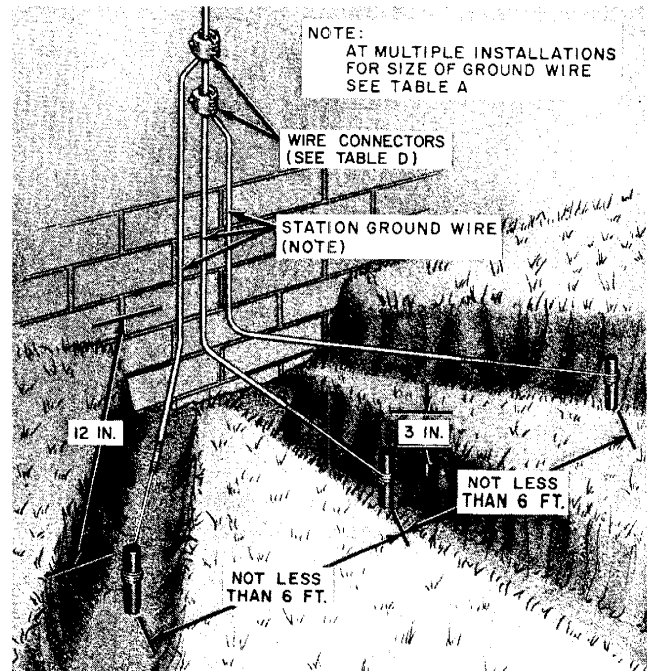
**7.04** When two or more protectors requiring ground rods are installed at the same location proceed as follows:

**Note:** Use the proper size station ground wire as listed in Table A.

- (a) If a power ground rod is not available, install a ground rod for each protector. Bond all protectors together. No more than 3 ground rods need be placed. Place station ground wire from each ground rod as shown in Fig. 29.

- (b) If a power ground rod is available, one telephone ground rod is sufficient. Bond all protectors together and bond telephone ground rod to power ground rod (Fig. 11).

**7.05** Multiple station protectors, such as the 109, 116, or 117 type, may be connected to any of the grounds shown in Fig. 6 through 18 but should not be connected to a single telephone ground rod unless the rod is bonded to the power system ground rod. If a power ground rod is not available, a multiple station protector may be connected to an array of three telephone ground rods, spaced at least 6 feet apart and bonded together with No. 6 station ground wire (Fig. 29).



**Fig. 29—Three Ground Rods**



## INSIDE WIRE AND CABLE SELECTION

### 1. GENERAL

**1.01** This section contains information formerly covered in Section 461-200-180, Issue 7, which is hereby canceled.

**1.02** This section describes the selection of inside wire and cable, which has been changed to:

- Include B and D Station Wire.
- Include F and G Cross-Connecting Wire.
- Include C Drop Wire.
- Delete Jacketed and GS Station Wire and E Drop Wire now being rated MD.
- Delete D Cross-Connecting Wire now being rated MD.
- Delete ABAM and ABMM Cable. Information is provided in Section 632-034-101.

**1.03** In selecting wire or cable, the following should be considered:

- **Type and gauge** of wire or cable to meet the specific job requirements.
- **Number of conductors** necessary for service and providing an economical allowance for future requirements.
- **Location of terminal**, protector, connecting block, telephone set, conduit facilities provided, etc.
- Customer satisfaction with appearance and routing of wire and cable.

### 2. SELECTION

#### (a) *Ordering Guide*

##### *Inside Wire*

Cordage, Flat, 4 Conductor, KS-7144

Wire, Block, E (Type\*)

Wire, Cross-Connecting, F (Type\*)

Wire, Cross-Connecting, G (Color \*) (Type\*)

Wire, Drop, C

Wire, Ground, No. (Gauge\*)

Wire, Station, B (Color\*)

Wire, Station, D (Color\*)

Wire, Station, SK

##### *Inside Cable*

Cable, Wiring, Inside, D, No. (Pair\*)

Cable, Wiring, Inside, E

\*Include desired type, color, gauge, and/or pair from Table A or F.

#### (b) *Inside Wire*

(1) **Code, type, gauge, color, and use** are found in Table A.

(2) **D Station Wire** is intended for general use in station wiring as a replacement for JKT and GS Station Wire.

- It is smaller in diameter and more flexible than JKT or GS, and the plastic jacket has improved frictional properties permitting placement without the aid of lubricants.



**Do not use privately owned wire or cable systems without the approval of a supervisor.**

TABLE A  
SELECTION OF WIRE

CODE OF WIRE (NOTE)	TYPE	GAUGE	COLOR						GROUND	CLASS OF SERVICE				USE				REMARKS
			LT OLIVE GRAY	IVORY	BLACK	WHITE	VIOLET	WHITE AND VIOLET		SIGNAL	PROTECTOR	INDIVIDUAL	PTY	COIN	CIRCUITS	CROSS-CONN		
Station	D	Quad	•															Use for all interior station wiring including ducts and all conduits. May be run outside on wall of building for short runs between terminal and protector, protector and station, extension station, or bell where the wire run on building extends outdoors.
	B	2 Pair	•	•														
	SK	Pair	•	•														
Ground	Pair	20	•						•									Adhesive-backed wire. Use where impossible or impracticable to use D station wire. Shielded Wire Ground Wire Capacity
	Single	14	•						•									
	Single	12	•						†									
E Block	Single	10	•						•									Size No. Fused Fuseless† 14 1 to 3 1 12 4 to 6 2 10 7 or more 3 to 6 6 Any number Any number
	Single	6	•						•									
	Single	21½							•									
F Cross-Conn	Pair	24																Used outdoors, in freezing rooms, factories, and for short runs in homes or offices. Use for all indoor cross-connections between incoming cables and station equipment. (Do not use in central office distributing frame.)
	Triple																	
	2 Pair																	
G Cross-Conn	3 Pair	22																Use for cross-connections in outdoor terminals. (Do not use in building.) Use violet for battery and white for ground. May be substituted for E block wire.
	Single																	
	Pair																	
C Drop	Pair	18½															Use under rugs and carpets.	
KS-7144 Flat Cordage	Quad	18	•															

Note: All wires listed should not be used near heat sources exceeding 140 degrees Fahrenheit.  
\* Local option.

† Any ground wire that can be used as a protector ground can also be used as a signal ground. Because of expense, it is not recommended that No. 12, 10, or 6 gauge wire be placed for use as signal ground only.

- It can be used for indoor or outdoor runs and may be terminated on any terminals which will accommodate 22 AWG conductors. **Do not use D Station Wire to span, eg, between buildings.**
- The insulation of the individual conductors is distinctively colored to provide identification. Refer to Table B for color codes.

**TABLE B.**

**D STATION WIRE**

**CONDUCTOR IDENTIFICATION**

TYPE	CIRCUIT NO.	COLOR	
		TIP	RING
Quad	1	Green	Red
	2	Black	Yellow

(3) **B Station Wire** is for use in areas where it is impossible or impracticable to use D Station Wire and standard fasteners due to construction of building.

- An adhesive-backed wire, rectangular in cross-section.
- May be used on most types of surfaces; however, it should not be used on damp or dirty surfaces, raw plaster, or a coarse surface such as cinderblock or untreated concrete.
- Wire runs should be limited to 100 feet for any single line installation, and 60 feet for installations involving two talking circuits.
- The insulation is slotted permitting separation of conductor pairs as well as individual conductors.
- Pair identification is established by raised areas spaced along surface of insulation.

(4) **SK Station Wire** is a shielded twisted pair wire.

- It is used in loudspeaker systems as amplifier output leads and associated wiring.
- Insulation of individual conductors is colored red or green.

(5) **Ground wire** is a single conductor insulated wire.

- No. 6 ground wire is used to make ground connections to protected cable, cable terminals, protector mountings, and to groups of station protectors.
- No. 10, 12, and 14 ground wire is used to make ground connections primarily in station wiring.

(6) **E Block Wire** is used in block distribution and in ring runs on buildings. It may also be used inside factories, freezing rooms, or for short runs in homes.

- May be used in spans not exceeding 35 feet in length.
- Ridge tracers are provided in the insulation for conductor identification. Refer to Table C.

**TABLE C**

**E BLOCK WIRE**

**CONDUCTOR IDENTIFICATION**

TYPE	RIDGE TRACER		
	DOUBLE	SINGLE	PLAIN
Single	•		
Double		•	•
Triple	•	•	•

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(7) **F Cross-Connecting Wire** is used for all indoor cross-connection applications between incoming cables and station equipment. (Not for use in central offices.)

- Conductor identification is established through use of colored insulation in combination with single dashes of colored ink. Refer to Table D.

**TABLE D  
F CROSS-CONNECTING WIRE  
CONDUCTOR IDENTIFICATION**

TYPE	WIRE		
	TIP	RING	SLEEVE OR GROUND
Pair	Y-BL	BL-Y	
Triple	O-BK	BL-BK	G-BK
2 Pair	R-BL	BL-R	
	R-O	O-R	
3 Pair	W-BL	BL-W	
	W-O	O-W	
	W-G	G-W	

(8) **G Cross-Connecting Wire** is used for cross-connections in outdoor terminals.

- It should not be used in buildings due to its limited fire-retarding properties.

- The colored insulation provides conductor identification. Refer to Table E.

**TABLE E  
G CROSS-CONNECTING WIRE  
CONDUCTOR IDENTIFICATION**

TYPE	COLOR	
	BATTERY	GROUND
Single	Violet	or White
Pair	Violet	White

(9) **C Drop Wire** is a parallel pair wire used for subscriber loop runs between poles and from pole to house.

- It should not be used for runs exceeding 500 feet in length due to transmission limitations.
- A single ridge tracer is provided on jacket adjacent to one conductor for identification.

(10) **KS-7144 Flat Cordage** is used for station wiring under rugs on subscriber premises.

- Insulation of individual conductors is colored red, green, yellow, and black for identification.

(c) **Inside Wiring Cable**

- (1) **Code, pair, gauge, and use** are found in Table F.

**TABLE F  
SELECTION OF INSIDE WIRING CABLE**

CODE OF WIRE	NO. OF PAIRS	GAUGE	SHEATH			DUCT AND CONDUIT SYSTEMS	USE		REMARKS
			SHEATHLESS	LIGHT OLIVE GRAY	POLYVINYL CHLORIDE (PVC) PLASTIC		TERMINALS AT		
							DAMP LOCATIONS	DRY LOCATIONS	
D Inside Wiring	6, 12, 16, 21, 25, 50, 75, 100	24	•	•	•	•	•	Annealed-copper conductors (plastic insulated) color coded	
E Inside Wiring	6	24	•				•		

(2) *D Inside Wiring Cable* is for general use in customer telephone systems wiring. The plastic jacket has improved frictional properties permitting placement without the aid of lubricants. Lubricants could eventually corrode and clog conduit, making it more difficult to place additional wire.

- All pairs, in the 6- to 25-pair sizes, are stranded around each other to form the cable.

- The 50- to 100-pair sizes are composed of 2 to 4 units of 25 pairs each. The units are stranded together to form the core. Each unit has a different color binder for unit identification. Refer to Table G.

- The colored insulation in combination with single dashes of colored ink provide individual conductor identification. Refer to Table G.

**TABLE G**  
**D INSIDE WIRING CABLE**  
**CONDUCTOR IDENTIFICATION**

PAIR	RING WIRE	TIP WIRE	BINDER COLOR FOR 50, 75, AND 100 PAIRS
1	BL-W	W-BL	BL-W
2	O-W	W-O	
3	G-W	W-G	
4	BR-W	W-BR	
5	S-W	W-S	
6	BL-R	R-BL	
7	O-R	R-O	
8	G-R	R-G	
9	BR-R	R-BR	
10	S-R	R-S	
11	BL-BK	BK-BL	
12	O-BK	BK-O	
13	G-BK	BK-G	
14	BR-BK	BK-BR	
15	S-BK	BK-S	
16	BL-Y	Y-BL	
17	O-Y	Y-O	
18	G-Y	Y-G	
19	BR-Y	Y-BR	
20	S-Y	Y-S	
21	BL-V	V-BL	
22	O-V	V-O	
23	G-V	V-G	
24	BR-V	V-BR	
25	S-V	V-S	
26-50	Repeat First 25 Colors		O-W
51-75	Repeat First 25 Colors		G-W
76-100	Repeat First 25 Colors		BR-W

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- Runs should be limited to 150 feet in length.
- (3) *E Inside Wiring Cable* is used for pre-wiring houses during construction.
- The insulated conductors are twisted into pairs, and the pairs are stranded together to complete the cable.
  - The colored insulation in combination with single dashes of colored ink provide individual conductor identification. Refer to Table H.

**TABLE H  
E INSIDE WIRING CABLE  
CONDUCTOR IDENTIFICATION**

PAIR	WIRE	
	RING	TIP
1	BL-W	W-BL
2	O-W	W-O
3	G-W	W-G
4	BR-W	W-BR
5	S-W	W-S
6	BL-R	R-BL



## SELECTION OF ROUTE FOR STATION WIRE AND CABLE

### 1.00 INTRODUCTION

1.01 This practice covers the general factors to be considered in running station wires or cables.

1.02 Fig. 1 shows the various points which should be considered in selecting routes for wires. Consideration should be given to the location of the telephone, protector, and ground clamp, as well as to the drop wire and point of entrance, before planning the wire route.

### 2.00 SELECTION OF BUILDING ENTRANCE

2.01 Inspect building thoroughly to locate service entrance conduit and use it if provided.

2.02 Where no service entrance conduit has been provided, select an entrance point from Table A.

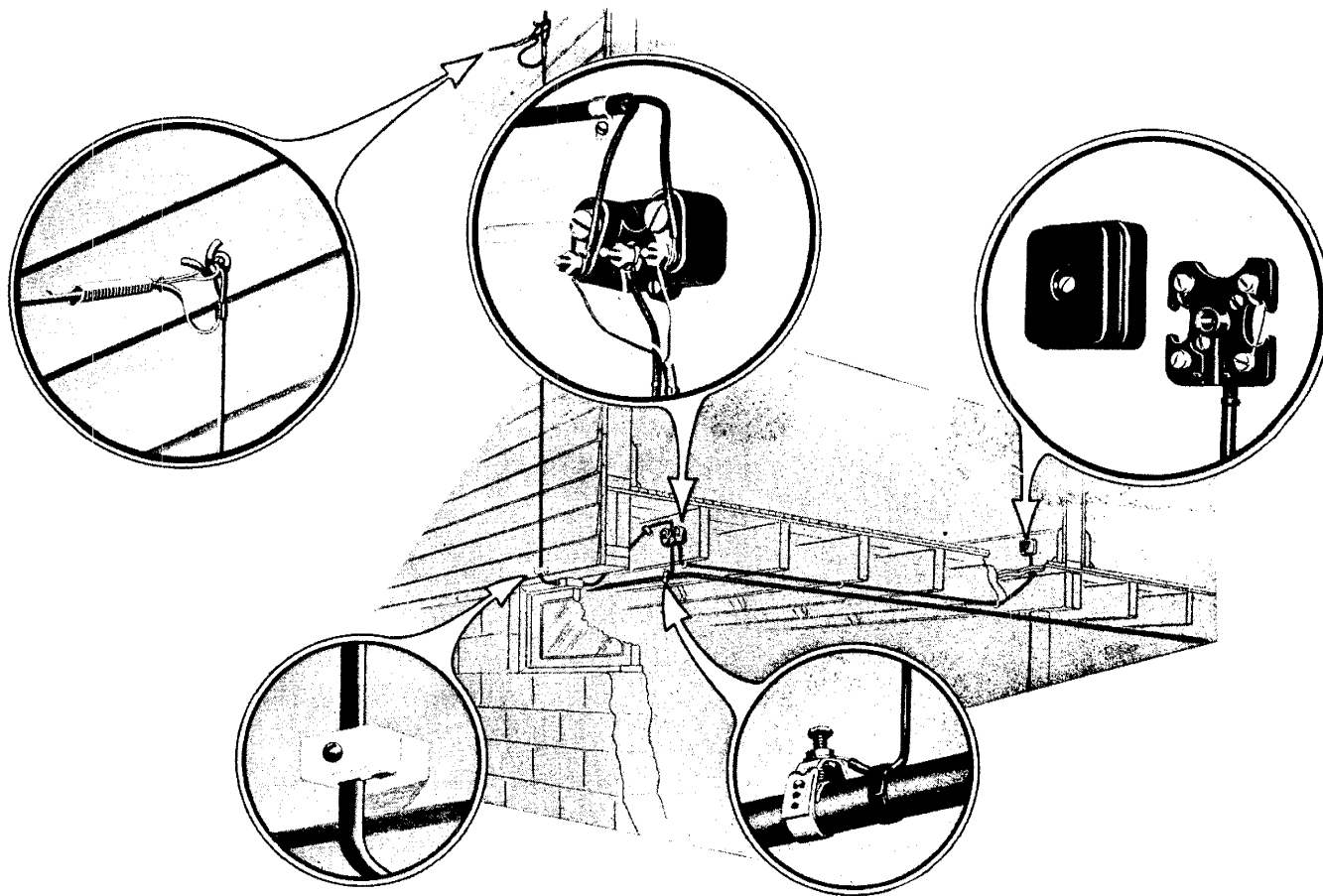


Fig. 1 — Typical Wiring Routes

TABLE A

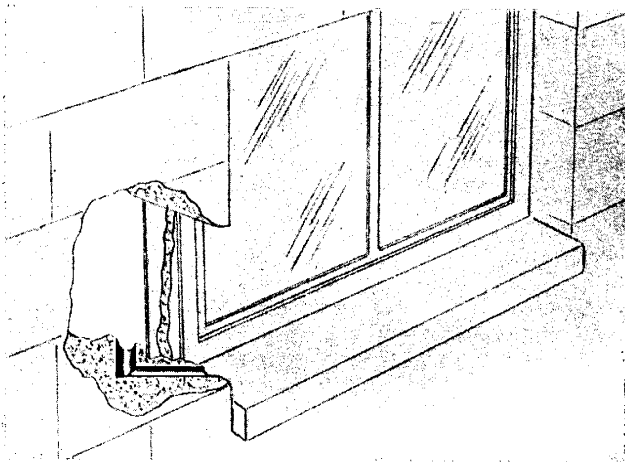
Type of Construction	Point of Entrance				
	Wooden Window Frame	Wooden Door Frame	Foundation Sill	Outside Wall*	Metal Window Frame †
Masonry or Brick	•	•			•
Wood or Stucco on Wood (basement ceiling unplastered)	•	•	•	•	
Wood or Stucco on Wood (basement ceiling plastered)	•	•		•	

\* To wire direct to set or connecting block.  
 † See 2.03.

**UNUSUAL BUILDING ENTRANCES**

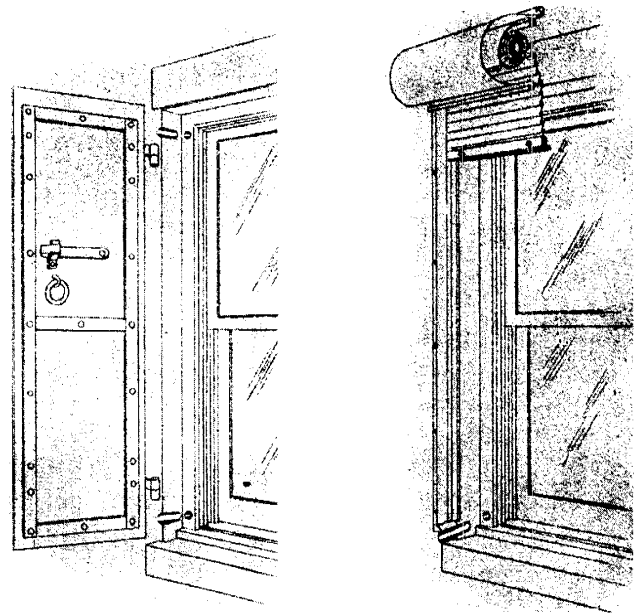
**2.03** For entrances at metal frame windows and doors:

- Do not make entrance through metal door frames.
- When metal window frame is set in masonry or bricks, enter as shown in Fig. 2.



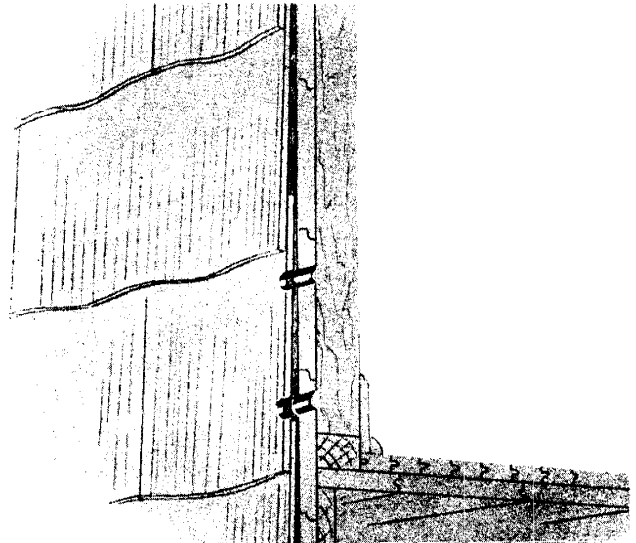
**Fig. 2 – Entrance at Metal Window Frame**

- Cut slot in seam of brick as shown in Fig. 3. Be sure slot is deep enough so wire is cleared when shutter or screen is operated.



**Fig. 3 – Entrance at Shutter of Fire Screen**

- Locate hole as shown in Fig. 4 so as to avoid drilling through two shingles.



**Fig. 4 – Entrance Through Composition Shingles**

**3.00 GENERAL LOCATION REQUIREMENTS**

**3.01 Facilities to Look For**

- Are conduits or raceways provided?
- Is there wire or cable in place which can be re-used?

- Can wire or cable be concealed or run inconspicuously?
- Will wire run present a good appearance?

**3.02** Follow customer's wishes, considering:

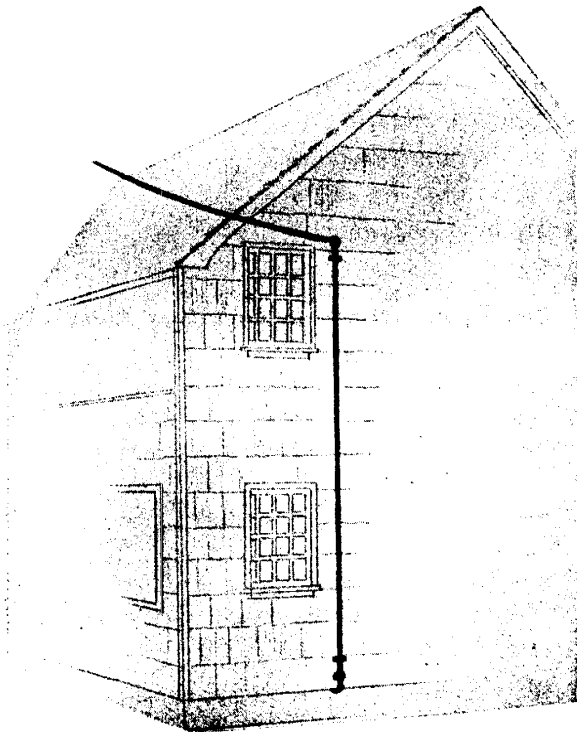
- Good safety sense.
- Minimum future maintenance.

**3.03** *Common Sense Factors*

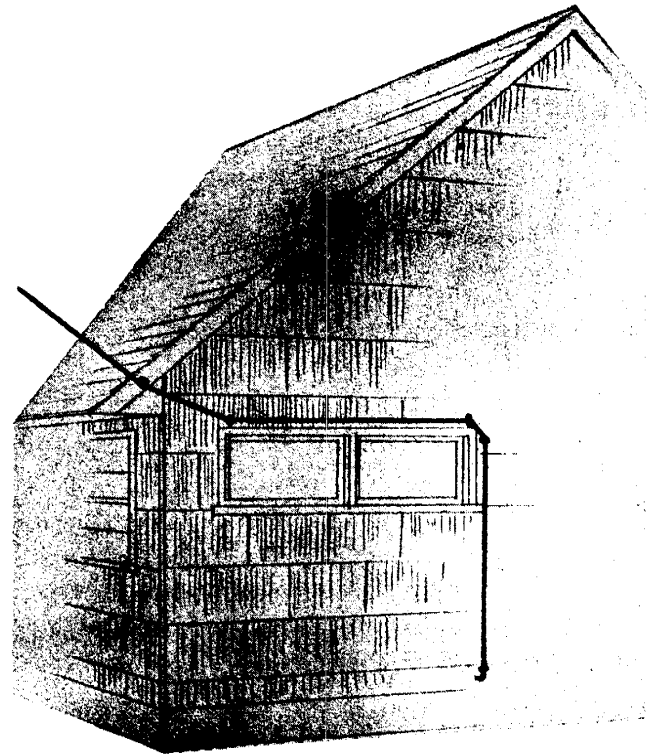
- Run wire or cable horizontally or vertically in a straight line.
- Choose color of wire or cable to blend with or match surfaces.
- Use baseboards or other trim where conduit is not provided.
- Make use of wooden surfaces in preference to others where possible.
- Keep runs as short as is consistent with good appearance and minimum maintenance.

**3.04** After location of first attachment has been determined, consider the following factors:

- Locate the drop or block wire run on the building with a view to permanency, accessibility, and appearance.
- On building walls finished with stucco, rigid composition shingles, brick veneer, and similar materials, locate attachments on wood trim where practicable.
- Locate preferably on the rear and side walls of a building (see Fig. 5).
- Place horizontal run above the reach of the public (see Fig. 6).
- Locate the run so as to require the minimum length of wire and as few turns as practicable.
- Do not run wires in front of signs, doors, windows, fire escapes, awnings, etc.
- Do not place wire runs on walls which are likely to be built against.
- Do not run wires diagonally on a building, except in short runs necessary to change direction of run.



**Fig. 5** — Typical Drop Run



**Fig. 6** — Horizontal Drop Run

- Avoid attachments on tin, sheet metal, or other materials requiring frequent repairs or renewals.
- Avoid locating on intermediate structures of a deteriorated or temporary construction. Select alternate route.
- When making a wire run on a building wall near cable, proceed in one of the following ways:
  1. Use rings installed with cable clamps as shown in Fig. 7.
  2. Remove nails or screws that hold cable clamps and replace with drive rings.
  3. Install separate wire run paralleling cable.

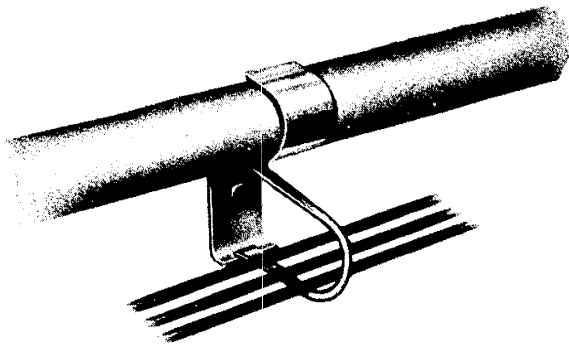
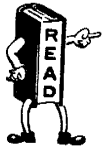


Fig. 7 — Drop Wire and Cable



*Wires or cables shall not be placed in conduits or raceways which contain electric wires not properly separated by partitions from the space provided for telephone wires or cables.*

**3.05 AVOID** the following locations when placing wire or cable:

- Damp locations.
- Locked storerooms, etc.
- Temporary structures.
- Runs that provide support for foreign objects.
- Excessively hot locations, steam pipes, etc.
- Locations where wires and cables will be subjected to abrasion.

**3.06** In explosive atmospheres, locate and install wiring as covered by specific instructions in accordance with the equipment being installed.

**3.07 Requirements for Ground Wire Runs**

- Make runs as short as possible.
- Locate wire where it is least likely to be disturbed.
- Run protector ground wire exposed, except where conduit has been provided.
- Do not place protector ground wire in ring runs.
- Signal ground wire may be placed in rings.
- When existing protector ground wire has become enclosed by a ceiling or partition, re-use if continuity can be checked and ground clamp is accessible.

**4.00 MAKING USE OF WIRE DISTRIBUTING SYSTEMS**

**4.01 Distributing Systems in Office Buildings**

- Office buildings are generally provided with an exchange cable terminated in a main terminal on the ground floor and distributed to each floor through a building or house cable.
- In some cases, the exchange cable may be distributed directly to each floor.
- For information regarding the building conduit system, consult the plan at the main terminal or contact the building superintendent.

**4.02 Various Types of Wire Distributing Systems**

- Steel underfloor duct system.
- Fiber underfloor duct system.
- Conduit underfloor wall system.
- Metal base raceways.
- Wood base raceways.
- Molding raceways.
- Cable.

**4.03 Distributing Systems in Apartment Houses, Hotels, and Hospitals**

- Generally, these buildings provide a main terminal location in the basement or ground floor and a wall conduit system to each apartment or room.
- In large buildings, there may be house cable from the main terminal to each floor with a terminal on each floor and conduits to the various apartments or rooms from the floor terminal.

**4.04 Wiring Systems in Private Residences**

- Some homes are equipped with a built-in protector cabinet and/or conduit to the proposed location of the telephone.

- Conduit may be provided to a service entrance head from the protector cabinet.
- Pull-wires or specially built wiring channels may be provided.
- Telephone outlets may have been placed and wired during construction of building.
- Always inspect for or inquire about these facilities and make use of them wherever possible.

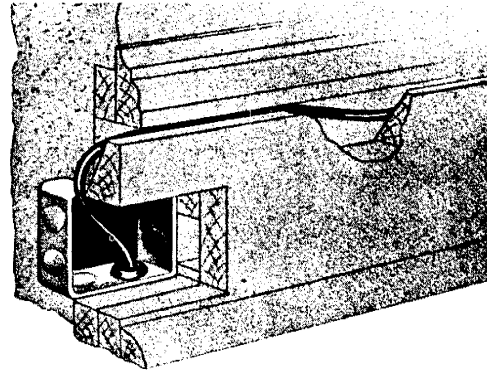
**5.00 SELECTION OF EXPOSED WIRING ROUTE**

**5.01** In general, an exposed wire route should be used only where no concealing facilities are available.

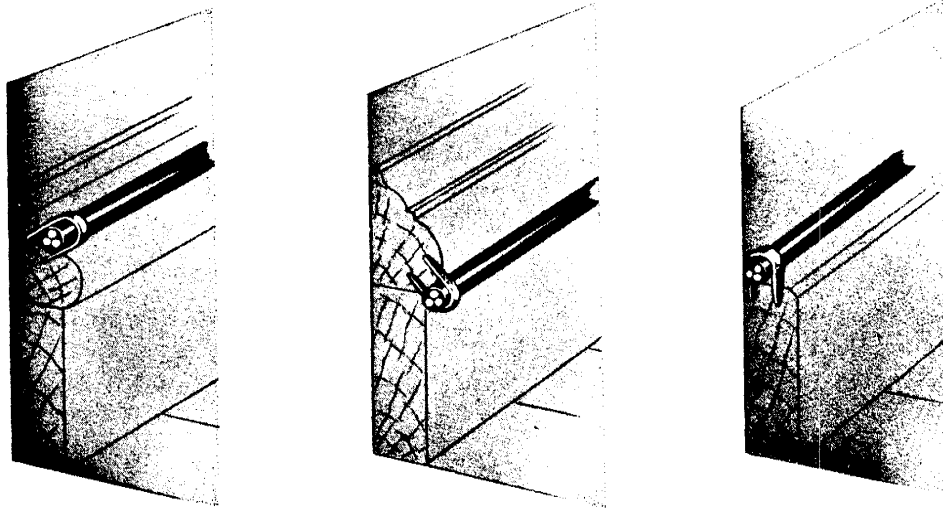
**5.02 Wiring in Finished Rooms and Offices**

- Run wires along baseboards, on top of picture moldings, or on door or window casings, so that they will be as inconspicuous as possible (see Fig. 8, 9, and 10).

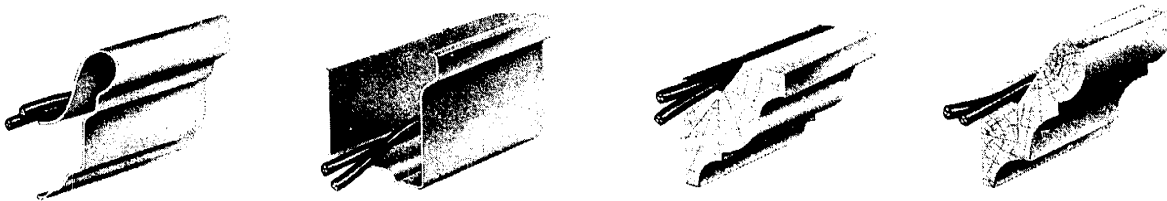
- Where trim cannot be followed, run wires horizontally or vertically but not diagonally.
- Choose color of wire and fasteners to match or blend with color of surface where wires are attached.



**Fig. 8 – Wiring from Conduit to Baseboard**



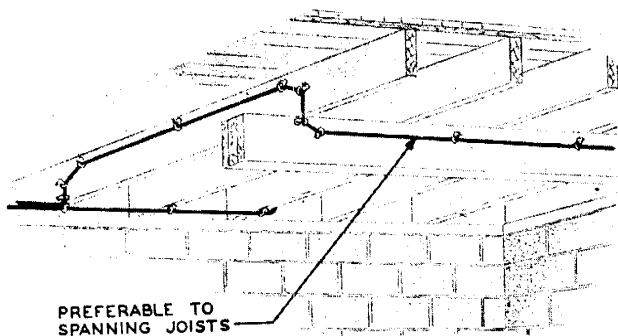
**Fig. 9 – Wiring on Baseboards**



**Fig. 10 – Wiring in Picture Moldings**

**5.03 Wiring in Cellars, Factories, Storerooms, etc**

- Place wire and cable where they will be least likely to be broken or detached. Provide protection if necessary.
- Consider the shortest, most direct right-angle route unless otherwise specified.
- • Select a wire route which will be safe and accessible.
- • Follow the ceiling line rather than baseboard in heavily traveled passageways.
- If necessary to follow chair rails, use the underside.
- When possible, follow joists.
- If necessary to span joists, run wiring not more than 3 inches from wall (see Fig. 11).



**Fig. 11 – Spanning Joists**

**6.00 USING CONCEALED AND OVERFLOOR CONDUITS**

Consider the following factors when using conduits:

- Whenever conduit is provided for telephone wires and it meets the prescribed specifications, it should be used.
- Check to be sure conduit does not contain electrical wires not associated with telephone equipment. If it does, follow local instructions.
- Place sufficient number of wires for possible future use in accordance with local procedures.

- Conduit systems are part of the permanent installation and are furnished, installed, and maintained by the building people.
- Consult the building people before extending wiring beyond the provided system.
- When necessary to provide wiring through concrete floors or similar construction from floor to floor and conduit is not provided, inspect premises for pipes through floor which may be provided for such use.

**7.00 PLACING STATION WIRE AND CABLE IN BUILDING RISER SHAFTS**

**7.01** Building riser shafts are generally of two types:

- **Closed riser shafts** consist of a series of closets, aligned vertically one above the other, usually beginning in the basement and extending throughout the height of the building. The closets are interconnected by a cable slot or pipe sleeves through the floors.
- **Open riser shafts** usually extend from the basement to the roof of the building with no floor separations. They are similar in construction to elevator shafts.

**7.02** To conform with the National Electric Code, observe the following when placing wire and cable in building riser shafts:

**Closed Riser Shafts**

- Polyethylene sheath cable may be placed if fire stops are placed in the slots or floor ducts at each floor. Fire stops should consist of a packing of asbestos or fibre glass with a thin topping of water plug cement or equivalent.
- If lead sheath cable or polyvinyl chloride (PVC) jacketed station wire and inside wiring cable is placed, fire stops are not required.

**Open Riser Shafts**

- The use of polyethylene sheath cable is restricted unless it is enclosed in a non-combustible conduit.
- Lead sheath cable and PVC jacketed station wire and inside wiring cable may be placed with no restrictions.

SEPARATION AND MECHANICAL PROTECTION

FOR WIRE AND CABLE

1. GENERAL

1.01 This addendum is issued to provide instructions concerning the use of drop wire attachments on buildings of flammable construction in Massachusetts.

1.02 This is a partial revision and cancels Addendum C23.007. The word "flammable" has been substituted for "wooden" in connection with building construction.

1.03 In Massachusetts, insulated attachments should be used to properly insulate drop wires on all buildings whether fused or fuseless protection is used.

1.04 To properly insulate drop wires on all buildings of flammable construction in Massachusetts, insulated screw eyes, or "C" knobs shall be used instead of drive rings, staples or cable clamps.

1.05 Clearance and mechanical protection requirements for wires run outside of buildings will remain the same.





## SEPARATION AND MECHANICAL PROTECTION FOR WIRE AND CABLE

### 1. GENERAL

1.001 This addendum supplements Section 461-200-201, Issue 6.

1.002 This addendum is issued to add minimum separation requirements for Communication Wires.

### 3. SEPARATIONS

The following supplemental information applies to Part 3 of the section:

(a) TABLE A — revised.

TABLE A

Type of Plant Involved		Minimum Separations	Protection Required if Minimum Separations Cannot be Obtained (See Note 1)
Communication Wires	Community television systems coaxial cables with shields at ground potential	None	



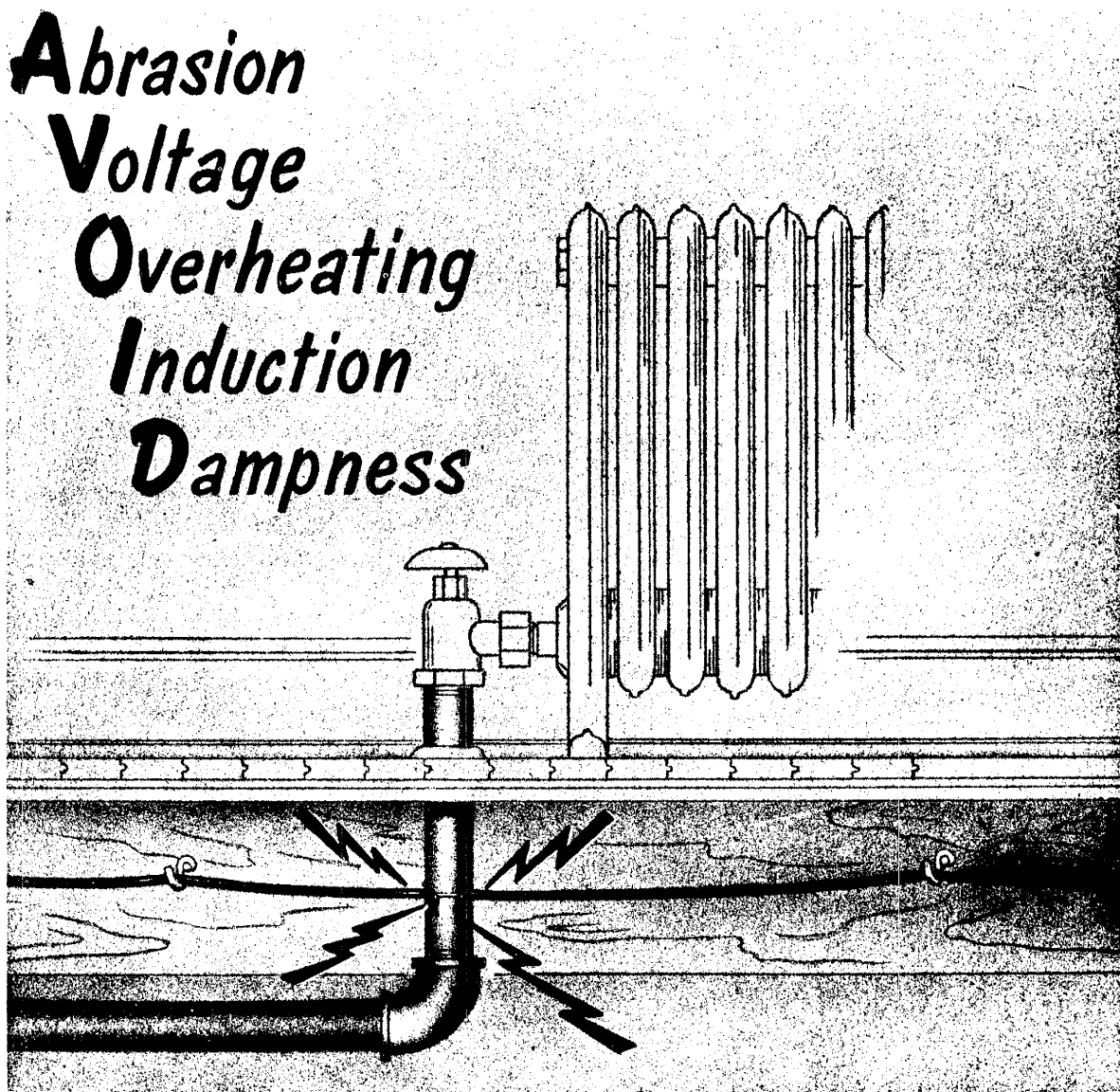
## SEPARATION AND MECHANICAL PROTECTION FOR WIRE AND CABLE

### 1.00 INTRODUCTION

1.01 This section specifies the minimum separations that are required in or on buildings, and in the span to buildings, between telephone wiring and foreign conductors or metallic objects.

1.02 This section is reissued to cover changes in Tables A and B, and to add Table C.

1.03 Due to extensive changes, marginal arrows have been omitted.



## SECTION 461-200-201

### 2.00 GENERAL

**2.01** In general, the separations are required for electrical reasons. However, uncovered steam and hot water pipes, stationary metal gratings, etc, also must be considered because of excessive heat and abrasion.

**2.02** Cold water pipes sweat under certain conditions; therefore, cross wires *over* rather than under the pipes.

**2.03** All station wires or cables installed in explosive atmospheres shall be placed in accordance with the instructions pertaining to that equipment.

**2.04** Wire or cable shall not be placed in pipe, conduit, or compartment containing electric light and power wires or cables, nor in the same outlet box, junction box, or compartment unless separated from the electric light and power wires by a suitable partition.

**2.05** Whenever practicable avoid running telephone wire or cable in the same conduit, molding, or runway with foreign signal circuits which are operated by battery or from a step-down transformer. Strict adherence to this recommendation will minimize the possibility of interference by either or both parties during placing or maintenance activities.

### 3.00 SEPARATIONS



*The separations shown in Tables A, B, and C are minimum requirements. Greater separations shall be provided where readily obtainable.*

**3.01** Separations specified in Tables A, B, and C apply to crossings and parallel runs.

**3.02** In Tables A and B the specified separations must be obtained for parallel runs.

**3.03** The specified separations must be obtained at crossings designated *No Alternative* in Tables A and B.

**3.04** Separations and protection requirements for wiring, placed on outside walls of buildings, that is to be extended to off-premises stations, outdoor stations, loud ringing bells, etc, are the same as specified for drop and block wire and are shown in Table B.

**3.05** Separations of less than 6 feet between drop, block, station wiring, station cabling, or telephone ground wires and lightning wires or rods are permissible under the following conditions: ***In no case shall the separation be less than 4 inches.***

- a. Where telephone, power, and lightning rod ground connections are made to a common grounding medium such as a cold water pipe.
- b. Where separate driven ground rods are used for telephone, power, and lightning rod installations, ***and the ground rods are bonded together.***

**3.06** Tables A and B list the minimum separations between telephone wiring and foreign conductors or metallic objects outside or inside buildings.

**3.07** Table A applies only to telephone wiring between the protector (fuseless or fused) and the telephone equipment and to telephone wiring requiring no protector.

**3.08** Table B applies only to telephone wiring (drop or block) attached to the building and feeding a protector (fuseless or fused).

**3.09** Table C lists the minimum separations that shall be obtained between drop wire in the span to a building and foreign conductors or metallic objects.


### 4.00 DEFINITIONS


Terms used in Tables A, B, and C are defined below:

- Bare Wire—A conductor having no covering or insulation whatsoever.
- Open Wiring—A wiring method using cleats, knobs, tubes, and flexible tubing for

*(Continued on page 4)*

TABLE A

Minimum separations between telephone wiring, outside or inside buildings, and type of plant indicated are below. This applies only to telephone wiring from fuseless or fused protector to telephone equipment and to telephone wiring requiring no protector. Separations apply to crossings and to parallel runs.			
Type of Plant Involved		Minimum Separations	Protection Required if Minimum Separations Cannot be Obtained (See Note 1)
Electric Supply	 Bare light or power wire of any voltage	5 feet*	No Alternative*
	Open wiring of any voltage	2 in.	See Note 2
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires	none	
Radio and Television	Antenna lead-in and ground wires	4 in.	See Note 2
Signal or Control Wires	Open wiring or wires in conduit or cable	none	
Telephone Drop or Block Wire	Using fused protectors	2 in.	See Note 2
	Using fuseless protector or where no protector required	none	
Telephone Ground Wire		none	
Sign	Neon signs and associated wiring from transformer	6 in.†	SK station wire with shield grounded or lead cable with sheath grounded. Ground requirements same as for signaling ground. See section entitled Protector and Signaling Grounds
Lightning System	Lightning rods and wires	6 ft	See 3.05
Pipe	Steam or hot water or heating ducts	1 in.‡	Split porcelain tube extending 2 inches beyond each side of object being crossed
Stationary Grating, Metal Shutter Grillwork, etc		E, P, or S wire guard, or two layers of friction tape required in all cases to resist abrasion	

\*  Power is to be turned off if working above bare wire. Ladders shall be placed so as to maintain a 5-foot minimum clearance.

† To prevent accidental breakage, avoid neon sign location if alternative run is possible.

‡ Excessive heat may damage plastic-insulated wires; therefore, avoid heating ducts and other heat sources.

**Note 1:** Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

**Note 2:** Plastic tube; E, P, or S wire guard; or two layers of friction tape extending 2 inches beyond each side of object being crossed. Add split porcelain tube to existing wire.

**SECTION 461-200-201**

the protection and support of insulated conductors run in or on buildings, and not concealed by the building structure.

- Service Drop—The overhead service conductors between the last pole or other aerial

support and the first attachment to the building.

- Nonmetallic Sheathed Cable—An assembly of two or more insulated conductors having an outer sheath of moisture resistant, flame retardant, nonmetallic material.

**TABLE B**

**Minimum separations between telephone wiring, outside or inside buildings, and type of plant indicated are below. This applies only to telephone wiring (drop or block) attached to buildings and feeding a fuseless or fused protector. Separations apply to crossings and to parallel runs.**

Type of Plant Involved		Minimum Separations	Protection Required if Minimum Separations Cannot be Obtained (See Note 1)
Electric Supply	<b>THINK</b> Bare light or power wire of any voltage	5 ft*	No Alternative*
	Service drops or open wiring not over 750 volts	4 in.	P or S wire guard extending 2 inches beyond each side of object being crossed
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires	2 in.	
Radio and Television	Antenna lead-in and ground wires	4 in.	
Signal Wire	Open wiring or wires in conduit or cable	2 in.	
Communication Wire	Foreign open wiring and wires in conduit or cable	2 in.	
	Between exposed and unexposed Telephone Company wires		
Metallic Object	Downspouts and gutters	2 in.	
	Stationary gratings, etc	P or S wire guard or two layers of friction tape required in all cases to resist abrasion	
Telephone Ground Wire		none	
Sign	Neon signs and associated wiring from transformer	6 in.	S wire guard, 12 inches long†
Lightning System	Lightning rods and wires	6 ft	See 3.05
Telephone Ground Rods to Other Ground Rods		6 ft	No Alternative

\* **THINK** Power is to be turned off if working above bare wire. Ladders shall be placed so as to maintain a 5-foot minimum clearance.

† To prevent accidental breakage, avoid neon sign location if alternative run is possible.

**Note 1:** Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

TABLE C

Minimum separations between drop wire span to buildings and type of plant indicated are below.			
Type of Plant Involved		Drop Wire Span to Building Minimum Separation	
		Crossing	Parallel
Electric Supply	Service drops or open wiring not over 750 volts	2 ft	1 ft
	Wires in conduit, or in armored or nonmetallic sheath cable	4 in.	4 in.
Radio and Television	Antenna lead-in and ground wires	2 ft	1 ft
Signal Wires	Open wiring	2 ft	1 ft
	Wires in conduit or cable	4 in.	4 in.
Communication Wires	Foreign open wiring	2 ft	1 ft
	Foreign wires in conduit or cable	4 in.	4 in.
Metallic Objects	Rain spouts, gutters, etc	4 in.	4 in.
Ground Wires	Ground wires (except radio, television, and lightning ground wires)	4 in.	4 in.
Lightning	Lightning wires and rods	6 ft	6 ft
Signs	Neon sign and associated wiring from transformer	1 ft	1 ft

## 5.00 WIRE PROTECTION

**5.01** Where it is not practicable to obtain recommended minimum separation at crossings other than those shown as No Alternative in Tables A and B, or where wire or cable runs are subject to mechanical damage, abrasion, or excessive heat, a protective covering is required as follows:

- Split porcelain tube extending 2 inches beyond each side of object being crossed when excessive heat is a factor (see Fig. 1).

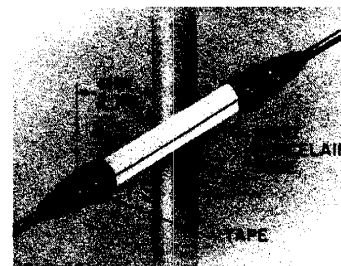


Fig. 1 — Crossing Exposed Steam Pipes

- Split porcelain tube only where tube is added to existing wire. Use a split tube as follows:
  1. Place flat side of tube in a plane parallel to pipe, electric wires, etc.
  2. Secure split tube by placing two turns of lashing wire about 1 inch from each end of tube (see Fig. 2).
  3. Bend pigtail over and cover lashing wire with two layers of friction tape.
  4. Use clamps or staples as shown in Fig. 3 if support for tube is needed.

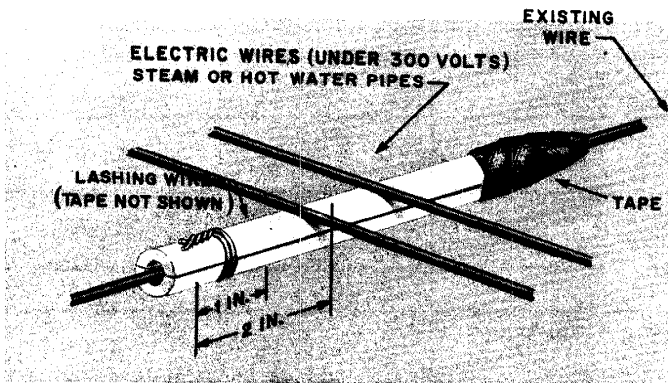


Fig. 2 — Securing Split Tubes

- Plastic tube, P or S wire guard, or two layers of friction tape extending 2 inches beyond each side of object being crossed.

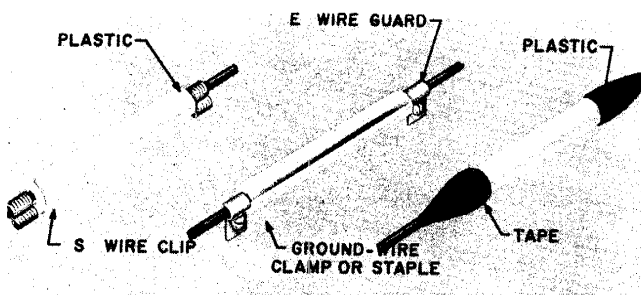


Fig. 3 — Securing Plastic Tubes or E Wire Guard

- P or S wire guard, plastic tube, or two layers of friction tape shall be used in all cases where telephone wiring is subject to abrasion or mechanical damage. E wire guard (plastic tubing) may be used in place of friction tape or P wire guard on station wiring within buildings where improved appearance is desired. (See Fig. 4.)

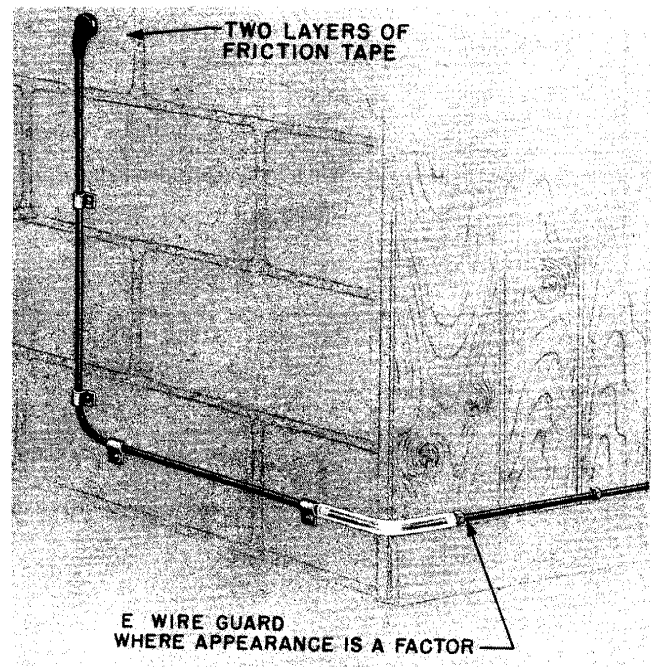


Fig. 4 — Use of Tape or E Wire Guard

5.02 Where plastic insulated station wire or cable passes through wall or floor adjacent to wall or baseboard, protection with friction tape or E wire guard is not required unless wire is subject to mechanical damage or abrasion.

5.03 Where station wiring passes over floor away from wall or baseboard, protect it from mechanical damage with overfloor ducts and associated fittings as covered in the section entitled Overfloor Ducts, Identification and Installation.



5.04 Fig. 5 through 12 are typical examples of wiring requiring protection.

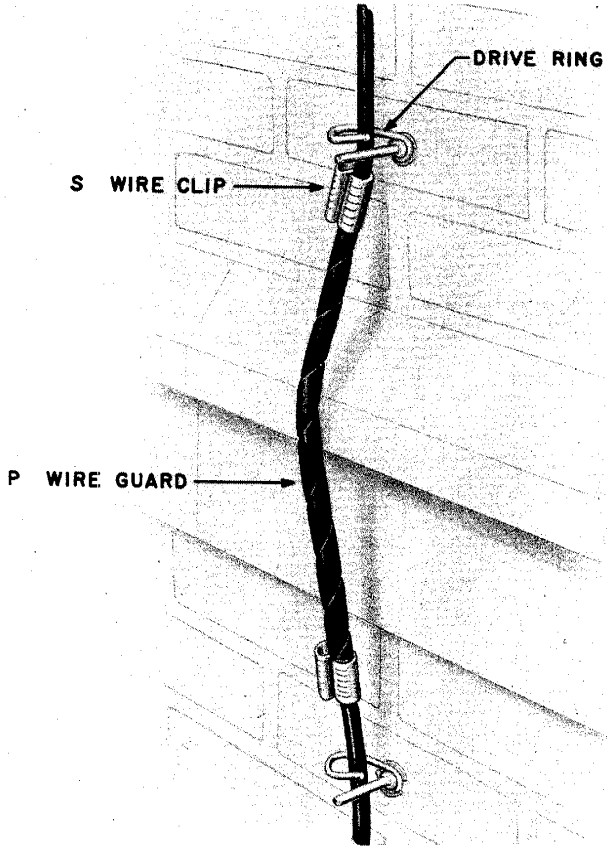


Fig. 5 — Crossing Masonry Building Projection

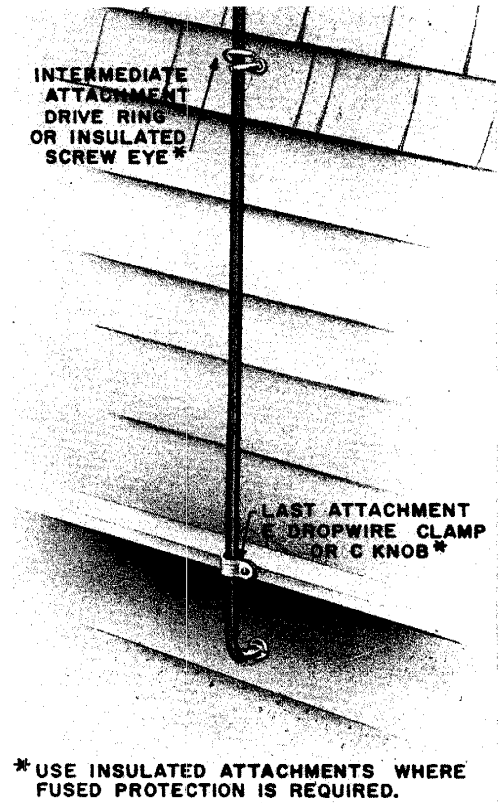


Fig. 6 — Crossing Wood or Stucco on Wood Building Projection



*Do not run wires or cables through removable gratings.*

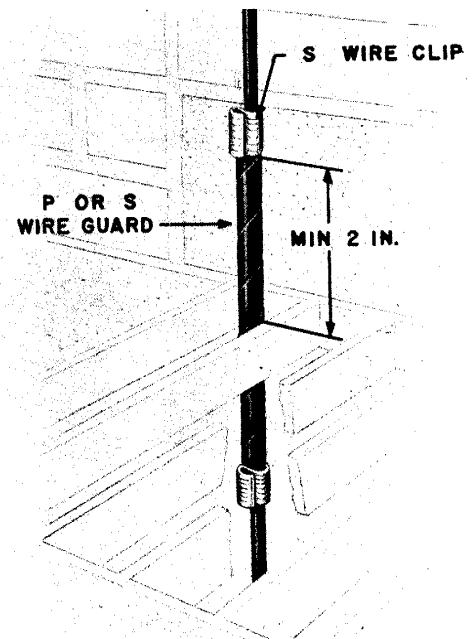
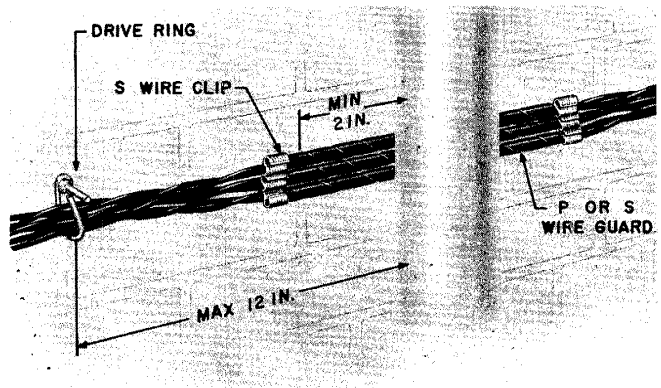
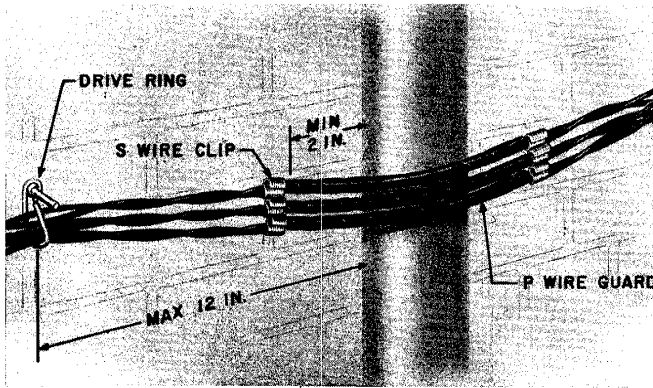
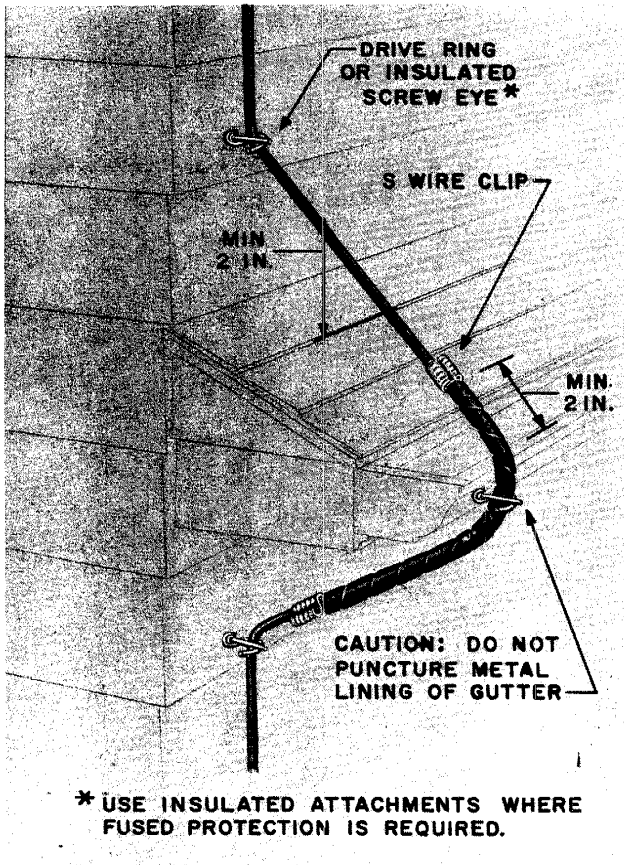


Fig. 7 — Protecting Wire Run through Stationary Metal Grating

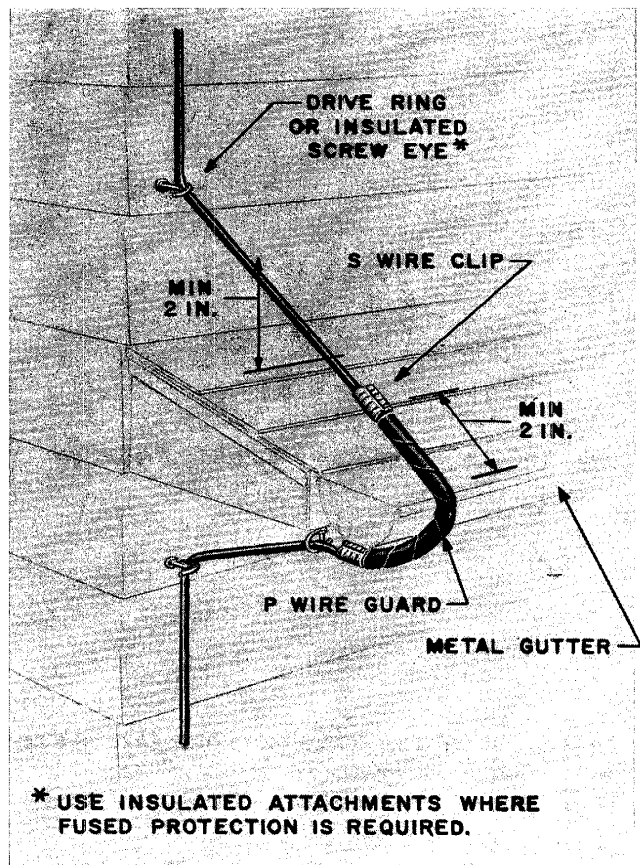


Masonry or Brick Surface

Fig. 8 – Wires Crossing Downspout

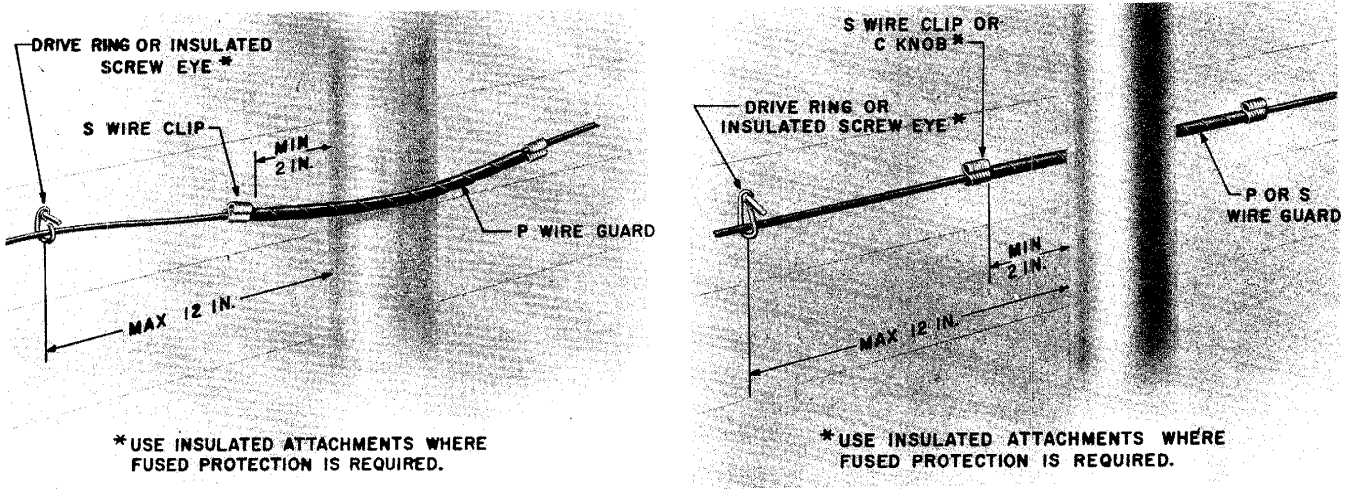


Metal-Lined Wooden Box Gutter



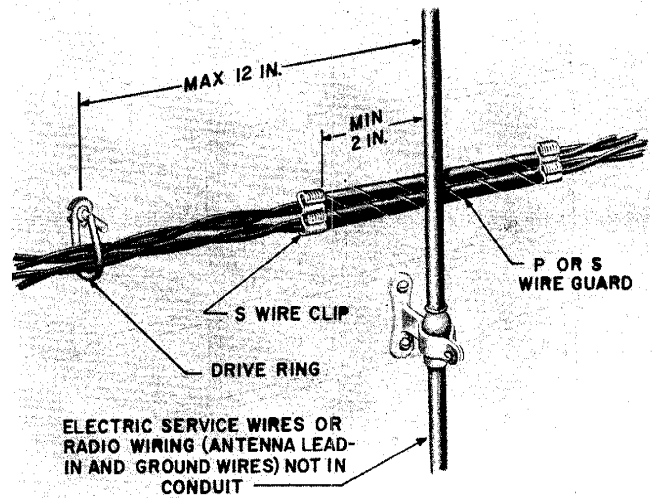
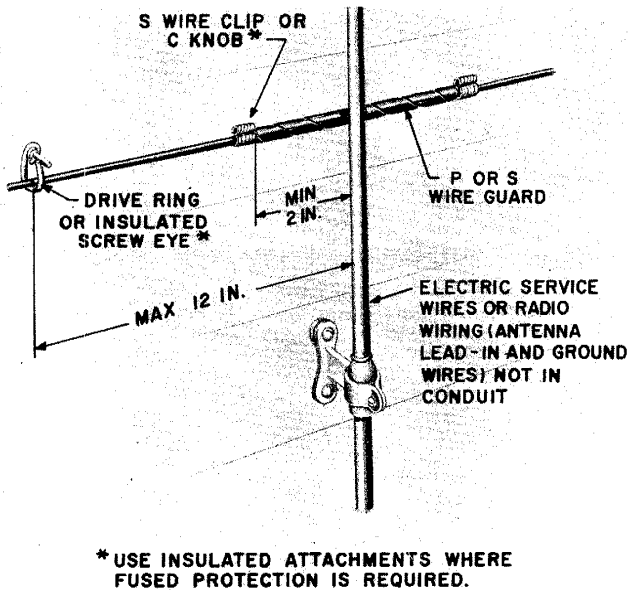
Metal Gutter

Fig. 9 – Crossing Building Overhangs and Gutters



Wood, Stucco on Wood, or Metal Siding on Wood Surface

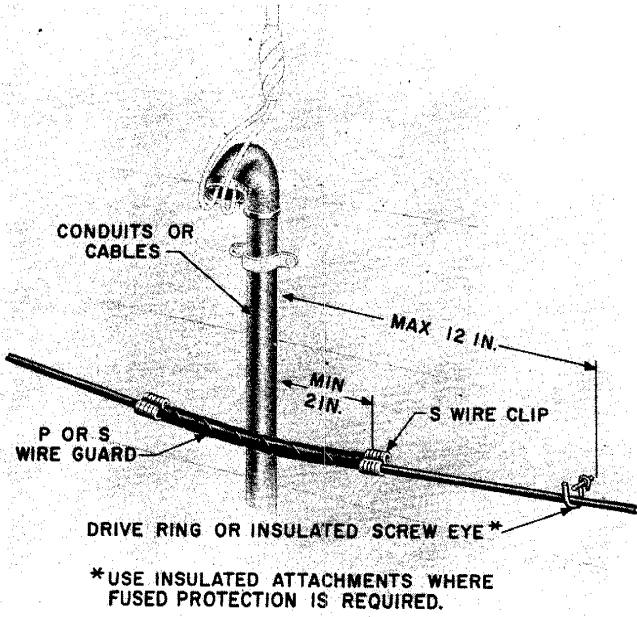
Fig. 10 – Wires Crossing Downspout



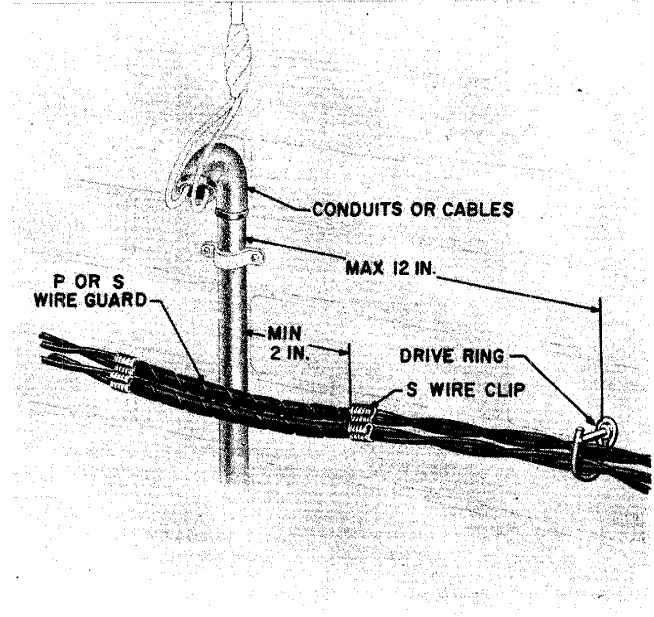
Wood, Stucco on Wood, or Metal Siding on Wood Surface

Masonry or Brick Surface

Fig. 11 – Wires Crossing Power Service, Radio Wires, or Television Wires



Wood, Stucco on Wood, or Metal Siding  
on Wood Surface



Masonry or Brick Surface

Fig. 12 — Wires Crossing Foreign Cables, Metal Conduits, Open Signal Wires, or Ground Wires

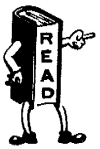
## CONCEALING WIRE AND CABLE WITHOUT CONDUITS OR RACEWAYS

### 1.00 INTRODUCTION

This section covers the general factors to be considered in concealing wire and cable without conduits or raceways. Due to extensive changes marginal arrows have been omitted.

### 2.00 FISHING WIRE AND CABLE IN WALLS

#### 2.01 General



*Consider making runs on the outside of the building rather than fishing walls. Fish wire and cable only where appearance will not permit exposed runs, in accordance with local instructions.*

- Consider runs through closets, cupboards, etc, rather than fish.
- Do not place plastic cable in shafts without baffles, because of fire hazards.
- Generally, outside walls are easier to fish than partitions.
- Where customer will not permit an exposed run and excessive time is required to conceal the run, consult your supervisor.

#### 2.02 Fishing from Upper Floor to Basement

- When fishing from the upper floor to the basement, consider the type of construction used in the building.
- Consider the location of obstructions.
- Never fish between two studdings when electric light wiring is present. Presence of electric wiring is generally indicated by light switches, fixtures, or outlets.

- In order to drill through obstructions between floors, the molding at baseboard and floor should be loosened. Consider the following procedure in loosening and replacing molding:

1. Place a wood chisel under or in back of the molding and pry up or out.
2. Then place a screw driver between molding and baseboard. (See Fig. 1.)

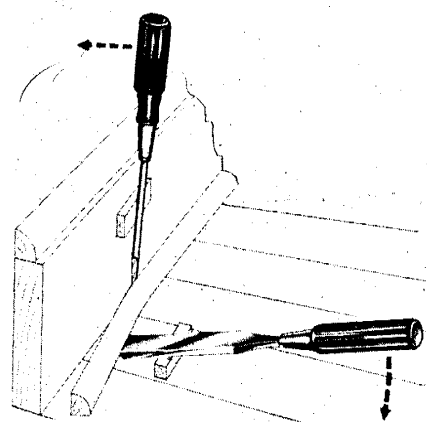
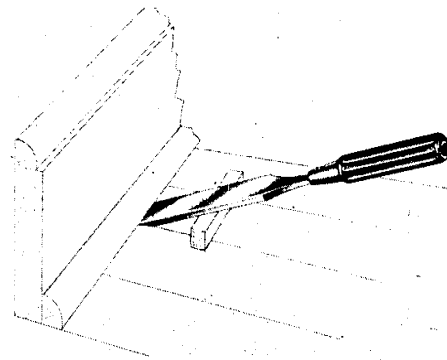
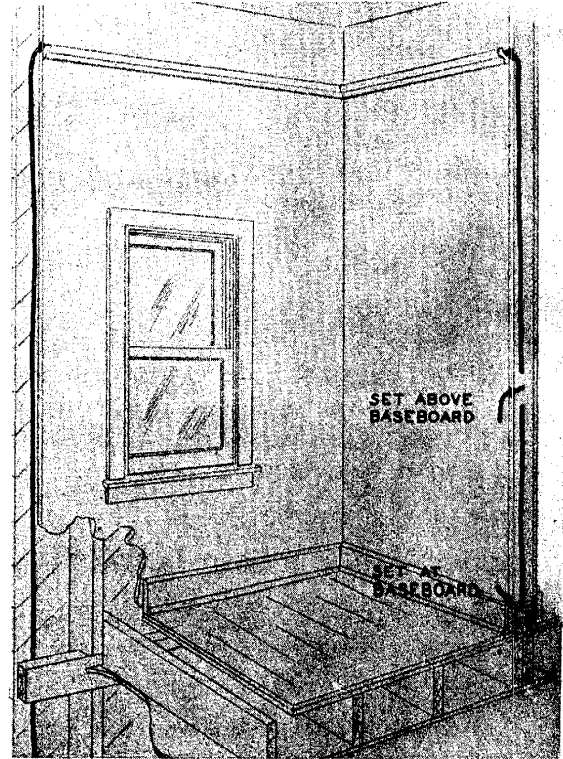


Fig. 1 — Procedure for Removing Molding

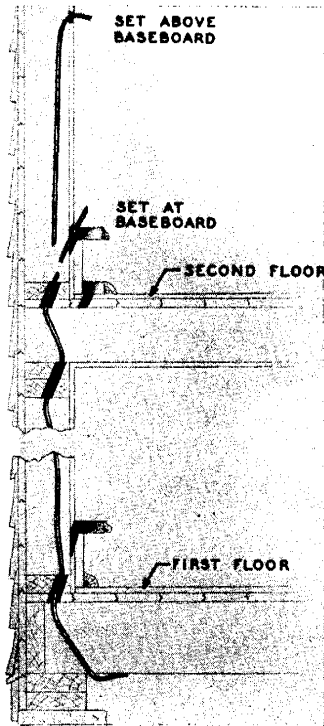
**SECTION 461-200-202**

3. Pry carefully with chisel and screw driver to loosen nails which have been driven in diagonally.
  4. Move tools forward as the molding is loosened and keep tools as near nail locations as possible.
  5. Loosen molding only as far as necessary to provide room for boring.
  6. Withdraw nails from molding by pulling the head through to the underside with diagonal pliers.
  7. Removing nails this way leaves the paint and putty undisturbed on the face of the molding.
  8. When replacing the molding, remove all dirt and chips from behind the molding and press the molding back into position, starting at the unloosened end.
  9. Fasten molding with thin wire finishing nails.
- In general, no obstructions will be found in fishing brick or balloon (no obstructions between studs) frame houses (see Fig. 2).
  - When fishing walls with obstructions, proceed as follows:
    1. Loosen molding above baseboard on upper floor and drill hole downward through wall and plates above joist.
    2. Loosen molding at baseboard on upper floor and drill hole downward through floor and plates below joist.
    3. Loosen molding above baseboard on first floor and bore downward through wall and plates.



**Fig. 2 — Locating on Inside Wall**

4. On upper floor, pass fishing chain with twine attached through hole above baseboard; and with a piece of wire, hook chain through hole at baseboard and pass it through plates.
  5. On first floor, find fishing chain through hole above baseboard and pass it through plates.
  6. If basement has a ceiling, drill hole upward at location of chain and fish it out into basement.
  7. Tie on wire and pull it up to upper floor by use of twine.
- Fig. 3 shows a method of fishing walls.
  - When location of set, connecting block, etc, is some distance above baseboard, drill hole



**Fig. 3 – Fishing Outside Walls**

at location and fish from there down, proceeding as outlined in 2.02.

- When drilling plates, locate them by feeling with the bit to determine proper position for drilling as shown in Fig. 4.
- In locating the set, connecting block, etc, on an inside wall, proceed as shown in Fig. 2.
- Some of the obstructions which may be encountered are shown in Fig. 5.



*If locations of obstructions are not known or cannot be determined readily, bore hole with search bit to locate them.*

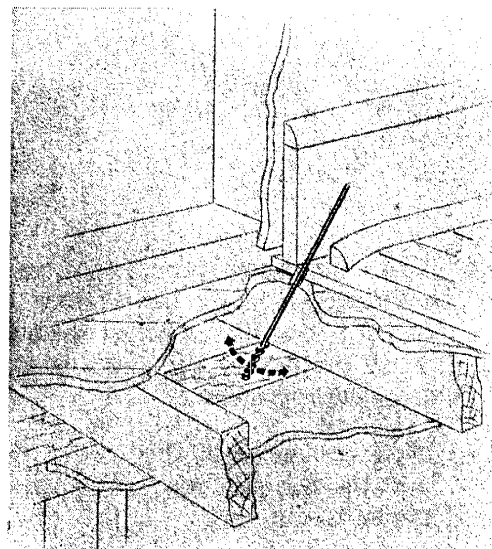
### 2.03 Fishing Walls on the Same Floor

- In general, only outside walls should be fished, and then only when necessary.

- Make runs on baseboards or around door and window frames where permissible.
- Sound out walls or partitions by tapping lightly before attempting to fish.

### 3.00 PLACING FLAT RUBBER CORDAGE

- When it is necessary to put set on a desk or table which is located away from the wall, and no conduit has been provided, use flat rubber cordage under the rug or carpet, providing permission has been obtained from the customer.
  1. Measure off sufficient cordage to reach from the terminating point on the desk to the rug.
  2. Make a butt mark on the cordage, allowing about a 10-inch slack.
  3. Strip conductors from the protective covering one at a time back to the butt marks and tape the four conductors together.



**Fig. 4 – Locating Plates**

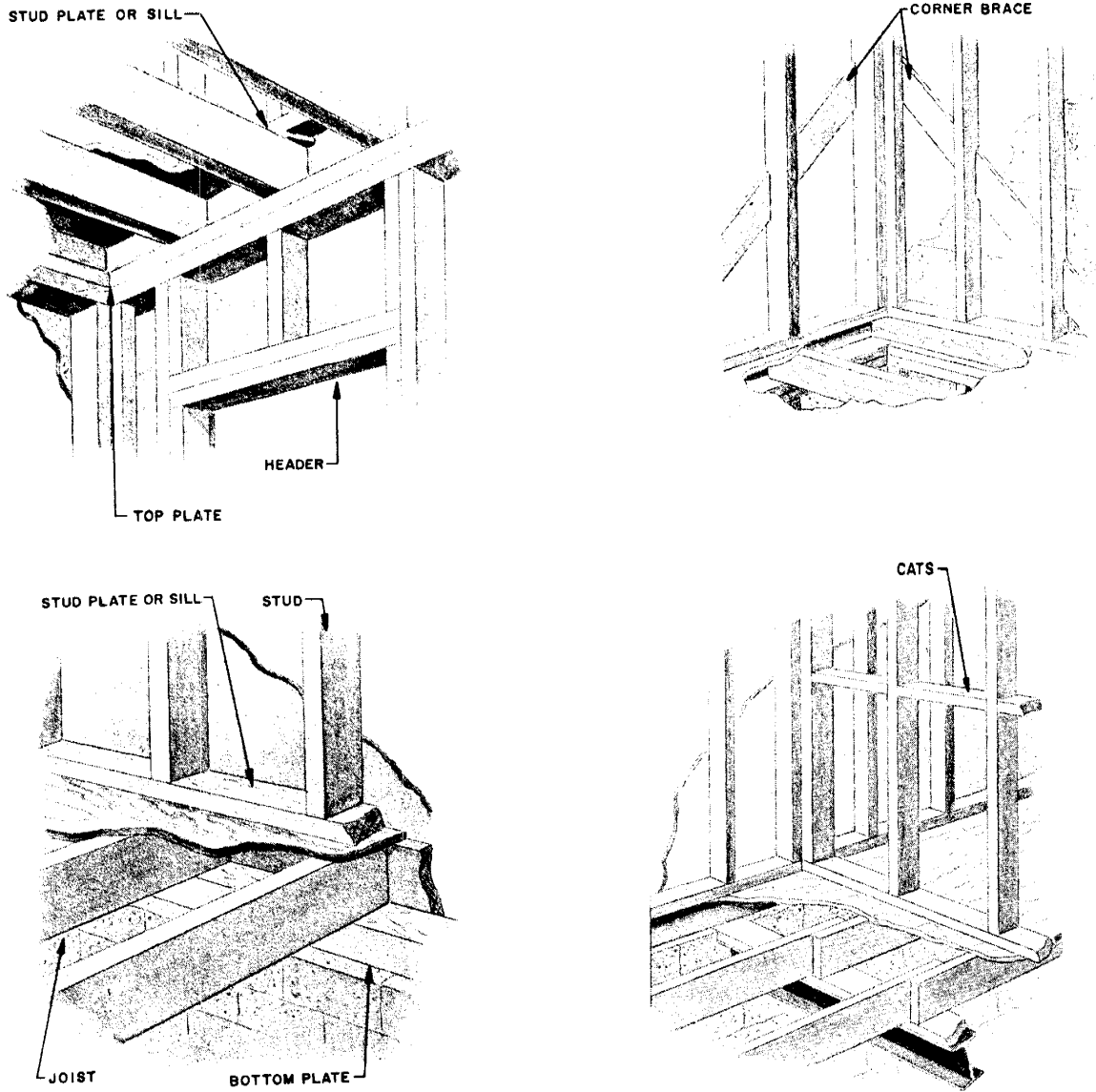


Fig. 5 – Wall Obstructions

4. After obtaining permission from the customer, separate the threads of the carpet or rug with a pencil and push the taped portion of the cordage through from the underside.
5. Place cordage smoothly under the rug with the flat side against the floor, and extend to the wall.
6. Strip back, tape, and terminate conductors on a connecting block as shown in Fig. 6.

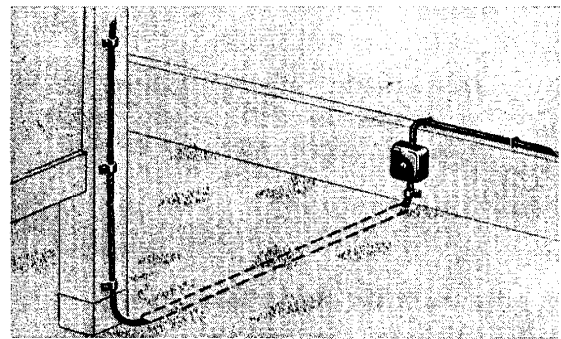


Fig. 6 – Placing Flat Rubber Cordage



## STATION WIRE AND CABLE ATTACHING AND FASTENING

**1. GENERAL**

**1.001** This addendum supplements Section 461-200-210, Issue 3.

**1.002** This addendum is issued to:

- Revise 2.01
- Revise 2.02
- Revise Table B to include the E stapler and H and J staples, and to remove the T-18 staple and the Heller M stapler.

**2. ATTACHMENTS USED IN FINISHED ROOMS AND OFFICES**

The following changes apply to Part 2 of the section:

(a) 2.01—revised

(b) 2.02—revised

(c) Table B—revised.

**2.01** Staples of various sizes and materials used in hand-operated staplers are used to secure station and ground wire and smaller inside wiring cables to wood surfaces.

**2.02** Table B shows the staples recommended for wood surfaces with finishes available and stapler machine used. Detailed information on the various staplers and staples is covered in the 080 division of the Plant Series.

**TABLE B  
SELECTION OF STAPLES**

STAPLES						
TYPE	FINISH	SIZE (INCHES)		SHAPE OF CROWN	USE	STAPLER
		LENGTH	WIDTH			
H*	Zinc or Ivory	3/8	.150	Rounded	With D station wire, and small gauge ground wire in all type wood	Heller TMN conversion or E
J†	Copper Coated					
E*	Zinc or Ivory	3/8	3/16			Heller TM
F†	Copper Coated					
G*	Zinc Coated	5/8	1/2	Flat	With 25-pair inside wiring cable in all type wood	D

\* For indoor use.

† For outdoor use or where appearance is unimportant.

**Note:** Staples are not recommended for use in plaster.



## STATION WIRE AND CABLE ATTACHING AND FASTENING

### 1. GENERAL

1.01 This section contains general descriptions and instructions for use of various attachment or fastening devices used in running station wire and cable between wiring entrances and subscriber apparatus.

1.02 This section is reissued to:

- Add 1.06
- Include information on the D Stapler and G Staples
- Revise Tables A and B.

1.03 See Section 461-200-200 for detailed instructions governing the selection of route and the placing of inside wire and cable. Detailed descriptive information of the various attachments and fasteners illustrated in this section is covered in the 080 division of the Plant Series.

1.04 In order to obtain secure attachments and to avoid damage to building surfaces, follow the instructions outlined in Section 080-720-105. Of particular importance are the clearance and lead holes for fasteners.

1.05 Table A shows the recommended spacing between attachments when used on horizontal or vertical wire runs. The spacing of attachments from corners or turns is also shown.

**TABLE A  
SPACING REQUIREMENTS OF ATTACHMENTS**

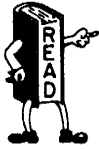
FASTENERS		SPACING				
		HORIZONTAL		VERTICAL RUN		FROM CORNER
		FEET	INCHES	FEET	INCHES	INCHES
Cable	more than 12-pair cable		16	4		2
Clamps	less than 12-pair cable		16		16	2
Cable	more than 12-pair cable		14	3		2
Clasps	less than 12-pair cable		14		14	2
B Adhesive Clips			12		12	2
B Station Wire Clamps			16		16	2
B Station Wire Nail			16		16	2
Staples	Station Wire		7-1/2		7-1/2	1
	25-pair D inside wiring cable		12		12	2
Bridle Rings		4				2 thru 8-1/2*
Drive Rings		4		8		2 thru 8-1/2*
Wire Loops		4		8		2 thru 8-1/2*
Toggle Bridle Rings		4		8		2 thru 8-1/2*
Insulator Supports		4		8		2 thru 8-1/2*
B Beam Clip		4		8		2 thru 8-1/2*
B Hanger Clip		As Required				

\*When changing direction of wire or cable runs where wire loops, bridle rings, drive rings, toggle bridle rings, insulator supports, and B beam clips are used, the fasteners should be spaced to hold the wire or cable at approximately a 45-degree angle.

**SECTION 461-200-210**

**1.06** For information on attaching and fastening of B station wire, see Section 461-200-206.

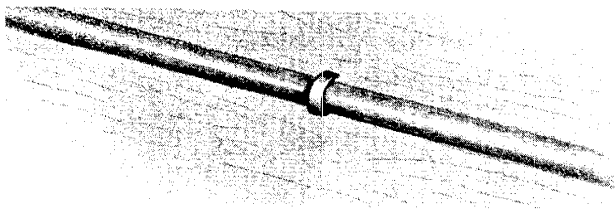
**2. ATTACHMENTS USED IN FINISHED ROOMS AND OFFICES**



*Choose colors of attachment to match wire or cable.*

**STAPLES (Fig. 1 and Table B)**

**2.01** Staples of various sizes and materials used in hand- or hammer-operated staplers, are used to secure station and ground wire and smaller inside wiring cables to wood surfaces.



**Fig. 1—Staple**

**2.02** Table B shows the staples recommended for wood surfaces with finishes available and stapler machine used. See Section 080-110-102 for description and operation of stapler.

**B STATION WIRE NAIL (Fig. 2)**

**2.03** This nail is used to fasten JKT (MD) Station Wire to plaster or wood surfaces. It can be used with D Station Wire if care is taken to ensure that the smaller diameter wire is sufficiently secure by the arm of the nail. B Station Wire Nails are available in 1/2-inch and 7/8-inch lengths, in ivory (—50) and light olive gray (—49) finish. The 7/8-inch length is also available in galvanized finish for outdoor use.

**B STATION WIRE CLAMP (Fig. 3)**

**2.04** This clamp is used to support JKT (MD) Station Wire. It is available in ivory (—50), light olive gray (—49), or a galvanized finish.



**Fig. 2—B Station Wire Nail**

**TABLE B  
SELECTION OF STAPLES**

TYPE	FINISH	SIZE (INCHES)		SHAPE OF CROWN	USE	STAPLER
		LENGTH	WIDTH			
E*	Zinc and Ivory	3/8	3/16	Rounded	With D or JKT (MD) station wire, and No. 10 or smaller ground wire in all type wood	Heller TM or Heller M
F†	Copper Coated					
G*	Zinc Coated	5/8	1/2	Flat	With 25-pair inside wiring cable in all type wood	D
T-18* (Arrow)	Zinc Coated	3/8	3/16	Rounded	With D station wire and No. 10 or smaller ground wire in hard wood	Heller TM

\*For indoor use.

†For outdoor use or where appearance is unimportant.

*Note:* Staples are not recommended for use in plaster.

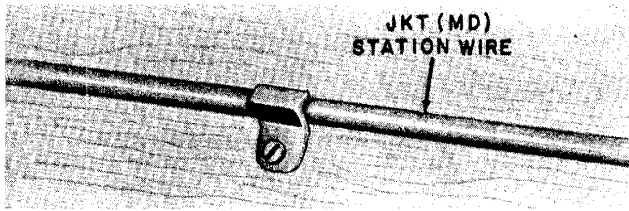


Fig. 3—B Station Wire Clamp

2.05 Table C contains the recommended fastener to be used to attach these clamps to various surfaces.

TABLE C  
FASTENERS FOR B STATION WIRE CLAMP

SURFACE	FASTENER
Metal or Asbestos Siding	5/8-in. No. 6 self-tapping screw
	5/8-in. No. 6 RH galvanized wood screw. C Plastic Anchor, 3/16 x 1 in.
Wood, Indoors	5/8-in. No. 6 RH blued wood screw
Wood, Outdoors	5/8-in. No. 6 RH galvanized wood screw
Stucco (Wire and Paper Backing)	1-in. No. 6 self-tapping screw (cadmium plated) or wall screw anchor (correct size)
Masonry	No. 2 B Masonry Fastener

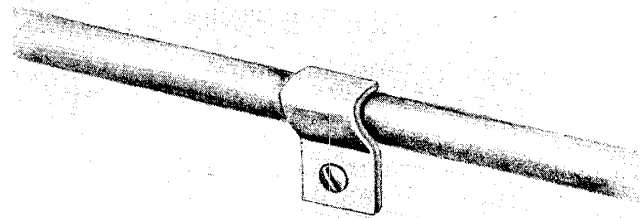


Fig. 4—Cable or Inside Wiring Clamp

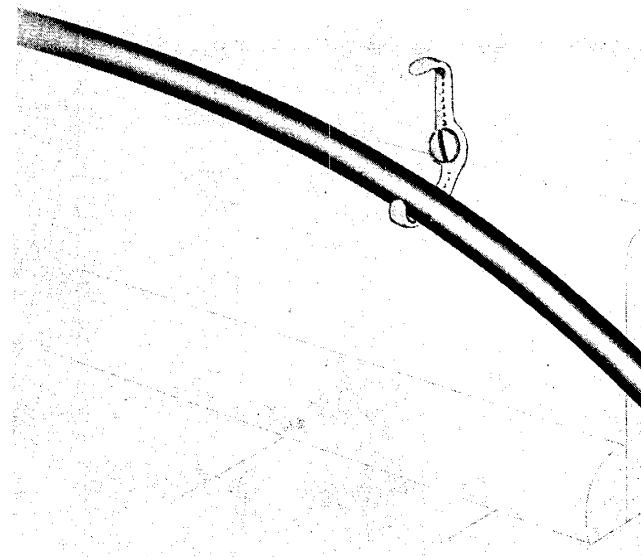


Fig. 5—Cable Clasp

**CABLE CLAMPS AND CABLE CLASPS (Fig. 4 and 5)**

- 2.06 These attachments are used to support inside wiring cable or more than one station wire.
- 2.07 Clamps and clasps of various sizes are available as shown in Table D. See Sections 080-720-146 and 080-270-147 for description, sizes, and capacity of clamps and clasps.
- 2.08 Table D contains the fastener to be used to attach cable clamps and cable clasps to various surfaces.

**B ADHESIVE CLIP (Fig. 6)**

2.09 This clip is used to fasten D Station Wire and JKT (MD) Station Wire where it is undesirable to penetrate surfaces with screws or nails. It is available in ivory (—50) or light olive gray (—49) finishes.



*High temperatures may deteriorate B Adhesive Clips during storage; therefore, those not used before date on container should be tested for tackiness.*

TABLE D

## FASTENERS FOR CABLE CLAMPS AND CABLE CLASPS

SURFACE	CLAMP NO.	CLASP NO.	FASTENER	REMARKS
	COLOR			
	LIGHT OLIVE GRAY, IVORY, GALVANIZED	LIGHT OLIVE GRAY, IVORY		
Woodwork	No. 3 and 5*	No. 7	1/2 in. No. 6 RH blue wood screw	
	No. 6, 7, 8, 10, and 12*	No. 9 and 14	5/8 in. No. 8 RH blue wood screw	
	No. 13 and 17		1 in. No. 10 gal- vanized wood screw	
Plywood, Masonite	No. 3 and 5*	No. 7	1/2 in. No. 6 RH blue wood screw  B Wall Screw Anchor 1/8 in. x 3 in. toggle bolt	Make wood screw attachments at stud locations.  Use No. 1 B Wall Screw Anchor on wall thickness 1/16 in. to 1/4 in. Use No. 2 B Wall Screw Anchor on wall thickness 1/4 in. to 3/8 in. Use No. 3 B Wall Screw Anchor on wall thickness 3/8 in. to 3/4 in.
	No. 6, 7, 8, 10, and 12*	No. 9 and 14	5/8 in. No. 8 RH blue wood screw 3/16 in. x 1 in. C Plastic Anchor B Wall Screw Anchor 1/8 in. x 3 in. toggle bolt	
	No. 13 and 17		1 in. No. 10 galvanized wood screw 1/4 in. x 1 in. C Plastic Anchor B Wall Screw Anchor 3/16 in. x 3 in. toggle bolt	

\* Inside wiring clamp only.

TABLE D (CONT)

FASTENERS FOR CABLE CLAMPS AND CABLE CLASPS

SURFACE	CLAMP NO.	CLASP NO.	FASTENER	REMARKS
	COLOR			
	LIGHT OLIVE GRAY, IVORY, GALVANIZED	LIGHT OLIVE GRAY, IVORY		
Plasterboard, Plaster on Wood Lath, and Plaster on Metal Lath	No. 3 and 5*	No. 7	1 in. No. 8 RH blue wood screw B Wall Screw Anchor 1/2 in. No. 8 self-tapping screw	Make wood screw attachment at stud locations.
	No. 6, 7, 8, 10, and 12*	No. 9 and 14	1 in. No. 8 RH wood screw 3/16 x 1 in. C Plastic Anchor B Wall Screw Anchor 1 in. No. 8 self-tapping screw	Use No. 1 B Wall Screw Anchor on wall thickness 1/16 in. to 1/4 in. Use No. 2 B Wall Screw Anchor on wall thickness 1/16 in. to 3/8 in. Use No. 3 B Wall Screw Anchor on wall thickness 3/8 in. to 3/4 in.
	No. 13 and 17		1 in. No. 10 RH galvanized wood screw 1/4 in. x 1 in. C Plastic Anchor B Wall Screw Anchor 7/8 in. No. 14 self-tapping screw	

\* Inside wiring clamp only.

**2.10** Install B Adhesive Clip as follows.

- (1) Thoroughly moisten adhesive surface with trichloroethylene.
- (2) Allow adhesive to become tacky.
- (3) Press clip to bonding surface for about 5 seconds.
- (4) Allow clip to set for 15 minutes.
- (5) Place station wire in clip and form tabs over wire.

**3. CELLARS, FACTORIES, OR WHERE APPEARANCE IS UNIMPORTANT**



*In general, the same types of attachments used in finished rooms apply for cellars, factories, or where appearance is unimportant. However, they should be of an appropriate finish. In addition to these attachments, drive rings, B Wire Loops, and toggle bridle rings are also available for use at these locations.*

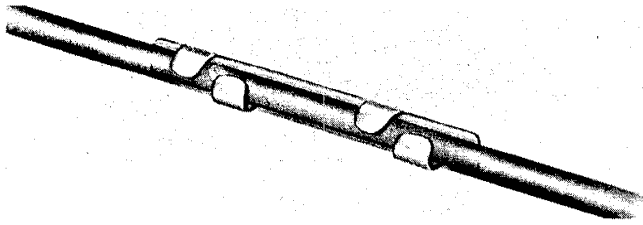


Fig. 6—B Adhesive Clip

**DRIVE RINGS (Fig. 7 and 8)**

3.01 Drive rings are formed steel loops having a pointed shaft suitable for hammer-driven attachment to wood or masonry surfaces. They are available in seven sizes for use with station wire or cables. On wood surfaces, attach drive rings to beams or studding. On masonry surfaces, use with D Drive Anchors (Fig. 8).

*Note:* For masonry surfaces, B Wire Loops with D Masonry Fasteners (3.08) are preferred.

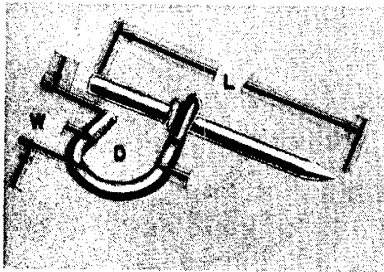
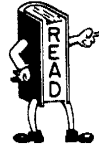


Fig. 7—Drive Ring

3.02 Table E shows the various drive rings with dimensions and D Drive Anchor used on masonry surfaces. Refer to Section 080-720-112 for information on installing anchors.

**B WIRE LOOP (Fig. 9)**

3.03 B Wire Loops are formed sections of wire used with D Masonry Fasteners as an intermediate support for station wires and inside wiring cables attached to masonry surfaces. They are available in four sizes as shown in Table F.



*Wire loops with the D Masonry Fastener are preferred over drive rings in masonry surfaces because the fasteners are driven directly into the masonry surface without a predrilled hole.*

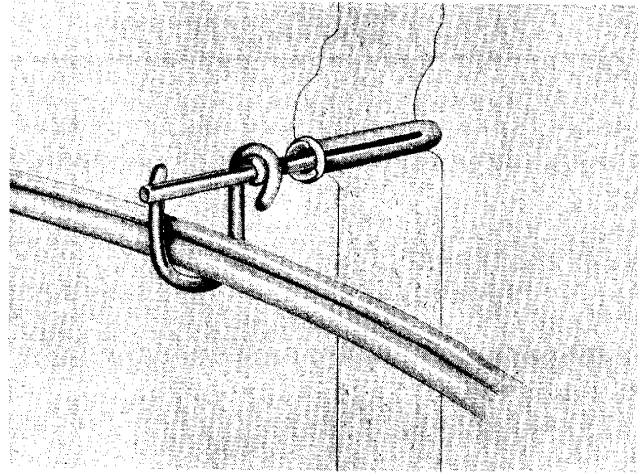


Fig. 8—Drive Ring Attached to Masonry

3.04 Table F also contains the recommended D Masonry Fastener used to attach the B Wire Loop to various surfaces.

**TABLE E  
DRIVE RINGS**

SIZE	DIMENSIONS IN INCHES			ANCHOR SIZE (IN.)	
	D	W	L	DIA.	L
1/2	1/2	1/2	2-1/16	3/16	7/8
5/8	5/8	3/4	2-1/4	1/4	1
5/8L	5/8	3/4	2-3/4		
7/8	7/8	1-1/2	2-9/16	1/4	1
7/8L	7/8	1-1/2	3-1/16		
1-1/4	1-1/4	2-3/8	2-15/16	5/16	1-1/4
1-1/4L	1-1/4	2-3/8	3-7/16		

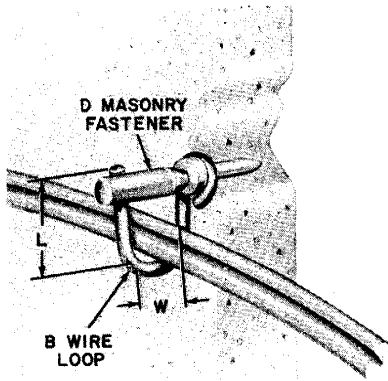
L sizes have extra long shafts and cannot be used with B Drive Anchors.



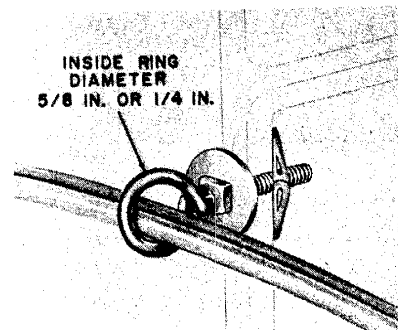
**TABLE F**  
**B WIRE LOOP**

B WIRE LOOP SIZE NO.	WIDTH OF OPENING	LENGTH OF LOOP (INSIDE)	D MASONRY FASTENER FOR		
			CONCRETE	MORTAR	BLOCK*
1/2	1/4-in.	3/4-in.	3	4	5
5/8	1/2-in.	1-1/8-in.			
7/8	5/8-in.	2-1/16-in.			
1-1/4	5/8-in.	2-3/4-in.			

\*Cement or cinder blocks.



**Fig. 9 — B Wire Loop with D Masonry Fastener**



**Fig. 10 — Toggle Bridle Ring**

**TOGGLE BRIDLE RING (Fig. 10)**

**3.05** This attachment, available in two sizes, 5/8-inch and 1-1/4 inch, is used to attach station wire and cable to hollow surfaces. A predrilled 3/4-inch clearance hole is required.

*Note:* For best results and a secure installation, clearance holes should be restricted to 3/4-inch diameter.

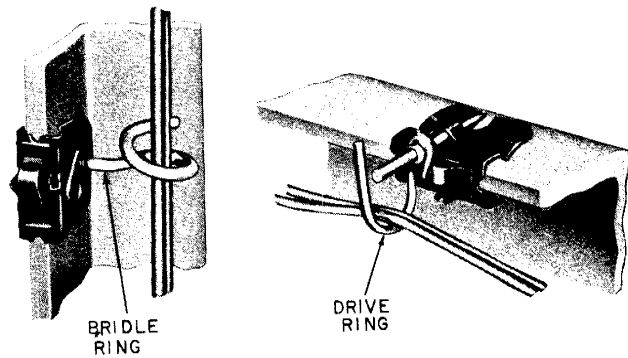
**4. ATTACHING TO STEEL STRUCTURES**

**B BEAM CLIP (Fig. 11)**

**4.01** The B Beam Clip, equipped with either a drive ring or the B or M Bridle Ring, is used to support wire runs on I beams, angle irons, etc, on beam thickness of 1/8-inch to 1/2-inch.

**B INSULATOR SUPPORT (Fig. 12)**

**4.02** The B Insulator Support, equipped with a B or M Bridle Ring, is used to support wire runs on I beams, angle irons, etc, on beam thickness up to 3/4-inch.



**Fig. 11—B Beam Clamp**

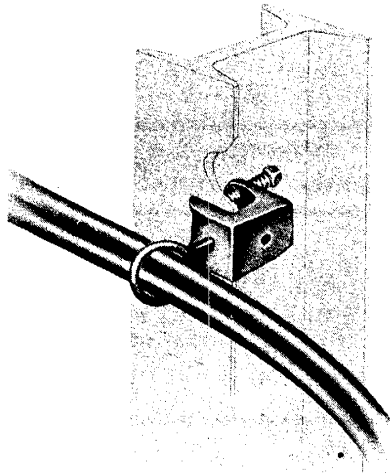


Fig. 12—B Insulator Support

**B HANGER CLIP (Fig. 13)**

4.03 The B Hanger Clip, equipped with a drive ring and attached to a 1/4-inch ceiling hanger rod or No. 8, 10, or 12 gauge steel wire, is used to support wire runs above suspended false ceiling.

4.04 Although the clip is particularly useful on hanger rods or wire, it may be used wherever other types of wire or rods are conveniently located.

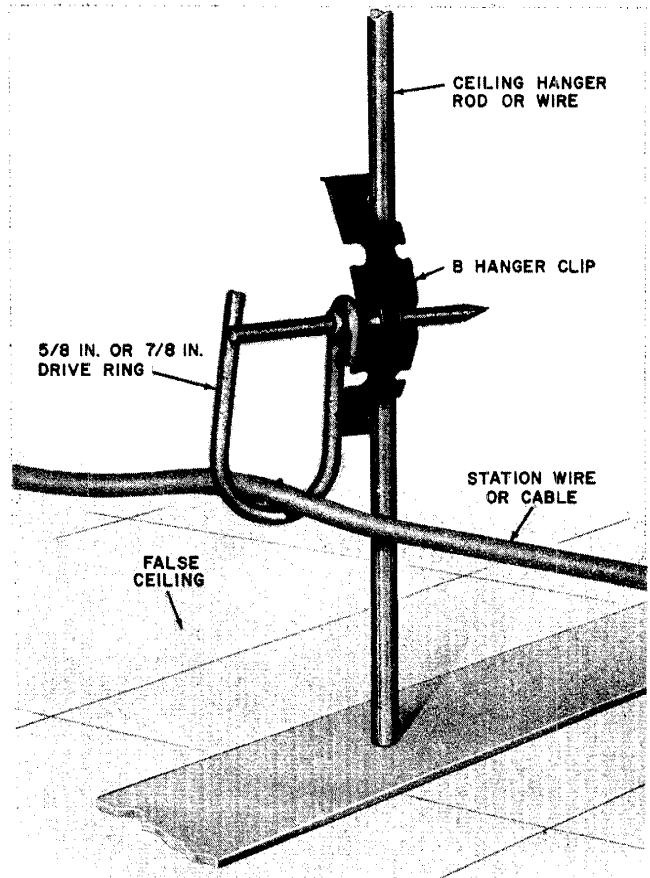


Fig. 13—B Hanger Clip, Installed

### ATTACHING AND FASTENING GROUND WIRE

1. GENERAL

1.01 Space ground wire fasteners as follows:

- Space 24 inches apart on ordinary ground wire runs.
- Space 16 inches apart when wire is subject to displacement.
- Place on every beam when spanning beams.
- Place within 3 inches of wall when run parallel to wall on beams.

1.02 Fasteners for ground wire and their use are shown in Fig. 1.

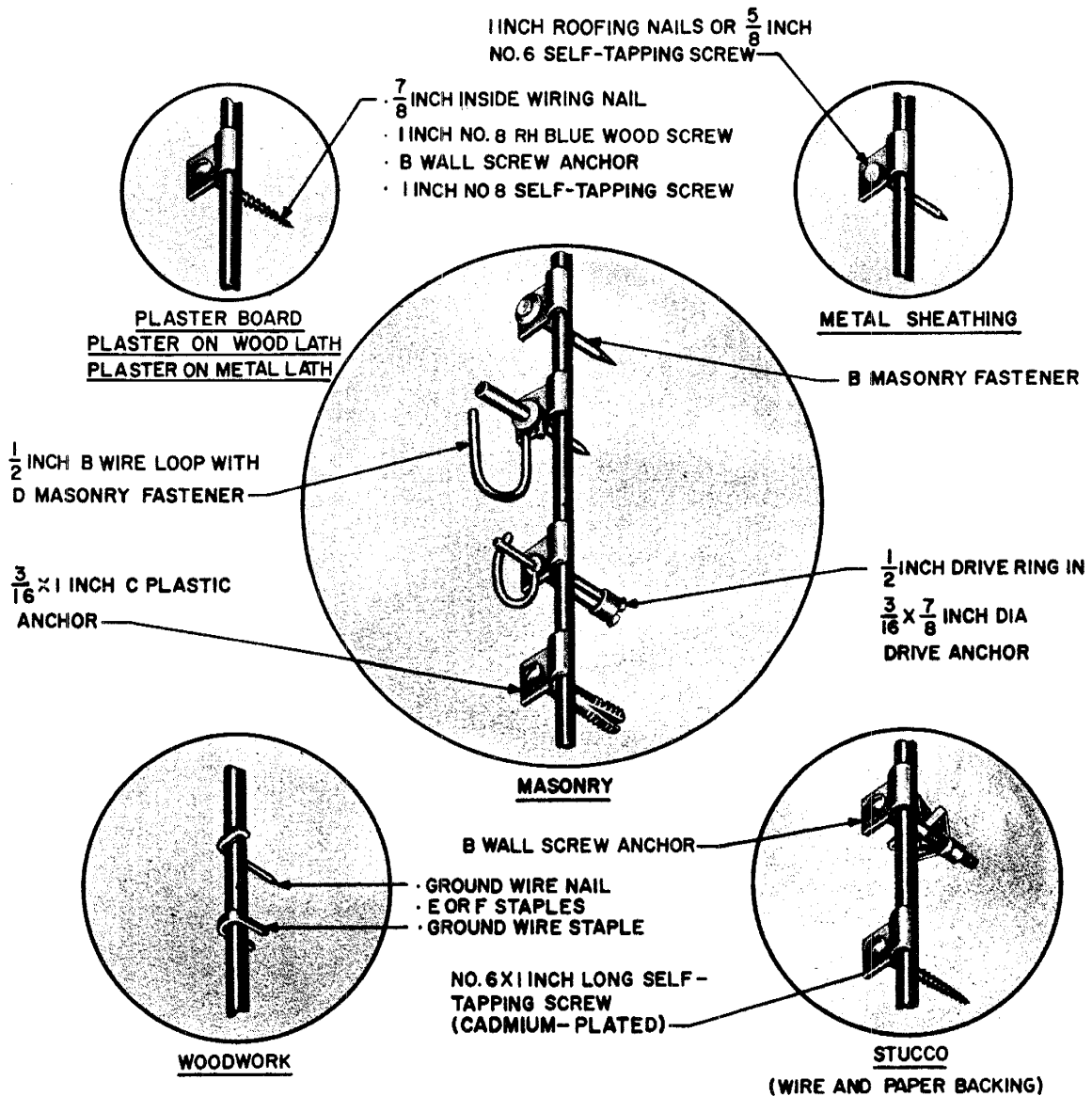


Fig. 1 — Fasteners for Ground Wire



**CONNECTING BLOCKS**  
**SELECTION**

**1. GENERAL**

**1.01** Information in this section was formerly contained in Sections 461-610-100, 461-615-101, 461-616-101, 461-616-130, and 461-617-101.

**1.02** See Section 461-600-101 for Designation Strips and Methods of Marking.

- Table A — Selection — Screw-Type Connecting Blocks

- Table B — Selection — Binding Post-Type Connecting Blocks

**2. SELECTION**

**2.01** For selection of connecting blocks, the following tables are provided:

- Table C — Selection — Clip-Type Connecting Blocks

**TABLE A**  
**SCREW-TYPE CONNECTING BLOCKS**  
**SELECTION**

CONNECTING BLOCK	NUMBER OF PAIR	NUMBER OF TERMINALS	PRINCIPAL USE	IDENTIFICATION SECTION REFERENCE
42A	2	4	Terminate or bridge in multiple spade tipped mounting cords, and/or wire and inside wiring cable conductors.	461-602-100
44A	5	10		
1044A				
47C	6	12	Terminate or bridge in multiple spade tipped mounting cords, and/or wire and inside wiring cable conductors at flush mounted installations.	
47D	2	4		
47E	6	12		
47F	2	4		
71A(MD)	6	12	0 and 1 button panel tel sets.	461-606-100
71B				
74A	2-1/2	5	Control of inductive noises in the 220A hand tel set and associated base.	
74B				
75A	25	50	Multibutton panel tel sets.	

**TABLE B**  
**BINDING POST-TYPE CONNECTING BLOCKS**  
**SELECTION**

CONNECTING BLOCK	NO. OF PAIR	NO. OF TERMINALS	PRINCIPAL USE	IDENTIFICATION SECTION REFERENCE
30A	6	12	General Station Systems	461-601-100
30B	11	22		
30C	16	32		
30D	26	52		
31A	6	12		
31B	11	22		
31C	16	32		
31D	26	52		
<b>BINDING POST-TYPE INSULATION-CRUSHING WASHERS</b>				
30A2	6	12	Building Terminals	461-601-100
30B2	11	22		
30C2	16	32		
30D2	26	52		
57A2-10	10	20	Terminate drop and block wire and PIC cable	461-603-100
57A2-16	16	32		
57A2A-6 *	6	12		
57A2B-6 *	6	12		
57A2B-10 *	10	20		
57A2B-16 *	16	32		
57B1A-10 *	10	20		
57B1A-16 *	16	32		
57B1A-25 *	25	50	Building Terminals	461-603-100
57B1A-50 *	50	100		
59A1-11	11	22		
59A1-16	16	32		
59A1-25	25	50	With B buried cable terminals	461-603-100
59A1-50	50	100		
60A1-6	6	12		
60A1B-3 *	3	6	Replaces 60A1-6	461-603-100
60A2-6	6	12		

\* Equipped with fuseless protection.

**TABLE C**  
**CLIP-TYPE CONNECTING BLOCKS**  
**SELECTION**

CONNECTING BLOCK	NO. OF PAIR	NO. OF CONNECTORS	TERMINATIONS PER CONNECTOR	PRINCIPAL USE	IDENTIFICATION SECTION REFERENCE*
66A1-25(MD)	25	50	6	General Station Systems	461-604-102
66A2-25(MD)					
66A2-50(MD)	50	100			
66B1-25(MD)	25	50	3	General station systems — Furnished with 300- and 500-type key service units.	
66B3-50	50	100			
66B4-25	25	50	6	General station systems when multiplying capacities are required.	
66B5-37	37	26			
		48			
66C1-16	16	32	4	General Station Systems	
66C2-16					
66C2-32					32
66E1-32	32	64	2	Furnished with switching system No. 400.	
66E3-25	25	50		To connect and/or multiple plug ended tel sets and raw ended cable.	
66E4-25					
66L3-50	50	100	3	General station and outside plant applications.	
66L3-100	100	200			
66M1-50	50	100	2	Terminating arrangements of cables and key telephone systems	
F-56999	25	50	6	With other plug-ended ca- bles for a quick-connect distribution terminal.	461-605-100
F-57000					
F-57001	50	100	3		

\* See Section 461-604-100 for Tools, Adapters, Terminating, and Maintenance; and Section 461-604-101 for Numbering, Wiring Plan, and Distribution Terminal Arrangements.





## CONNECTING BLOCKS

### 71-, 74-, AND 75-TYPE

### IDENTIFICATION, INSTALLATION, AND WIRING

#### 1. GENERAL

1.01 Information in this section was formerly contained in Section 461-610-100.

#### 2. IDENTIFICATION

##### 71-Type Connecting Block

2.01 The 71-A connecting block has been rated MD (manufacture discontinued).

2.02 The 71-B connecting block (Fig. 1) is similar to the 71-A (MD) except it has mounting screw slots instead of holes. The connecting blocks consist of a phenol fabric base equipped with 12 double-screw terminals. The blocks are used for mounting in 113-type and 114A apparatus boxes for installation of panel telephone sets (Table A).

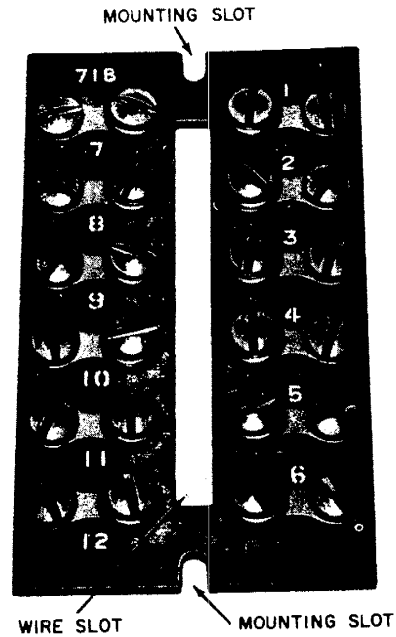


Fig. 1—71B Connecting Block

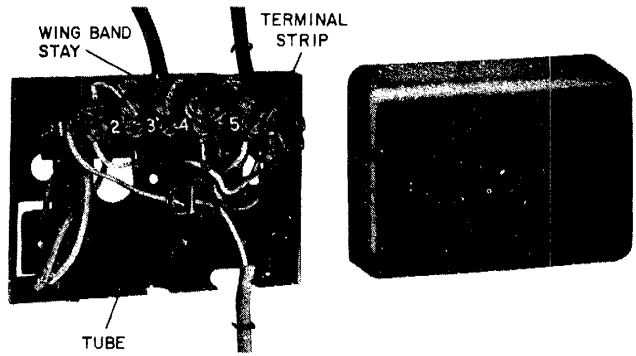
**TABLE A**  
**IDENTIFICATION**  
**CONNECTING BLOCKS**  
**71-, 74-, AND 75-TYPE**

BLOCK, CONNECTING	FURNISHED WITH	COVER COLOR	TYPE MOUNTING	NO. OF PAIR	DIMENSIONS (APPROX. INCHES)		
					LENGTH	WIDTH	DEPTH
71A (MD)	Mounting Screws		113-Type and 114A Apparatus Box*	6	3 9/16	2	3/8
71B					3 15/32		
75A				25	7 3/8	4 1/2	1/2
74A	Cover 425A Tube	Light Olive Gray (-49)	Nonflush	2 1/2	4 1/16	2 3/4	1 5/8
74B	Cover 426A Tube	Ivory (-50)					

\*Apparatus box not furnished with connecting block. Order separately if required.

**74-Type Connecting Block (Fig. 2)**

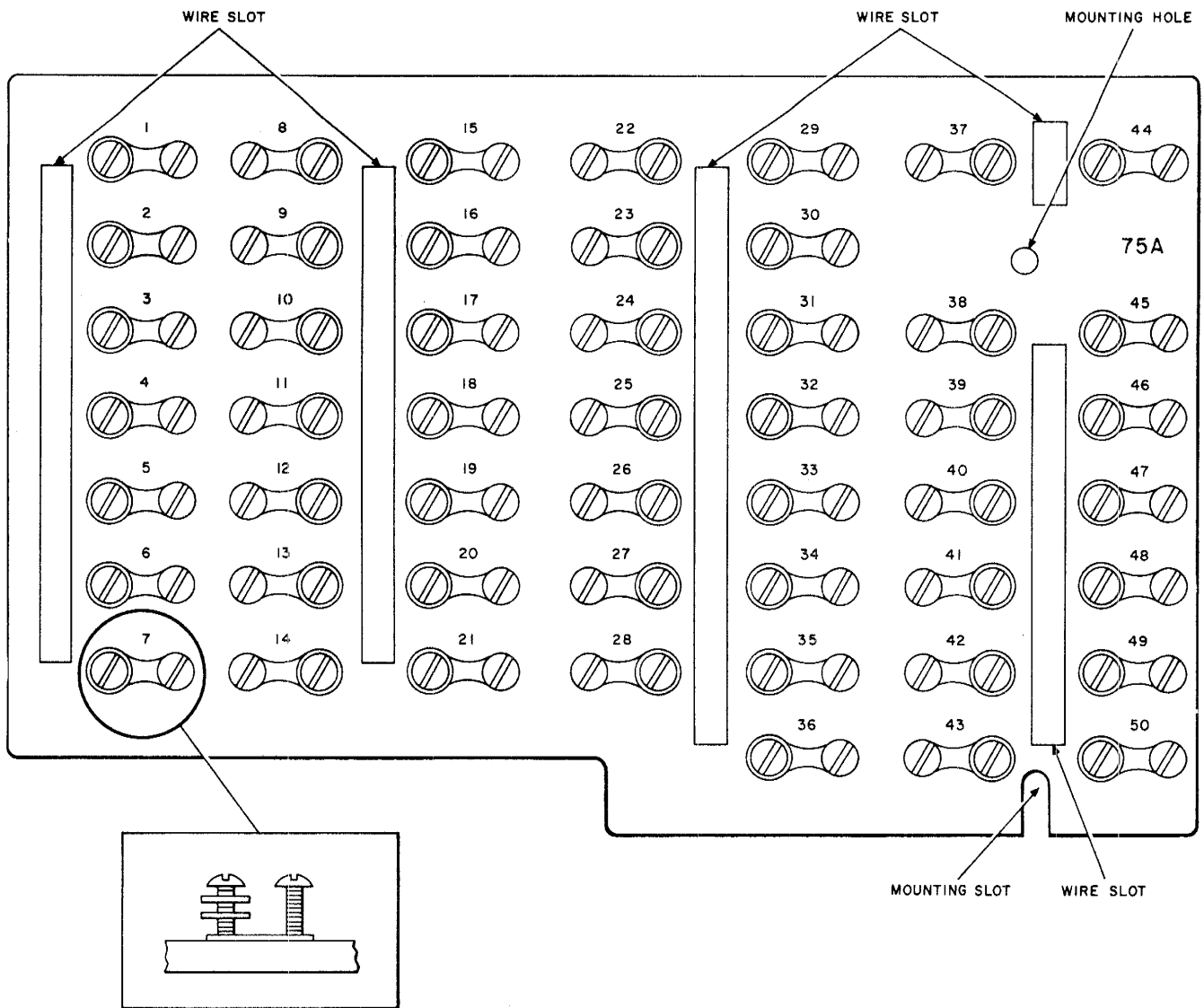
2.03 The 74-type connecting block consists of a terminal strip, cold cathode tube, and plastic cover (Table A). This block is used when extreme noise conditions exist on 4-party full selective or 8-party semiselective service, and a cold cathode tube cannot be mounted inside the telephone set.



**Fig. 2—74-Type Connecting Block**

**75A Connecting Block (Fig. 3)**

2.04 This block consists of a plastic base equipped with 50 double-screw terminals. It is designed for mounting in 113-type and 114A apparatus boxes for installation of panel telephone sets (Table A).



**Fig. 3—75A Connecting Block**

### 3. INSTALLATION AND WIRING

**3.01** The 74B connecting block may be mounted on all types of surfaces. Backboards should be used only when mounting on damp walls and when use of a backboard will facilitate installation. Provision is made in the base of the connecting block for entrance of inside wiring and cords with

winged stays (Fig. 2). Cords with loop stay-hooks are fastened under the cover screw. Terminate conductors of inside wire and cord in accordance with connection section for the telephone set.

**3.02** 71-Type and 75A connecting blocks should be installed, wired, and terminated in accordance with the section covering each particular set.



## JACKS FOR PORTABLE TELEPHONE SETS SELECTION

### 1. GENERAL

1.01 This section is reissued to:

- Change title
- Remove identification and installation information.

### 2. SELECTION

2.01 Table A lists jacks for portable telephone use with location, contact, mounting, color, and mating plug information. Detailed jack information is found in the indicated section.

**TABLE A**

LOCATION	CONTACTS	MOUNTED	COLOR	JACK	MATING PLUG	OTHER INFORMATION IN SECTION
Indoor	4	Nonflush	Light Olive Gray (-49)	404B (MD)	283B or 505A	461-630-101
			Ivory (-50)	549A		
		Flush	Light Olive Gray (-49)	493A (MD)		
			Ivory (-50)	548A		
			Brown (-54)	497A (MD) 550A 391A		
	8	Nonflush	Light Olive Gray (-49)	392A	274A	
			Ivory (-50)	551A		
	12	Flush	Light Olive Gray (-49)	541A	504A	
			Ivory (-50)	547A (MD)		
			Brown (-54)	547B		
Outdoor	3	Flush	Brass	KS-8420 KS-8421	KS-8419	461-630-102
	4	Nonflush	Aluminum	KS-16151 List 1, MD	283B or 505A	
	4 or 12	Flush or Nonflush		*KS-19316: List 1 (MD)	283B 504A 505A	
				List 2 (MD)	283B or 505A	
	4	Box Cover Nonflush		List 3 (MD)	504A	
	12			List 4	283B	
	4 or 12			List 5	504A	
		*KS-20202, List 1		505A		

\* Housings only; refer to Section 461-630-120 for adaptable jacks which must be ordered separately.



**JACKS AND JACK MOUNTINGS  
FOR PORTABLE TELEPHONE SETS, INDOOR TYPE  
IDENTIFICATION, INSTALLATION, AND CONNECTIONS**

**1. GENERAL**

**1.001** This addendum supplements Section 461-630-101, Issue 1.

**1.002** This addendum is issued to:

- Revise 1.04
- Add 4.04.

The following change applies to Part 1 of the section:

- (a) 1.04—revised.

**1.04** Mount jacks in a uniform manner so that when the plug is inserted, the set mounting cord enters the bottom of the plug.

**4. CONNECTIONS**

The following change applies to Part 4 of the section:

- (a) 4.04—added.

**4.04** Wiring variations (eg, class-of-service, etc, normally made in the connecting block) *should not be made* in the jacks; any variations should be made in the plugs.

*Caution: Test each jack location for correct continuity.*





## JACKS AND JACK MOUNTINGS FOR PORTABLE TELEPHONE SETS, INDOOR TYPE IDENTIFICATION, INSTALLATION, AND CONNECTIONS

### 1. GENERAL

1.01 This section is issued to:

- Rearrange information formerly found in Section 461-630-100
- Show manufacture discontinued (MD) apparatus
- Revise figures of 548A and 549A jacks

1.02 Some areas require at least one telephone set or ringer connected permanently to the line. Check local instructions governing line ringers.

1.03 Do not use hand telephone sets (those requiring a subscriber set) and telephone sets together in the same jack and plug system.

1.04 Mount jacks in a uniform manner so that plugs can be inserted in the same way throughout the customer's premises.

1.05 Portable telephone sets should be kept indoors when not in use. Advise the customer of the importance of protecting a telephone set from inclement weather in order to maintain good telephone service.

### 2. IDENTIFICATION

#### (a) *Illustration Index*

391A Jack	Fig. 1
392A Jack	Fig. 2
404B Jack (MD)	Fig. 3
493A Jack (MD)	Fig. 4
497A Jack (MD)	Fig. 4
541A Jack	Fig. 5, 6 and 7

547B Jack	Fig. 8
548A Jack	Fig. 9
549A Jack	Fig. 10
550A Jack	Fig. 11
551A Jack	Fig. 12
43-Type Brackets	Fig. 13
63A Bracket	Fig. 14
74A Bracket (MD)	Fig. 15
Bracket, KS-19407, List 1	Fig. 16
16-Type Faceplates	Fig. 17

#### (b) *Ordering Guide*

Jack, 391A-(*)
Jack, 392A-(*)
Jack, 541A-(*)
Jack, 547B-(*)
Jack, 548A-(*)
Jack, 549A-(*)
Jack, 550A-(*)
Jack, 551A-(*)
Bracket, 43B
Bracket, 63A
Bracket, KS-19407, List 1
Faceplate, 16A-(*)
Faceplate, 16B-(*)
Faceplate, 16D-(*)

\*Add color suffix

#### (c) *Replaceable Optional Components*

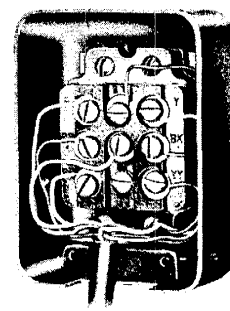
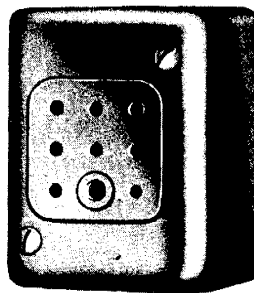
P-88C949 Coverplate
P-88C950 Coverplate
P-88C954 Coverplate

(d) Color

**TABLE A**  
**COLOR ORDERING GUIDE**

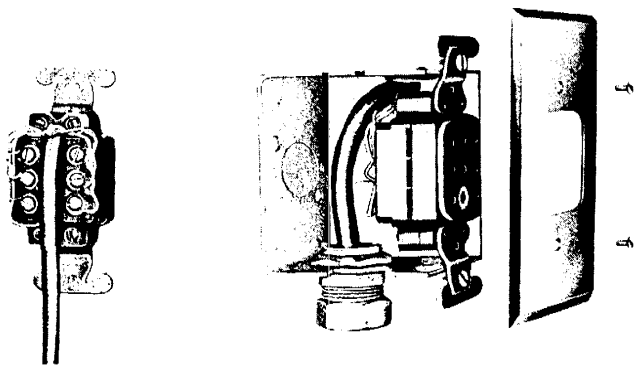
JACK AND FACEPLATE	LIGHT OLIVE GRAY (-49)	IVORY (-50)	BROWN (-54)
391A	•	•	•
392A	•	•	•
541A	•	•	•
547B	•*	•*	•*
548A	•	•	•
549A	•	•	•
550A	•*	•*	•*
551A	•	•	•
16A	•	•	•
16B	•	•	•
16D	•	•	•

\*Additional faceplates in colors corresponding to jack.



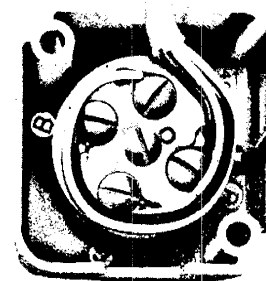
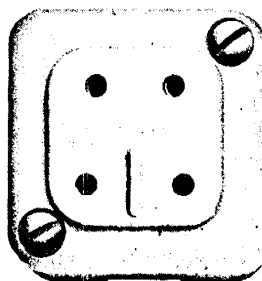
- 8 CONTACTS
- NONFLUSH BASEBOARD MOUNTED
- MATES WITH 274A PLUG
- METAL COVER

Fig. 2 — 392A Jack



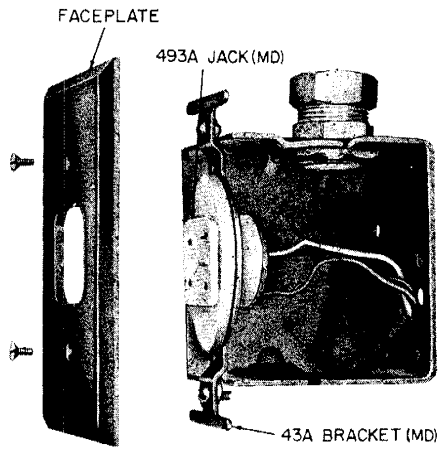
- 8 CONTACTS
- FLUSH WALL MOUNTED
- MATES WITH 274A PLUG
- MOUNTING HARDWARE AND FACEPLATE SUPPLIED

Fig. 1 — 391A Jack Unmounted and 391A Jack Mounted in Standard Electrical Outlet Box



- REPLACED BY 549A JACK
- 4 CONTACTS
- NONFLUSH MOUNTED
- MATES WITH 283B AND 505A PLUGS
- MOUNTING HARDWARE SUPPLIED

Fig. 3 — 404B Jack (MD)



- REPLACED BY 550A JACK
- 4 CONTACTS
- FLUSH WALL MOUNTED
- MATES WITH 283B AND 505A PLUGS
- MOUNTING HARDWARE SUPPLIED

Fig. 4 — 497A Jack (MD) Mounted in Standard Electrical Outlet Box

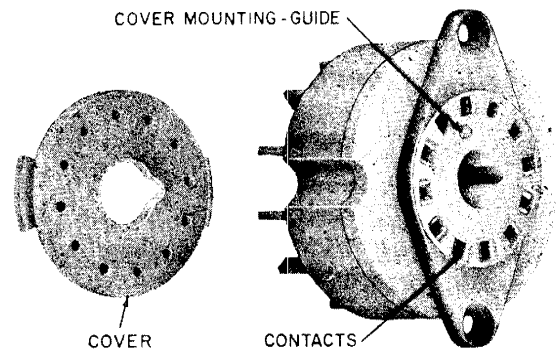
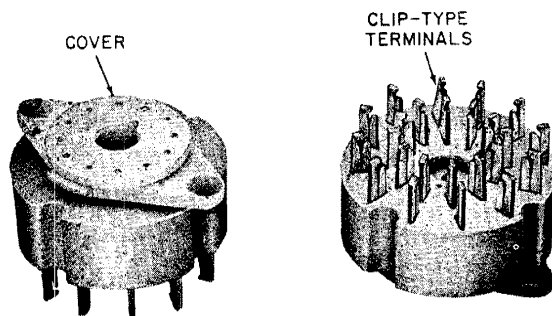


Fig. 6 — 541A Jack, Cover Removed



- 12 CONTACTS
- FLUSH MOUNTED USING 63A OR KS-19407, L1 BRACKET AND 16A FACEPLATE
- MATES WITH 504A PLUG

Fig. 5 — 541A Jack

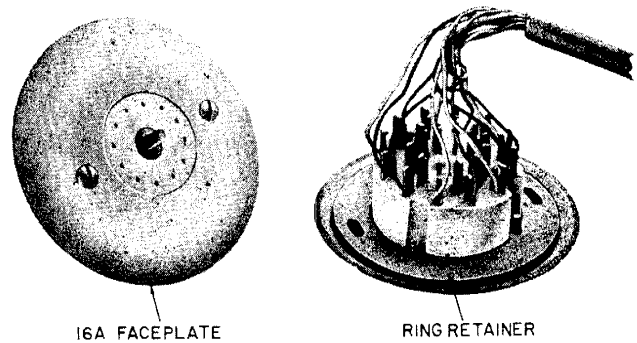
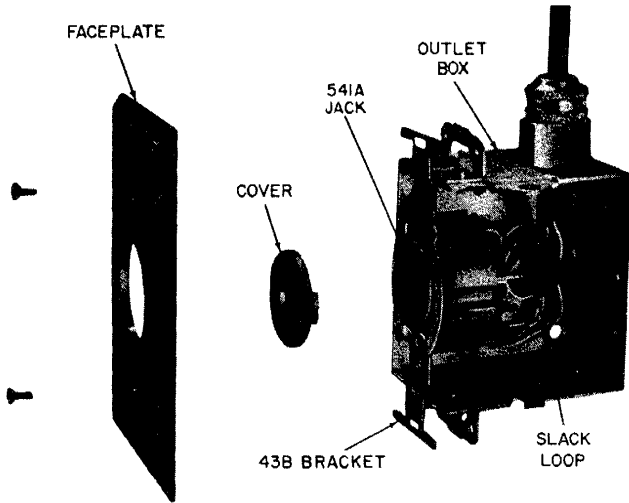


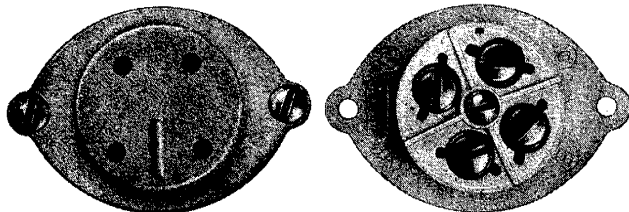
Fig. 7 — 541A Jack With Faceplate and Terminated 541A Jack, Using Retainer

**SECTION 461-630-101**



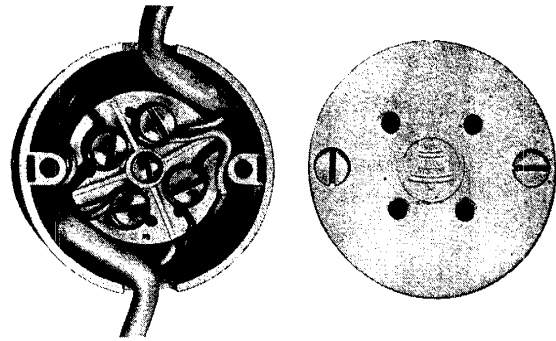
- REPLACES 547A EQUIPPED WITH 74A BRACKET (MD)
- 12 CONTACTS
- FLUSH WALL MOUNTED
- MATES WITH 504A PLUG
- MOUNTING SCREWS AND FACEPLATE SUPPLIED
- OPTIONAL COLOR FACEPLATES

**Fig. 8 — 547B Jack Mounted in Standard Electrical Outlet Box**



- 4 CONTACTS
- FLUSH MOUNTED:  
USING 63A OR KS-19407, L1 BRACKET AND 16A FACEPLATE  
OR  
IN STANDARD ELECTRICAL OUTLET BOX USING 43B BRACKET  
OR  
IN WOODWORK USING 1-1/4 INCH HOLE
- MATES WITH 283B AND 505A PLUGS
- MOUNTING SCREWS SUPPLIED
- REPLACES 493A JACK

**Fig. 9 — 548A Jack**



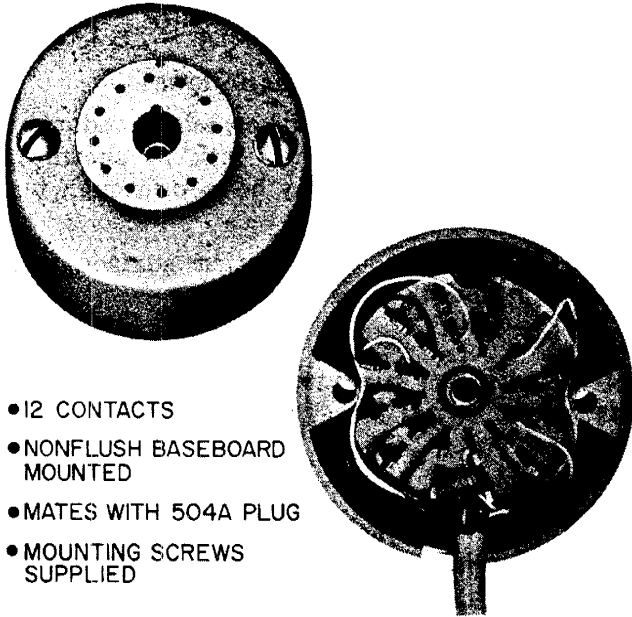
- 4 CONTACTS, DOUBLE TERMINAL
- NONFLUSH BASEBOARD MOUNTED
- MATES WITH 283B AND 505A PLUGS
- MOUNTING SCREWS SUPPLIED

**Fig. 10 — 549A Jack**



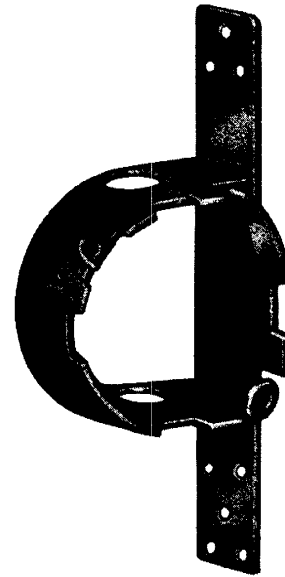
- 4 CONTACTS
- COMPONENTS:  
548A JACK  
43B BRACKET  
FACEPLATE
- EARLY PRODUCTION SUPPLIED WITH 43A BRACKET (MD)
- MATES WITH 283B OR 505A PLUG
- 6 MOUNTING SCREWS SUPPLIED

**Fig. 11 — 550A Jack, Mounted**



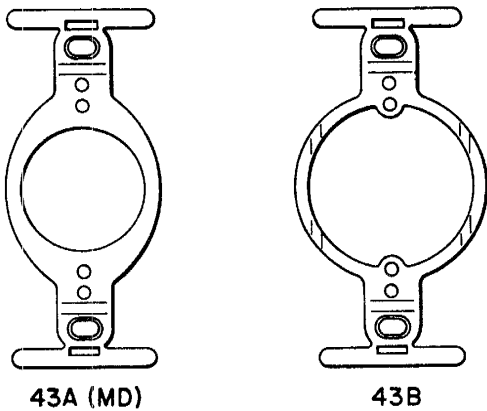
- 12 CONTACTS
- NONFLUSH BASEBOARD MOUNTED
- MATES WITH 504A PLUG
- MOUNTING SCREWS SUPPLIED

Fig. 12 — 551A Jack



- USE TO PREWIRE BUILDING DURING CONSTRUCTION
- MOUNTED TO STUDDING
- USE WITH 16-TYPE FACEPLATE
- FOR MOUNTING
  - 493A JACK (MD)
  - 541A JACK
  - 548A JACK

Fig. 14 — 63A Bracket

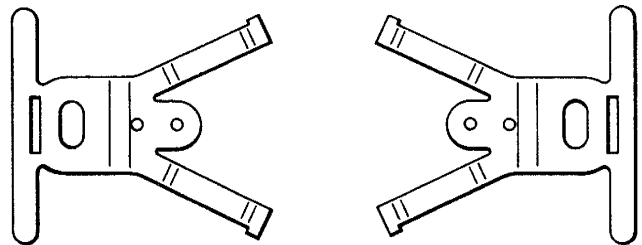


43A (MD)

43B

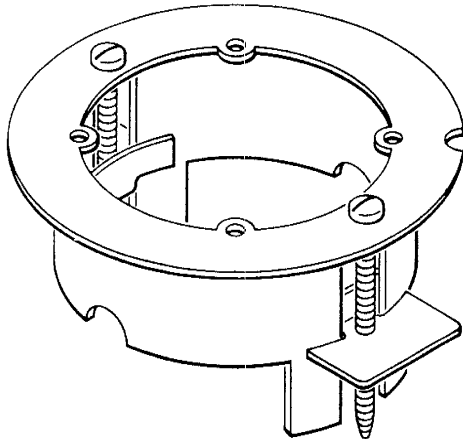
- TO MOUNT JACKS IN STANDARD ELECTRICAL OUTLET BOX
- BREAK-OFF WINGS
- REPLACED BY 43B BRACKET
- TO MOUNT 493A JACK (MD) 548A JACK
- COMPONENT OF 497A JACK (MD) 550A JACK (OLD)
- TO MOUNT 493A JACK (MD) 541A JACK 548A JACK
- REPLACES 43A BRACKET (MD) 74A BRACKET (MD)
- COMPONENT OF 547B JACK 550A JACK (LATEST)

Fig. 13 — 43-Type Bracket



- REPLACED BY 43B BRACKET
- COMPONENT OF 547A JACK (MD)

Fig. 15 — 74A Bracket (MD)



- USE FOR EXISTING WALLS
- WALL HOLE 2-1/4 IN. DIA
- WALL THICKNESS LIMIT 1-1/4 IN.

Fig. 16 — KS-19407, List 1 Bracket

### 3. INSTALLATION

#### INSTALLATION OF NONFLUSH JACKS

##### 392A Jack

**3.01** Install 392A jack (Fig. 2) as follows:

- (1) Connect cable conductors to jack and dress as shown in Fig. 2.
- (2) Fasten base assembly to mounting surface with 3/4-inch No. 8 RH blued wood screws.
- (3) Fasten cover over base assembly with furnished machine screws.

##### 404B (MD) and 549A Jacks

**3.02** Install 404B (Fig. 3 and 549A (Fig. 10) jack as follows:

- (1) Connect station wire to jack and dress as shown in Fig. 3 and Fig. 10.
- (2) Fasten jack to mounting surface with furnished screws.

##### 551A Jack

**3.03** Install 551A jacks as follows:

- (1) Connect station wire or cable conductors to clip terminals of jack as shown in Fig. 12. Conductors may be loop-through terminated.
- (2) Fasten jack to mounting surface with furnished screws.

#### INSTALLATION OF FLUSH-TYPE JACKS IN STANDARD ELECTRICAL OUTLET BOXES

##### 391A Jack

**3.04** The 391A jack is mounted in standard electrical outlet box (Fig. 1) as follows:

- (1) Connect station wire to jack and dress as shown in Fig. 1.
- (2) Mount jack in outlet box using furnished screws.
- (3) Fasten faceplate on jack using furnished screws.

##### 497A Jack (MD)

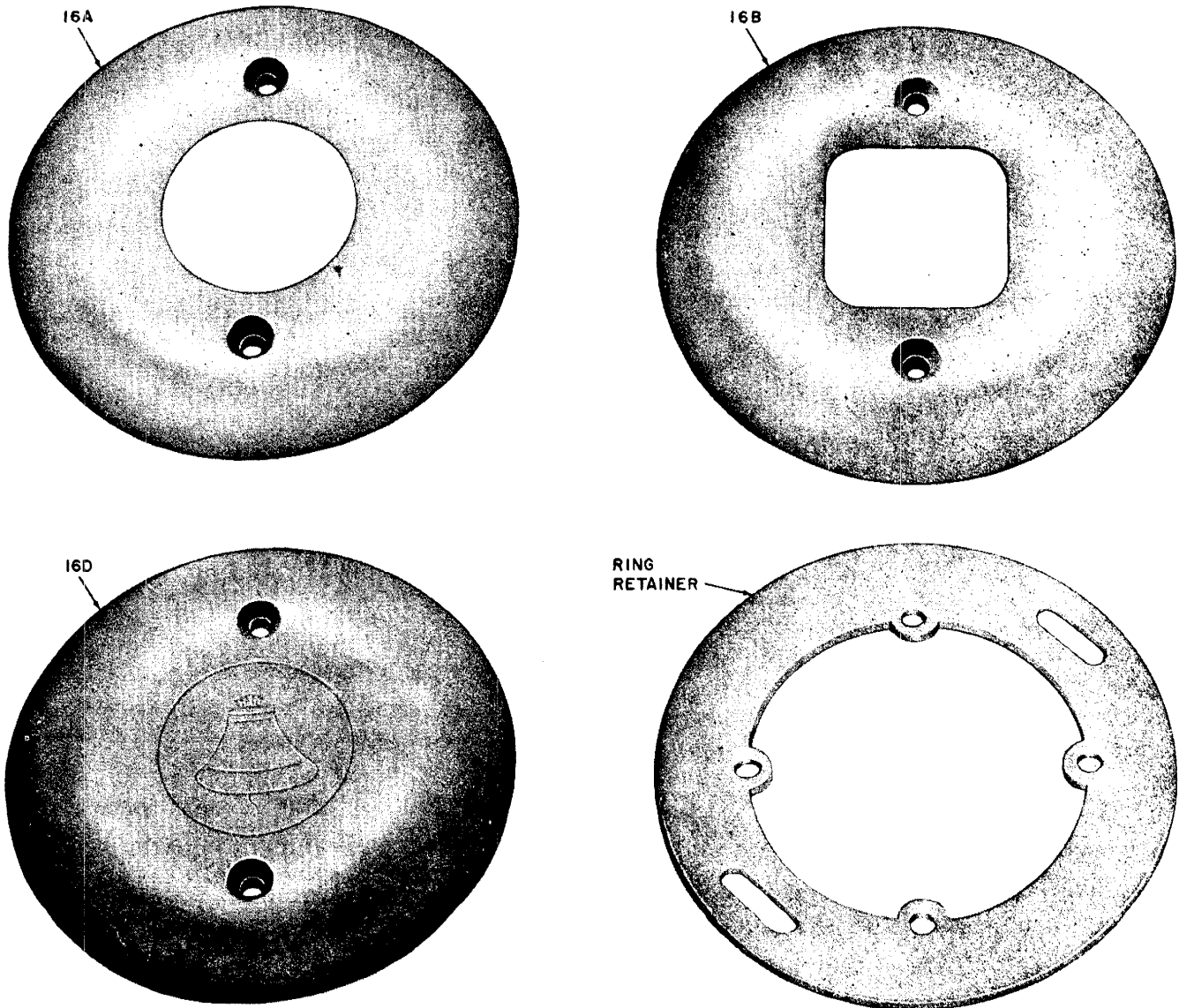
**3.05** The 497A jack (MD) is mounted in standard electrical outlet box (Fig. 4) as follows:

- (1) Mount 493A jack on 43A bracket.
- (2) Connect station wire to jack.
- (3) Dress wire as shown in Fig. 4.
- (4) Mount jack equipped bracket in outlet box.
- (5) Fasten faceplate with furnished screws.

##### 547A (MD) or 547B Jack

**3.06** Install as follows:

- (1) Attach 541A jack on 74A bracket (Fig. 8) or 43B bracket.
- (2) Connect station wire or cable to jack.
- (3) Dress wire as shown in Fig. 8 (leave slack loop).
- (4) Mount jack and bracket assembly in outlet box.
- (5) Install faceplate. (The cover must be on jack before placing faceplate.)



- MOUNTS TO  
63A BRACKET USING RING RETAINER  
KS-19407, L1 BRACKET (RING NOT REQUIRED)
- MOUNTING SCREWS AND RING RETAINER  
SUPPLIED

Fig. 17 — 16-Type Faceplate

**SECTION 461-630-101**

**493A (MD) or 548A Jack**

**3.07** Install as follows:

- (1) Connect station wire or cable to jack.
- (2) Attach jack to 43-type bracket.
- (3) Attach 43-type bracket to outlet box.
- (4) Install suitable faceplate.

**550A Jack**

**3.08** The 550A jack (Fig. 11) is assembled in the same manner as the 497A (MD) jack (3.05). It consists of a 548A jack (Fig. 9), 43A or 43B bracket, faceplate, and mounting screws.

**INSTALLATION OF FLUSH-TYPE JACKS IN 63A OR KS-19407, LIST 1 BRACKET**

**3.09** The 493A (MD), 541A (Fig. 5) and 548A (Fig. 9) jacks can be mounted on a 63A or KS-19407, List 1 bracket (Fig. 16) with a 16-type faceplate (Fig. 17). Use the same color faceplate as the jack.

**3.10** When mounting jacks on the 63A bracket, the 16-type faceplate ring retainer is required. The 16-type faceplate can be mounted to the KS-19407, List 1 bracket without ring retainer.

- (a) The 493A (MD) or 548A jack is installed on the 63A bracket as follows:
  - (1) Mount the ring retainer on bracket.
  - (2) Connect station wire to jack.
  - (3) Mount jack on ring retainer.
  - (4) Mount faceplate on ring retainer.

- (b) The 493A (MD) or 548A jack is installed on the KS-19407, List 1 bracket as follows:
  - (1) Connect station wire to jack.
  - (2) Mount jack on bracket.
  - (3) Mount faceplate to bracket.

**541A Jack**

**3.11** The 541 jack is installed in the 63A bracket as follows:

- (1) Mount ring retainer on 63A bracket.
- (2) Connect station wire or cable leads to clip terminals of jack (Fig. 5).
- (3) Mount jack on ring retainer (Fig. 7).

- (4) Place cover on jack.
- (5) Mount faceplate on retainer ring.

**3.12** The 541 jack is installed in the KS-19407, List 1 bracket as follows:

- (1) Connect station wire or cable leads to clip terminals of jack (Fig. 5).
- (2) Place cover on jack.
- (3) Position faceplate over cover and fasten faceplate and jack to bracket.

**4. CONNECTIONS**

**4.01** Only one conductor shall be connected to a single clip of a clip-type jack terminal. The loop-through method for terminating IW cable may be used on jacks which have dual clip-type terminals.

**4-CONDUCTOR JACKS**

**4.02** Connect conductors as indicated by the color designators stamped next to the terminals. The red conductor is terminated at the R terminal, etc.

**8- AND 12-CONDUCTOR JACKS**

**4.03** Table B shows the connections for 8- and 12-conductor jacks.

**TABLE B  
8- AND 12-CONDUCTOR JACKS  
CONNECTIONS**

INSIDE WIRE QUAD	D AND E INSIDE WIRING CABLE	NO. TERMINALS	
		8	12
TERMINAL DESIGNATIONS			
1st	Red	R	1
	Green	G	2
	Yellow	Y	3
	Black	BK	4
2nd	Red	W	5
	Green	R-R	6
	Yellow	Y-Y	7
	Black	BK-BK	8
3rd	Red		9
	Green		10
	Yellow		11
	Black		12



## JACKS AND JACK MOUNTINGS FOR PORTABLE TELEPHONE SETS, OUTDOOR TYPE IDENTIFICATION, INSTALLATION, AND CONNECTIONS

### 1. GENERAL

1.001 This addendum supplements Section 461-630-102, Issue 1.

1.002 This addendum is issued to:

- Revise 1.04
- Add 4.05.

The following change applies to Part 1 of the section:

- (a) 1.04—revised.

1.04 Mount jacks in a uniform manner so that when the plug is inserted, the set mounting cord enters the bottom of the plug.

### 4. CONNECTIONS

The following change applies to Part 4 of the section:

- (a) 4.05—added.

4.05 Wiring variations (eg, class-of-service, etc, normally made in the connecting block) **should not be made** in the jacks; any variations should be made in the plugs.

**Caution:** *Test each jack location for correct continuity.*



## JACKS AND JACK MOUNTINGS FOR PORTABLE TELEPHONE SETS, OUTDOOR TYPE IDENTIFICATION, INSTALLATION, AND CONNECTIONS

### 1. GENERAL

1.01 This section is issued to:

- Rearrange information formerly found in Section 461-630-100.
- Show manufacture discontinued (MD) apparatus.

1.02 Some areas require at least one telephone set or ringer connected permanently to the line. Check local instructions governing line ringers.

1.03 Do not use hand telephone sets (those requiring a subscriber set) and telephone sets together in the same jack and plug system.

1.04 Mount jacks in a uniform manner so that plugs can be inserted in the same way throughout the customer's premises.

1.05 Portable telephone sets should be kept indoors when not in use. Advise the customer of the importance of protecting a telephone set from inclement weather in order to maintain good telephone service.

KS-19316, List 4 Housing Fig. 4

KS-19316, List 5 Cover Fig. 5

KS-19316, List 6 Housing Box Fig. 6 and 7

KS-20202, Lists 1 and 2 Housing Fig. 8

### (b) *Ordering Guide*

Jack, KS-8420

Jack, KS-8421

Housing, Weatherproof, KS-19316, L4

Cover, Weatherproof, KS-19316, L5

Housing Box, KS-19316, L6

Housing, KS-20202, L1 or L2

*Note:* If an outdoor switch is required, refer to Section 463-246-100.

### 2. IDENTIFICATION

#### (a) *Illustration Index*

KS-8420 Jack Fig. 1

KS-8421 Jack Fig. 2

KS-16151, List 1 Jack (MD) Fig. 3

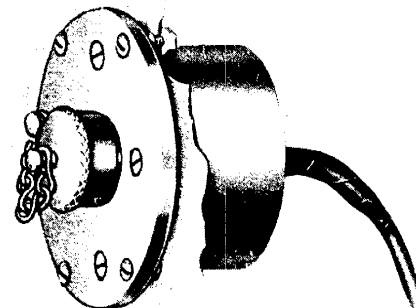


Fig. 1 — KS-8420 Jack, Installed

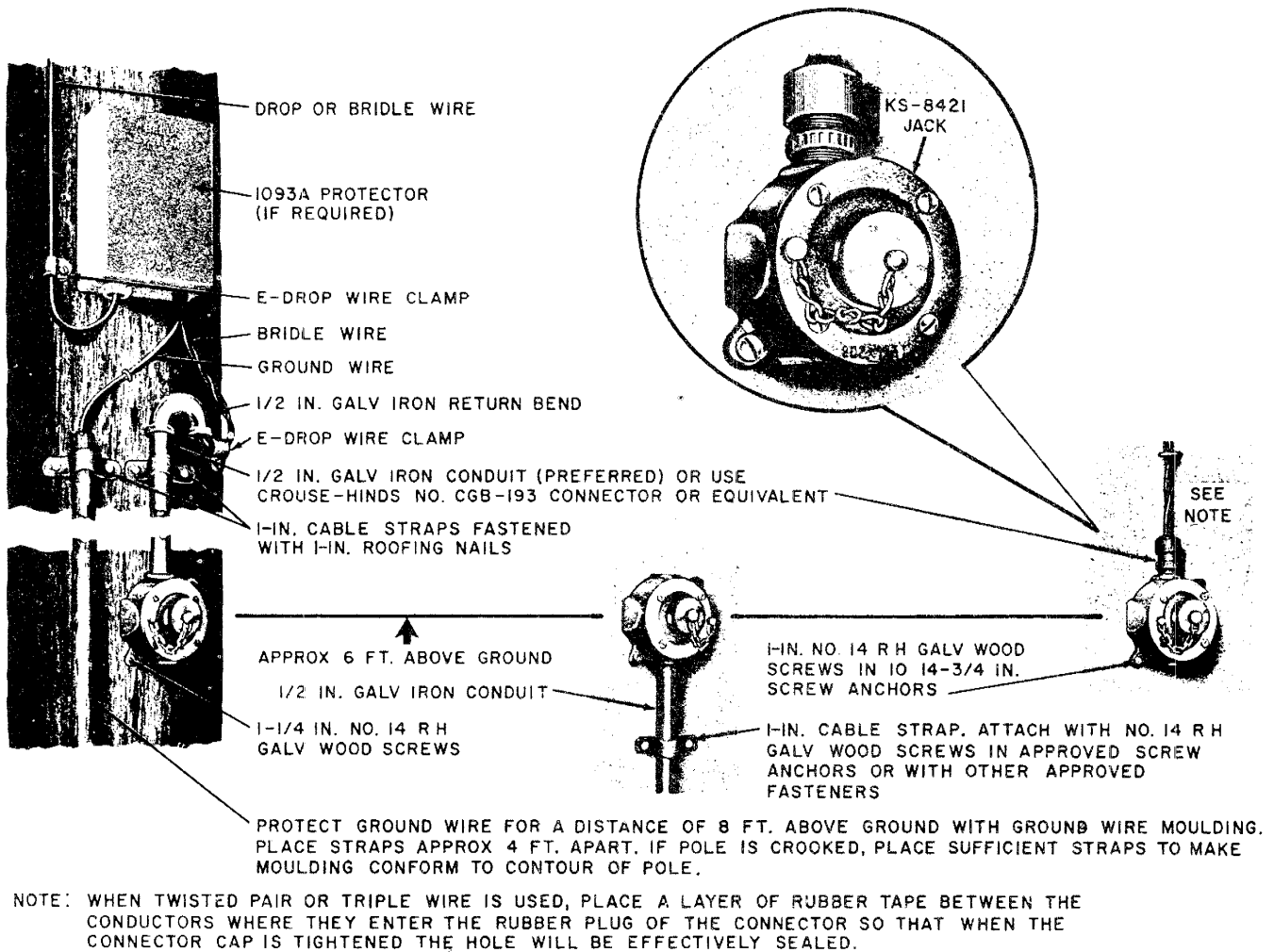


Fig. 2 — KS-8421 Jack, Typical Installation

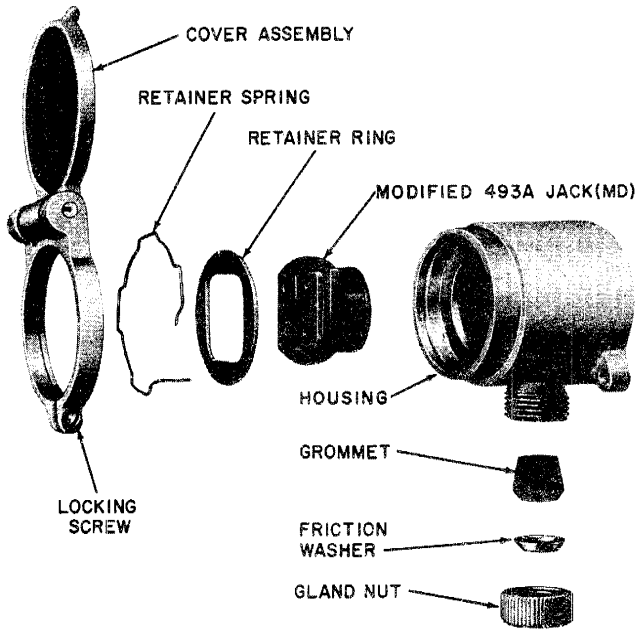


Fig. 3 — Assembly of KS-16151, List 1 Jack (MD)

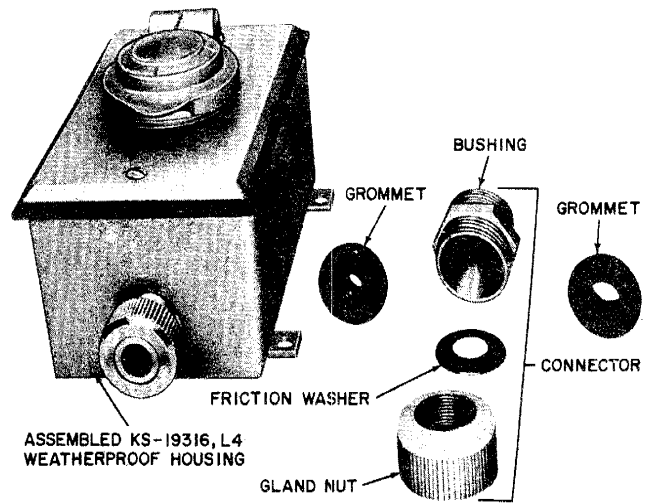
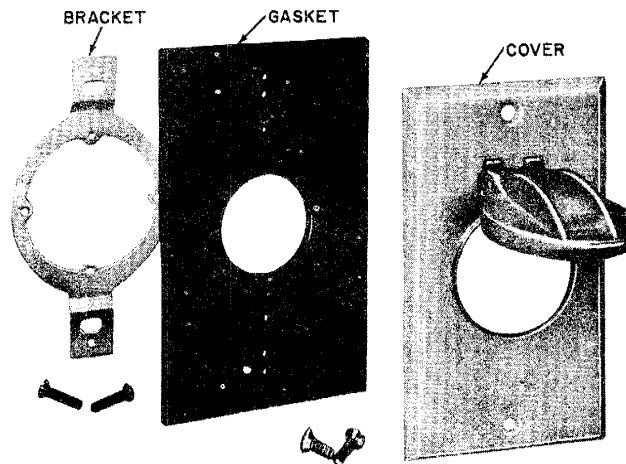


Fig. 4 — KS-19316, List 4 Housing and Components (2 of 3 Grommets Shown)



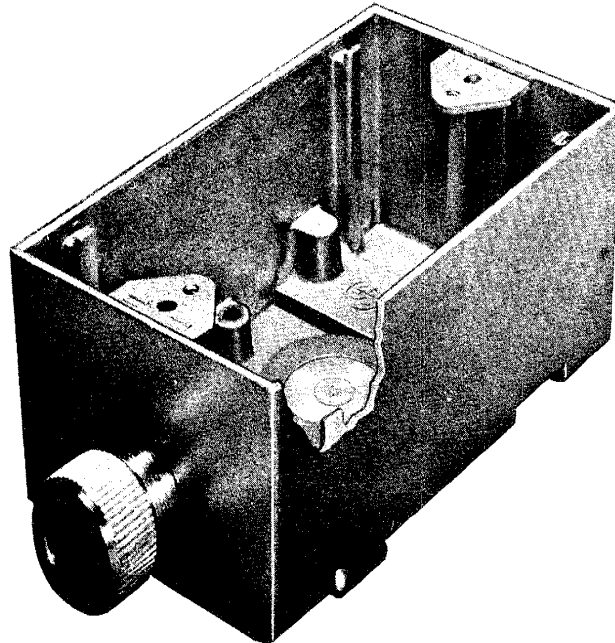
● FOR USE WHERE BOX FOR JACK HAS BEEN INSTALLED OR REPLACEMENT PARTS FOR KS-19316, LIST 4.

● ACCEPTS:  
493A JACK (MD)  
541A JACK  
548A JACK

● MOUNTS TO STANDARD ELECTRICAL OUTLET BOX

● MOUNTING SCREWS SUPPLIED

Fig. 5 — KS-19316, List 5 Cover



- FURNISHED WITH LATER PRODUCTIONS OF KS-19316, LIST 4 HOUSING
- WITH REVERSIBLE MOUNTING LUGS

Fig. 6 — KS-19316, List 6 Housing Box

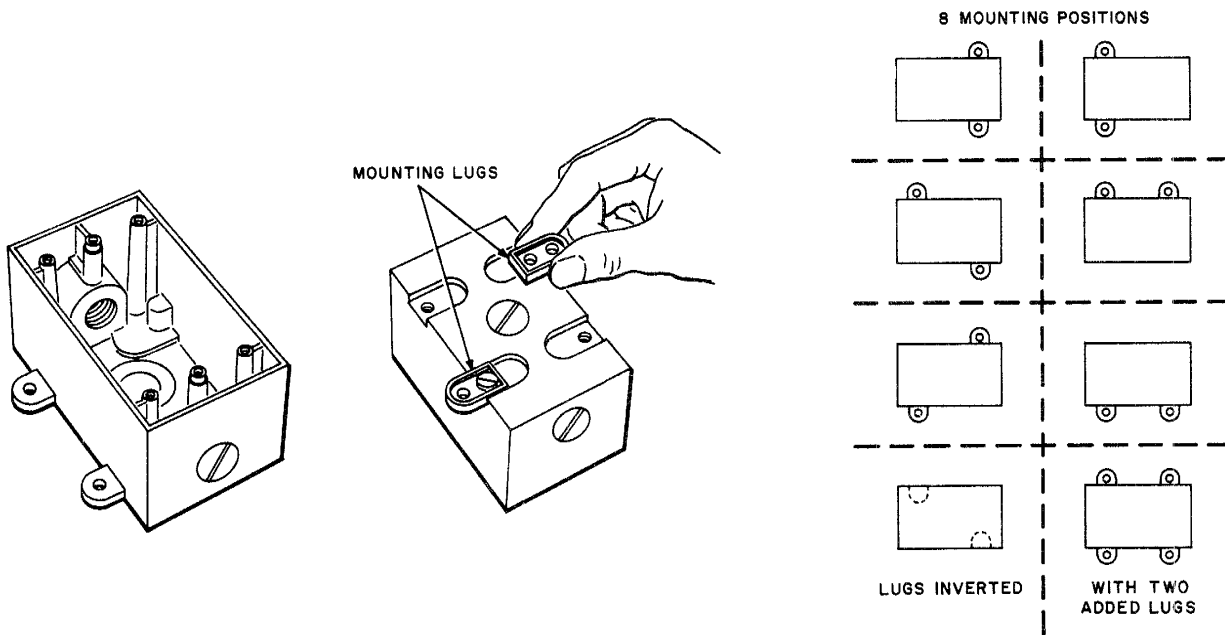


Fig. 7 — Housing Box Showing Reversible Mounting Lugs

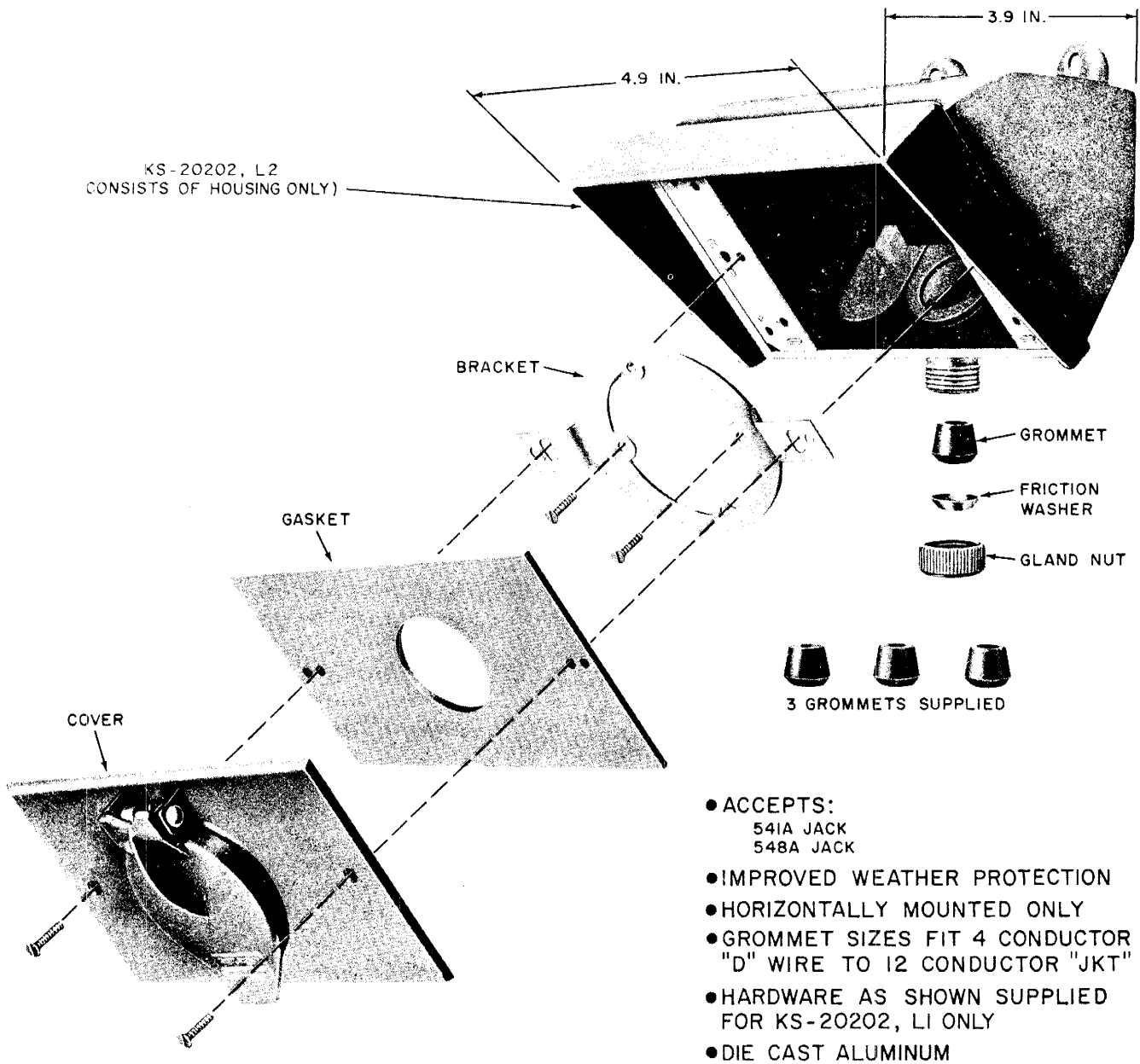


Fig. 8 — Assembly of KS-20202, Lists 1 and 2 Weatherproof Housing

**3. INSTALLATION**

***KS-8420 Jack***

**3.01** Install as follows:

- (1) Arrange for a 2-11/16 inch hole at location selected for jack installation.
- (2) Temporarily insert jack in hole and mark fastener holes.
- (3) Remove jack and drill fastener holes.
- (4) Connect wire as shown in Fig. 9.
- (5) Secure jack to mounting surface with four No. 8 brass wood screws or No. 8 RH brass machine screws.

***KS-8421 Jack***

**3.02** Install as follows:

- (1) Arrange drop wire or bridle wire and conduit at location selected for installation.
- (2) Secure the jack housing to the mounting surface using suitable fasteners.
- (3) Connect wire to terminal block as shown in Fig. 9.
- (4) Mount terminal block to jack housing.
- (5) Install cover on housing.

***KS-16151, List 1 Jack***

**3.03** Install as follows:

- (1) Arrange drop wire at location selected for installation.
- (2) Hold housing to mounting surface and mark fastener holes.
- (3) Remove housing and drill fastener holes.
- (4) Secure jack to mounting surface with No. 8 brass wood screws or No. 8 RH brass machine screws.

- (5) Place gland nut, friction washer, and grommet onto cable.
- (6) Run cable inside housing and adjust grommet and friction washer for watertight fit with gland nut.
- (7) Connect conductors to 493A jack.
- (8) Install 493A jack, retainer ring, retainer spring, and cover assembly in this order.
- (9) Tighten locking screw.

***KS-19316, List 4 Housing***

**3.04** Install as follows:

- (1) Arrange cable at location selected for jack installation.
- (2) Use housing box with positioned mounting lugs to mark lug mounting holes.
- (3) Drill holes and secure housing box to mounting surface with No. 8 brass wood screws or No. 8 RH brass machine screws.
- (4) Place gland nut, friction washer, and grommet on cable.
- (5) Run cable inside housing and adjust grommet and friction washer for watertight fit with gland nut.
- (6) Attach bracket to housing box.
- (7) Connect wire or cable to jack.
- (8) Install jack to bracket. Supplied cover for 541A jack is not required and may be discarded.
- (9) Install gasket and cover for watertight fit.

***KS-20202, List 1 Housing***

**3.05** Install as follows:

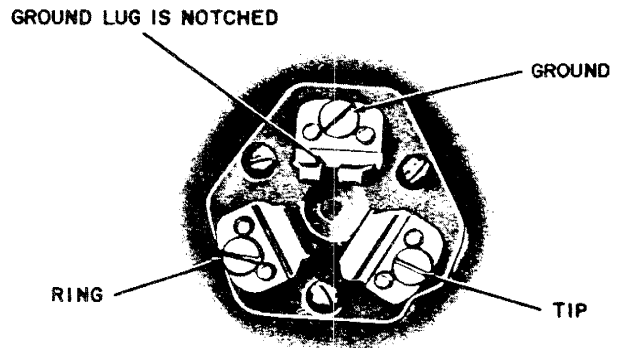
- (1) Arrange cable or drop wire at location selected for installation.
- (2) Hold housing to mounting surface and mark fastener holes.



- (3) Remove housing and drill fastener holes.
- (4) Secure housing to mounting surface with No. 8 brass wood screws or No. 8 RH brass machine screws.
- (5) Place gland nut, friction washer and grommet onto cable or drop wire.
- (6) Run cable or drop wire inside housing and adjust grommet and friction washer for watertight fit with gland nut.
- (7) Install bracket and arrange cable or drop wire through center of bracket.
- (8) Connect conductors to selected jack.
- (9) Install jack to bracket. Supplied cover for 541A jack is not required and may be discarded.
- (10) Install gasket and cover.

**4. CONNECTIONS**

- 4.01** Figure 9 shows connections for KS-8420 and KS-8421 jacks.
- 4.02** Only one conductor shall be connected to a single clip of a clip-type jack terminal.
- 4.03** For a 4-conductor jack, connect conductor as indicated by the color designator stamped next to the terminals. The red conductor is terminated at the R terminal, etc.
- 4.04** Table A shows the connections for 12-conductor jacks.



**Fig. 9 — Connections for KS-8420 and 8421 Jacks**

**TABLE A**

**12 CONDUCTOR JACK CONNECTIONS**

D AND E WIRING CABLE	TERMINAL DESIGNATION
BL-W	1
W-BL	2
O-W	3
W-O	4
G-W	5
W-G	6
BR-W	7
W-BR	8
S-W	9
W-S	10
BL-R	11
R-BL	12



**PLUGS**  
**FOR PORTABLE TELEPHONE SETS**  
**IDENTIFICATION AND CONNECTIONS**

**1. GENERAL**

**1.01** This section is reissued to:

- Show 283B(MD) plug.
- Revise Table A.
- Add Table B.
- Add connection information on the current model 505A plug.
- Add connection information on the current model D3BU and D4BP Cords.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.02** Some areas require at least one telephone set ringer or separate ringer permanently

connected to the line. Check local instructions governing line ringers.

**1.03** Portable telephone sets should be kept indoors when not in use. Impress upon the customer the importance of protecting telephone sets from inclement weather in order to maintain good telephone service.

**1.04** For associated jacks see Section 461-630-100.

**2. IDENTIFICATION**

**2.01** Table A lists plugs used with portable telephone sets; Table B lists the available colors.

**504A PLUG**

**2.02** The 504A is a 12-terminal plug (Fig. 1) consisting of a molded plastic block, cord tip guide, and cap assembly held together by one

**TABLE A**  
**PLUGS**

TYPE	NO. OF CONTACTS	FIG. NO.	ASSOCIATED JACKS
KS-8419	3	7	KS-8420 KS-8421
505A	4	3,4	404B (MD) 493A (MD), 548A, 497A (MD), 549A, 550A, KS-16151, L1 (MD)
283B (MD)		8	
423A		6	
274A	8	5	391A, 392A
504A	12	1,2	541A, 547A (MD), 551A, 547B

**TABLE B**  
**COLOR ORDERING GUIDE**

COLOR	TYPE PLUG					
	504A	505A	274A	423A*	KS-8419	283B(MD)
BLACK — 3	•	•				•
LT. OLIVE GRAY —49			•			
IVORY —50	•	•	•			
GREEN —51	•	•				•
RED —53	•	•				
BROWN —54			•			
YELLOW —56	•	•				•
WHITE —58	•	•				•
ROSE PINK —59	•	•				•
LT. BEIGE —60	•	•				•
LT. GRAY —61	•	•				•
AQUA BLUE —62	•	•				•
TURQUOISE —64	•	•				•
BRASS					•	

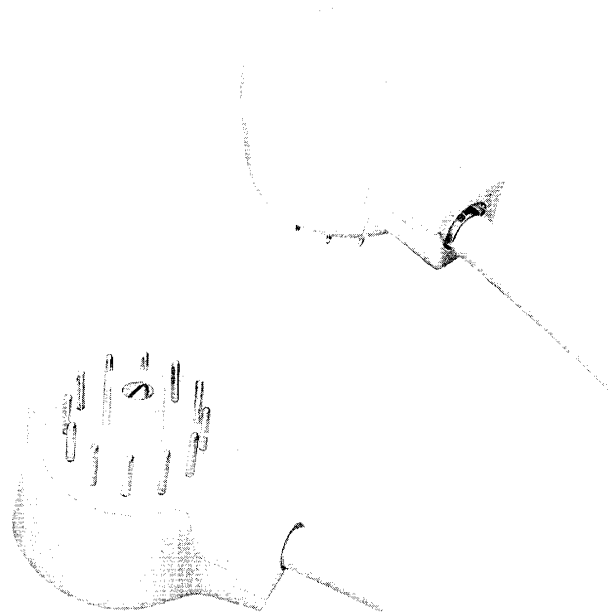
\*This plug is inside the 750 telephone set and may be any color as it is made from scrap plastic.

screw. Each terminal is equipped with a socket-type connector to receive the cord tip. A cord tip guide (Fig. 2) covers the terminals. The terminals are numbered 1 through 12 and match numbering on the 541A jack. The plug can be inserted into the jack in only one position.

**2.03** Included with the plug is a metal cord stay designed for use with cords equipped with a wire S hook. The S hook is removed and discarded. The cord stay, inserted into the vacated band hole, serves as a wing band. Slots are provided on the plug block and shell (Fig. 2) to hold a wing band or the cord stay. The wing band or cord stay seated in the slot prevents the mounting cord from slipping out of the plug.

### 505A PLUG

**2.04** The 505A plug (Fig. 3) is a 4-contact plug similar to the 504A plug; in addition, however, it has a cord fastener (Fig. 4) which holds the cord in place while spade tips are being connected. The cord fastener also anchors the mounting cord in the assembled plug.



**Fig. 1—504A Plug**

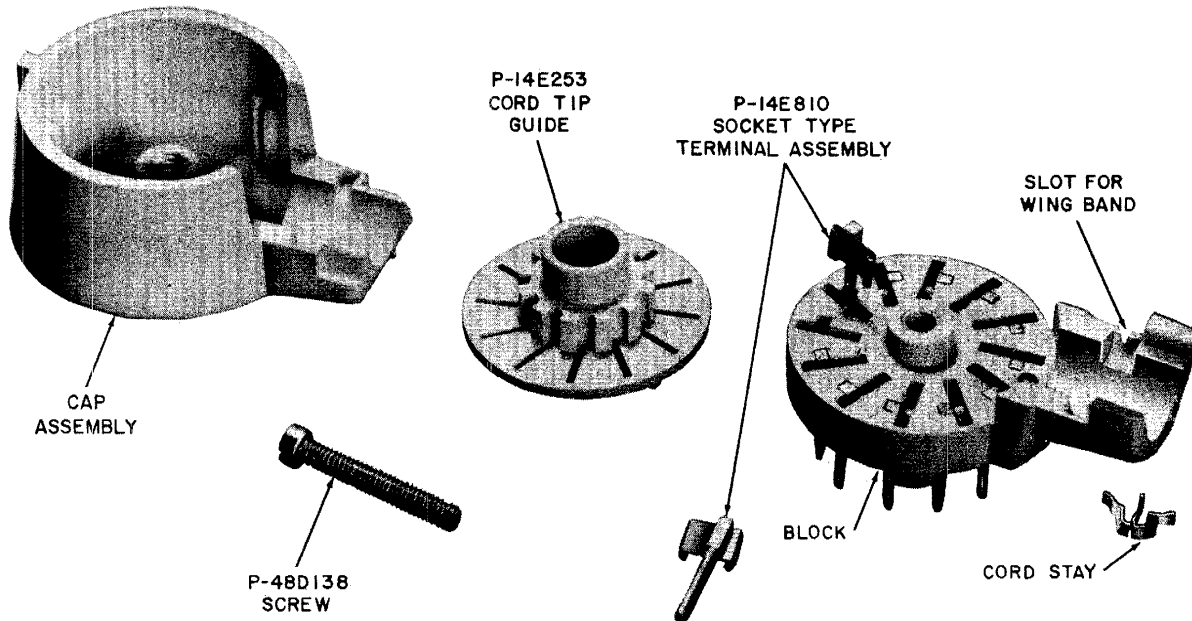


Fig. 2—504A Plug Disassembled

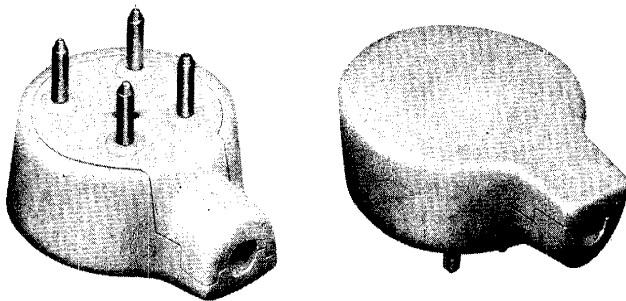


Fig. 3—505A Plug

**2.05** The current model cord tips guide is shown in Fig. 4. It provides a cutout to permit the use of a cord equipped with a flat eyelet stay band.

#### 274A PLUG

**2.06** The 274A plug (Fig. 5) is a 2-piece, 8-contact plug of molded plastic. It is intended for use with braided fabric covered mounting cords and is equipped with two eyes to which the braid is secured. It is available in color as shown in Table B.

#### 423A PLUG

**2.07** The 423A plug (Fig. 6) is a 2-piece, 4-contact molded plastic plug for use with the 750-type panel telephone set. U-shaped projections are molded in the base for securing the mounting cord.

#### KS-8419 PLUG

**2.08** The KS-8419 plug (Fig. 7) is a 3-contact, brass plug intended for connecting telephone sets installed on boats, trains, or auto trailers to outdoor jacks of PBX or CO lines. This plug is intended for use with KS-8420 or KS-8421 jacks.

#### 283B(MD) PLUG

**2.09** The 283B(MD) plug (Fig. 8) is a 2-piece, 4-contact plug of molded plastic in colors to match telephone set colors as shown in Table B. The mounting cord is secured by either a wing band inserted into a slot in the cover or an S hook or flat eyelet stay band secured with a self-tapping screw packed with the plug.

### 3. CONNECTIONS

**3.01** Wiring variations (eg. class-of-service, etc, normally made in the connecting block)

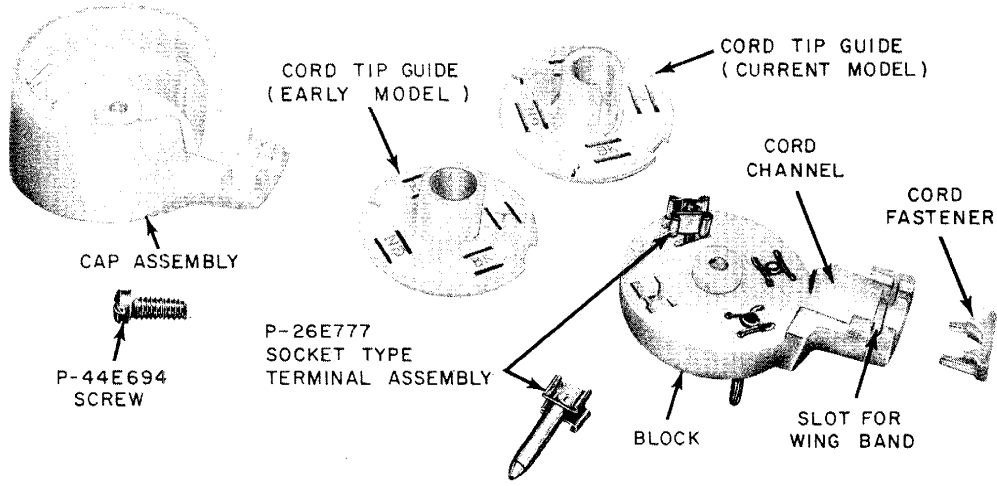


Fig. 4—505A Plug Disassembled

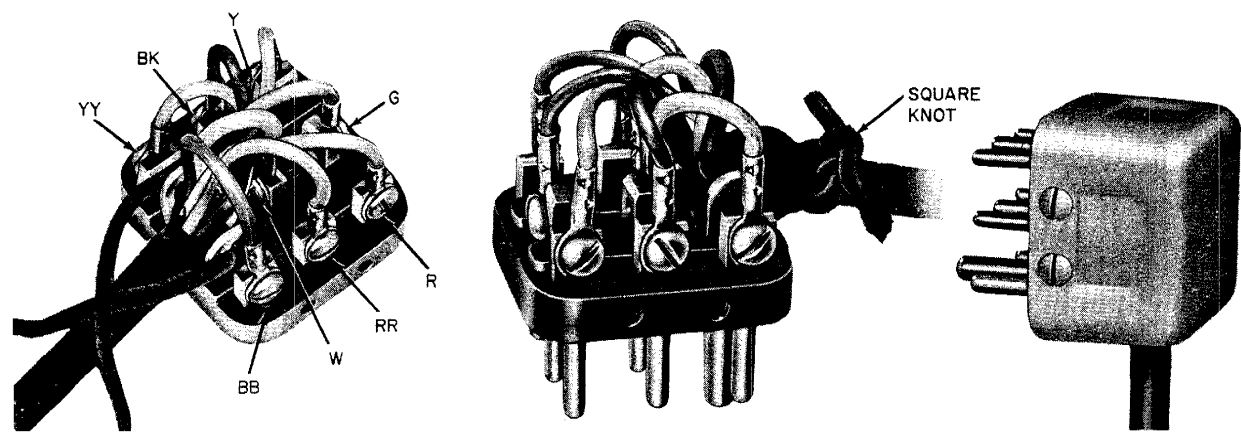


Fig. 5—274A Plug

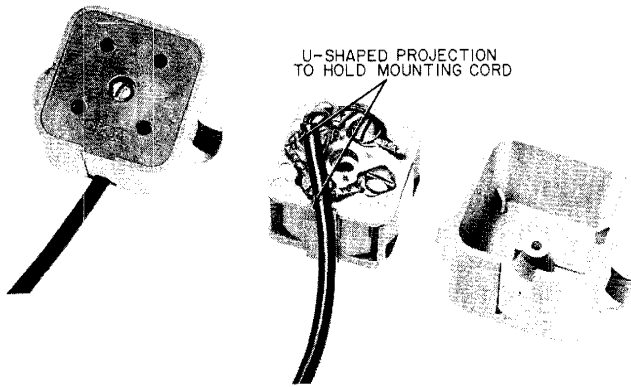
should be made in the plugs. Do not make wiring variations in the station jacks. When required, two spade tips may be placed under one screw head. In some plugs, eg, 505A, there are two socket-type connectors on each terminal pin. These extra terminal connectors may be used to bridge spade tip conductors. If the extra connectors are used to store unused cord conductors, the unused conductors must be insulated at the telephone set end.

**504A PLUG**

**3.02** Connections for the 504A plug (Fig. 1) are as follows:

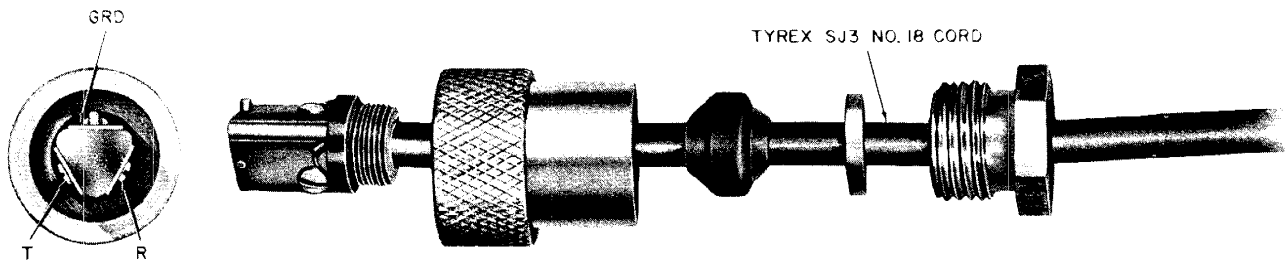
- (1) Place cord tip guide on block (Fig. 2).
- (2) Insert mounting cord tips into socket-type terminals of plug.

**Note:** For mounting cord conductor connections, refer to connection section for the telephone set.

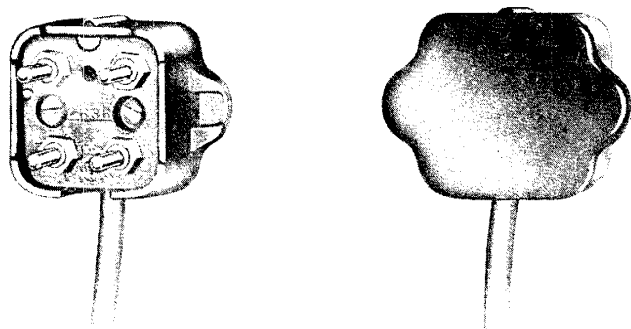


**Fig. 6—423A Plug, Front View and Rear View Cover Removed**

- (3) Dress conductors so they will lie within the cap of plug.
- (4) Place wing band or cord stay of mounting cord in its proper slot.
- (5) Place cap on plug so cord and wing band or cord stay will seat properly. Be sure no leads are pinched.
- (6) Snap two sections of neck together.
- (7) Insert screw and tighten.



**Fig. 7—KS-8419 Plug**



**Fig. 8—283B (MD) Plug**

**505A PLUG**

**3.04 Connecting Current Model D3BU or D4BP Mounting Cord to a Current Model 505A Plug:**

- (1) Position flat eyelet stay band in the cord channel so that the screw hole is over the screw hole in the center of the cord tip guide (see Fig. 9).
- (2) Fit cord fastener into groove in the cord channel and press until it snaps into position.
- (3) Connect the mounting cord spade tips in the socket-type terminals.

- (4) Insert screw through hole in block and stay band.
- (5) Dress conductors so they will not obstruct the center of the cord tip guide.
- (6) Position cap assembly on cord tip guide and block; check that no cord leads are pinched and tighten screw.

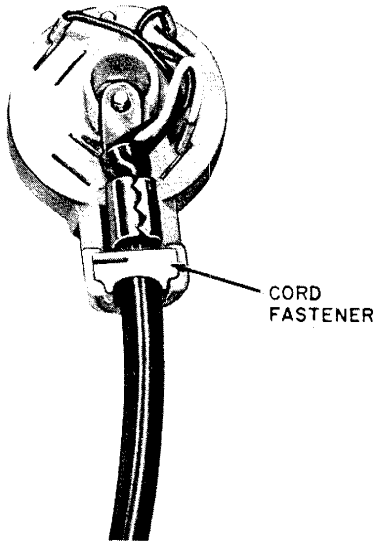


Fig. 9—Current Model D3BU Cord Connected to Current Model 505A Plug

**3.05 Connecting Current Model D3BU or D4BP Mounting Cord to an Early Model 505A Plug:**

- (1) Cut flat eyelet stay band approximately 1/8 inch from end of cord jacket using 8-inch sidecutters, or equivalent (Fig. 10).

**Caution:** When cutting the stay band, take precautions to prevent the severed end from striking personnel or apparatus.

- (2) Make a right angle bend in the remaining length of stay band in the direction away from the cord conductors.
- (3) Position the mounting cord into the cord channel of the block, as shown in Fig. 10.

- (4) Fit the cord fastener into the groove in the cord channel and press until it snaps into position.
- (5) Connect the mounting cord spade tips in the socket-type terminals.
- (6) Dress the conductors so they will not obstruct the center of the cord tip guide.
- (7) Position the cap assembly on the block so that the right angle bend of the stay band is supported by the inner surface of the cap assembly; check that no cord leads are pinched.
- (8) Insert cover screw and tighten.

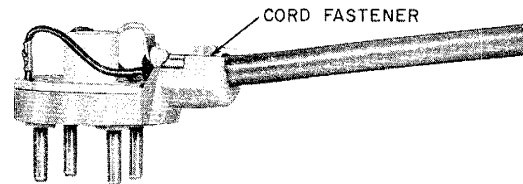
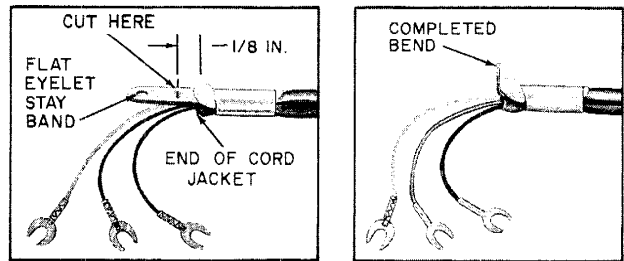


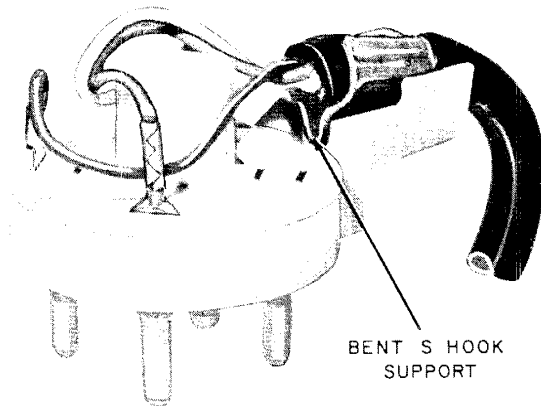
Fig. 10—Connecting Current Model D3BU or D4BP Cord to Early Model 505A Plug

**3.06 Connecting Early Model D3BU or D4BP Mounting Cord to Current or Early Model 505A Plug:**

- (1) Remove P-18E457 adapter [3.11(b)(1)] and S hook from the cord.
- (2) Make a right angle bend in the S hook support of the stay band in the direction away from the cord conductors (Fig. 11).
- (3) Position the mounting cord in the cord channel so the S hook support is seated in the slot adjacent to the cord tip guide (Fig. 11).



- (4) Fit the cord fastener into the groove in the cord channel and press until it snaps into position.
- (5) Connect the mounting cord spade tips in the socket-type terminals.
- (6) Dress cord conductors so they will not obstruct the center of the cord tip guide.
- (7) Position cap assembly on cord tip guide and block; check that no cord leads are pinched.
- (8) Insert cover screw and tighten.



**Fig. 11—Early Model D3BU Cord Connected to 505A Plug**

**3.07 Connecting 505A Plug to a Cord Equipped With a Wing Band:**

- (1) Fit the cord tip guide into place on the top of the block.
- (2) Position the mounting cord into the cord channel of the block so that the cord wing band fits into the wing band slot (Fig. 4). One ear of the wing band will extend into the wing band slot of the cord fastener.
- (3) Fit the cord fastener into the groove in the cord channel and press until it snaps into position.
- (4) Arrange the mounting cord spade tips in the socket-type terminals.

- (5) Adjust the conductors so that they will not obstruct the center of the cord tip guide.

**274A PLUG**

**3.08** Connections for 274A plug are as follows:

- (1) Make connections as indicated by color designations stamped adjacent to terminals.
- (2) Connect cord spade tips as shown in Fig. 5.
- (3) Tie mounting cord securely.
- (4) Place shell on base and tighten screws.

**423A PLUG**

**3.09** Connections for the 423A plug (Fig. 3) are as follows:

- (1) Make connections as indicated by color designations stamped adjacent to terminals.
- (2) Connect cord tips as shown in Fig. 6.
- (3) Lay jacketed portion of cord in the two molded U-shaped projections.
- (4) Place cover on base and tighten screw.

**KS-8419 PLUG**

**3.10** Connections for the KS-8419 plug are as follows:

- (1) Plug components are assembled to TYREX SJ3 No. 18 cord or equivalent (Fig. 7).
- (2) In TYREX SJ3 No. 18 cord or equivalent, the black conductor should be used for the ring (negative) side of the line. The white conductor should be used for tip (positive) side of the line. The green conductor is the ground conductor.
- (3) One terminal of the KS-8419 plug has a small lug protruding from the contact. This lug and the notched terminal on KS-8420 and KS-8421 jacks are provided to ensure that the plug is inserted in one position only.

## SECTION 461-630-105

- (4) When ground is necessary for service, the green conductor should be terminated on the notched terminal.

### 283B(MD) PLUG

3.11 Connections for 283B(MD) plugs are as follows:

(a) **Using Current Model D3BU or D4BP Cord:**

- (1) Make a slight bend in the flat eyelet stay band in the direction away from the cord conductors.
- (2) With cord conductors up, insert RM-658901 self-tapping screw with P-284139 flat washer (shipped with 283B(MD) plug) through hole in stay band. Using farthest hole opposite cord entrance, anchor cord securely (Fig. 12).
- (3) Make connections as indicated by color designations stamped adjacent to terminals.
- (4) Seat base of plug in its cover; check that no cord leads are pinched. Tighten cover screws.

(b) **Using Early Model D3BU or D4BP Cord:**

- (1) Remove P-18E457 adapter from cord (Fig. 13).
- (2) Using long-nose pliers and 8-inch sidecutters or equivalent (Fig. 14), turn large eye of S hook clockwise until positioned 90 degrees away from small eye of S hook.
- (3) With small eye of S hook up, insert RM-658901 self-tapping screw with P-284139 flat washer through large eye of S hook. Using farthest hole opposite cord entrance (Fig. 15 and 16), anchor cord securely.

**Note:** An RM-658901 self-tapping screw and a P-284139 flat washer will be shipped with each 283B(MD) plug (Fig. 16).

- (4) Lay the cord conductors out straight from the cord (Fig. 15). Pass the green conductor clockwise under the cord stay and terminate it on the GN punching. Pass the red conductor counterclockwise under the cord stay and terminate it on the R punching. Pass the yellow conductor clockwise under and then

over the top of the cord stay; terminate on the Y punching. If the black conductor is used, pass it counterclockwise, under, and then over the cord stay; terminate it on the BK punching.

- (5) Bend cord spade tips and dress red and green conductors so they lie outside of the mounting screw hole guides (Fig. 16).

- (6) Seat base of plug in cover before tightening screws to prevent pinching of conductors.

(c) **Using Cord Equipped With Wing Band:**

- (1) Make connections as indicated by color designations stamped adjacent to terminals (Fig. 12).
- (2) Bend cord spade tips up as shown in Fig. 12.
- (3) Place one edge of wing band in the larger (shallow drilled) of the two holes in the base.
- (4) Place cover so cord and wing band will seat properly in their slots.
- (5) Seat base of plug in its cover before tightening screws to prevent pinching of cord conductors.

(d) **Using Cord Equipped With Stay Hook:**

- (1) Insert RM-658901 self-tapping screw through P-284139 flat washer. Using farthest hole opposite cord entrance, start screw into hole.
- (2) With cord conductors up, slide cutout in stay hook under flat washer and tighten screw.
- (3) Make connections as indicated by color designations stamped adjacent to terminals (Fig. 12).
- (4) Bend cord spade tips up as shown in Fig. 12.
- (5) Seat base of plug in its cover; check that no leads are pinched. Tighten cover screws.

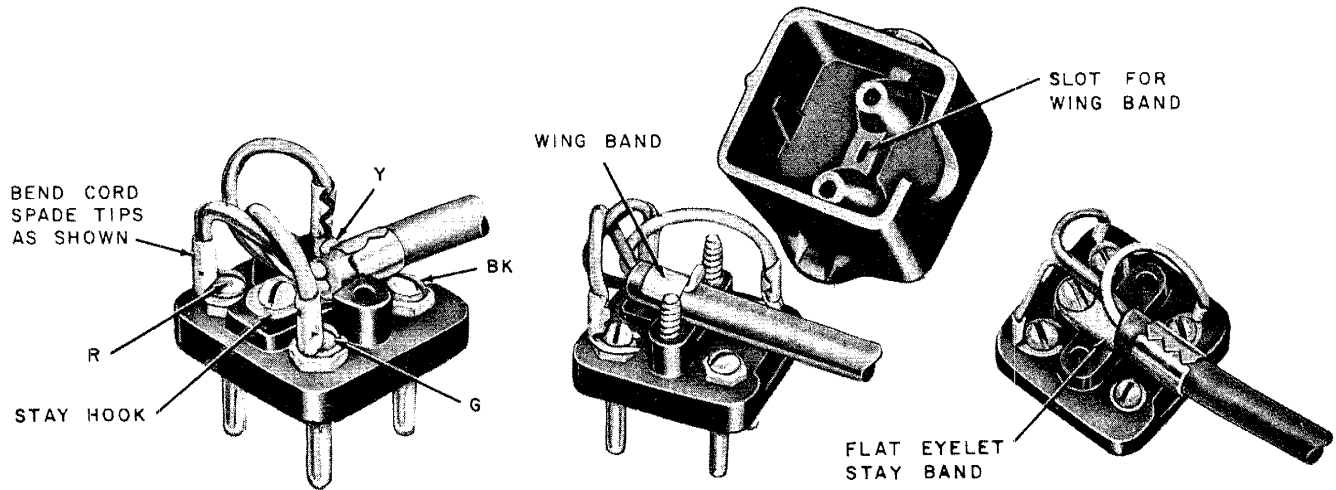


Fig. 12—Terminating Cords Equipped With a Stay Hook, Wing Band or Flat Eyelet Stay Band on a 283B(MD) Plug

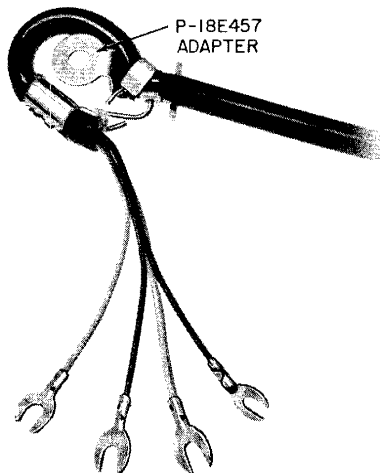


Fig. 13—Early Model D4BP Cord and Adapter

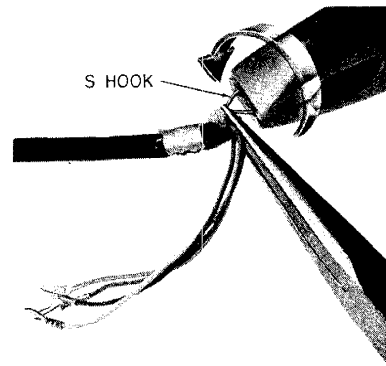


Fig. 14—Bending S Hook

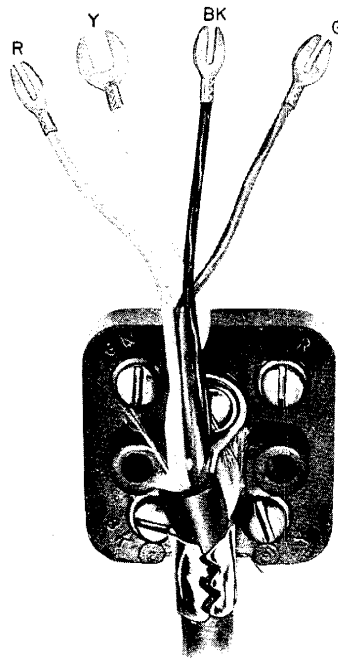


Fig. 15—Early Model D4BP Cord Ready to Terminate

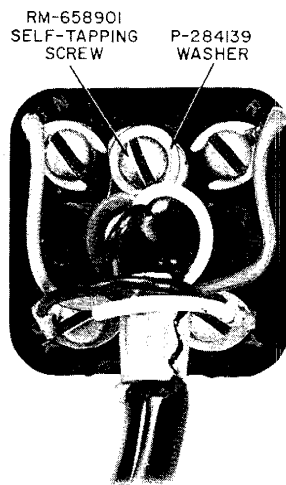


Fig. 16—Early Model D4BP Cord Terminated on 283(MD) Plug

STATION PROTECTION  
MAINTENANCE

1. GENERAL

- 1.01 This addendum is issued to clarify instructions concerning protection requirements.
- 1.02 Inspections are required on all maintenance visits to see that the station protection complies with the specifications contained in BSP 638-215-300.
- 1.03 When 58AP or older type protectors are found on maintenance visits they shall be replaced with the proper type protector as specified in BSP 638-215-300. This requirement may be deferred during heavy work load periods when authorized by local supervision. In such cases it will be necessary for the craftsman to prepare a Plant Upkeep Order, Form 694 indicating the work to be performed.



## STATION PROTECTION MAINTENANCE

### 1.00 GENERAL

1.01 This section provides maintenance information for station protectors, associated protector mountings, and the 150A cover.

1.02 Information for converting the 98A and 106C protectors to fuseless operation is also provided.

1.03 Fused protectors on stations served by grounded metal sheath cable should be converted when the station is visited except when it would be necessary to place a new ground wire. The number of converted fuseless protectors which may be connected to ground wire of various sizes is covered in the section entitled Station Protection, Installation.

1.04 When station protectors, served by metal sheath cable, are in locations where atmos-

pheric corrosion is a problem, use a 123A1A protector and 150A cover in place of a converted protector and associated protector mounting.

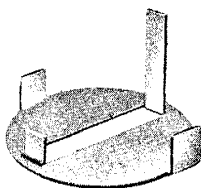
1.05 This section is reissued to revise paragraph 3.01.

1.06 Due to extensive changes marginal arrows have been omitted.

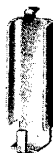
### 2.00 CONVERSION OF 98A AND 106C PROTECTORS TO FUSELESS OPERATION



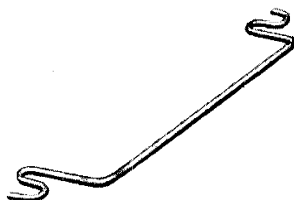
*When converting station protectors on SSM (Special Safeguarding Measures) and/or SSP (Special Service Protection) lines, arrangements must be made to have the special lines taken out of service before doing any work on the protector, since this work could readily cause service interruptions.*



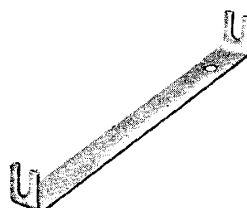
120A ADAPTER



121A ADAPTER



211A CONNECTOR



213A CONNECTOR

2.01 The following adapters and connectors (Fig. 1) are used in converting protectors:

- The 120A adapter and 211A connector are no longer manufactured but may be used, if available, from existing stocks. They may not be used to convert 98A protectors manufactured prior to 1939 because the 120A adapter will not fit over the larger ground electrode employed in these earlier protectors.
- The 121A adapter and 213A connector may be used to convert all 98A protectors.

Fig. 1 — Adapters and Connectors

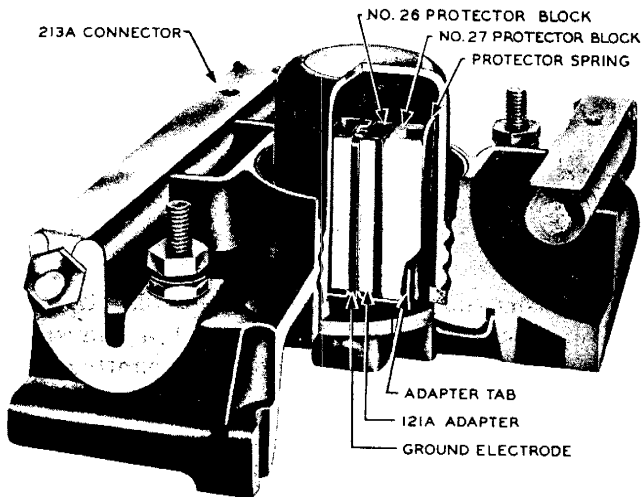


Fig. 2 — Converted 98A Protector Using 121A Adapters and 213A Connectors

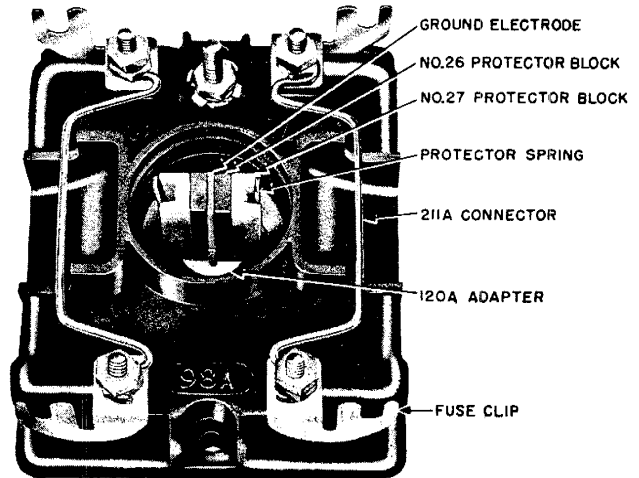


Fig. 3 — Converted 98A Protector Using 120A Adapters and 211A Connectors

2.02 For conversion of 98A protectors that are in service, see Fig. 2 and 3 and refer to Table A. Connectors may be omitted as specified in 2.04.

2.03 For conversion of 106C protectors to fuseless operation, two connectors are required except as covered in 2.04 where connectors may be omitted. When connectors are used to convert 106C protectors, they are installed in the same manner as that outlined in Table A for 98A protectors; no adapters are required. *The 106A protector cannot be converted to fuseless operation because of insufficient current-carrying capacity.*

2.04 Alternate methods of converting to fuseless operation are:

- The 98A protector may be converted by connecting line wires directly to station side of protector if they are of sufficient length. The connectors may be omitted. The 120A or 121A adapter(s) must still be used.
- The 106C protector may be converted by connecting line wires directly to station side of protector if they are of sufficient

length. The connectors may be omitted. No adapters are necessary. (Fig. 4.)

### 3.00 MAINTENANCE

3.01 Station protectors should be inspected on every visit to customer's premises.

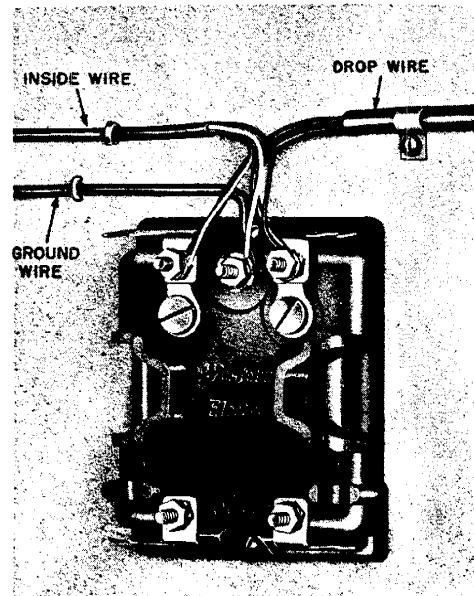


Fig. 4 — Alternate Method of Converting 106C Protector



**TABLE A**  
**CONVERSION OF 98A PROTECTOR**

Using a 120A Adapter and Two 211A Connectors		Using Two 121A Adapters and Two 213A Connectors	
Step	Procedure	Step	Procedure
1	Disconnect line and station wires.	1	Remove cap and No. 26 and 27 protector blocks.
2	Remove cap and No. 26 and 27 protector blocks.	2	Insert the 121A adapters all the way into the protector well with flat side against the ground electrode.
3	Insert 120A adapter over ground electrode. Press adapter all the way down.	3	Check for ground on all binding post terminals (Note 1).
4	Check for grounding on all binding post terminals (Note 1).	4	Remove adapters.
5	Replace No. 26 and 27 protector blocks. Make certain that they are properly seated on the face of the adapter.	5	Assemble a No. 26 and a No. 27 protector block in each adapter.
6	Check for grounds (Note 1).	6	Install assemblies in protector well.
7	Remove 11C fuses.	7	Check for grounds (Note 1).
8	Place 211A connectors under the bottom binding post nuts. Tighten binding post nuts securely (Note 2).	8	Loosen both nuts on 11C fuses.
9	Reconnect line and station wires.	9	Insert 213A connector over each fuse with bent down ends inside fuse clips and pilot hole at the instrument end of the protector (Note 3).
		10	Tighten nuts on fuses.

**Note 1:** If an adapter does not provide solid ground with the carbon blocks removed or if ground exists when the carbon blocks are in place, discard adapter and replace with one that will meet requirements. If the requirements cannot be met on second attempt, do not try to convert the protector; instead, install a fuseless protector. *Do not attempt to bend or adjust adapter tabs or protector block springs.*

**Note 2:** Fuse clips may be removed. A binding post washer (P-234967) should be placed under the bottom nut and the 211A connector placed between the washer and the bottom binding post nut when clips are removed.

**Note 3:** In cases where fuses have shrunk slightly, one or both connector ends may be placed outside fuse clips. Some bowing of the connector may be encountered with short fuses; this condition is not considered objectionable. If desired, a bow may be placed prior to installation. With 213A connectors, the fuses only provide a physical means for securing the connectors in place; defective fuses may be used for this purpose.

3.02 When a protector is visited, the following work operations shall be performed:



*Inspect the ground wire, ground clamp, and ground tag. If the grounding medium is not the best choice available (as outlined in the section entitled Protector and Signaling Grounds), change the ground connection to use the best grounding medium present, or report the substandard condition to supervision for later correction. If the best medium available is a ground rod, make sure that the telephone rod is bonded to the power ground rod, as directed in the section mentioned above.*

- Replace protectors, mountings, and associated parts which are defective or are in poor condition.
- Replace broken or cracked carbon blocks on the 98-type protector.
- If No. 26 protector block is excessively pitted, turn over and re-use opposite side if it is in good condition. If neither side is satisfactory, replace block.
- Replace all 2A1-type protector units (carbon block assemblies used in 111A, 106A, 106C, 106CA, 116A, 116C, 117A, and 117B protectors) or 2B1A protector units (carbon block assembly used in 123A1A protector) that ground the line.
- Replace converted 98A protector when operated due to a power cross (permanent contact between spring and adapter tab). (When the protector is subject to continuous current discharges such as those resulting from power crosses, the protector springs become annealed and deformed near their point of contact with the No. 27 protector blocks thus making solid contact with the adapter taps and, thereby, providing a low-resistance path to ground.)
- Inspect wire terminations at protector for tightness, broken wires, and corrosion.

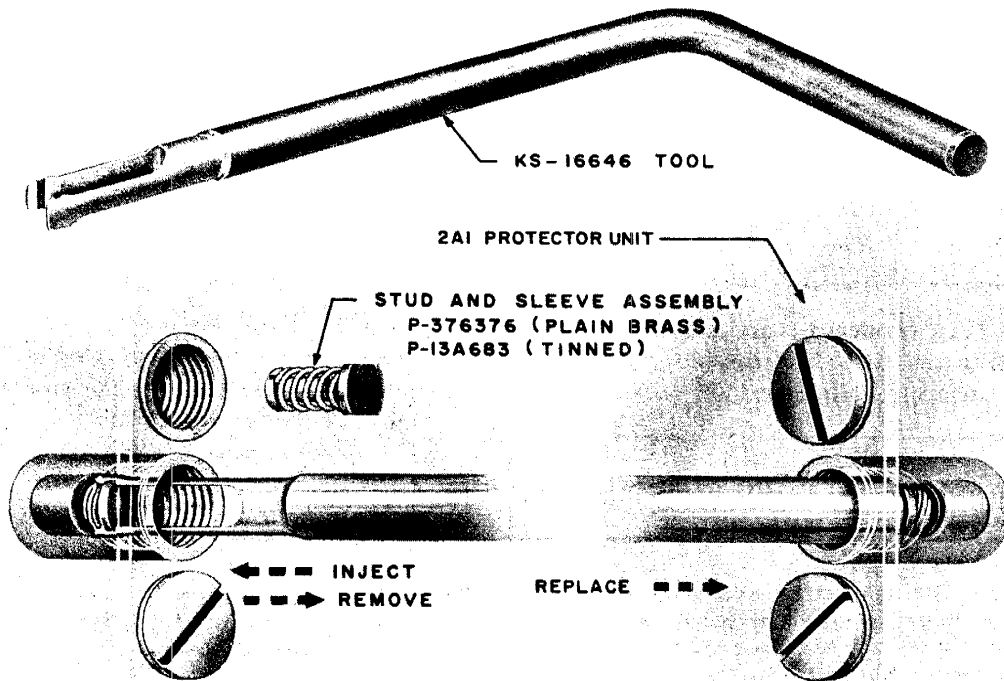


Fig. 5 — KS-16646 Tool

**4.00 STUD AND SLEEVE ASSEMBLY REPLACEMENT**

**4.01** The stud and sleeve assembly associated with station protectors (such as 106A, 116C, or 117B) using a 2A1-type protector unit may become damaged due to heavy power or lightning surges. This will be evidenced by the end of the stud and sleeve assembly's becoming pitted and burned or by the lack of spring tension in the assembly.

**4.02** The KS-16646 tool is used to remove damaged stud and sleeve assemblies and to insert the replacement (Fig. 5). Replacement should not be attempted on 106CA or 111A protectors.

**4.03** The P-13A683 stud and sleeve assembly is used in station protectors using 2A1-type protector units and is tinned to ensure a low-resistance path through the protector.

**4.04** The P-376376 stud and sleeve assembly (plain brass) is used in some types of cable terminals and not in station protectors.

**5.00 DISCONNECTS**

The disposition of wire where protector is removed on disconnects shall be treated as described in the section entitled Handling Wire and Cable.



## AUXILIARY SIGNALS

### INSTALLATION AND MAINTENANCE

#### 1. GENERAL

1.01 This section contains installation and maintenance procedures for the KS-16301 and KS-8000 series signals with associated apparatus.

1.02 This section is reissued to include a 3-conductor cord for Backbox, KS-16301, List 8.

1.03 All KS-16301 series signaling devices not intended for use with 115-volt, ac power will be provided with two warning tags, one on the signal unit frame and one on the signal unit power cord near the plug. The tags will specify the power source requirements. For example:

**WARNING: FOR USE WITH 48 VOLTS  
DC ONLY**

#### 2. PLANNING

##### (a) *Safety Hazards*

- Place signal in location that is not hazardous to maintenance personnel who may have to work on it; avoid locations such as stairways, or near moving machinery.



*Under no circumstances should the cord provided for commercial power be passed through a hole in a wall or be fastened to a wall.*

##### (b) *Typical Installation Assembly*

- A typical signal (Fig. 1) includes a backbox, a signal premounted to gridded cover, and a control relay.

##### (c) *Location*

- Place signal for best sound distribution.

- Locate signal where it will not be damaged or made inaccessible to repair personnel.

##### (d) *Customer Provided Wiring*

- Prior to installation, make a definite agreement with the customer covering the provision of any necessary power wiring.

- Locate power outlet within power cord reach of backbox.

##### (e) *Limitations*

- Any telephone station having auxiliary signals (except a PBX station) must be equipped with a ringer connected to the line at all times.

##### (f) *Type of Installation*

- The type of the backbox determines the type of installation (see Table A).

#### 3. INSTALLATION

##### (a) *Weatherproof Power Outlet KS-16301 (Fig. 2)*

- Provided to customer as required.

##### (b) *Backbox*

- Mount on a vertical surface.
- Use two slotted holes and one regular hole for attaching backbox to surface.
- Use rustproof fasteners.
- Install backbox, List 9 or 11 so that the customer may have the commercial power connected (Fig. 3).
- Terminate 3-conductor cord as shown in Figure 4. ←

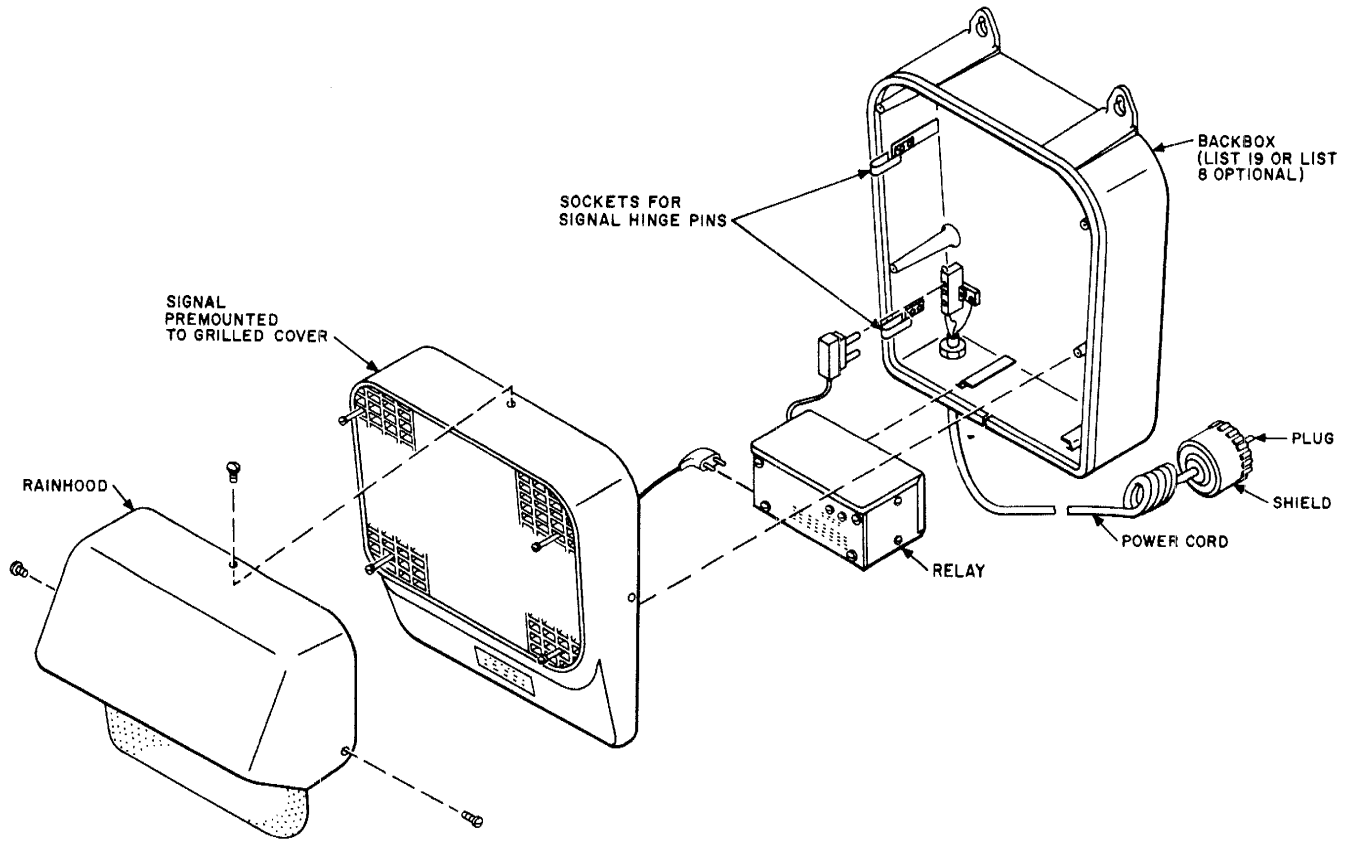


Fig. 1—Exploded View of Assembled Signal Using Relay

TABLE A

BACKBOX	TYPE OF INSTALLATION
L8	Indoor — Power Cord — Use With Relay
L9	Indoor — Conduit — Use Without Relay
L11	Outdoor — Conduit — Use Without Relay
L19	Outdoor — Power Cord — Use With Relay

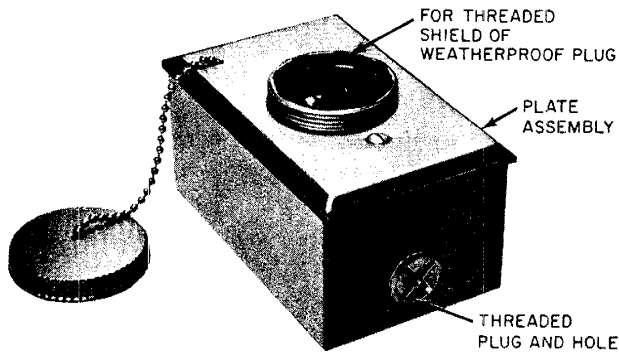


Fig. 2—Weatherproof Power Outlet KS-16301, List 18

- An entrance hole for the telephone wires is located in the bottom of each backbox (Fig. 5).
- Be sure that the gasket on the backbox is in place (Fig. 4).

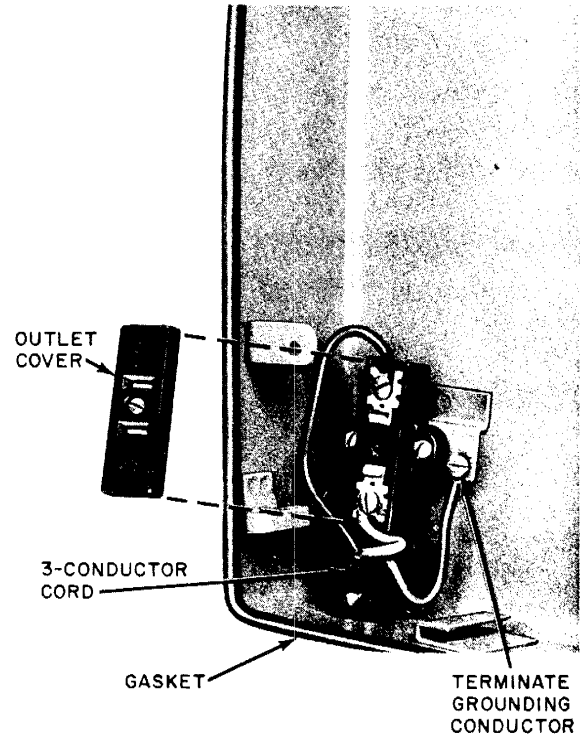


Fig. 4—Power Cord Termination

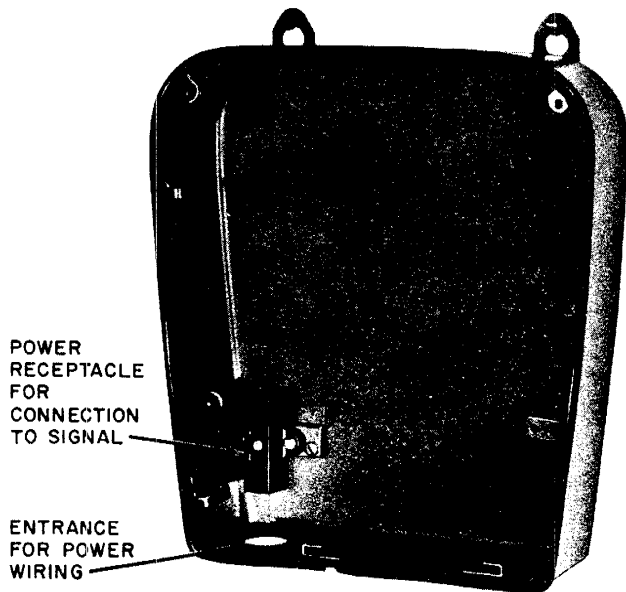


Fig. 3—Backbox, KS-16301, List 9

(c) *Control Relay, KS-16301 (Fig. 6)*

- Mount relay in the horizontal position on mounts provided in backbox (Fig. 1).
- Use a full cable pair for each signal circuit when signaling circuits and talking circuits are in the same cable.
- When no talking circuits are involved, low-voltage signal circuits may use half of a cable pair or inside wire.

(d) *Signals, KS-16301*

- Engage the two pins on front cover to form a hinge with the two sockets which emerge from backbox (Fig. 1).
- Fasten the signal to the backbox with four machine screws which are furnished (Fig. 1).

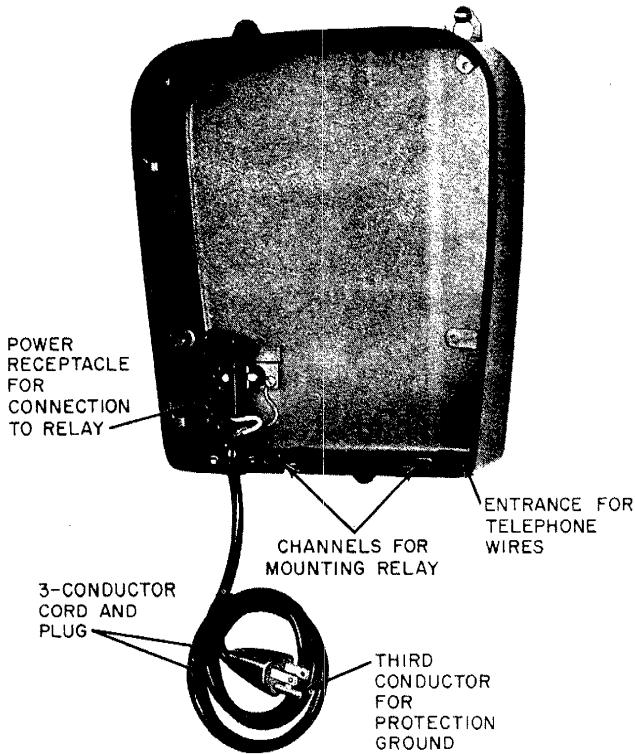


Fig. 5—Backbox, KS-16301, List 8

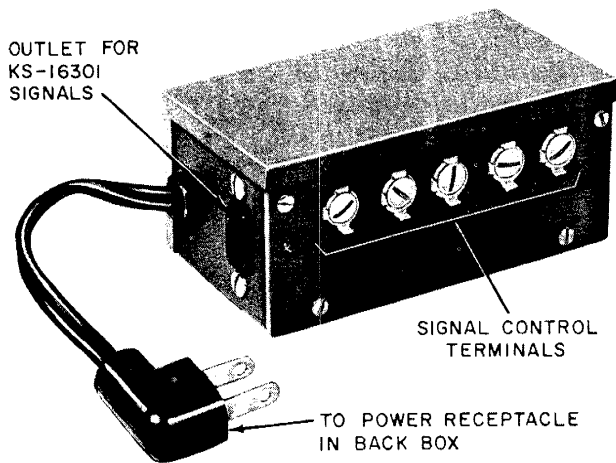


Fig. 6—Control Relay, KS-16301, List 15

(e) *Rainhood*

- For protection against the weather and insects.
- Attach with furnished screws to the signal unit (Fig. 1).

(f) *Signals, KS-8000 Series*

- The signals are for indoor locations.
- Signal is already attached to a backboard.
- Has slotted mounting holes for easy removal from backboard.
- Has 2-conductor cord for terminating on a 42-type connecting block or equivalent.

4. MAINTENANCE



*Before performing any work on equipment connected to commercial power, de-energize the power supply circuit. The customer shall arrange for power disconnection and reconnection on power circuits other than plug and outlet.*

Signals, KS-16301

4.01 The KS-16301, List 3 (vibrating bell) has a volume adjustment. On the Wheelock Signal Company-type, the adjustment is a hexagonal nut on the rear of the signal (Fig. 7). The Sperti-Faraday Company-type adjustment is on the back of the bell resonator. The direction of adjustment is stamped near the adjusting nut or screw.

4.02 The KS-16301, List 4 (single-stroke bell) uses a cotter key volume adjustment. The signal is shipped with the key inserted through the lowest of the three holes in the sleeve that contains the plunger for maximum volume. To decrease volume, move cotter key to intermediate or top hole in the sleeve (Fig. 8).

4.03 Replace defective signals with complete list number.

Relays, KS-16301

4.04 The Lists 15, 16, and 17 relays should meet the following requirements:

- The armature should not chatter when the relay is operated with the specified voltage.
- The armature should not bind or stick; gauge by feel.



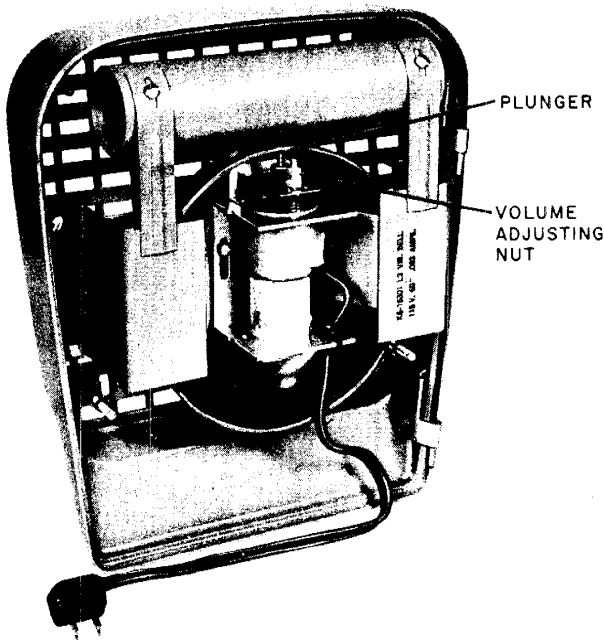


Fig. 7—KS-16301, List 3 Bell—Vibrating

- The armature airgap is adjusted on Wheelock Signal Company relays by moving a lever on the bottom of the relay.
- In Sperti-Faraday Company relay, the armature airgap is adjusted by rotating the armature airgap adjusting screw 1/2 turn to the desired setting.
- Minimum contact pressure is 6 grams, measured with relay operated either electrically or manually; use 70H gauge.
- The contacts should make almost simultaneously; gauge by eye.
- The armature and pole piece should be free of dirt or metal filings. Clean with 1/2-inch relay cleaning strips or equivalent.

4.05 List 15 relays used as a ringing bridge should not chatter on dial pulsing enough to cause the contacts to make. Check position of HI or LO sensitivity adjustment, ie, HI for long loop or LO for dial area. If relay meets all requirements but chatters on dial pulsing, replace in accordance with local instructions.

**KS-8229 Signal Chime**

4.06 The volume of the KS-8229 signal chime may be adjusted by a screw (Fig. 9). No other adjustment should be made. Should the plunger stick in its guide, remove plunger and clean with mineral spirits. If this does not correct operation, replace signal.

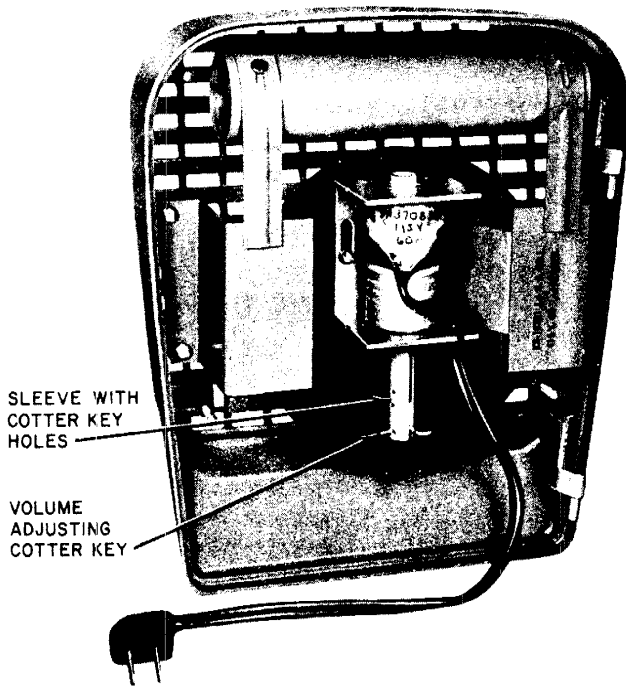


Fig. 8—KS-16301, List 4 Bell—Single Stroke

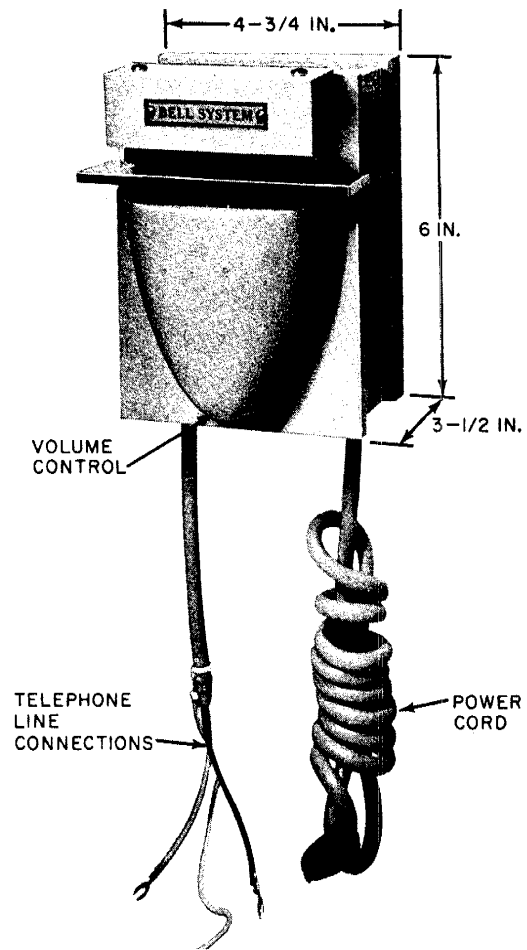


Fig. 9—KS-8229 Signal Chime

## AUXILIARY SIGNALS CONNECTIONS

### 1. GENERAL

**1.01** This section describes and illustrates typical connections for power relays and auxiliary signals.

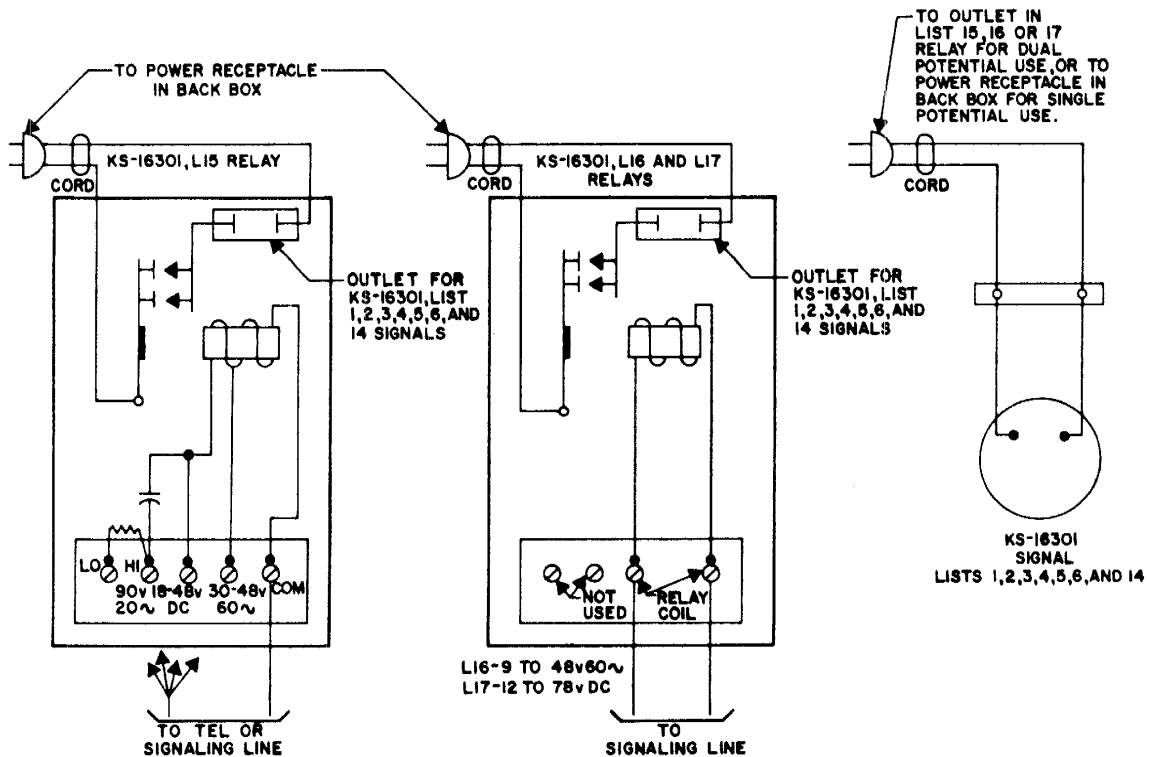
**1.02** This section is reissued to show that the control relay contacts are now in parallel in the circuit.

**1.03** Certain auxiliary signals and power relay sets for use on telephone lines are equipped with a 0.5- or 0.45-mf capacitor in series with a relay which operates on telephone ringing current. The relay and capacitor constitute a high-impedance ringing bridge which is subject to provisions of the section covering ringing bridge limitations.

**1.04** The total number of auxiliary signals connected to a power relay set should not exceed the current carrying capacity of the relay contacts. Individual signal-operating currents are covered in the section on auxiliary signals identification. Current carrying capacity of power-relay set contacts are covered in the section on power relay sets.

### 2. CONNECTIONS

**2.01** Connections for KS-16301 signals and relays are shown in Fig. 1.



**Fig. 1 - KS-16301 Signal and Relay**

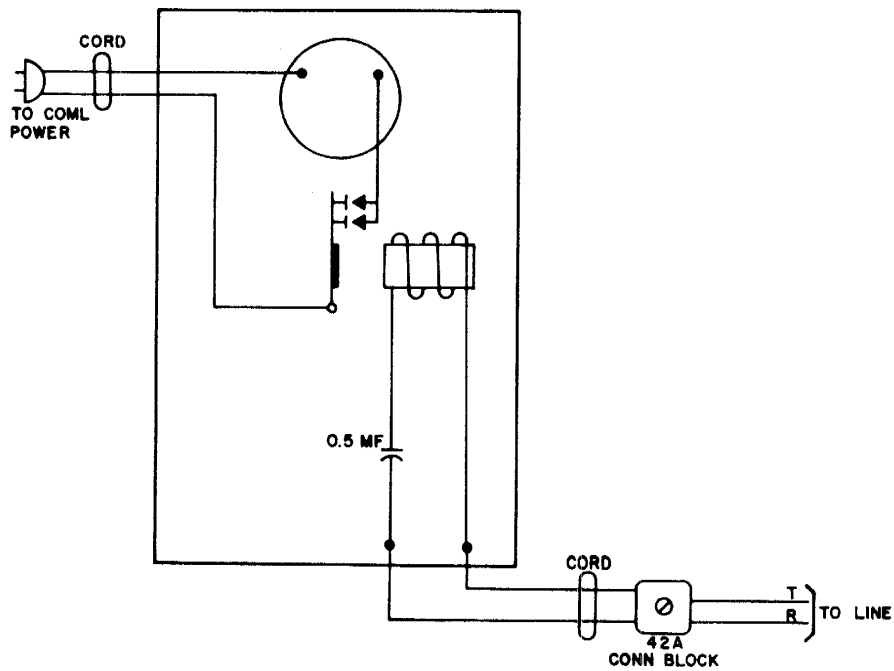
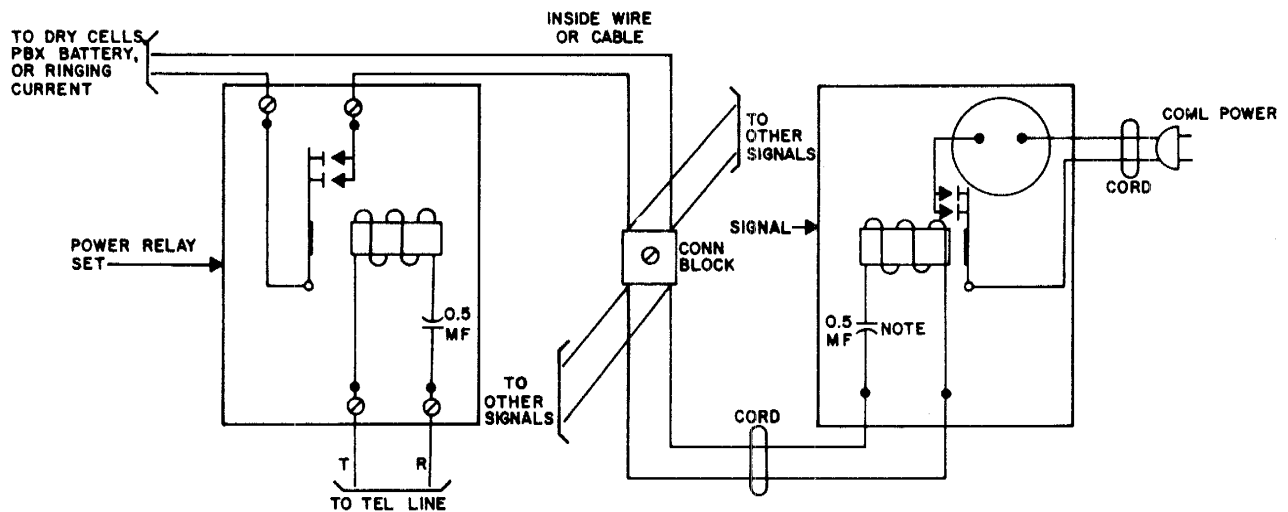


Fig. 2 - Typical Relay Equipped Signal

2.02 Connections for typical relay equipped signals are shown in Fig. 2.

2.03 Several signals may be connected as shown in Fig. 3. This has the advantage of only one ringing bridge on the telephone line for several auxiliary signals. Special commercial power wiring is not needed between relay set and signals.



NOTE: SIGNALS DESIGNED FOR USE WITH DC DO NOT CONTAIN A CAPACITOR.

Fig. 3 - Multiple Signal

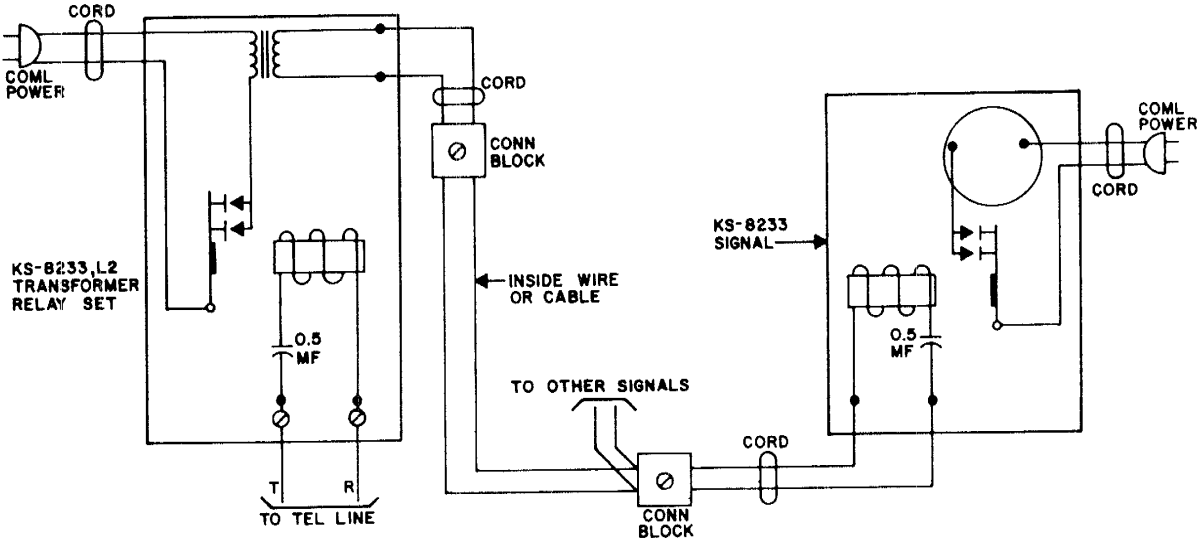
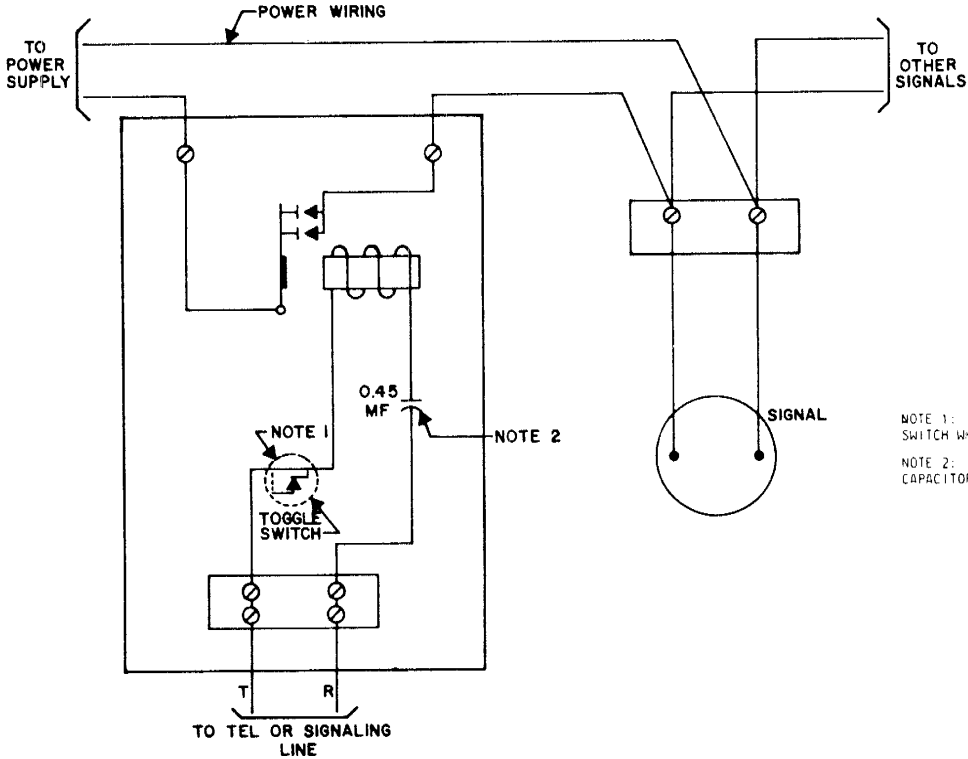


Fig. 4 - KS-8233, L2 Transformer Relay Set

2.04 The KS-8233, L2 transformer relay set has been used to connect several signals to one telephone line, as shown in Fig. 4. This may be encountered in some existing installations.

2.05 Connections for signals which do not have a self contained power relay are shown in Fig. 5. These signals require commercial power wiring between relay set and signal.



NOTE 1: LIST 9 RELAY IS EQUIPPED WITH A TOGGLE SWITCH WHICH WILL DISCONNECT RELAY FROM LINE.  
 NOTE 2: LIST 11 AND 12 RELAYS DO NOT CONTAIN A CAPACITOR.

Fig. 5 - KS-16626 Power Relay Set

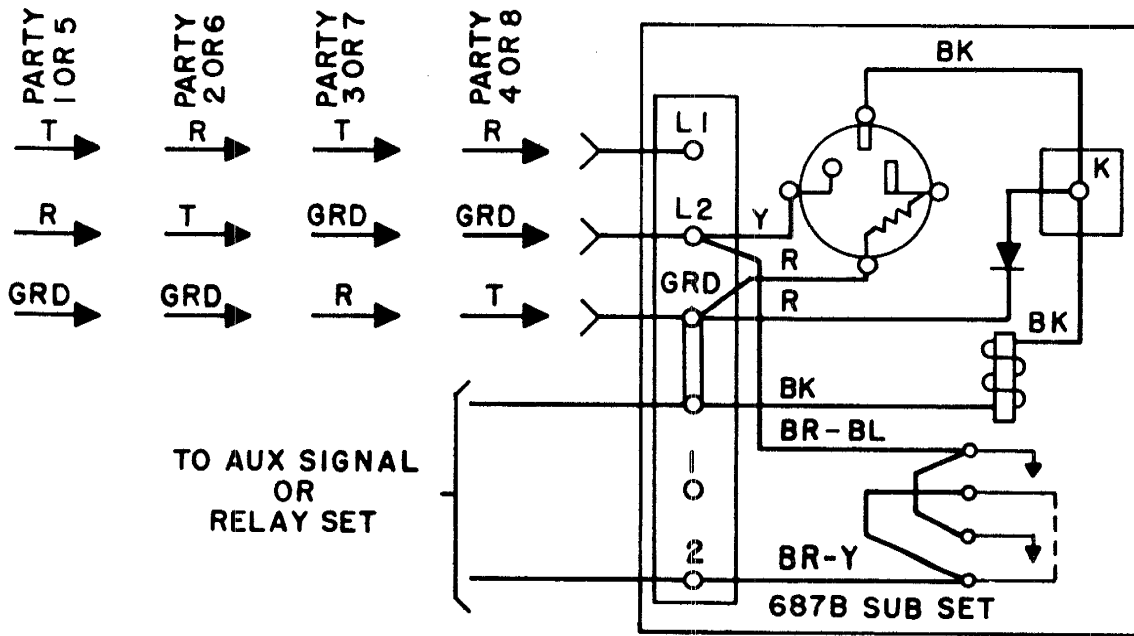


Fig. 6 - Auxiliary Signals on Party Lines

2.06 Auxiliary signals may be installed on 4-party full selective or 8-party semiselective lines by connecting a 531C or 687B subscriber set as shown in Fig. 6.

2.07 Connections for noncontinuous low voltage signals such as bells, buzzers, and lamp indicators are shown in Fig. 7.

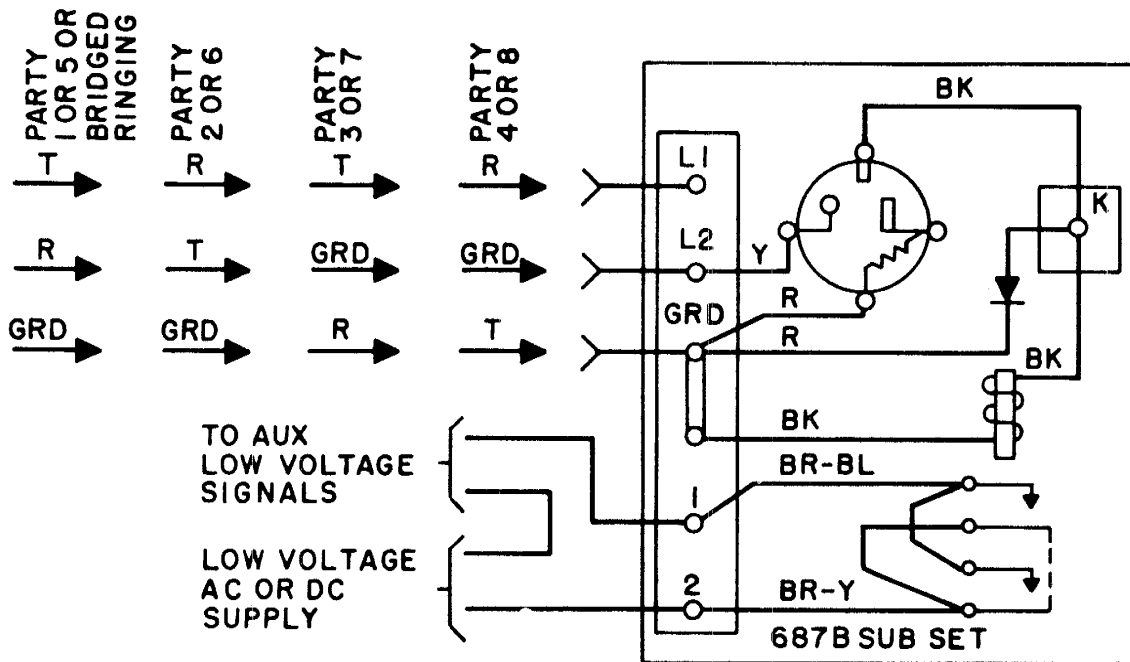


Fig. 7 - Noncontinuous Low Voltage Auxiliary Signals

**2.08** Continuous operating signals, either low voltage or power operated, should be connected as shown in Fig. 8. Low voltage signals connect directly to the 15C key telephone unit.

### 3. CIRCUIT OPERATION

**3.01** The circuit operates as follows (Fig 8):

- (a) Ringing current applied to line operates R relay through its secondary winding, through top contacts 1 and 2 of SR relay to ground.
- (b) R relay locks operated by battery through its primary winding, through its own top contacts 1 and 2, through bottom contacts 3 and 2 of SR relay, through bottom contacts 1 and 2 of TO relay (Z wiring) to ground, or to switch to ground (Y wiring).
- (c) R relay operated completes circuit through its own top contacts 3 and 4 to operate auxiliary relay or signal.
- (d) Bottom contacts 1 and 2 of R relay may be used to operate a line lamp indicator.
- (e) When call is answered, B relay operates by central office or PBX battery through station.
- (f) SR relay operates by battery through its winding through contacts of B relay (operated), and through bottom contacts 1 and 2 of TO relay to ground (Z wiring).
- (g) Operation of SR relay opens locking circuit of R relay which releases.
- (h) Circuits to auxiliary signal and line lamps open when R relay releases.
- (i) Unanswered calls are handled by a time-out feature. When R relay operates, ground is connected through bottom contacts 3 and 4, through 112-ohm heater winding of TO relay (Z wiring), and through top contacts 3 and 2 of TO relay to battery. After approximately 30 seconds, thermally operated bottom contacts 1 and 2 of TO relay will open. This opens locking circuit of R relay, and circuit restores to normal.
- (j) If call is answered, SR relay operates as previously described. Circuit is completed from battery through TO relay, through bottom contacts 1 and 2 of SR relay (operated), and through bottom contacts 1 and 2 of TO relay to ground. This opens heater winding circuit of TO relay.

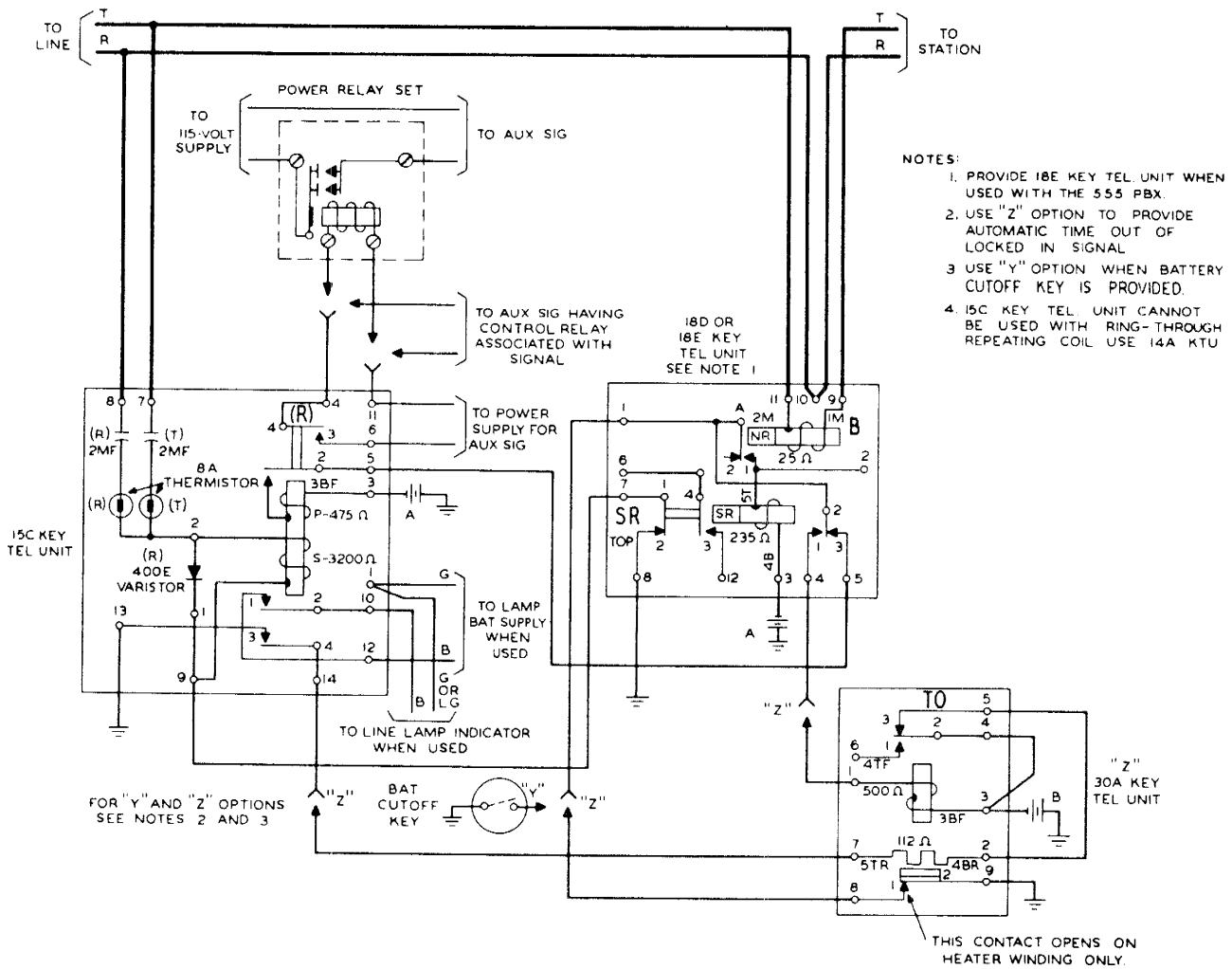


Fig. 8 - Connections and Circuit Operation for Continuous Auxiliary Signals



## RINGING BRIDGE LIMITATIONS

### 1. GENERAL

1.01 This section covers maximum number and types of ringing bridges which may be employed for various service arrangements.

1.02 This section is reissued to add:

- ANI (Automatic Number Identification).
- New ringers.
- F1A ringer—chime condition.
- G-, M-, and N-type ringers.
- Additional information affecting ringing bridges.

1.03 General information defining types of service and types of ringing bridges is included.

1.04 Ringing bridge limitations for special services are subject to SD drawings and section covering specific equipment involved.

### 2. CLASSIFICATION

2.01 Ringers are classified in two groups:

- (a) High impedance — having a total dc coil resistance of 2500 ohms or more.
- (b) Low impedance — having a total dc coil resistance of less than 2500 ohms.

2.02 Ringing bridges are also classified in two groups:

- (a) High impedance — consisting of one high-impedance ringer in series with a capacitor of 0.4 to 0.65 uf (microfarads).

- (b) Low impedance — consisting of one low-impedance ringer in series with a capacitor of 1.0 or 2.0 uf microfarads).

2.03 Ringing bridges are also classified as:

- (a) Capacitor type—using a capacitor in series with a ringer.
- (b) Tube type — using a cold cathode electron tube in series with a ringer.

### 3. NONPOLARIZED RINGING

3.01 Any ringing system where ringing selectivity is not provided, or is accomplished by means other than polarized ringing current is classified as nonpolarized.

3.02 Individual line bridged ringing (Fig. 1) consists of a ringer, in series with a capacitor, bridged across the line.

3.03 Two-party full selective ringing (Fig. 2) is accomplished by connecting a ringer, in series with a capacitor, from each side of the line to ground.

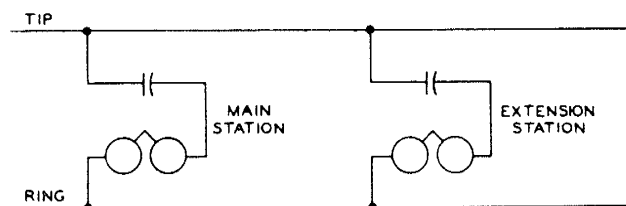


Fig. 1 — Individual Lines — Bridged Ringing

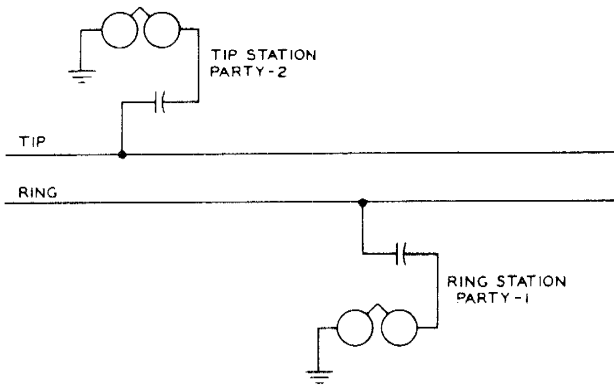


Fig. 2 — Two-Party Full Selective Grounded Ringing

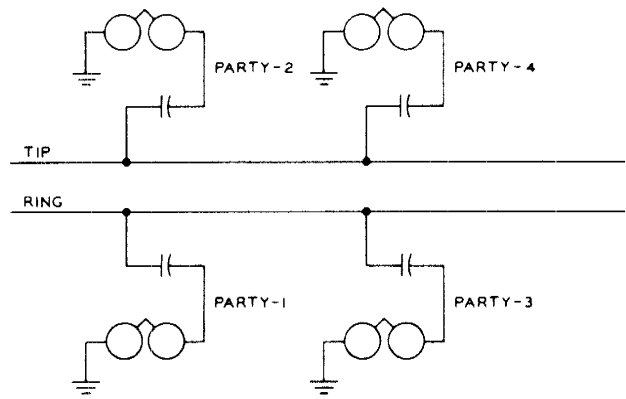


Fig. 3 — Four-Party Semiselective Grounded Ringing

**3.04** Four-party semiselective ringing (Fig. 3) is accomplished by connecting the capacitor ringing bridges of two stations from each side of the line to ground. Code ringing is used to differentiate between stations on same side of line.

**3.05** Multiparty divided code ringing is accomplished by same method employed for 4-party semiselective ringing. On a full line, one half the ringing bridges are connected between one side of the line and ground.

**4. POLARIZED RINGING**

**4.01** This is any ringing system which accomplishes ringing selectivity through ringing bridges which are connected, poled, and biased to operate on a particular polarity ringing current.

**4.02** Four-party full selective or 8-party semiselective ringing (Fig. 4) is accomplished by using sets employing a cold cathode electron tube in the ringing circuit.

**4.03** Tube and ringer at the station are connected and poled to operate on only positive or only negative superimposed ringing supply.

**4.04** One code—two code ringing signals, used as required, alert desired station.

**5. MAGNETO RINGING**

**5.01** This is a ringing system employing ac (alternating current) to operate ringers.

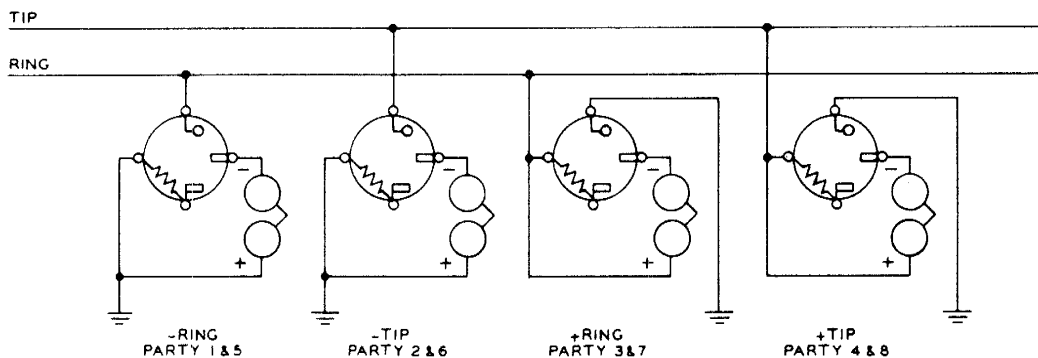


Fig. 4 — Four-Party Full Selective and Eight-Party Semiselective Tube Type Ringing Bridges

**5.02** Four-party selective ringing is accomplished by employing two oppositely poled biased ringers connected directly from each side of the line to ground. Series capacitors are not used.

**5.03** Ringing is accomplished by applying correctly poled pulsating current between one side of the line and ground.

## **6. RINGING BRIDGE LIMITATIONS**

**6.01** The following information covers limitations on number and type of ringing bridges used on:

- Individual lines.
- 2-party full selective lines.
- 4-party semiselective lines.

**6.02** Table A lists various ringing bridge components. Table B lists the maximum number of ringing bridges permitted per main station for each class of service.

**6.03** Where high-impedance ringers are used on grounded ringing lines to limit inductive noise, it is necessary to limit the unbalance between the two sides of the line.

**6.04** Table C lists figures as units of unbalance. These may be applied to ringing bridges to determine balance between two sides of the line.

**6.05** Unbalance between two sides of a line shall not exceed three units. (See Table D.)

**6.06** The following information covers maximum number of ringing bridges which may be employed for various central office arrangements providing the following services:

- 4-party full selective.
- 8-party semiselective.

- Divided code.

- 4-party semiselective lines using tube type ringing bridges to combat inductive interference.

**6.07** Table E outlines ringing bridge limitations for:

- (a) 4-party full selective and 8-party semiselective service using tube type ringing bridges.
- (b) Divided code ringing service using capacitor ringing bridges.
- (c) 4-party semiselective and divided code ringing service using tube ringing bridges to combat inductive noise.

**6.08** The 4-element cold cathode electron tubes may be substituted for 3-element tubes where inductive voltages are high enough to break down starter gaps and cause noise (sputtering). See section covering inductive noise. The use of 4-element tubes in no way alters the number of ringing bridges permitted.

**6.09** If required, the 687B subscriber set may be used to increase the number of ringing bridges per polarity on each side of the line.

## **7. APPLICATION OF 687B SUBSCRIBER SET**

**7.01** The 687B subscriber set may be employed to advantage if:

- (a) It is necessary to accommodate a greater total number of ringers than those allowed on first line of A in column 1, Table E.
- (b) The minimum loop requirements to avoid pretripping cannot be met.

**7.02** The 687B subscriber set has a cold cathode tube and a relay in place of a ringer. When the relay is operated, the signal contacts may be used in any of the following combinations:

- (a) To connect one or two high-impedance capacitor ringing bridges to the line.

- (b) To control a signal or other apparatus energized from a local low voltage source.
- (c) To connect one high-impedance capacitor ringing bridge as well as control locally energized apparatus.

**7.03** For connection of 687B subscriber set, refer to section on subscriber sets, ringers, and relay type polarized ringing.



*There is one important restriction on the use of this subscriber set. When such a set is used at a given station to connect one or two high-impedance capacitor ringing bridges to the line, a similar set must be used at any other station of the same polarity on same side of the line.*

**7.04** Fig. 5 and 6 show examples of 687B subscriber set application to an 8-party semi-selective line with no inductive interference.

**7.05** To install extension ringer at party 5 (Fig. 6), use 687B subscriber set at party 5 and party 1.

**7.06** The condition illustrated in Fig. 6 gives four negative, tube controlled, high-impedance capacitor ringing bridges on the ring side of the line.

**7.07** To install an extension at positive party 7 (Fig. 6), use 687B subscriber set at both party 7 and party 3.

**7.08** These arrangements are necessary because the tube and relay of the 687B subscriber sets plus the high-impedance capacitor ringing bridges under their control presents a lower impedance to the line than does a single tube type ringing bridge. This deprives the regular tube ringing bridge of same polarity of necessary ringing current for proper operation.

**7.09** Where no capacitor ringing bridges are involved, it is not necessary to change other tube ringing bridges of the same polarity on the same side of line when signals are added.

## 8. SPECIAL RINGING BRIDGE LIMITATIONS

**8.01** Deduct one ringing bridge from the allowable number for each of the following associated with other audible or visual signal:

- Intercept line.
- Peatrophone.
- 3-, 4-, and 6-inch gongs.
- Neon lamp.
- Control equipment.

**8.02** Deduct two ringing bridges on individual or 2-party lines, and one ringing bridge on 4-party lines from allowable number for each:

- Automatic answering and recording set.
- Automatic answering set.

**8.03** Each audible signal (R) relay associated with a wiring plan (1A, 1A1, 1A2) is equivalent to two high-impedance ringers.

**8.04** Not more than two high-impedance ringers may be connected to a wiring plan line circuit.

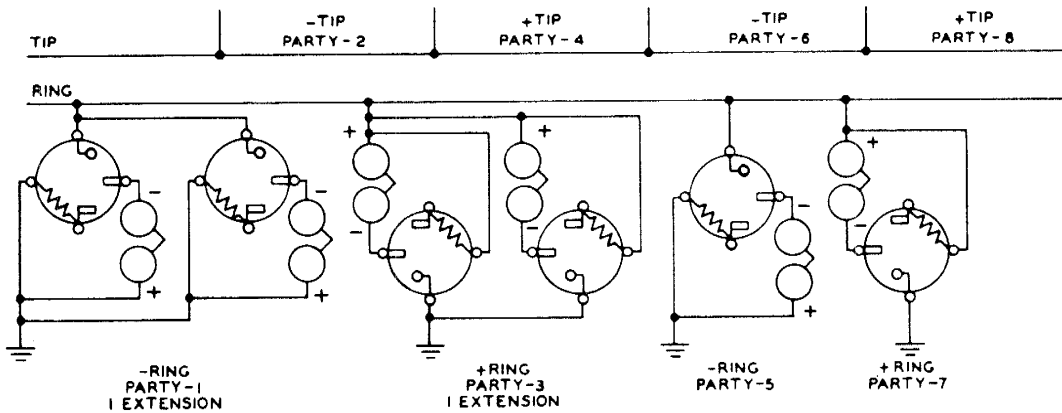
## 9. F1A RINGER IN CHIME CONDITION

**9.01** The chime feature is obtained by rectifying ac ringing current with an integral half-wave rectifier and applying the dc to the ringer coil. One gong is struck as ringing voltage is applied and the other gong as ringing voltage is removed.

## 10. AUTOMATIC NUMBER IDENTIFICATION

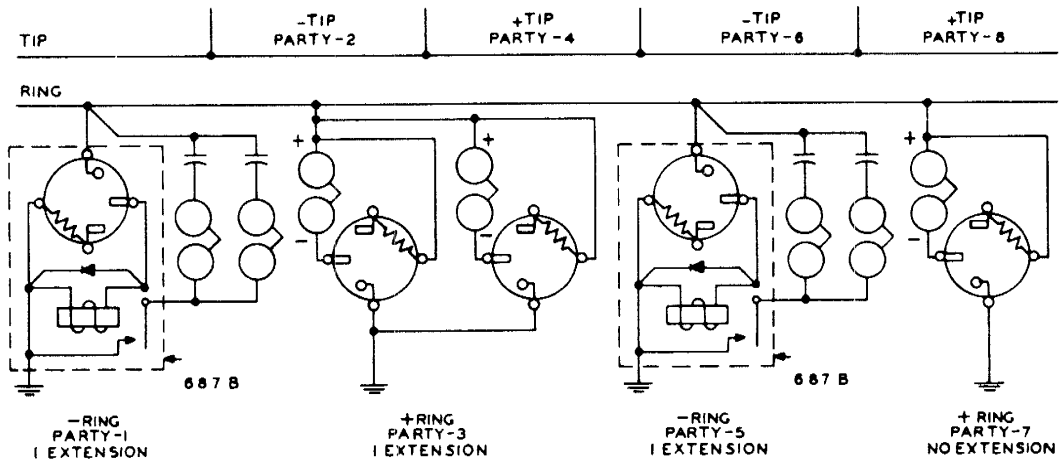
**10.01** The dc resistance required for party identification has been established at 1000 and 2650 ohms.

**10.02** Where space permits, a split coil of 1000-ohm and 2650-ohm segments is used. This type ringer provides a mechanical advantage in connecting the ringer in the telephone set.



**Note:** Party 1 has one extension ringer = Total of 3 negative bridges on ring.  
 Party 3 has one extension ringer = Total of 3 positive bridges on ring.  
 Party 2 or 6 could have one extension ringer = Total of 3 negative bridges on tip.  
 Party 4 or 8 could have one extension ringer = Total of 3 positive bridges on tip.  
 = Total of 12 ringing bridges on line.

**Fig. 5 – Application of Extension Ringers**



**Fig. 6 – Application of 687B Subscriber Set**

**SECTION 500-114-100**

**10.03** Smaller ringers (G, M, and N types) utilize a single coil of fine wire tapped out at 1000 ohms and 2650 ohms. The additional turns required for ringer operation appear in a third segment of the coil between the slate-red and red leads.

**10.04** Fig. 7 shows schematic diagrams and connection information for various ringers as adapted to available services.

**TABLE A – RINGING BRIDGE COMPONENTS**

Ringers		Impedance		DC Coil Resistance			Microfarads Capacitance
Type	Code	Low	High	Low	High	Total	
B1	A,* D, E,* F, AA,* AB, AL		•	2300	2300	4600	0.5
B2	A,* AL		•	960	3640	4600	0.5
B3	A†	•		1000	1000	2000	Tube
B4	A	•		510	510	1020	2.0
C2	A*		•	1000	2650	3650	0.45
C3	A*	•		2075		2075	2.0
C4	A		•	1000	2650	3650	0.45
C5	A		•	1000	2650	3650	0.45
D1	A, B, C, D, E		•	1000	2650	3650	0.45
E1	A, B, C, D		•	1000	2650	3650	0.45
F1	A		•	1000	2650	3650	0.45
G1	A, B		•	1000	2650	3650	0.45
H1	A		•	1000	2650	3650	0.45
J1	A		•	1000	2650	3650	0.45
L1	A		•	1000	2650	3650	0.45
M1	A†		•	1000	2650	3650	0.45
M2	A†		•	1000	2650	3650	0.45
N1	A		•	1000	2650	3650	0.45
P-	(Trimline Sets) ‡		•	1000	2650	3650	0.45
392	J*	•		500	500	1000	1.0
392	L*		•			2500	0.5
KS-16626	L8, L9, L10, L13, L1,* L2,* L3,* L6*		•			4500	0.45-0.5
KS-16626	L14,† L7*†	•				1100	
KS-8227			•			4660	0.5
KS-8228			•			4660	0.5
KS-8229			•			4660	0.5
592	A*		•			4600	0.5
21A	Indicator		•				0.5 Equiv
687	B†		•				

\* Rated Manufacture Discontinued (MD).

† Indicates ringer used with cold cathode tube.

‡ Ringer is used in Trimline sets (have an F- number at present).

**TABLE B**  
**MAXIMUM NUMBER OF RINGING BRIDGES PERMITTED PER MAIN STATION**

Class of Service	Total Ringing Bridges				
	High-impedance Bridges			Low-impedance Bridges	
	Capacitors				
	0.45 uf	0.5 uf	0.5 to 0.65 uf	1 uf	2 uf
Individual Line, PBX Station (except as below); 2-party Selective Flat and Message Manual; 2-party Selective Flat Dial (without Tip Party Identification); Coin Collectors	5	4	4	0	0
	2	2	2	1	0
	0	0	0	2	0
	0	0	0	0	1
PBX Stations for Night and through Dial Connections when there is an AC Bridge in PBX Trunk or Cord Circuit	4	3	2	0	0
	2	1	1	1	0
2-party Selective Flat and Message Dial and Tip Party Identification. See Note	5	4	0	0	0
	2	2	0	0	0
	0	0	0	2	0
4-party Semiselective	3*	2	2	0	0
	0	0	0	1	0

**Note:** Tip party identification requirements:

- In crossbar automatic message accounting, zone registration, and/or message rate 2-party service, a 1000-ohm ground from the tip party in dial areas.
- In step-by-step automatic ticketing, step-by-step with AMA, and modified crossbar with AMA, a 3640-ohm ground (B-type ringer) or 2650-ohm ground (C-type ringer) from tip party flat rate service.
- If high-impedance ringers are used in these central office areas, only B2A, C2A, or C4A ringers may be installed. High-impedance ringing bridges other than those mentioned above may be used as extension ringers when they are not required for tip party identification.

\* Four-party semiselective service may have one additional ringing bridge at one station on either side of the line when all ringers on the side of the line involved are C type.

**TABLE C**  
**UNITS OF UNBALANCE**

High-impedance Ringing Bridges Continually Connected to Ground	Units of Unbalance
Electron Tubes Used to Control Signals	0
Indicator — 21A	0
Ringer — Plain Coil Cover	1
Ringer — Red Stripe Coil Cover	2
KS-Type Ringers	1
592A Ringer — Red Stripe Coil Cover	2

**TABLE D**  
**EXAMPLE — LINE UNBALANCE**

Stations on Line	Tip Side	Ring Side
First Station	1 C4A Ringer	2 C4A Ringers
	= 1 Unit	= 2 Units
Second Station	1 C4A Ringer	3 C4A Ringers
	= 1 Unit	= 3 Units
Total	2 Units*	5 Units*

\* 3 units — Maximum Allowable Unbalance.

TABLE E

RINGING BRIDGE LIMITATIONS FOR 4-PARTY FULL SELECTIVE, MULTIPARTY LINES AND LINES USING TUBE TYPE RINGING BRIDGES TO COMBAT INDUCTIVE INTERFERENCE

Central Office Ringing Arrangement	(1) 4-party Full Selective and 8-party Semi-selective Service (Tube type Ringing Bridges)					(2) Divided Code Ringing Service (Capacitor Ringing Bridges)*			(3) 4-party Semi-selective and Divided Code Ringing Service (Tube Ringing Bridges Used to Combat Inductive Interference, AC-DC Ringing)		
	Maximum Number of Ringing Bridges				Total on Line	Maximum Number of Ringing Bridges		Total on Line	Maximum Number of Ringing Bridges		Total on Line
	Ring		Tip			Ring	Tip		Ring	Tip	
	+	-	+	-	+			-			
A Ringing Current through Trip Relay	3	3	3	3	12†‡	5	5	10			
	4	4	4	4	16**						
B Ringing Current through a 220-ohm Resistor, Trip Relay in Ground Return Side	4	4	4	4	16	5	5	10	6	6	12
C Ringing Current through a 13D Lamp, Trip Relay in Ground Return Side	6	6	6	6	24	5	5	10	6	6	12
D Long Line Circuit Arranged to Repeat Ringing through a 13G Lamp, Tripping During Silent Interval Only††	6	6	6	6	24						
E Manual Ringing through 13D Lamps or Lower Resistance	6	6	6	6	24	10	10	20	6	6	12

\* C-type ringers are required on dial lines to meet maximum nominal value capacity limits.

† 300-ohm minimum loop resistance is required to prevent pretrip if more than two ringing bridges per polarity are used on the same side of the line.

‡ Three tubes of each polarity on each side of the line is the maximum unless auxiliary circuits or equipment are employed.

\*\* The use of 687B subscriber sets makes possible the use of four tube-controlled capacitor ringing bridges for each polarity on each side of the line. Not more than two 687B subscriber sets per polarity may be used on each side of the line.

†† This long line equipment does not provide for additional ringing bridges in all cases, but does appreciably increase the ranges at which the same number of ringing bridges will operate.



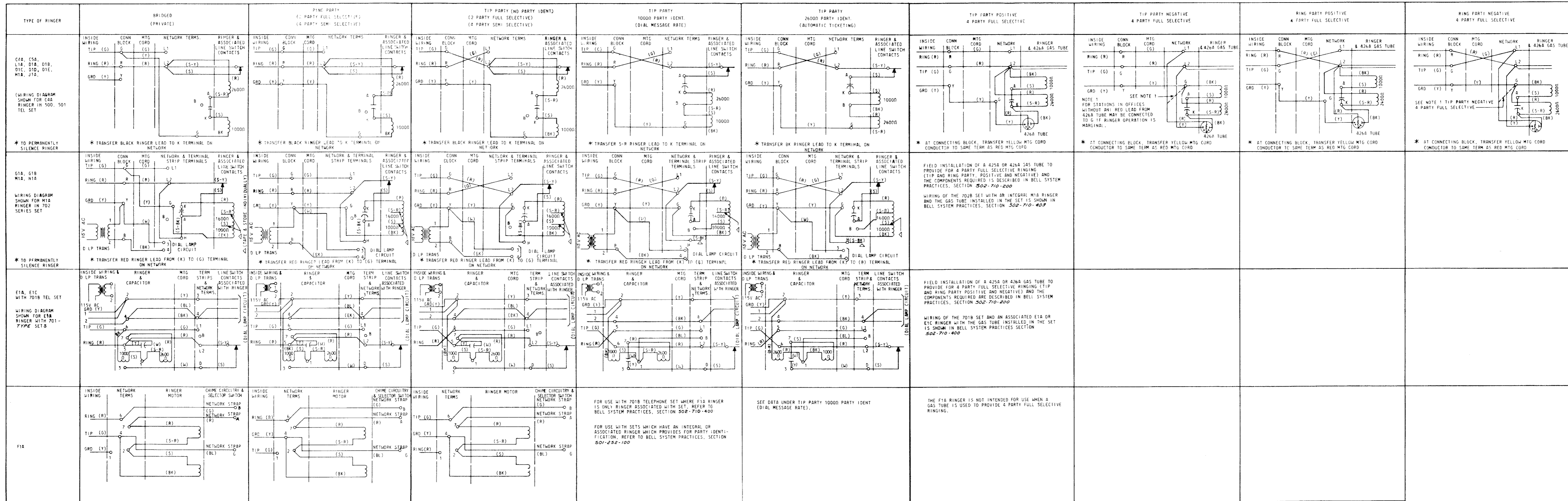


Fig. 7 - Ringer Connection Information



SPECIAL CONNECTIONS FOR TELEPHONE SETS AND SUBSCRIBER SETS  
USING 3-ELEMENT ELECTRON TUBES IN RINGING CIRCUIT

1.00 INTRODUCTION

This section is issued:

- To give 3-element tube connections at negative ring and tip parties of 4-party full selective and 8-party semiselective lines in step-by-step offices with Automatic Number Identification (ANI).

2.00 GENERAL

- 2.01 Connect R lead from 426A tube to L1 on all negative ring and tip parties at 4- and 8-party stations. This bridges the control gap of the tube across the line and prevents bell tap and possible false test for tip party.
- 2.02 Fig. 1 shows these tube connections using the 556-type telephone set as an example.

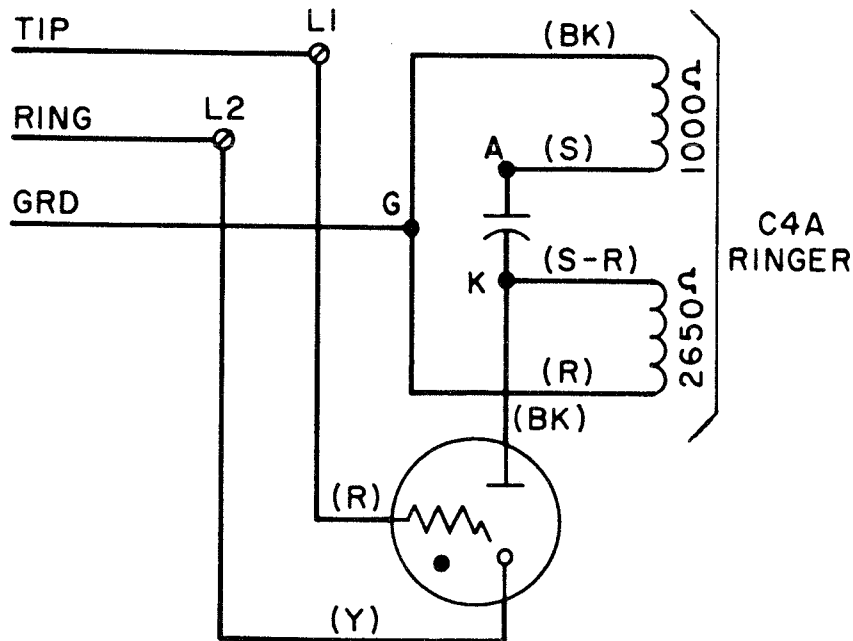


Fig. 1 - Tube Connections for 556-Type Telephone Set at Negative Ring Station

**SECTION 500-115-400**

2.03 The connection information given here will be included in the following sections when they are reissued.

- 502-200-401 Subscriber Sets - 634AT - Common Battery - Induction Coil Type - Connections
- 502-200-406 Subscriber Sets - 686A - Common Battery - Network Type - Connections
- 502-210-401 Subscriber Sets - Ringer and Relay Types - Polarized Ringing - 531C, 534DT, 592C, 687B - Common and Local Battery - Connections
- 510-110-405 Subscriber Sets - 634YT - Local Battery - Connections
- 510-110-408 Subscriber Sets - 634YDT - Local Battery - Connections
- 502-400-404 Telephone Sets - 306A, C, 5306C (Tube Sets) - Common Battery - Connections
- 502-400-406 Telephone Sets - 306G (Tube Set) - Common Battery - Connections
- 510-130-401 Telephone Sets - 309A, C - Local Battery - Connections
- 502-400-411 Telephone Sets - 356A, C (Tube Sets) - Common Battery - Connections
- 502-510-401 Telephone Sets - 500C, D and 501C, D - Common Battery - Connections
- 502-510-402 Telephone Sets - 500E, F and 501F - (Plunger Switch to Prevent Party-Line Interference) - Common Battery - Connections
- 502-510-403 Telephone Sets - 500H (Illuminated Dial) - Common Battery - Connections
- 502-510-406 Telephone Sets - 500P and 501P - (Illuminated Dial) - Common Battery - Connections
- 502-510-408 Telephone Sets - 500U and 501U - (Illuminated Dial and Night Light) - Common Battery - Connections
- 502-520-402 Telephone Sets - 532A, B and 533A, B - (Amplifier Sets for Impaired Hearing) - Common Battery - Connections
- 502-520-400 Telephone Sets - 507A, B; 509A, B; 557A, B; and 559A, B - (Amplifier Sets for Long Loops) - Common Battery - Connections
- 502-510-410 Telephone Sets - 554A, B and 556A, B - Common Battery - Connections
- 502-710-400 Telephone Sets - 701B - Connections
- 502-710-401 Telephone Sets - 701D - Connections
- 502-410-400 Telephone Sets - 300, 325 Types - Outdoor Locations - Connections

## STATION SETS AND APPARATUS FOR SPECIAL APPLICATIONS

### SELECTION

#### 1. GENERAL

1.01 This section is reissued to:

- Include information formerly contained in Section 500-126-100 which is hereby canceled
- Delete reference to telephone sets *not* for general use
- Add new telephone sets, apparatus, uses, and features
- Combine and expand information on telephone sets, apparatus, and equipment for use by the handicapped (Table D)
- Change title

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.02 For transmission zoning requirements, refer to Section 500-110-100.

1.03 For selection information on station sets for general use, refer to Section 500-122-180.

#### 2. SELECTION

2.01 For available apparatus and color information, refer to Section 500-120-100.

#### TABLE INDEX

- A — 2-Piece Sets for Specific Use
- B — Telephone Sets and Apparatus for Specific Use
- C — Telephone Sets With Specific Feature
- D — Apparatus for Handicapped Subscribers

TABLE A

2-PIECE SETS FOR SPECIFIC USE

SPECIFIC USE OR FEATURE	TYPE OF HAND TELEPHONE SET
755A PBX	212L
1- or 3-type speakerphone	211*N, P

\* Used with 685A subscriber set.

TABLE B

TELEPHONE SETS AND APPARATUS FOR SPECIFIC USE

SPECIFIC USE	TYPE TELEPHONE SET	
	ROTARY DIAL (OR APPARATUS)	"TOUCH-TONE" <sup>®</sup> DIAL
CALL DIRECTOR <sup>®</sup> Telephone Set	608, 618, 619, 625, 630* series, 682A, 683A	1630 and 2630 series
Card Dialer	660A, 662A, 663A, 664A	1660 and 2660 series
Data Service	503B, 513B, 567PB*, 569NB	
Elevator or Portal	322	

**TABLE B (Cont)**  
**TELEPHONE SETS AND APPARATUS FOR SPECIFIC USE**

SPECIFIC USE	TYPE TELEPHONE SET	
	ROTARY DIAL (OR APPARATUS)	"TOUCH-TONE" <sup>®</sup> DIAL
Emergency Reporting	570 (Section 502-550-100) 695A Subscriber Set (for outdoor), 1A Telephone Reporting Set	
Explosive Atmosphere	320, KS-14476, KS-14548, 502A/B	
Head Telephone Set	514B 563HB* 608C, 618B  638C, 639D 663A 664A 682A and 683A	1514B 1563HB 1636C, 1637D, 1638C, and 1639D  1663B 1664A  2636C, 2637D, 2638C, 2639D, 2664A
Hotel-Motel PBX	543DB	
Mines or moist locations with nonexplosive atmosphere	KS-19148	
Noisy Locations	500-type telephone set provided with booth or enclosure	
	535A/B	
	G8 handset used with 500 series sets	
	No. 9797 (confidencer) transmitter fits F-type handset, transmission level below regular telephone transmitter	
	KS-16664, List 1 transmitter, fits G-type handset, transmission level below regular telephone transmitter	
One Number Dialer	43A	
Outdoor Location	325M/N, 525A/B 965A subscriber set	
Panel, Recess Mounted	750 series	1750 and 2750 series

**TABLE B (Cont)**  
**TELEPHONE SETS AND APPARATUS FOR SPECIFIC USE**

SPECIFIC USE	TYPE TELEPHONE SET	
	ROTARY DIAL (OR APPARATUS)	"TOUCH-TONE" <sup>®</sup> DIAL
Party Line Interference (Section 500-112-100) (Section 501-375-100)	302AA*, 302AC*, 306G*, 500E, F*; 501F*	
Radio Broadcast Lineup	331-	
Radio Frequency Interference (telephone sets modified for)	(Section 500-150-100)	
Wall Mounted	550 series 851A	1550 and 2550 series 2851A
2-Line Service	511-, 558- 515B, 555B 711B*, 712B, 713B	1510F, 1511, 1558D 1515B, 1555B 1712B 2511F, 2515B, 2558B, 2660A, 2712B
2-Wire/4-Wire	500AD 568HB*, HF*, HI*, HR 608A*/B, 618A*/B, 625A, 665A, 682A, 683A	1568HT* 1580A, 2580A
755 PBX	Key station: 462AC*, 466AC* 566MB*, 566MD  Keyless station: 500 and 700 series TRIMLINE (220A)	TRIMLINE <sup>®</sup> (1220A) 1500 series 1700 Princess <sup>®</sup> series 2660B 2700 Princess series

\* MD

**TABLE C**  
**TELEPHONE SETS WITH SPECIFIC FEATURES**

SPECIFIC FEATURE	TYPE TELEPHONE SET	
	ROTARY DIAL	"TOUCH-TONE" <sup>®</sup> DIAL
Customer adjustable ringer volume control	500, 600, 700, 5300, 5400 series; TRIMLINE (220A) and 300* series E/W P-10E100 ringer volume control assembly	1500, 1600, 1700 series  TRIMLINE (1220A), 2500, 2600 2700 series
Dial-In-Handset	TRIMLINE (220A)	TRIMLINE (1220A)

**TABLE C (Cont)**  
**TELEPHONE SETS WITH SPECIFIC FEATURES**

SPECIFIC FEATURE	TYPE TELEPHONE SET	
	ROTARY DIAL	"TOUCH-TONE" <sup>®</sup> DIAL
Exclusion plunger or Key	502A/B, 503B 511C/D 541* 545BA*, BB*, BBR, GBR, 552† 558CR, DR, F† 565GA*†, GB*†, GK† HA*†, HB*†, HK†, LA*†, LB*†, LD*†, LK† 568HB*, HR*, HT*, HF, HR 569NB, 711B* 712B 751A*, B*, C, D	1502B, 2502B, 1510F 1511D, F, H, 2511F/H 1543DB  1558D, 2558D 1565HK*†, LK†; 2565GK†, HK†, LK†  1568HT*  1712B, 2712B 1751C/D, 2751C/D
Extension cutoff  Extension ringer Cutoff  Internal Ringer Cutoff	410* 5400 series 510A/B 511A, B, C, F, H  558A, B, C, D 711B* 712B	1510F, 2510F 1511D†, 2511F/H 1515B, 1555B, 2515B, 2555B 1558D, 2558D  1712B, 2712B
Illuminated Dial	500H, P, U* 501P/U* 701, 702, 711, 713  TRIMLINE (220A)	1702B/D, 1712B, 1713B 2702B/D, 2712B, 2713B TRIMLINE (1220A)
Message waiting lamp	500W/Y 514B E/W D-17998 Kit of Parts 701D* 702D	1500Y, 2500Y   1702D, 2702D
Modular	Section 503-XXX-XXX	
Night Light	500U*, 501U* 701B*/D* 702B/D 711B* 712B 713B	1702B/D, 2702B/D  1712B, 2712B 1713B, 2713B
Repertory Dialer		1671A, 2671B1M



**TABLE C (Cont)**  
**TELEPHONE SETS WITH SPECIFIC FEATURES**

SPECIFIC FEATURE	TYPE TELEPHONE SET	
	ROTARY DIAL	"TOUCH-TONE" <sup>®</sup> DIAL
1A Home Interphone	S11C, D, F, H 558C, D, F 711B* 712B 750A/B 751A*, B*, C, D 752A/B 754A	1511D, F, H; 2511F 1558D, 2558D  1712B, 2712B 1750A/B, 2750A/B 1571A/B, 2751C/D 1752A/B, 2752A/B 2754A
1-Type Speakerphone (replaced by 3-type speakerphone)	211P/N (See Table A)  500R/S, 511C, D, F, H, 558C, D, F, 565G*, H*, L*, 566MB*/MD, 592A*/B*, 600 A*/B*, 601A*, 630A*, 631D, 632C, 656*, 711B*, 712B, 750A/B, 751A*/B	
2A Farm Interphone	511C, D, F, H 558C, D, F 711B* 712B	1511D, F, H; 2511F 1558D, 2558D  1712B, 2712B
3-Type Speakerphone	211N/P (See Table A) 500R/S 511C, D, F, H 558C, D, F 565G, HB, HDR, HK, LDR, L, MB 630D 631D 632C 634D 635D 661A* 662A 702B 711B* 712B 752A/B	1500S, 2500S 1511D, F, H; 2511F 1558D, 2558D 1565GK, HK, LK; 2565GK, HK, LK 1630D, 2630D 1631D, 2631D 1632C, 2632C 1634D, 2634D 1635D, 2635D  1662A/B, 2662A 1702B, 2702B  1712B, 2712B 1752A/B, 2752A/B

\* MD

† When separately ordered D-180243 Kit of Parts is adapted to telephone set.

‡ When separately ordered D-179935 Kit of Parts is adapted to telephone set.

**TABLE D**  
**APPARATUS FOR HANDICAPPED SUBSCRIBERS**

IMPAIRMENT	APPARATUS	REMARKS
Hearing impairment (See Section 500-128-180, Telephone apparatus for impaired hearing)	Bell Chime Ringer (F1A ringer)	Choice: musical chimes regular ring louder ring for greater distance (Section 501-252-100)
	Buzzer and Bells	When attached to sounding board such as desk panel, or bed headboard, produces penetrating sound. (Section 501-120-100)
	KS-14720, List 2 head telephone set	Bone conduction receiver (Section 501-225-100)
	G6-type handset	With transistorized receiver amplifier and handle level control (Section 501-211-102)
	Signal control unit (KS-16527, List 1 relay set or KS-16626, List 8 relay)	For indicating incoming call by turning on lamp or activating an alarm. (Section 463-120-100)
	S1A tone ringer	Concentrates all sound energy in frequency range where majority of persons with impaired hearing can still hear. (Section 501-260-100)
	Signal lamp (lamp indicators)	To indicate incoming call for use instead of, or in addition to regular telephone ringer. (Section 463-210-100)
	Tactile-Visual set§	Converts sound signals into sight signals (flashing-light) and touch signals (vibrating disk). Equipped with send button for Morse Code type transmission.*
	Watch case receiver	Allows a lip reader to use a regular telephone with the aid of another person using auxiliary telephone receiver to relay message.
	153B Amplifier	For use with a head telephone set by operators (Section 024-108-100)
6030A (MD) Key	111B amplifier contained in key — two operating positions — high and low. (Section 512-215-100)	
532A†, 532B† 533A†, 533B†	Telephone set with adjustable receiver amplification operated from CO line voltage using 151B amplifier. (Section 502-520-100)	

**TABLE D (Cont)**  
**APPARATUS FOR HANDICAPPED SUBSCRIBERS**

IMPAIRMENT	APPARATUS	REMARKS
Motion impairment	Card Dialer	Minimizes dialing errors. (Section 502-660-XXX and see Table B)
	KS-19796 head telephone set	Weighs less than 2 ounces with transistorized amplifier and selection of six plastic ear-piece sizes for comfortable fit.
	Low-torque rotary dial	Distribution house to modify 9-type dials by reducing number of motor spring pre-turns to one.
	Single button telephone (with adjustable arm to hold handset)	For persons unable to hold handset, adjustable arm holds handset in convenient position*
	School-to-Home Service (KS-19120 intercommunication system)	For children physically unable to attend school (Section 512-531-100)
	Speakerphone	Installed at conversational distance from caller, required effort is equal to holding conversation with person nearby.
	Tele-Class Services§	For handicapped student class physically unable to regularly attend class. System provides for maximum of 20 students who participate in classes from their individual homes or hospitals. Students are connected to control board by card dialing. Teacher control board designed for teacher to: <ul style="list-style-type: none"> <li>(a) Allow all students to hear teacher and each other.</li> <li>(b) Speak with each student privately.</li> <li>(c) Disconnect individual student while teacher hears and talks with class.</li> <li>(d) Divide class into small groups</li> <li>(e) Transfer half of class to second teacher in another location.</li> <li>(f) Plug-in tape recorder to present prepared information.</li> <li>(g) Teacher speakerphone for handfree conduct of lesson.*</li> </ul>
	Telephone set for head telephone use	Refer to Table B
	TOUCH-TONE service	Dialing with minimum effort
TRIMLINE telephone	Dialing while person is lying down with dial in handset.	

**TABLE D (Cont)**  
**APPARATUS FOR HANDICAPPED SUBSCRIBERS**

IMPAIRMENT	APPARATUS	REMARKS
Motion Impairment (cont)	4A key equipment	Used with handset. Requires only slight physical motion. Unit mounts on furniture or wall; includes separately mounted dial.
	52A-type head telephone set	Headset is adjustable to facilitate position of transmitter and receiver.
	53A-type head telephone set	When headband is removed, the unit becomes light weight handset.
Speech Impairment	Electronic Larynx (5-type artificial larynx)	Transmits substitute vibrations into the vocal tract 5A for men (low frequencies) 5B for women (high frequencies)*
	G7-type handset	With transistorized transmitter amplifier and handle level control (Section 501-211-102)
	507‡, 509‡, 536A‡, 536B‡, 557‡, 559‡	Telephone set with fixed transmitter amplification level. Intended for long loop applications.
Vision Impairment	Braille Kit No. 1018‡	Allows blind attendant operation of switchboards, such as 556- and 608-
	Card Dialer	Names in braille may be attached to top of cards (Section 502-660-XXX and see Table B)
	Seeing aid for PBX (Lamp Signal Detector Unit, J53128A, L2)	Allows blind attendant to locate illuminated line lamps and trunk or supervisory lamps on manual PBX by using light-sensitive probe (SD-65930) (Section 809-109-150) (Section 534-413-210)
	D-180252 Kit of Parts (P-22F332 Retainer and Guide Assembly)	Seeing-aid probe guide for CALL DIRECTOR-type telephone sets allowing use of standard lamp signal detector probe (J53128) to detect illuminated lamps. (Section 809-109-150)
	D-180254 through D-180264 Kit of Parts	New faceplates for various telephone consoles which facilitates blind attendant use of standard lamp signal detector probe (J53128) (Section 809-109-150)
Brain Damage	Repertory dialers	Refer to Table C

\* For further information, refer to local Marketing Services representative.

‡ MD

‡ Available from American Foundation for the Blind, Inc. 15 West 16th Street, New York City, New York

§ Not coded

## TELEPHONE APPARATUS FOR IMPAIRED HEARING SELECTION

### 1. GENERAL

**1.01** This section covers selection of apparatus to amplify incoming speech. It also covers selection of gongs which change the frequencies or tones of the ringing signal for those with impaired hearing.

**1.02** This section is reissued to include the G6AR hand set and eliminate the 52A and 53A gongs.

**1.03** A hearing impairment usually progresses so slowly that the loss is not apparent even to the individual involved until a loss of 20 to 25 per cent (15 to 20 db) has occurred. In greater losses there is reduced possibility for an audiometric measurement of the impairment, even for losses exceeding 50 to 60 per cent (40 to 50 db). This is due to:

- The cost involved.
- Natural reluctance for thorough checkups.
- Lack of ready facilities to obtain a detailed analysis of the hearing loss.

**1.04** Fortunately, regular telephone equipment is adequate until losses have progressed to this range of impairment. Special telephone equipment is usually not requested until the loss has progressed to a point where there is difficulty in understanding conversational levels at a distance of about 3 feet.

**1.05** Since the person with impaired hearing may not be the best judge of the nature or degree of his impairment, it is helpful to supplement a direct interview with observations of individuals closely associated with him. This is particularly true in regard to noticed difficulty in his ability to understand adequately over regular telephone equipment or his ability to hear the ringing signals normally furnished.

**1.06** In cases where special telephone equipment is needed, two general types of problems are involved:

- Inability to hear received speech.
- Inability to hear ringing signal.

**1.07** There are no formalized rules in determining the most appropriate telephone equipment for customers having impaired hearing. However, there are guides that suggest available apparatus that can be utilized. There is no available equipment for certain types of deafness.

**1.08** Experience has shown that people who have difficulty in hearing can be classified into five groups as compared to normal. Table A describes impairment characteristics and telephone apparatus recommended for speech amplification.

**1.09** Recommendations for customers who cannot hear ringing signals are discussed in 3.

**1.10** All installation and equipment changes must be authorized by a service order.

### 2. APPARATUS FOR AMPLIFYING INCOMING SPEECH

#### 532- and 533-Type Telephone Sets

**2.01** These sets are designed for receiver amplification. For further information, see section covering these sets.

#### G6AR Hand Set

**2.02** This handset is designed for receiver amplification. The G6AR hand set can be installed on any 500-type telephone set. For further information, see section covering handsets.

**TABLE A**  
**RECOMMENDED APPARATUS FOR HEARING IMPAIRMENTS**

Group Number	Impairment Characterized by:	Recommended Apparatus
1	No noticeable difficulty in hearing. Considered normal.	Regular apparatus.
2	Some difficulty in understanding speakers in public places such as church or theater. Unable to hear well in group conversations.	
3	Difficulty in understanding speech from a distance of 2 to 3 feet. Needs incoming speech amplifier on telephone. May be using hearing aid.	A 532- or 533-type telephone set or a G6AR hand set. A bone conduction receiver used with these sets may be helpful in some cases. See section on KS-14720, List 2 headset (bone conduction receiver).
4	Extreme difficulty in understanding conversation even with hearing aid.	A 106A loudspeaker set with a modified 500C/D telephone set. A bone conduction receiver may be used with this arrangement.
5	Unable to understand speech under any condition.	None available.

#### 106A Loudspeaker with 500-Type Telephone Set

**2.03** This arrangement is used when customer has extreme difficulty in hearing. The loudspeaker set with speaker disconnected acts as an amplifier for incoming speech.

**2.04** The loudspeaker set is equipped with a volume control which can be set to meet individual needs. Locate the loudspeaker set near its associated telephone set so the volume control is within easy reach of the telephone user.

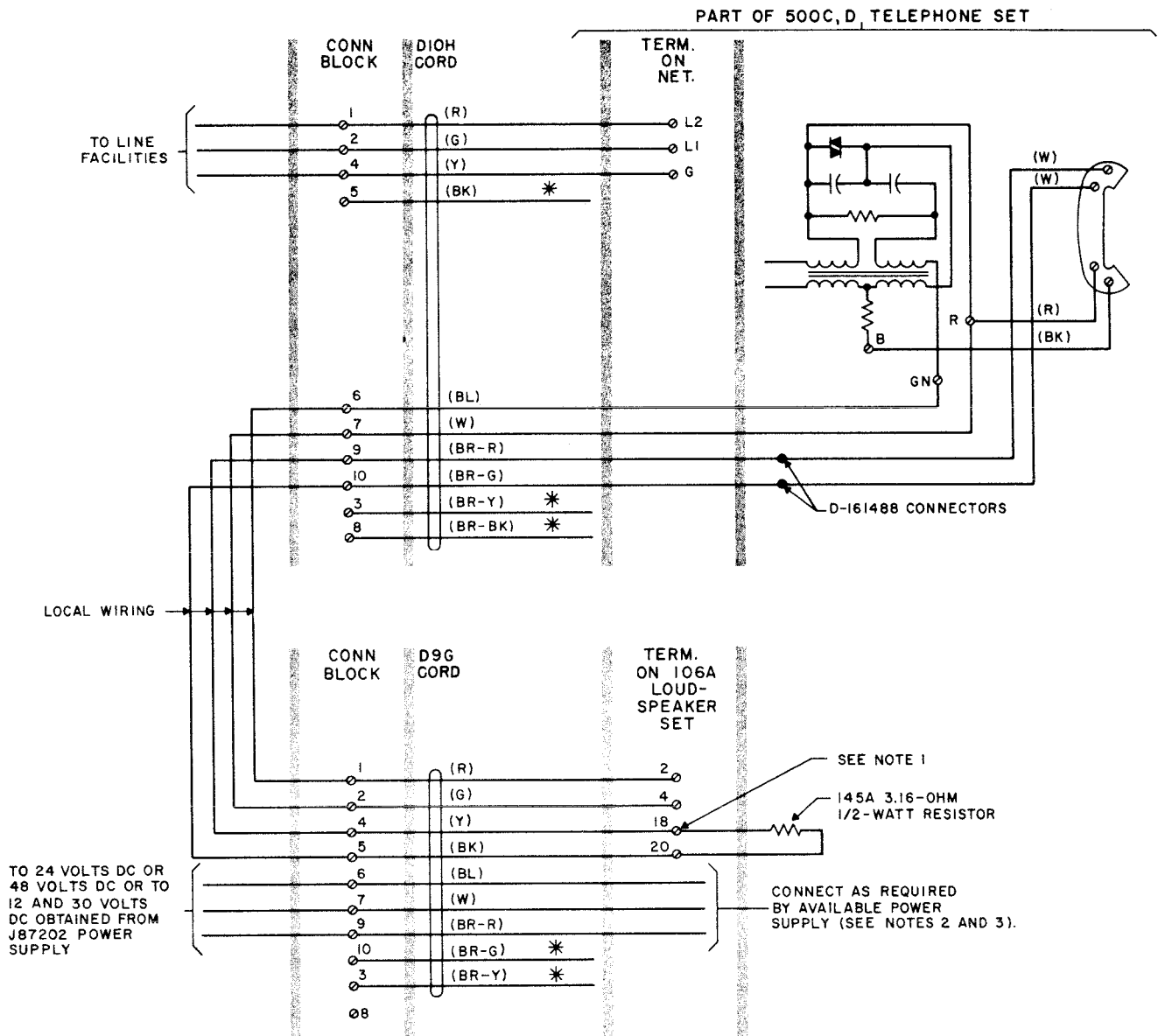
**2.05** The ON-OFF switch must be disabled so the amplifier is on at all times (Fig. 1).

**2.06** Modify the telephone set as follows:

- (1) Remove the varistor from across the receiver in the handset.
- (2) Remove the 3-conductor mounting cord and replace with D10H mounting cord.
- (3) Remove (W) handset lead from GN terminal of network and connect to (BR-R)

mounting cord conductor. Use D-161488 connector.

- (4) Remove (W) handset lead from R terminal of network and connect to (BR-G) mounting cord conductor. Use D-161488 connector. (Tape connectors separately and store out of way of moving parts.)
- (5) Connect (R) mounting cord conductor to L2 of network.
- (6) Connect (G) mounting cord conductor to L1 of network.
- (7) Connect (Y) mounting cord conductor to G of network.
- (8) Connect (BL) mounting cord conductor to GN of network.
- (9) Connect (W) mounting cord conductor to R of network.
- (10) Connect ringer according to type of service required. See section on connections of 500C, D, and 501C, D telephone sets.



**Note 1:** Remove strap between terminals 18 and 19 to disable speaker.

**Note 2:** Connect negative (-) side of battery to terminal 10 to disable ON-OFF switch.

**Note 3:** Connect power supply as shown in section covering 106A and 106B loudspeaker sets.

\* Insulate and store spare conductors.

**Fig. 1 – Connection Diagram**

**SECTION 500-128-180**

**2.07** Modify loudspeaker as follows:

- (1) Remove strap between terminals 18 and 19 to disable speaker.
- (2) Connect a 145A 3.16-ohm 1/2-watt resistor between terminals 18 and 20.
- (3) Install D9G cord (Fig. 1).

**2.08** After completing installation, adjust chassis gain control on loudspeaker set as follows:

- (1) Use input signal comparable to normal telephone conversation.
- (2) With cover removed, turn chassis gain control completely counterclockwise to obtain minimum gain. Use KS-6854 screwdriver or equivalent.
- (3) Turn external volume control completely clockwise.
- (4) Turn chassis gain control clockwise for maximum loudness or up to a point just before crosstalk is heard. Press the receiver cap against the cheek. If the receiver has a tendency to howl under these conditions, turn chassis gain control counterclockwise until howling is eliminated. Some howling may be expected when the receiver is not held against the ear or not otherwise sealed.
- (5) Loudness of signal can now be adjusted by external volume control.

**2.09** Additional information can be found in sections on the 106A and B loudspeaker sets.

**3. REMEDIAL MEASURES FOR CUSTOMERS WHO CANNOT HEAR RINGING SIGNAL**

**3.01** On all repair visits, make certain that:

- (a) Ringing apparatus is in proper adjustment.
- (b) Ringing apparatus is centrally or otherwise favorably located.
- (c) Ringing apparatus is not concealed by drapes.

- (d) Desk telephone sets are located on a hard surface so that tone is reflected from the gongs of ringer.
- (e) Ringer volume control is set to maximum loudness.

**3.02** If telephone apparatus has B-type ringer, and the customer is still unable to hear the ringer, try one of the following:

- (a) Add a 101A gong attachment using 41-type gong. See the section on maintenance of B-type ringers.
- (b) Use a set equipped with a C4A ringer. A variety of gongs producing different frequencies is available. (See Table B.)

**Note:** Gongs should always be used in pairs as follows:

54A-55A	56A-57A
55A-56A	57A-58A
58A-59A	

**3.03** If customer still is unable to hear bell, provide one of the following:

- Extension telephone or ringer.
- BELL CHIME.
- Loud ringing bell.
- Auxiliary signal. (See section on identification of auxiliary signals.)

**Note:** Advise customer there is an additional charge for the above items.

**TABLE B  
GONGS**

Gong	Nominal Frequency Produced
54A	1280 CPS
55A	1610 CPS
56A	2025 CPS
57A	2555 CPS
58A	3220 CPS
59A	4060 CPS

**Note:** Even numbered gongs mount on movable arm of ringer. Odd numbered gongs mount on fixed gong post.



## RADIO SIGNAL SUPPRESSION FOR TELEPHONE SETS

### 1. GENERAL

1.01 This section contains information on the reduction of radio interference in telephone sets.

1.02 This section is reissued to:

(a) Add information on telephone sets modified for radio signal suppression by the local distributing house.

(b) Delete information on some suppression devices formerly installed by field personnel.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Radio interference frequently occurs where a radio station transmitter is located near telephone facilities. Generally the radio signal is picked up by the wire, which acts as an antenna, and demodulated (changed to audio frequency) by nonlinear components, such as varistors, transistors, and diodes in the telephone set. **However demodulation can also result from corroded connections and loose terminations.**

1.04 **Before ordering a telephone set modified for radio signal suppression check for the following:**

- **Corroded connections (inside and outside plant)**
- **Loose wire terminations (including set wiring)**
- **Abandoned drop wire still connected to line**
- **Inside wire connected but not used.**

**Installing a modified telephone set on the customers premises will not be effective if demodulation is caused by any of the above conditions.**

1.05 Telephone set components that may act as demodulators are:

- Speech equalization varistors in networks
- Transistors in amplifiers of some networks and handsets
- Varistors and transistors in TOUCH-TONE® dials
- Diodes in polarity guards
- Click suppression varistors across receiver units
- Carbon transmitters

1.06 With the introduction of the 425J and 4010E networks, the cause of radio signal demodulation in networks has effectively been minimized. In these networks the speech equalization varistors have been replaced by resistors and a strapping option which provides speech equalization.

1.07 All telephone sets, excluding coin, will be available from the local distributing house modified for radio signal suppression. Modification will include changing to new type network, where applicable, and placing bypass capacitors across all other components that may act as demodulators as listed in 1.05.



**Before ordering a modified telephone set make sure that demodulation is not occurring external to the telephone set (See 1.04).**

1.08 Where demodulation is attributed to components in the telephone set, in addition to changing to a modified set it is recommended that a 40BA capacitor be placed at the protector and a 1542A inductor at the connecting block. The capacitor will bypass, to ground, radio signals picked up by the drop wire while the inductor will tend to attenuate radio signals picked up by the inside wire.



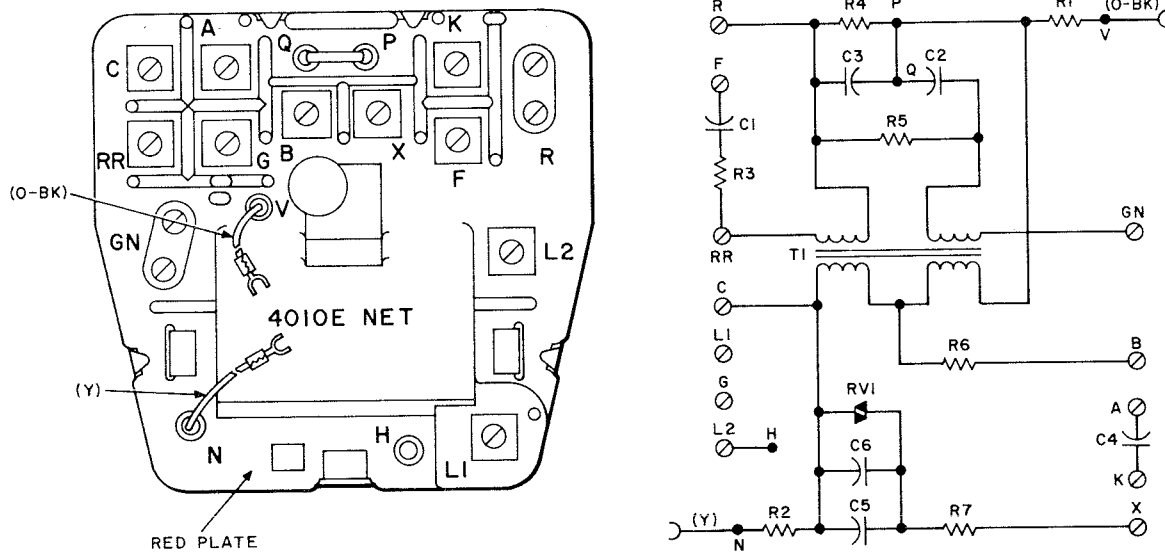


Fig. 2—4010E Network and Schematic

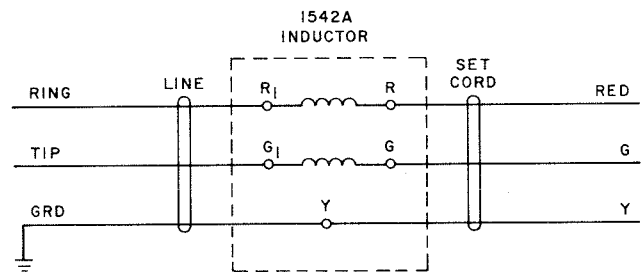
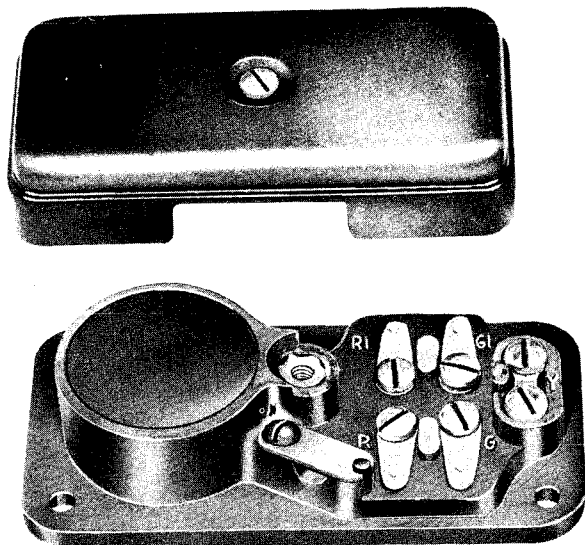


Fig. 3—1542A Inductor and Schematic

- Bypass capacitors installed across all other components of the telephone set that may act as demodulators, such as transmitter unit, receiver unit, transistors in amplifiers, polarity guards, etc.

(b) TRIMLINE® telephones will be modified by having bypass capacitors placed across all the components in the set that may act as demodulators.

(c) Modified sets will not be recoded but will be stamped on the bottom "RF SUPPRESSED SEE 500-150-100".

**2.03** TOUCH-TONE dials and all G-type handsets will be available from the local distributing house modified for radio suppression. These will be used where an adjunct dial must be installed or where the dial or handset must be replaced for maintenance reasons.

**2.04** Other modified telephone set components include 241A, 242B, and 277A amplifiers; D-180191 and D-180229 polarity guard assemblies; and 694A and B subsets. Modified versions of additional items will be made available in the future when they are needed.

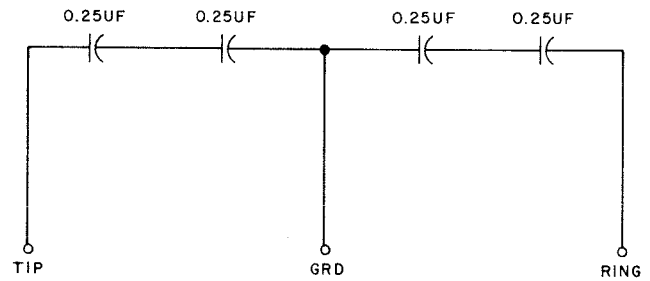
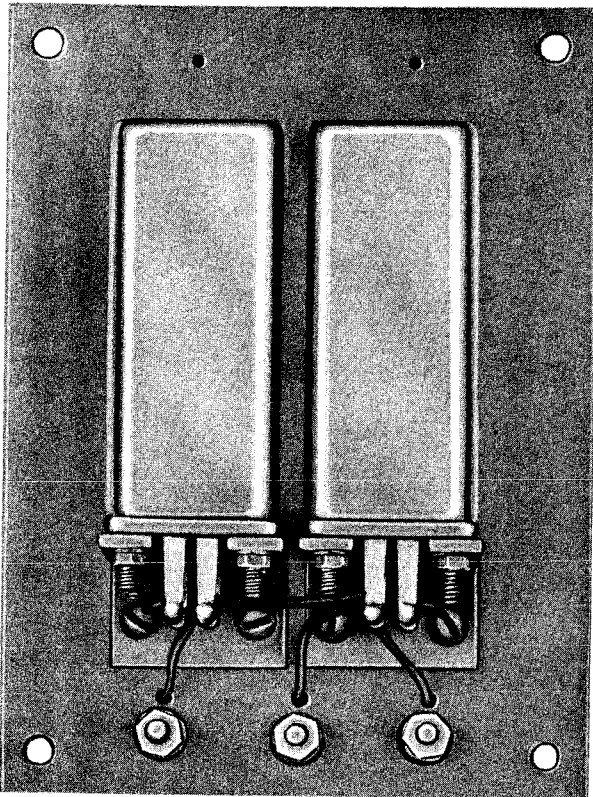


Fig. 4—40BA Capacitor and Schematic

**3. ORDERING GUIDE**

- Capacitor, 40BA
- Inductor 1542A---  
-49 Gray, -50 Ivory
- Set, Telephone---RF Modified
- Set, Telephone, Hand 220A---RF Modified
- Set, Telephone, Hand 1220A---RF Modified
- Set, Telephone, Hand 2220A---RF Modified

**Replaceable Components**

- Dial---(TOUCH-TONE only) RF Modified
- Set, Hand G---RF Modified

**4. INSTALLATION**

**4.01 Telephone Sets Equipped With 425J or 4010E Networks**

- (a) Installed in usual manner
- (b) For connections see connection section of type set modified
- (c) Sets are shipped with speech equalization option leads insulated and stored:
  - (1) For loops greater than 500 ohms leave insulated and stored.
  - (2) For loops 500 ohms or less connect "H" or "N" (Yellow) and "J" or "V" (Orange-Black) leads to terminals RR and R, respectively, on the 425J or 4010E network.

#### 4.02 *Modified TRIMLINE Telephones*

- (a) Install in usual manner
- (b) See Section 502-321-400 for connections

#### 4.03 *1542A Inductor* (Fig. 5)

- (a) Use as connecting block for telephone set cord.
- (b) Locate as near as possible to wall-type sets.

#### 4.04 *40BA Capacitor* (Fig. 6)

- (a) Install near and connect to protector with as short as possible piece of inside wire.
- (b) Station wires must connect to the capacitor
- (c) Mounted inside when outside protector is used
- (d) ***Protector ground must be upgraded to the best possible ground available.***

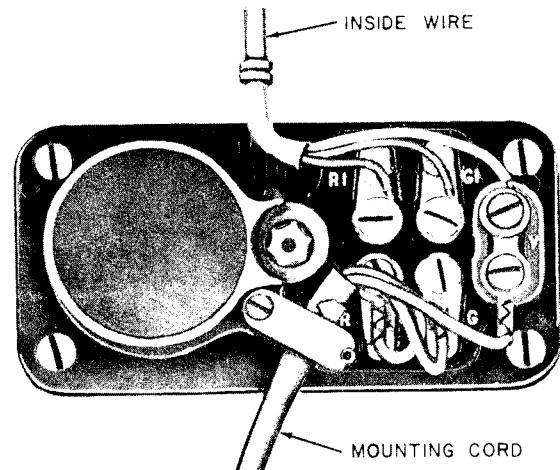


Fig. 5—Cording Diagram, 1542A Inductor

## 5. MAINTENANCE

5.01 Normal maintenance can be performed on modified telephone sets. Modified TOUCH-TONE dials and G-type handsets are available from the local distributing house for maintenance.

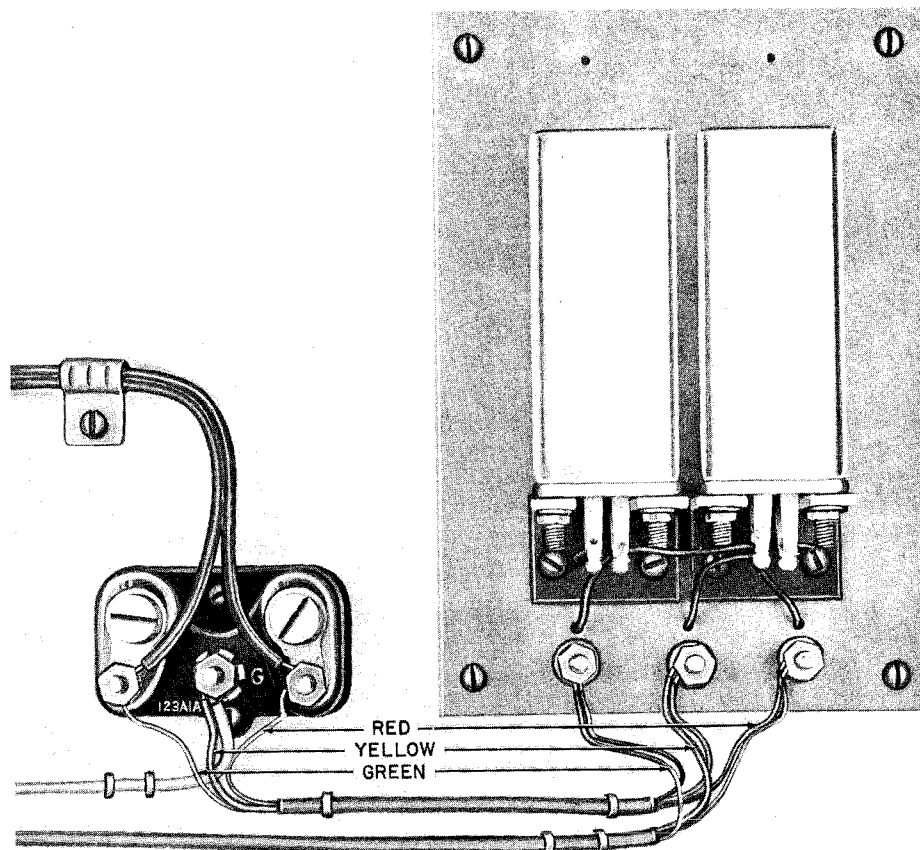


Fig. 6—1231A Protector with 40BA Capacitor Installed



## STATION TRANSFORMERS IDENTIFICATION

### 1. GENERAL

- 1.01 This section is reissued to add information on the 2186A transformer.
- 1.02 Locate transformers where they will be accessible for inspection and maintenance.
- 1.03 Transformers discussed in this section require a 110- to 125-volt ac power service outlet.



*Make sure that the 110- to 125-volt power service outlet is not under control of a switch.*

- 1.04 To prevent accidental removal, fasten power cords to the 110- to 125-volt ac outlet with a power-cord plug-retainer assembly. Fasten plug-in transformers with a 2A clamp.

### 2. 393B TRANSFORMER

2.01 The 393B transformer (Fig. 1) is used primarily as a power supply for 10-volt lamps in 1A, 1A1, and 1A2 key telephone systems. It is furnished in a metal box with a removable cover. The box is approximately 8-3/4 inches long, 4-1/4 inches high, and 4 inches deep.

2.02 The 393B transformer is equipped with two 2-amp fuses in parallel and furnishes 9 to 11-volts ac 2.8 amps. It will handle the load of seventy-two 51A lamps or equivalent.



*The 24-type fuses of later design are manufactured with a metallic surface on one side only. When placing these fuses in the 393B transformer, be sure the nonmetallic sides of the fuses are together on the center post (Fig. 1).*

2.03 When more than 18 lamps are supplied by each 2-amp fuse, the leads from the 393B transformer to the key equipment should be 20 gauge or larger. The battery lead must be fused

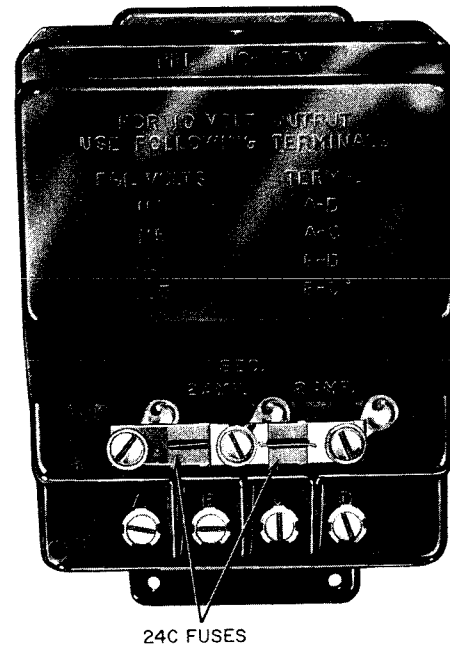


Fig. 1—393B Transformer

again at the key equipment with a 2-amp fuse as shown in Fig. 2.

2.04 Connect the leads from the 393B transformer to the key equipment as shown in Table A.

### 3. 2012A TRANSFORMER

3.01 The 2012A transformer (Fig. 3) supersedes the KS-16184, List 3 transformer.

3.02 The 2012A-42 transformer is rated MD and is replaced by the 2012A-49 (light olive gray) and 2012A-50 (ivory).

3.03 The 2012A transformer supplies power for telephone sets with dial night light feature.

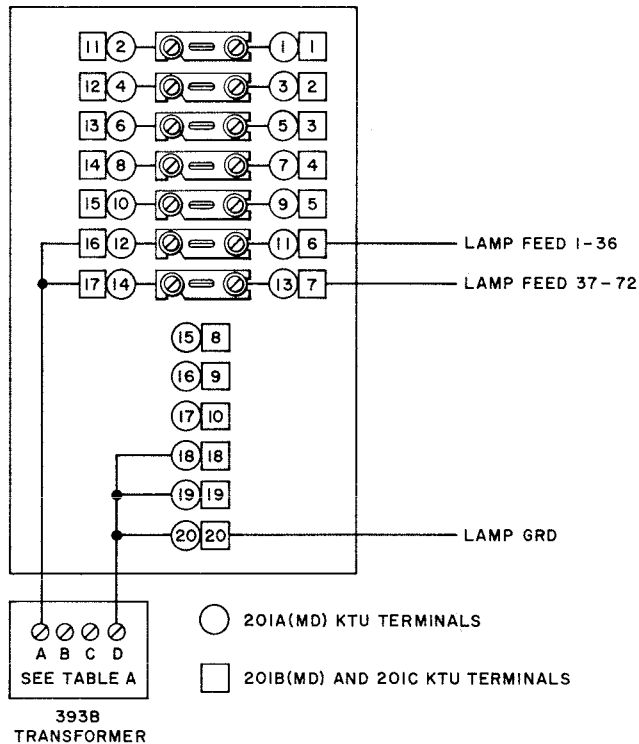


Fig. 2—201A (MD), 201B (MD) and 201C Key Telephone Units

TABLE A

TRANSFORMER CONNECTIONS

IF AC SUPPLY VOLTAGE IS	CONNECT THE LEADS FROM THE KEY EQUIP. TO TERM.
110	A and D
115	A and C
120	B and D
125	B and C

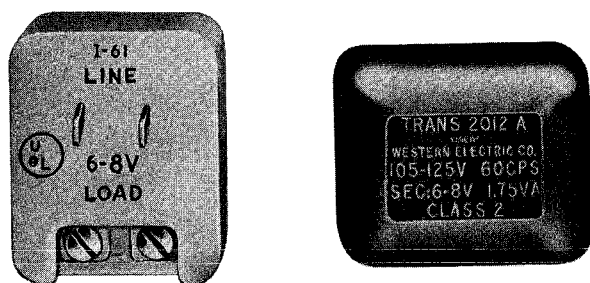


Fig. 3—2012A Transformer



*Do not use 2012A transformer to power 3A speakerphone systems.*

**3.04** This transformer is self-protecting. A pair of prongs for the primary terminals is provided so that the transformer can be mounted in a standard parallel-blade convenience receptacle. Screw terminals are provided for secondary winding in a recess on the same side of apparatus as the prongs.

**3.05** With 115-volts 60 cps applied to the primary winding, the secondary winding delivers approximately 7 volts at 0.250 amp.

**3.06** Only one dial light or night light may be connected to a 2012A transformer. See Table B for wiring limits. A 25-foot mounting cord is not recommended. The added resistance of this cord results in decreased illumination.



*When installing a dial light transformer, check that telephone protector and/or signaling ground conductor is connected to the best ground available as outlined in section covering protector and signaling grounds.*

**4. 2012B TRANSFORMER**

**4.01** The 2012B-42 transformer is rated MD and is replaced by the 2012B-49 (light olive gray) and 2012B-50 (ivory).

**4.02** The 2012B transformer (Fig. 4) is primarily intended to supply power to the 55A or 55B control unit in 3A speakerphone systems. The length of wire between the transformer and the control unit should not exceed 100 feet of standard inside wire.



*Do not use 2012B transformer as a 2012A transformer.*

**4.03** This transformer is self-protecting. A pair of prongs for the primary terminals is provided so that the transformer can be mounted in a standard parallel-blade convenience receptacle. Screw terminals are provided for secondary winding in a recess on the same side of apparatus as the prongs.



**TABLE B**  
**MAXIMUM LENGTHS**  
**OF DIAL LIGHTING PAIRS FOR DIAL NIGHT LIGHT TELEPHONE SETS**  
**(INSIDE WIRING CABLE OR JKT WIRE)**

FEATURE	TYPE TELEPHONE SET	TRANSFORMERS			
		KS-16940, L1		KS-16886, L2	2012A (Note 3)
		8 VOLT (Note 1)	6.3 VOLT (Note 1)	6.6 VOLT (Note 2)	
		MAXIMUM LENGTHS IN FEET (Note 4)			
Home Run Feeder Single Tel Set 1 Dial Light	500	350	150	300	150
	701	350	175	350	250
	702	350	175	350	250
	711	450	250	450	250
	712	450	250	450	250
	1702	350	175	350	250
	1712	450	250	450	250
Common Feeder 2 Tel Sets 1 Tel Line 1 Dial Light 1 Night Light	500	130	50	100	
	701	200	100	150	
	702	200	100	175	
	711	220	100	175	*
	712	220	100	175	
	1702	200	100	150	
	1712	220	100	175	
Common Feeder 3 Tel Sets 1 Tel Line 1 Dial Light 2 Night Lights	500	90	40	60	
	701	160	85	130	
	702	160	85	130	
	711	175	100	160	*
	712	175	100	160	
	1702	160	85	130	
	1712	175	100	160	
Common Feeder 2 Tel Sets 2 Tel Lines 2 Dial Lights	500	120			
	701	150			
	702	150			
	711	175	*	*	*
	712	175			
	1702	150			
	1712	175			

**Note 1:** The KS-16940,L1 transformer is designed to power 30 dial night light telephone sets and is not recommended for single telephone installations. Do not use common feeder where more than two sets may be off-hook at the same time. Home runs from each set to the transformer provide best illumination.

**Note 2:** The KS-16886,L2 transformer is designed to power ten dial night light telephone sets and is not recommended for single telephone installations. Do not use common feeder where more than one set may be off-hook at the same time. Home runs from each set to the transformer provide best illumination.

**Note 3:** The 2012A transformer is designed to power only one dial night telephone set.

**Note 4:** Lengths may be doubled if pairs for feeder are paralleled.

\* Not to be used for this feature.

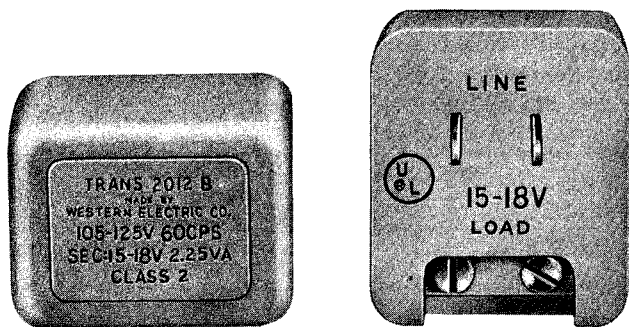


Fig. 4—2012B Transformer

4.04 With 115-volts 60 cps applied to the primary winding, the secondary delivers approximately 17 volts at 0.132 amp.

4.05 A 2A clamp should be used to secure the 2012-type transformer to a standard electrical service outlet (Fig. 5). The 2A clamp will prevent the transformer from being accidentally dislodged from the outlet.

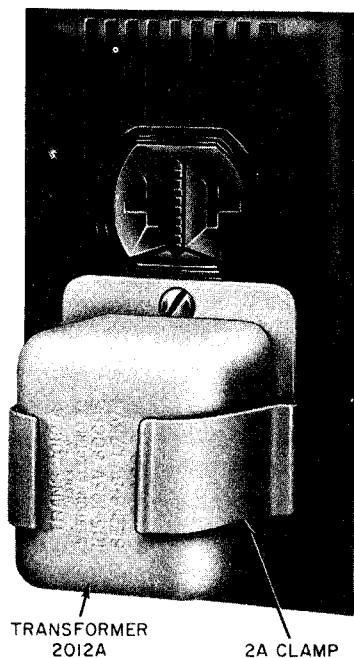


Fig. 5—2A Clamp

4.06 The 2A clamp is available in light olive gray (-49) and ivory (-50).

5. 2075A TRANSFORMER

5.01 The 2075A transformer (Fig. 6) supplies power (15 to 18 volts) for the 41A dial in the 660-, 662-, 663-, and 664-type telephone sets.

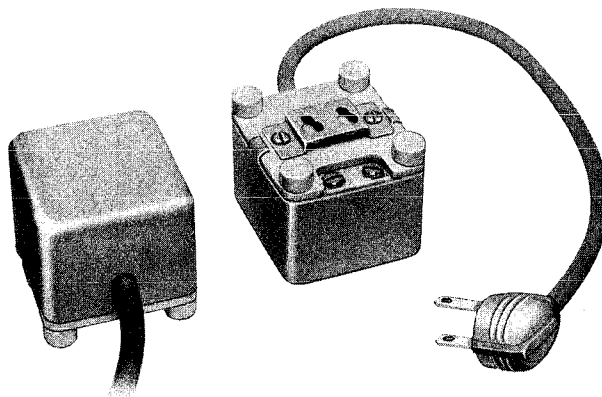


Fig. 6—2075A Transformer

5.02 The transformer is equipped with an 18-inch power cord terminated in a 2-pronged plug. This plug fits a standard parallel-blade convenience receptacle.

5.03 Keyhole slots are provided at the rear of the transformer for easy installation. Use a suitable backboard when mounting on surfaces requiring backboards.

6. 2186A TRANSFORMER

6.01 The 2186A transformer (Fig. 7) supplies power for the 700A and 700B subscriber sets.

6.02 The transformer is protected by an internal thermal overload safety switch which restores automatically. It is equipped with a 12-inch power cord connected to the primary winding. The secondary winding is terminated in screw terminals on the rear of the transformer.

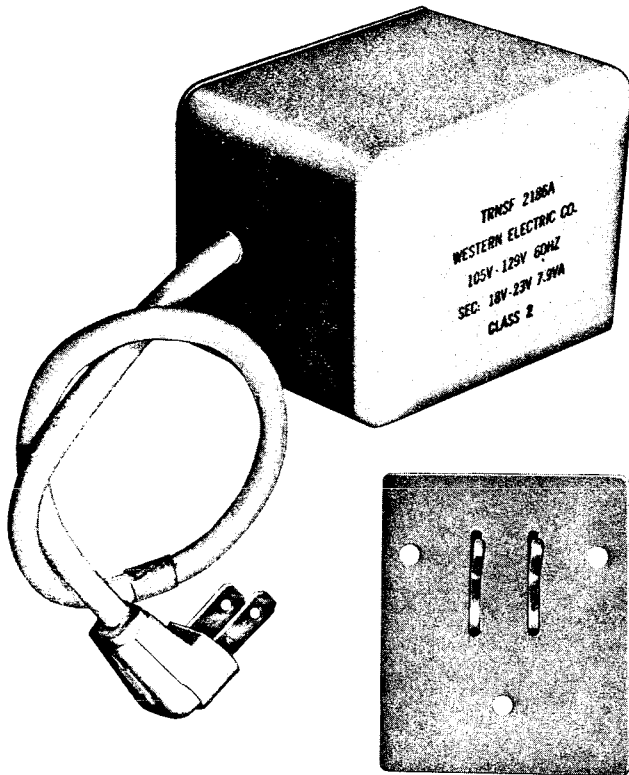


Fig. 7—2186A Transformer

6.03 With 117 volts, 60 Hz applied to the primary winding, the secondary delivers approximately 20 volts at 0.345 amp.

6.04 Keyhole slots are provided at the rear of the transformer for mounting purposes. Use the backboard furnished with the transformer on surfaces requiring backboards.

6.05 Attach backboard with appropriate fastening device depending on the type of mounting surface. ♦

**7. KS-5714 TRANSFORMER**

7.01 The KS-5714 transformer is used primarily to operate bells, buzzers, and lamps on station systems when the circuits are arranged to supply this load separately. It is furnished in a metal box with a removable cover. The box is approximately 8-3/4 inches long, 4-3/8 inches high, and 4 inches

deep, and is arranged for wall mounting. This transformer is self-protecting and has no fuses.

7.02 The KS-5714, List 2 transformer supplies 15-volts ac 2.2 amps.

7.03 The KS-5714, List 3 transformer supplies 15-volts ac 1.1 amps.

**8. KS-16886, LIST 2 TRANSFORMER**

8.01 The KS-16886, List 2 transformer (Fig. 8) is primarily intended as the centralized power supply for multiphone dial light installations and home interphone systems requiring approximately 6 volts. It is capable of handling up to ten dial light stations. See Table B for wiring limits. Additional taps at 10.5, 24, and 25.5 volts are also provided for other possible uses. This transformer is self-protecting and has no fuses.

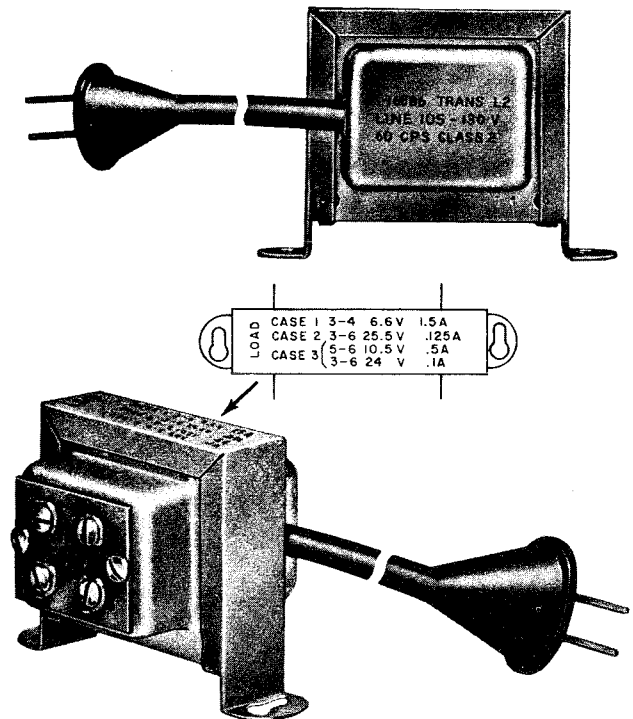


Fig. 8—KS-16886, List 2 Transformer

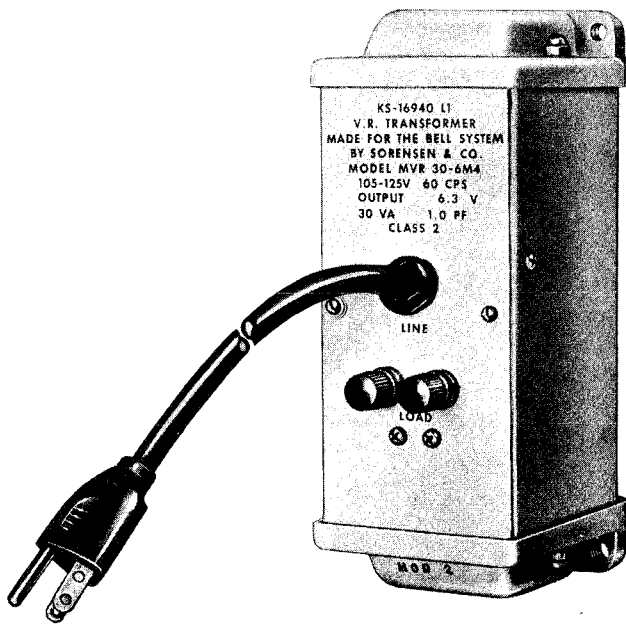
**SECTION 501-136-100**

**8.02** Over-all dimensions of the transformer are 2-3/4 by 3-3/4 by 2-3/4 inches. Power cord is 18 inches long and terminates in a 2-pronged plug. Weight is approximately 1-1/2 pounds.

**8.03** Keyhole slots provide easy installation. Use a suitable backboard when mounting on surfaces requiring backboards.

**9. KS-16940, LIST 1 V.R. TRANSFORMER**

**9.01** The KS-16940, List 1 V.R. transformer (Fig. 9) is primarily for use as centralized dial light power source to provide regulated power for dial lights and night lights on telephones. It will power 30 dial light telephone sets. This transformer is self-protecting. See Table B for maximum lengths of wiring.

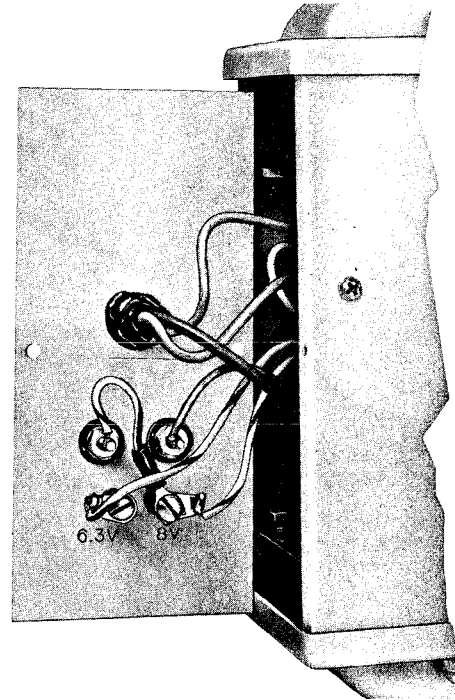


**Fig. 9—KS-16940, List 1 V.R. Transformer**

**9.02** Input is provided with a 2-foot 3-conductor power cord and plug. The ground prong of the plug is connected internally to the transformer case. The output is isolated from the input and the case and is terminated in two low voltage terminals on the case.

**9.03** Output taps of 6.3 and 8.0 volts are located on back of cover as shown in Fig. 10. The

transformer is shipped with movable lead connected to 6.3-volt tap.



**Fig. 10—Movable Lead Connected to 8-Volt Tap**

**9.04** To change connection to 8.0-volt tap:

- (1) Remove two screws holding cover to case.
- (2) Remove cover.
- (3) Change movable lead from 6.3-volt tap to 8.0-volt tap.

**9.05** Over-all dimensions of the transformer are 7-5/8 by 2-15/16 by 3-5/8 inches. The weight is approximately 5-1/2 pounds.

**9.06** Four 1/4-inch holes are provided on the case for mounting. Use a suitable backboard for mounting on surfaces requiring backboards.



*An adapter is needed to plug power cord in a standard parallel-blade ac outlet.*

**HANDSET CORDS**  
**IDENTIFICATION**

**1. GENERAL**

**1.01** This section is reissued to:

- Add H4BC, H4DE, H4DF, H5AD, and H5AE cords
- Revise color code of H4DD, H5P, and H6F
- Revise Table A

**1.02** Table A lists cords, ordering guide, design features, cords replaced, and intended uses.

**1.03** When ordering cords, specify desired cord, color code, and length (Table A).

Example: Cord, H4BL-58, 4 ft

**1.04** The second character of coded cords designates the number of conductors in the cord.

**TABLE A**  
**HANDSET CORDS**

ORDERING GUIDE				DESIGN FEATURES			REPLACES	INTENDED USE	
CORD	COLOR CODE*	LENGTH	JACKET	SPG.	STRT.	SPECIAL FEATURES		HANDSETS	
H2A	-3	10"	Textile		•			1011G	
H2B		4'	Nylon		•	Set end E/W 360A and 360B tool		1013A	
H2C		10"			•			1014A	
H3K	-54	6'	Textile		•		422	N0 1C	
H3L					•		786	1001M	
H3N-9		1'6"			•			H3N-10	322 Tel. set
H3AN	-3	4', 9'	Neoprene	•		Set end E/W bushing over flexible collar	H34	F6, AR-3 and F6 CR-3	
H3AR		4', 9', 13'	Vinyl	•			H3AJ-3	E1 and F1	
H3AS		1'3", 4', 9', 13'			•				H3AH-3
H3AT		3'		•				H3AM-3	F1BR-3
H3AU		2'5"			•		Armored — stainless steel, flexible hose covering	H3AP-3	F1K-3
H4A	-54	3'		Textile		•			1D
H4BC	-3				•				F2
H4BL	-3, -50, -51, -52, -56, -58, -59, -60, -61, -62, -64	4', 9'	Vinyl	•			H4BL-3 Replaces H4BK-3	G1DR G2CR	
H4BM	-3	4'	Neoprene	•		One end E/W connector		G5FR	
H4BN				•					G1BR
H4BP		3'		•					F2ER
H4BU		4'			•			H4T-9, H4W	F2B

TABLE A (Cont)  
HANDSET CORDS

ORDERING GUIDE				DESIGN FEATURES			REPLACES	INTENDED USE
CORD	COLOR CODE*	LENGTH	JACKET	SPG.	STRT.	SPECIAL FEATURES		HANDSETS
H4BW		4', 9', 13'	Vinyl		•		H4L-9, H4AL H4AN	E2B, E2C, F3K, F3L, F3M, F3V
H4BY					•		H4N, H4AM	E2A, E4A F3S
H4CA					•		H4U, H4Y	F2A
H4CB		4'		•		H4AD-9	F2B	
H4CC		4', 7'		•		H4AC-9	E2B, E2C, F3H	
H4CD		7'		•		H4AG	No. 102A key Equip. E/W attendant handset	
H4CE		8'		•		H4AP	F2D	
H4CF		4'		•	Neoprene		Set end E/W bushing over flexible collar	H4BE
H4CJ	-3, -50, -51, -52, -53, -54, -56, -58, -59, -60, -61, -62, -64	4' 9' 13'	Vinyl	•			H4BH-3 H4BR	G3AR
H4CL	-3, -50, -51, -53, -54, -56, -58, -59, -60, -61, -62			•			H4BG	
H4CM	-3	7'	Vinyl	•			H4BL-3	G2CR
H4CN		3'		•			H4BT-3	F2ER
H4CP	-3, -51, -60	1'2"		•			H4BS	G3FR
H4CS	-3			•				G1J
H4CT	-3, -50, -51, -53, -54, -56, -58, -59, -60, -61, -62, -64	4', 13'		•				4'-G6AR 13'-G10B
H4CU	-51, -58, -60, -61	4', 9'		•				G3L
H4CW	-52, -61	3'		•				G3M
H4CY	-3	2'5"			•	Armored — stainless steel, flexible hose covering		G3P
H4DA		4'6"		•			H4CG	G3R
H4DB	-3, -50, -51, -53, -54, -56, -58, -59, -60, -61, -62, -64	5'6", 9', 13'		•		Each end E/W push-in lock plug		220A, 1220A, 2220B, G12A
H4DD	-3, -51, -53, -56, -58, -59, -60, -61, -62, -64	4', 13'	•		One end E/W plug		G10D	
H4DE	-61	6'	Nylon		•	One end E/W push-in lock plug		No. 2C and No. 3C cord reel
H4DF		3'6"	Vinyl		•			Mart
H5E	-54	5'	Textile		•			F3AAW

**TABLE A (Cont)**  
**HANDSET CORDS**

ORDERING GUIDE				DESIGN FEATURES			REPLACES	INTENDED USE
CORD	COLOR CODE*	LENGTH	JACKET	SPG.	STRT.	SPECIAL FEATURES		HANDSETS
H5P	-3, -50, -51, -52, -53, -54, -55, -56, -58, -59, -60, -61, -62, -64	4'	Vinyl	•				G2ER
H5R	-3	4'			•			H5C F3P
H5S		7'		•				H5J F3
H5T		5'		•				H5D-H5K F3WW F3ADW
H5U		-3	4'	Textile		•	One shielded conductor	
H5W					•	One shielded conductor — one end E/W plug		No. 9 announcement system
H5Y	3'6"				•	One end E/W plug		G5NR
H5AA	-3, -50, -51, -53, -54, -56, -58, -59, -60, -61, -62, -64	5'6" 9', 13'	Vinyl	•		Each end E/W push-in lock plug		220A, 1220A, 2220B
H5AB	-3	4'		•				G5AR
H5AC	-3, -51, -56, -58, -59, -60, -61, -62, -64	5'6" 9' 13'	Vinyl	•		Handset end E/W push-in lock plug		220A 1220A 2220B
H5AD	-3, -50, -51, -53, -54, -56, -58, -59, -60, -61, -62, -64	5'6"		•		Each end E/W push-in plug, handset end has neon glow lamp in plug grommet		
H5AE				•		Handset end E/W push-in plug, neon glow lamp in plug grommet		G12A
H6A	-54	5'	Textile		•	One end E/W plug and connector		F3AW
H6B	-3	3'4"			•			H5M
H6C				•				G2BR
H6E	-3, -50, -51, -53, -56, -58, -59, -60, -61, -62, -64	4', 9', 13'	Vinyl	•				G5KR
H6F	-3, -51, -53, -56, -58, -59, -60, -61, -62, -64	4', 13'		•				

\* (-3) Black  
(-50) Ivory  
(-51) Green  
(-52) Gray

(-53) Red  
(-54) Brown  
(-55) Beige  
(-56) Yellow

(-58) White  
(-59) Rose Pink  
(-60) Light Beige  
(-61) Light Gray

(-62) Aqua Blue  
(-64) Turquoise





## STATION DIALS 5, 6, 7, AND 8 TYPES IDENTIFICATION AND MAINTENANCE

### 1. GENERAL

1.01 This section is reissued to:

- Add 8R-58 and 8S-52 dials.
- Delete 8H dial.
- Add P-11E007 plastic fingerwheel as replacement for P-19B524 fingerwheel.
- Delete Table C.

### 2. IDENTIFICATION

#### 5M-3 Dial

2.01 Intended for use with 5300-type telephone sets. See Fig. 1 and Table A for assembly of parts, and Fig. 2 for schematic.

2.02 The 164A number plate (Fig. 3) is intended for general station use with 5- and 6-type dials. (See Table B for other number plates available for use with 5- or 6-type dials.)

#### 6-Type Dials

2.03 See Tables C and D and Fig. 4 for usage and assembly of parts.

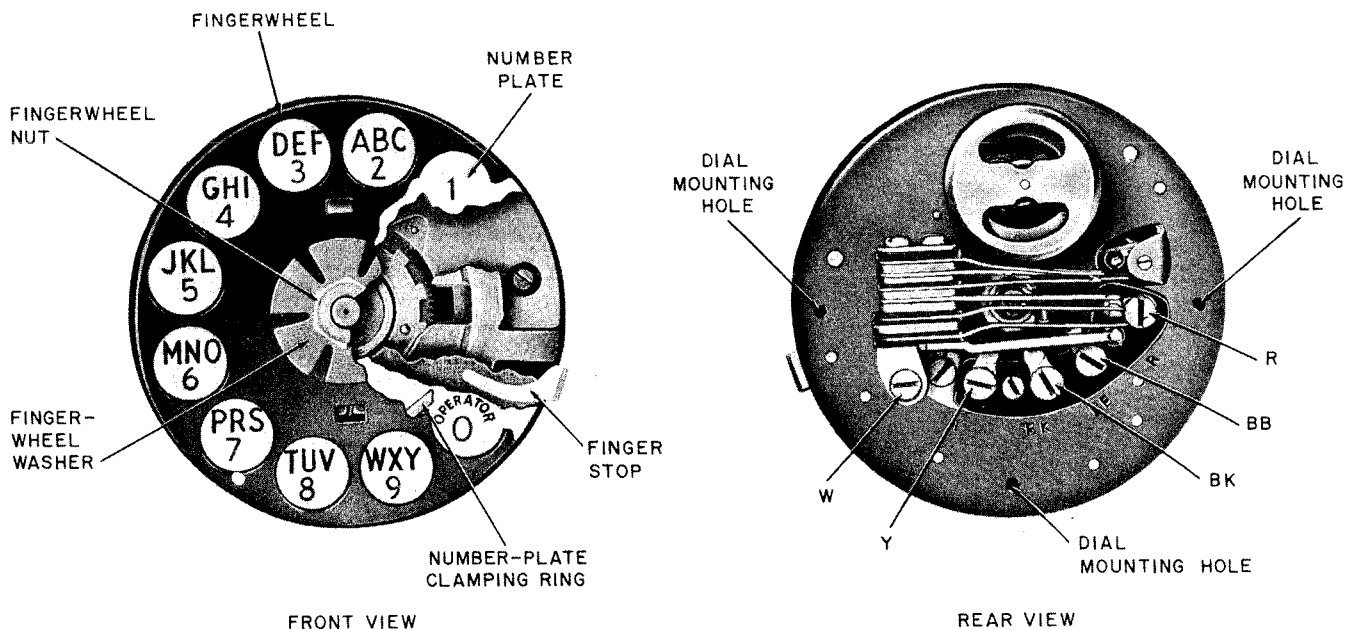


Fig. 1—5M-3 Dial

**TABLE A**  
**ASSEMBLY OF PARTS FOR 5M-3 DIAL**

DIAL TYPE	NUMBER PLATE	CARD HOLDER ASSEMBLY	FINGER-WHEEL	CLAMP PLATE	FINGERWHEEL WASHER	FINGERWHEEL NUT	DIAL MTG SCREW
5M-3	164C-3		P-11E007*	P-11E206	P-459447	P-153996	P-131556
		P-298106	P-153971				

\*Plastic

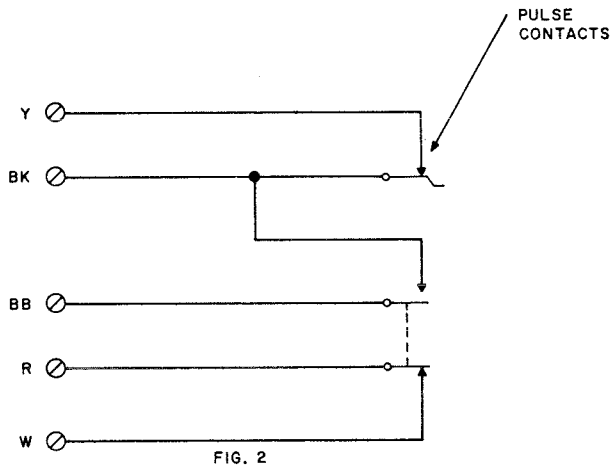


Fig. 2 — 5M-3 Dial Contact Schematic

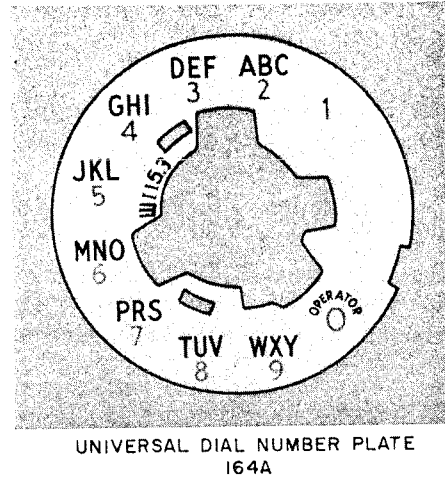


Fig. 3 — 164A Number Plate

**TABLE B**  
**NUMBER PLATES FOR 5- AND 6-TYPE DIALS**

CODE	NUMERALS	LETTERS	USE
147B	Red	Black	With 56A (MD) dial adapter and 5-type dial on coin collectors. Also used on 320- and 325-type (MD) telephone sets.
158B-3 158B-51 158B-60			With 63A dial adapter and 6-type dial on coin collectors
164A			5- and 6-type dials
164B	Numerals and letters omitted		5- and 6-type dials in 5300-type telephone sets
164C-3			6L, M, and N dials
164D			

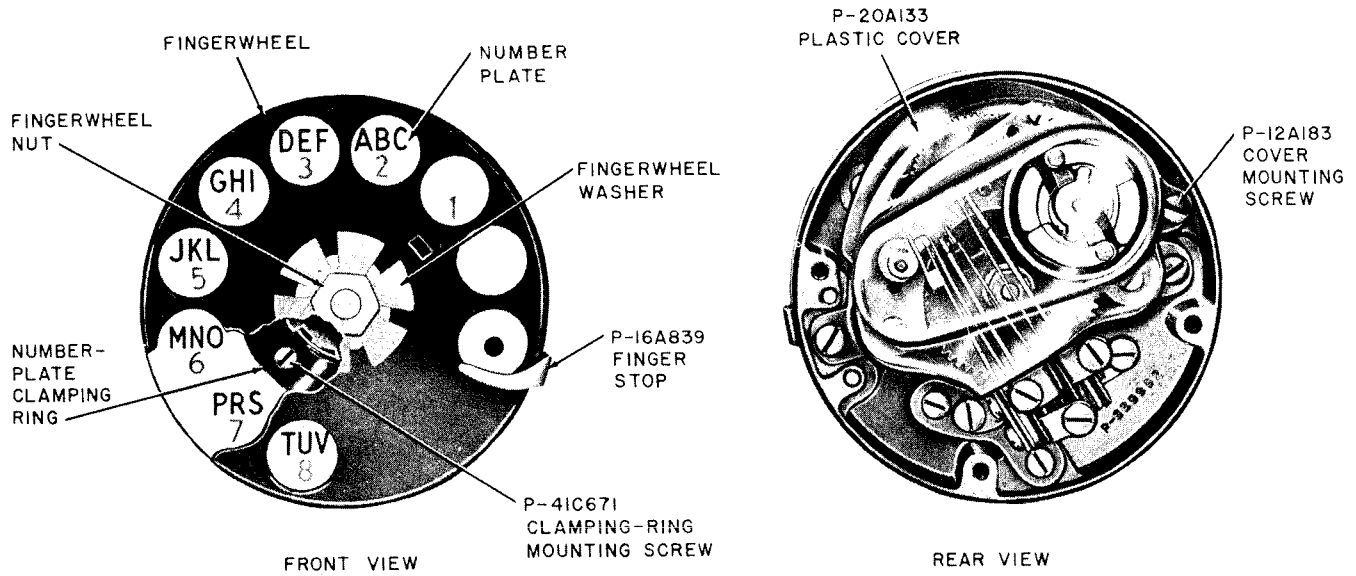


Fig. 4 — 6-Type Dial

TABLE C  
USE OF 6-TYPE DIALS

DIAL TYPE	SCHEMATIC FIG.	PULSES PER SECOND	USE
6A-3	5B	10	Subscriber stations. Also part of 1011G handset.
6C-3			Coin collectors with a 158B number plate and a 63A dial adapter.
6D-3			211MR-3 and 212MR-3 hand telephone sets.
6D-41			751A apparatus unit (MD)
6D-61			212LRW-61 hand telephone set
6E	5A	20	PBX and central office switchboards
6E-41			520 PBX, emergency reporting system
6F			PBX and central office switchboards arranged for high-speed dialing.
6F-43	5B	10	608A PBX
6G			555-type PBX
6H-3	5C	10	5300-type telephone sets
6J-3			211PR-3 hand telephone sets
6J-41			750F apparatus unit

**TABLE C (Cont)**  
**USE OF 6-TYPE DIALS**

DIAL TYPE	SCHEMATIC FIG.	PULSES PER SECOND	USE
6K-41	5C	10	112A key equipment in SAGE systems
6L-41			600-type telephone sets
→ 6M-3	5B		223-, and 233-type (MD) coin collectors
6N-3			610-type telephone sets for 756 PBX
6P-43	5A		608A PBX
6P-45			JCSAN/COPAN networks at U.S. Air Force installations
6R-3	5B		PBX and order turrets
6S-3	5C		525B telephone set

**TABLE D**  
**ASSEMBLY OF PARTS FOR 6-TYPE DIALS**

DIAL TYPE	NUMBER PLATE	CLAMP PLATE	FINGERWHEEL	CARD HOLDER ASSEMBLY	CARD RETAINER GROUP	CARD SUPPORT	
6A-3	164A	P-11E206	P-349543	P-298106	P-43A457	P-11E006	
6C-3	164B						
↗ 6D-3	164A		P-11E007*				
6D-41			P-11C079				
6D-61			P-11E007*				
6E			P-349543	P-298106			
6E-41			P-11E007*				
6F			P-349543	P-298106			
↘ 6F-43			P-11E007*				
6G			164C-3	P-349543			P-298106
6H-3							
6J-3							
6J-41	164A						
6K-41	164B						

TABLE D (Cont)  
ASSEMBLY OF PARTS FOR 6-TYPE DIALS

DIAL TYPE	NUMBER PLATE	CLAMP PLATE	FINGERWHEEL	CARD HOLDER ASSEMBLY	CARD RETAINER GROUP	CARD SUPPORT
6L-41	164D	P-11E206	P-11E007*			
6M-3						
6N-3						P-11E006 ←
6P-43	164A		P-349543	P-298106		
6P-45						
6R-3						
6S-3	164B					

\*Plastic ←

**Note:** P-12A937 clamping ring, P-459447 fingerwheel washer and P-153996 fingerwheel nut is part of above dials.

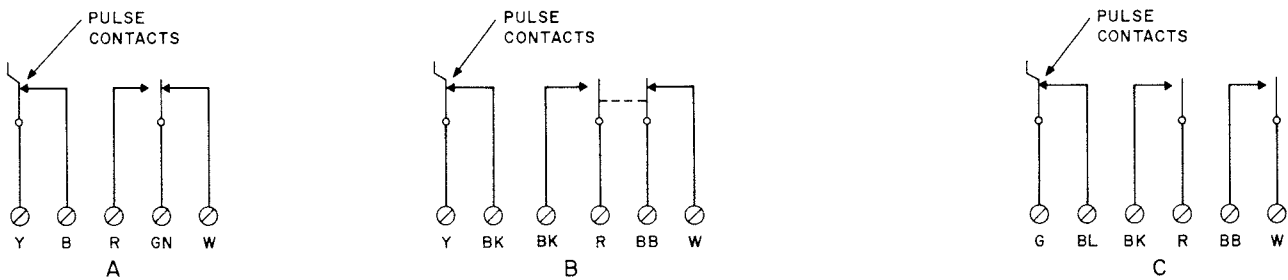


Fig. 5 — 6-Type Dial Contact Schematics (See Table C)

**7-Type Dials**

**2.04** See Tables E and F and Fig. 6 for usage and assembly of parts.

**8-Type Dials**

**2.05** See Tables G and H and Fig. 8 for use and assembly of parts and Table I for number plates.

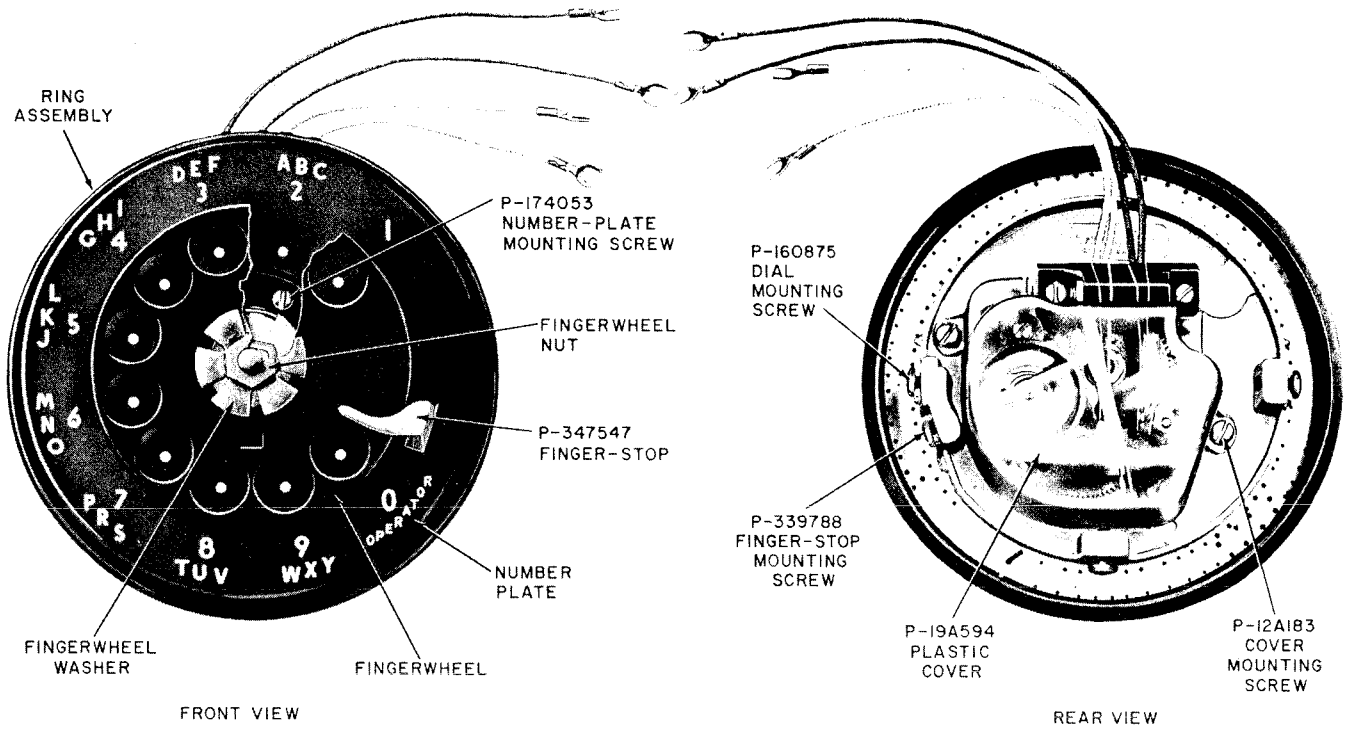


Fig. 6 — 7-Type Dial

TABLE E  
USE OF 7-TYPE DIALS

DIAL TYPE	SCHEMATIC FIG.	PULSES PER SECOND	USE
7A-3 (MD)	7A	10	General station
7C-* (MD)			General station with color
7D-3 (MD)			Replaces 7A
7E-3 (MD)	7C		Speakerphone, 1A and 1A1 key systems
7F-3	7B		Air Defense Warning System (CADW)
→ 7G-3 (MD)	7C		532-, 533-, 535-, and 536-type (MD) telephone sets
7H-* (MD)			Same as 7G-3; use on color sets
7J-* (MD)			Same as 7H
7K-3 (MD)			Modular telephone panels
7L-3 (MD)			691A-3 subscriber set

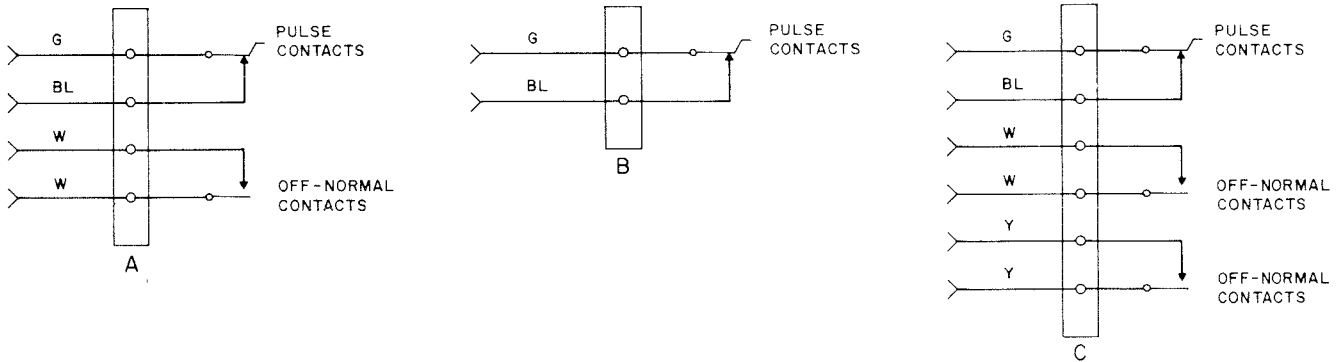
\* Available in standard colors.

**TABLE F**  
**ASSEMBLY OF PARTS FOR 7-TYPE DIALS**

DIAL TYPE	NUMBER PLATE	CLAMP PLATE	FINGERWHEEL	FINGERWHEEL WASHER	FINGERWHEEL NUT	RING ASSEMBLY	
7A-3 (MD)	P-349755	P-11E206	P-11E007†	P-459447	P-153996	P-347300 ←	
7C-* (MD)	P-80A4-*					P-17A422 ←	
7D-3 (MD)	P-80A403	P-349543	P-344917			P-349543	P-347300
7E-3 (MD)							
7F-3							
7G-3 (MD)	P-80A403	P-11E206	P-11E007†			P-17A422 ←	
7H-* (MD)	P-80A4-*						P-349543
7J-* (MD)							
7K-3 (MD)	P-81H503	P-83A203	P-349543			P-347300 ←	
7L-3 (MD)							

\* Available in standard colors.

†Plastic



**Fig. 7 — 7-Type Dial Contact Schematics (See Table E)**

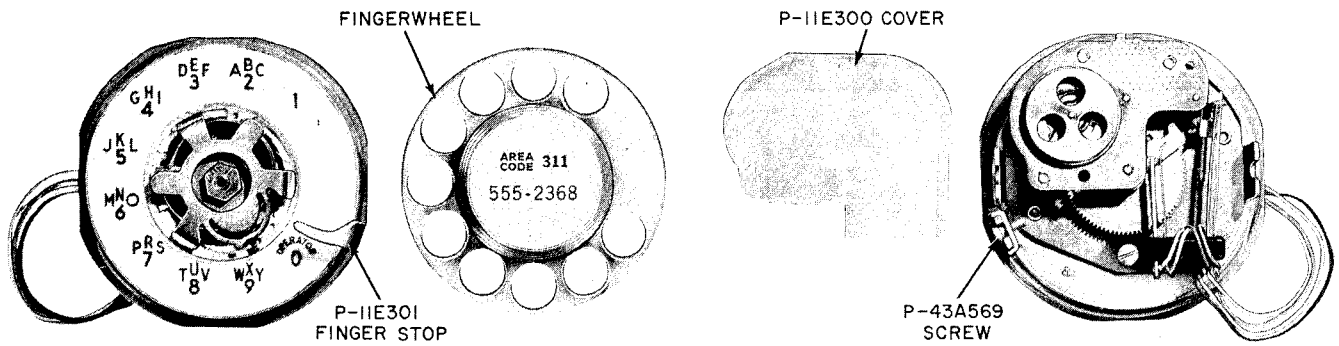


Fig. 8 — 8-Type Dial

TABLE G  
USE OF 8-TYPE DIALS

DIAL TYPE	SCHEMATIC FIG.	PULSES PER SECOND	USE
→ 8A	9A	10	701-type (MD) telephone sets
8B	9B		102A key equipment at FAA installations, 112A key equipment at NORAD installations
8C-58			600-type telephone sets
8E-52	9A		1A1 coin telephone sets
8E-61			11A and 11B apparatus units for 200, 400, and 600 series data sets
8F			32A, 33A, or 35A teletypewriter
8G			11-type apparatus units for data set 202C and data auxiliary set 804A2
8J	9B		20
8K-58			
8L-58	9A	10	3C and 4B telephone consoles
↗ 8M-52	9C		235G-67A coin collector
8P-58	9B		14A1- and 15A1-type telephone consoles
8R-58	9A		830A1M and 851A1M telephone sets
↘ 8S-52	9B		KS-20280 conference booth



**TABLE H**  
**ASSEMBLY OF PARTS FOR 8-TYPE DIALS**

DIAL TYPE	NUMBER PLATE	CLAMP PLATE	FINGERWHEEL	INDEX RING	FINGERWHEEL NUT
8A	P-11E295	P-11E291	P-11E007	P-12E059	P-44E959
8B					
8C-58	P-81K158				
8E-52	P-83B352		P-21F299	P-83B252	
8E-61	P-83B361			P-83B261	
8F	P-15E831		P-11E007	P-12E059	
8G	P-24E565				
8J	P-15E831			P-12E059	
8K-58	P-81K158				
8L-58	P-83B958				
8M-52	P-83B352			P-83B252	
8P-58	P-81K158				
8R-58					
8S-52	P-83B352		P-21F299	P-83B252	

**TABLE I**  
**NUMBER PLATES FOR 8-TYPE DIALS**

NUMBER PLATE	BACKGROUND COLOR	COLOR OF NUMBERS OR DOTS	COLOR OF LETTERS
P-11E295	White	Brown	Brown
P-81K158		Black	Black
P-15E831		Gray	Gray
P-83B958		Black	
P-83B352	Oxford Gray	White	
P-83B361	Light Gray	Oxford Gray	
P-24E565	Gray	White	

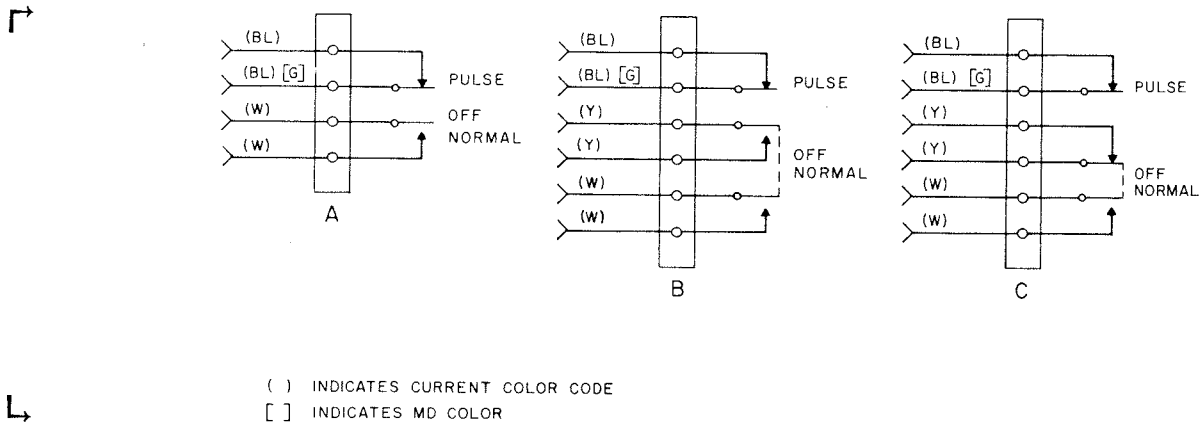


Fig. 9—8-Type Dial Contact Schematics (See Table G)

3. MAINTENANCE

General

3.01 Only items listed in the identification section shall be replaced in the field.

3.02 Dial should operate smoothly without slipping or skipping pulses. It should not require excessive windup force nor stop on slow return.

- Check by operating dial several times.
- Replace dial if it fails to meet requirements in 3.02 or if wrong numbers are suspected.

3.03 Cardholder tabs on underside of the fingerwheel should clear the number plate clamping ring. Remove cardholder from fingerwheel to readjust tabs.

3.04 The number plate should not be marred or the enamel chipped. The characters should be clearly legible.

- Clean dirty number plate with damp KS-2423 cloth.
- Replace broken number plates rather than replace the dial.

3.05 Parts of the dial shall not be broken or missing. (A broken buffer spring on a 5-type dial is permissible, Fig. 10.)

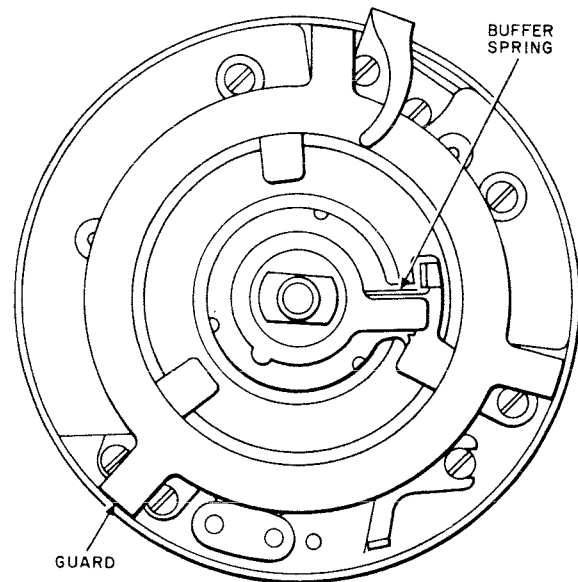


Fig. 10—5-Type Dial Showing Buffer Spring and Metal Guard

- Missing screws, washers, and eyelets should be replaced.
- All mounting screws should be in place and tight.
- Unused terminal screws should be securely tightened.
- Replace screws having stripped threads.

- Replace dial if dial case hole threads are stripped.

**3.06** The finger stop should not be loose or distorted. With the dial in its unoperated position the finger stop shall not cover any portion of the "0" hole of the fingerwheel on the 5-type dial and not more than 3/64-inch on the 6-, 7-, and 8-type dials.

**3.07** Cord tip terminations of the dial should be tightly clamped by their associated screws and not touching any other metal parts or adjacent cord tips.

#### Dial Straps

**3.08** When 5- or 6-type dials are used in station circuits where the R spring is not normally required, it is necessary to strap dial terminals R and BB with P-290076 dial straps as shown in Fig. 11.

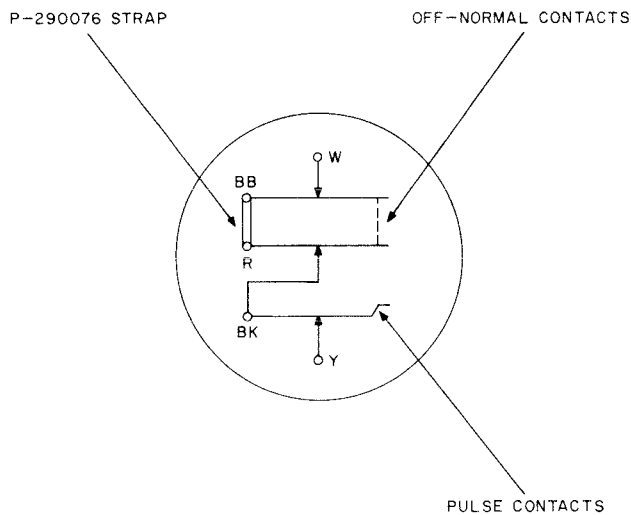


Fig. 11—Use of Dial Straps

#### Dial Contact Requirements

- 3.09** Contacts which test open should be cleaned by burnishing with a 265C tool.
- 3.10** Off-normal contacts should not move until the fingerwheel has moved at least 1/16 inch.

**3.11** On rundown of the dial the shunt contacts should not open until the last pulse is completed.

**3.12** If above requirements are not met, replace the dial.

#### Dial Speed Test

**3.13** In central offices equipped with automatic dial test equipment, test dial speed in the following manner:

- (1) Obtain dial tone.
- (2) Dial code number for dial speed test.
- (3) After dial tone is heard again, dial one of the following digits:
  - Digit number 2 (test for 8 to 11 pulses per second)
  - Digit number 3 (readjust, test for 9.5 to 10.5 pulses per second).
- (4) Listen for dial tone again, dial digit 0. One of the following audible signals will indicate how the dial meets the requirements of the test:
  - Ringing induction—dial speed satisfactory
  - Rapidly interrupted dial tone—dial speed fast
  - Slowly interrupted dial tone—dial speed slow



*The 20-pulse-per-second dial, or so-called high-speed dial, should not be used on customer station equipment. See 2.03 and 2.05.*

**3.14** If dial test circuits are not available, be guided by local instructions for testing dial speed.

#### Dial Speed Adjustments (5-Type Dial)

**3.15** The speed of the 5-type dial shall be within a minimum of 8 and maximum of 11 pulses per second. If the requirement is not met, adjust to a minimum of 9-1/2 or to a maximum of 10-1/2 pulses per second.

- (a) Use a 260 tool to adjust the speed as follows:
- (1) Place 260 tool on dial governor (Fig. 12) to hold the movable parts.
  - (2) Loosen governor adjusting screw enough to permit movement of the adjusting arm.
  - (3) Move adjusting arm toward F (to increase speed) or toward S (to reduce speed), gauging the amount of movement by the adjusting marks (Fig. 12).
  - (4) Tighten adjusting screw and remove tool.
  - (5) With receiver on-hook, dial 0 and visually determine if desired change in speed has been realized. If Central Office is equipped with automatic dial test equipment, see 3.13.
  - (6) Replace dial if speed cannot be adjusted to meet requirements.

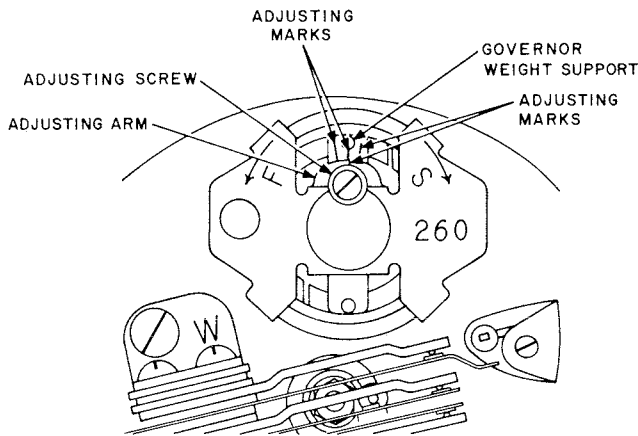


Fig. 12—Dial Governor With 260 Tool in Place

**3.16** The speed of 6-, 7-, and 8-type dials is not adjustable and the dial should be replaced when speed requirements are not met.

**Fingerwheel**

**3.17** The fingerwheel shall not wobble in excess of 1/16-inch at its outside edge throughout its full travel. Inspect visually.

**3.18** Clearance between edge of fingerwheel and finger stop at all points when 0 is dialed shall be 1/64-inch minimum. Inspect visually.

**3.19** Dials on which fingerwheels have been replaced and which still do not meet the above clearance requirements shall be replaced. These dials probably have bent shafts.

**3.20** If the fingerwheel is removed for any reason, fingerwheel washer P-459447 (if not already present) shall be placed between the fingerwheel and the fingerwheel nut, (Fig. 13) except when a plastic fingerwheel is used on 5-type dial.

**3.21** If the fingerwheel is removed from a 6- or 7-type dial of early manufacture, install a P-12A951 hub retainer (Fig. 13) to prevent the motor spring and hub assembly from jumping out of its proper position. (Replace dial if this occurs.) Dials of later manufacture (identified by a black finish fingerwheel nut) have either been equipped with a retainer or the hub has been staked on the shaft.

**Plastic Fingerwheel**

**3.22** Install as follows:

*Note:* When replacing a P-19B524 fingerwheel with a P-11E007 fingerwheel, the finger stop must be bent upward to clear the fingerwheel (Fig. 14).

- (1) With dial in normal position, place fingerwheel clamp on dial hub so that spring portion is near digit 9 on number plate, as shown in Fig. 15.
- (2) Place fingerwheel washer and nut on hub and tighten (omit spring washer on 5-type dial).
- (3) Place station number card in fingerwheel between window and card support.
- (4) Place fingerwheel over clamp with 0 hole directly on digit 9, making sure fingerwheel depressions are properly positioned on prongs of clamp plate, as shown in Fig. 16 (A).
- (5) Rotate fingerwheel in counterclockwise direction until clamp spring snaps into notch on underside of fingerwheel, as shown in Fig. 16 (B).

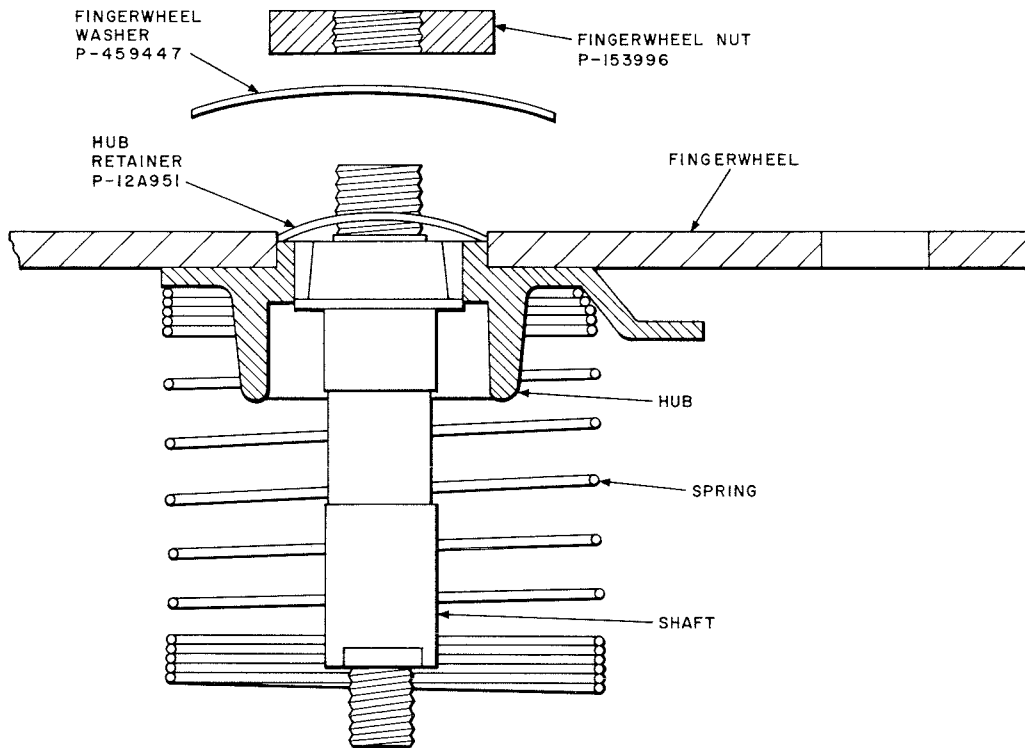


Fig. 13—Dial Hub Retainer and Spring Washer

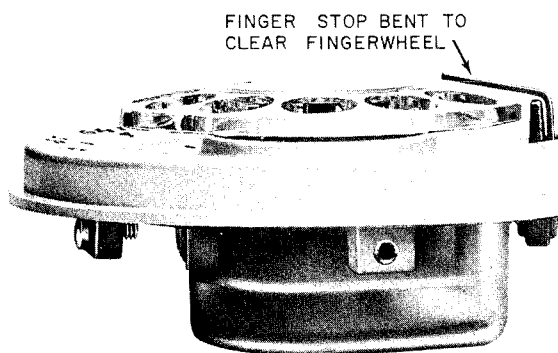


Fig. 14—7-Type Dial With P-11E007 Fingerwheel Installed

**3.23** Remove as follows:

- (1) Rotate fingerwheel in clockwise direction as far as possible.

- (2) Insert KS-16750, List 2 releaser into small hole located in edge of raised center of fingerwheel, as shown in Fig. 17 and push down to disengage the fingerwheel clamp spring. Continue to rotate the fingerwheel in a clockwise direction.

- (3) When clamp spring releases, remove fingerwheel and dial will return to normal.

**Number Plates**

**3.24** 5-Type Dial:

- (a) To change the number plate, remove the card holder fingerwheel nut, washer, fingerwheel, and number-plate clamping ring.
- (b) When replacing clamping ring over number plate, first insert a prong of clamping ring into lower slot in number plate, and then force the other two prongs into remaining slots.
- (c) The 164C-3 number plate used with 5M or 6H dial helps to simulate 7-type dial when

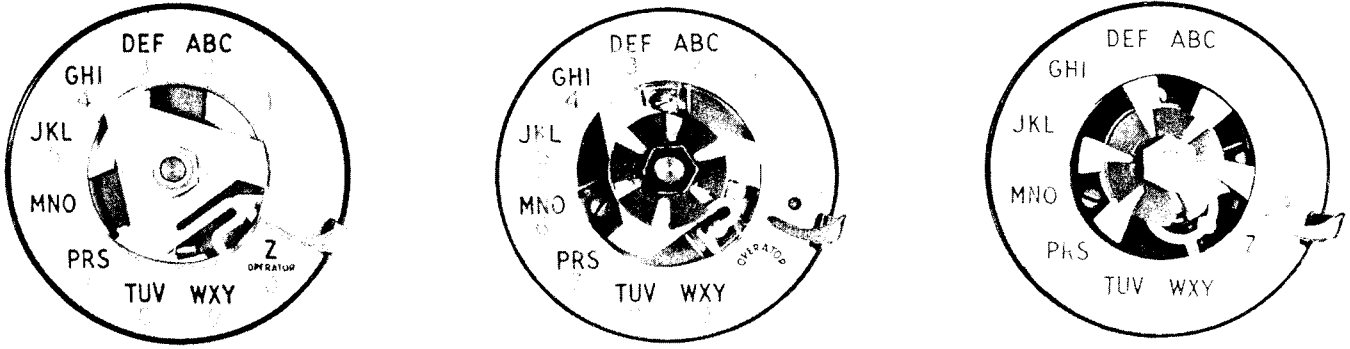


Fig. 15—Clamp Plates Mounted on Dials

used on 5300 and 5400 series telephone set, as shown in Fig. 18.

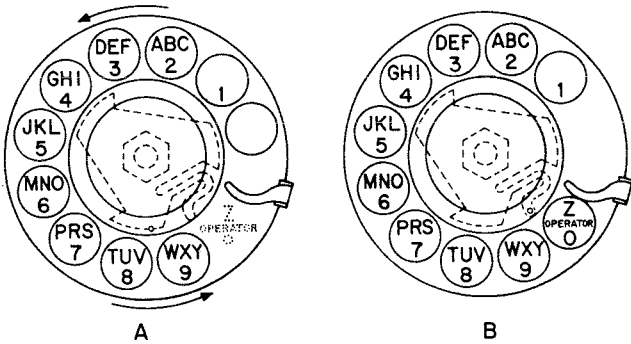


Fig. 16—Replacing Plastic Fingerwheels

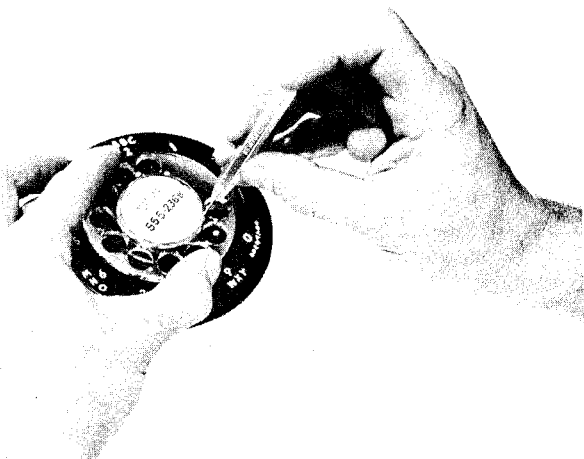


Fig. 17—Removing Plastic Fingerwheel

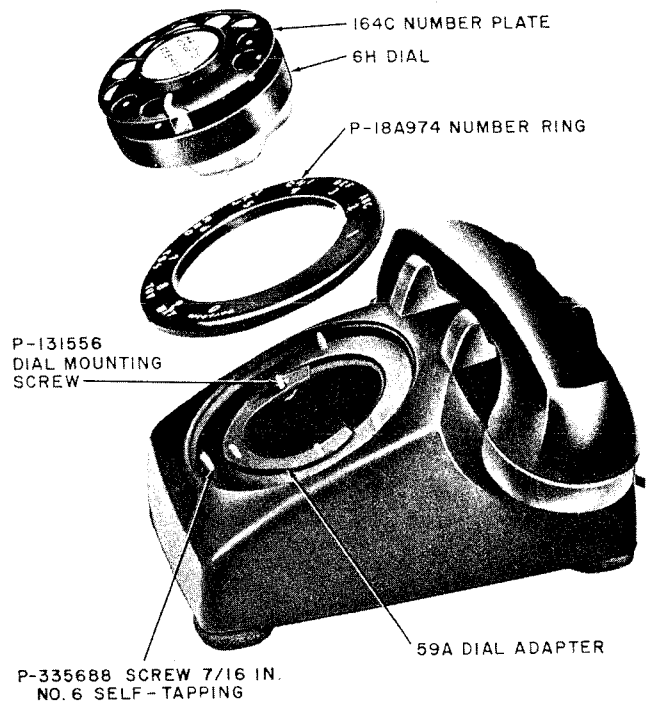


Fig. 18—6H Dial and P-18A974 Number Ring

3.25 6-Type Dial:

- (a) To remove number plate on a dial with a metal fingerwheel, remove the card holder, fingerwheel nut, fingerwheel (see 3.23 for plastic fingerwheel), and two exposed screws.

- (b) To replace number plate, reverse above procedures.

### 3.26 7-Type Dial:

- (a) To remove the number plate on dial with metal fingerwheel, remove the cardholder, frame, fingerwheel nut, washer, fingerwheel, finger stop, and two P-174053 BHM shoulder-type special screws.
- (b) To remove number plate on a dial with a plastic fingerwheel, follow the sequence in Fig. 17, 19, 20, and 21.
- (c) To replace number plate, reverse above procedures.

**Note:** Reuse ring assembly from old number plate.

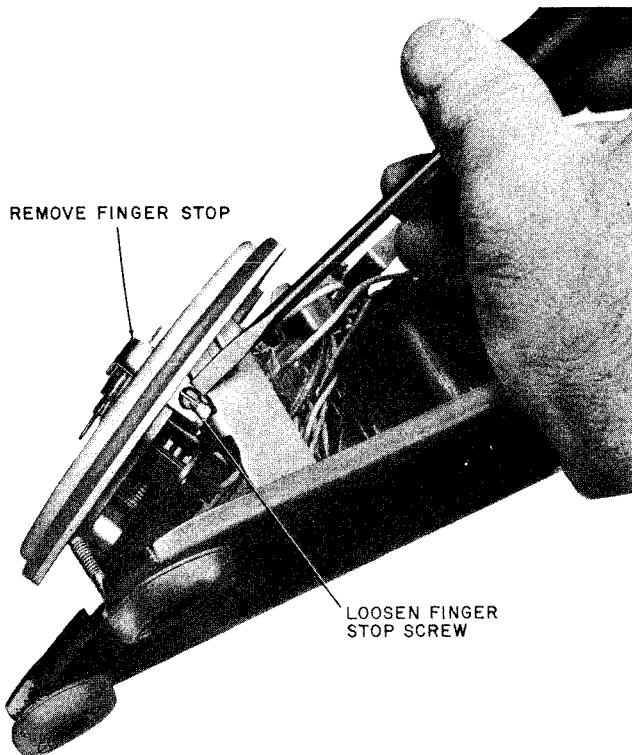


Fig. 19—Removing Finger Stop

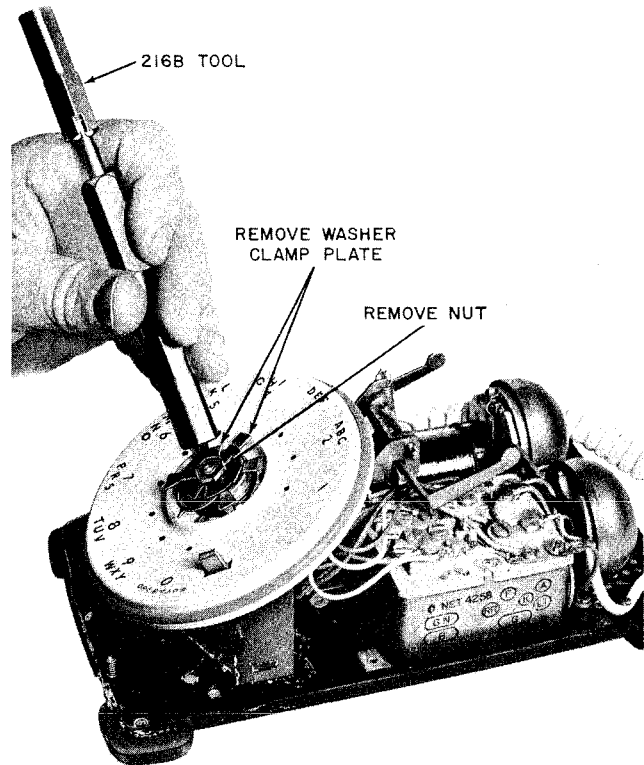


Fig. 20—Removing Nut, Washer, and Clamp Plate

### 3.27 8-Type Dial:

- (a) To remove number plate:
- (1) Remove plastic fingerwheel (see 3.23).
  - (2) Remove lock ring by rotating ring counterclockwise until it is free (Fig. 22). Then raise ring until it is just under clamp plate and slide toward rear of dial (Fig. 23) until upper end of ring can be lifted over clamp plate. Slide ring toward front of dial and remove.
  - (3) Lift number plate off dial.
  - (4) Before placing new number plate on the dial, wipe face of light shield clean.
- (b) To replace number plate, reverse above procedures.

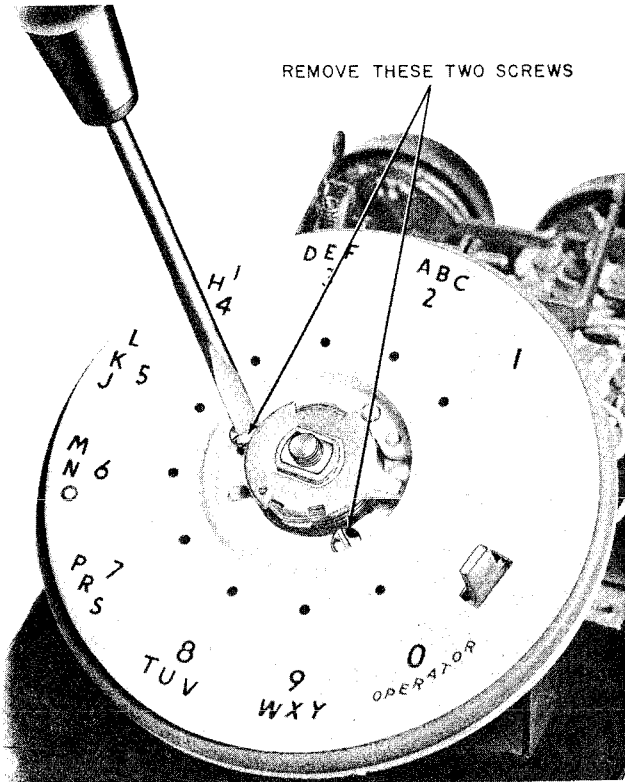


Fig. 21—Removing Number Plate Screws

(c) When changing from one color to another, the index ring must also be changed. See Table H for piece part information.

**Adjustments To Prevent Mechanical Noise—6- and 7-Type Dials**

3.28 In 6- or 7-type dials, the motor gear meshes with the intermediate gear on the governor gear train assembly (Fig. 24).

3.29 Excessive noise, binding, or lockup may be caused by:

- Too much backlash (loose mesh)
- Too little backlash (tight mesh).

3.30 For proper operation of dials, a slight perceptible backlash is required.

3.31 To get the "feel" of the gears, dial a series of zeros. Keep the finger in fingerwheel hole so that improper mesh can be felt either on wind-up or run-down.

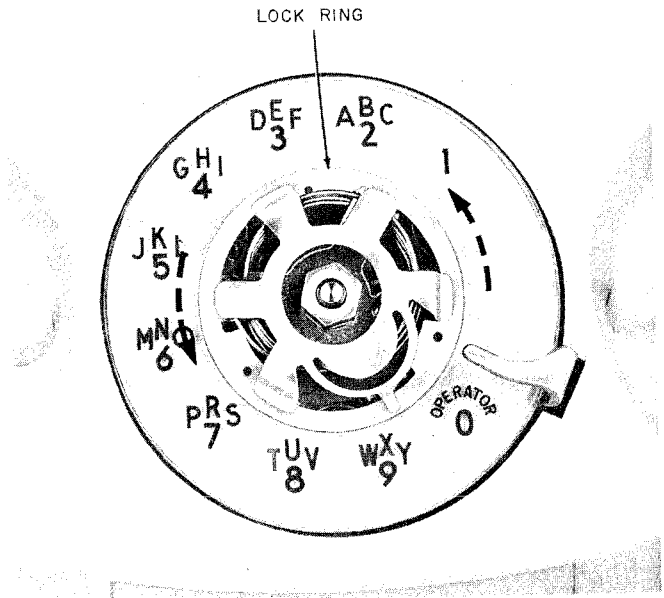


Fig. 22—8-Type Dial, Fingerwheel Removed to Show Lock Ring

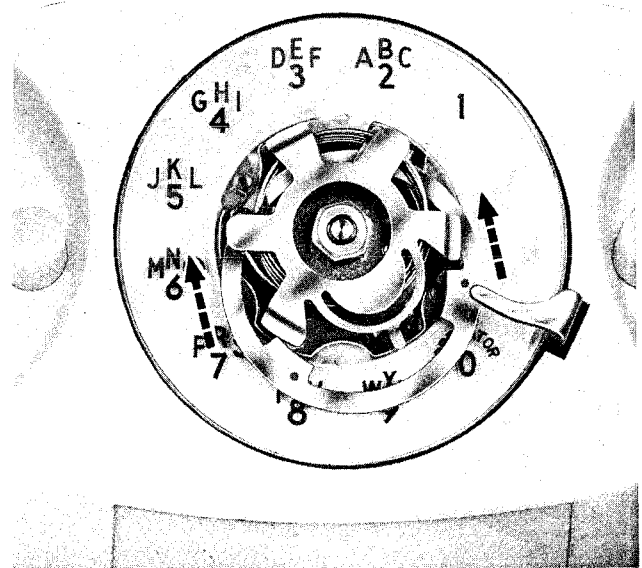
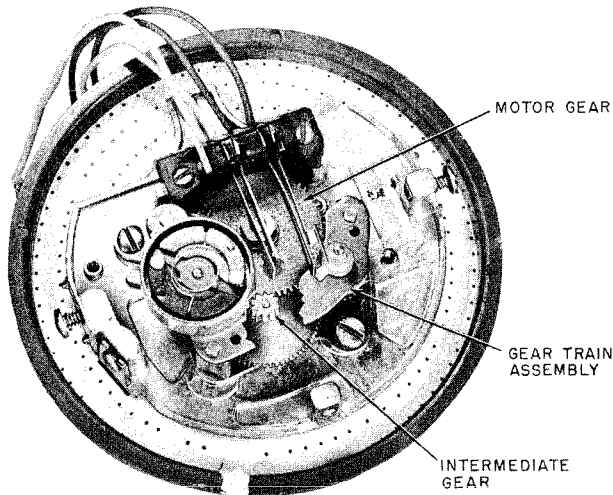


Fig. 23—Lock Ring in Extreme Forward Position for Removal

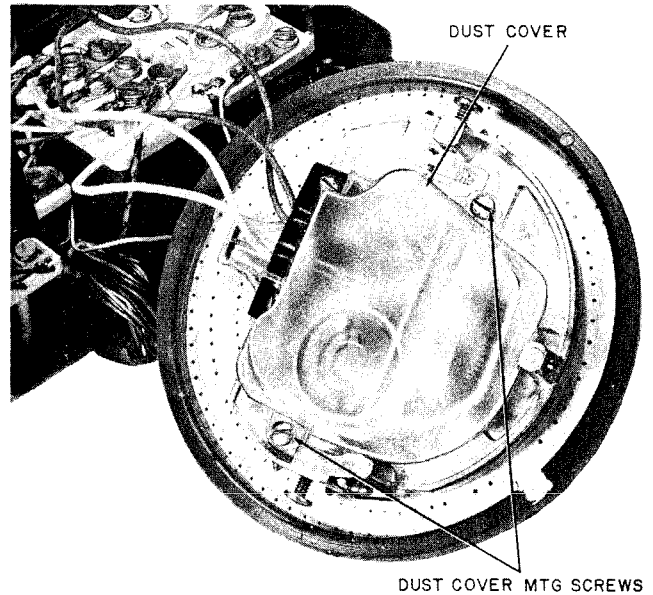
3.32 For a more positive backlash test, proceed as follows:

- (1) Remove housing from set.





**Fig. 24—7-Type Dial Gear Mesh**



**Fig. 25—7-Type Dial Removed From Set**

(2) Remove dial from dial mounting (Fig. 25). It is not necessary to disconnect spade tip conductors.

(3) Remove the dust cover from dial (Fig. 26).



*After dust cover is removed, do not touch dial contacts or governor. These two assemblies are carefully adjusted at the factory. Any distortion will change the percent break in pulsing contacts or speed of governor.*

(4) Grasp rim of fingerwheel with thumb and fingers. Rotate fingerwheel about 1 inch and hold in this position.

(5) Hold intermediate gear immobile with index finger of other hand (Fig. 27).

(6) Very gently rotate fingerwheel back and forth just enough to feel any backlash.

(7) Rotate fingerwheel to about 3/4 distance of its travel. Repeat steps (4), (5), and (6).

### 3.33 To adjust gear mesh:

(1) Loosen screw A (Fig. 28) just enough to allow the elongated slot in the gear train assembly to be moved.

(2) To tighten gear mesh, place screwdriver blade between raised detail on frame and gear train assembly (Fig. 28). Twist blade enough to slightly move the assembly. Test dial each time the assembly is moved using methods described in steps (4) through (7) in 3.32.

(3) To loosen gear mesh, place screwdriver blade between contact spring-block mounting support and gear train assembly (Fig. 29). Twist blade enough to slightly move the assembly. Test dial each time the assembly is moved using methods described in steps (4) through (7) in 3.32.

(4) Tighten screw A when adjustment is completed.

(5) Dial a series of zeros to test dial.

(6) If dial still does not operate properly, reassemble dust cover and replace dial.

(7) If dial operates properly, replace dust cover.

(8) Reassemble dial.

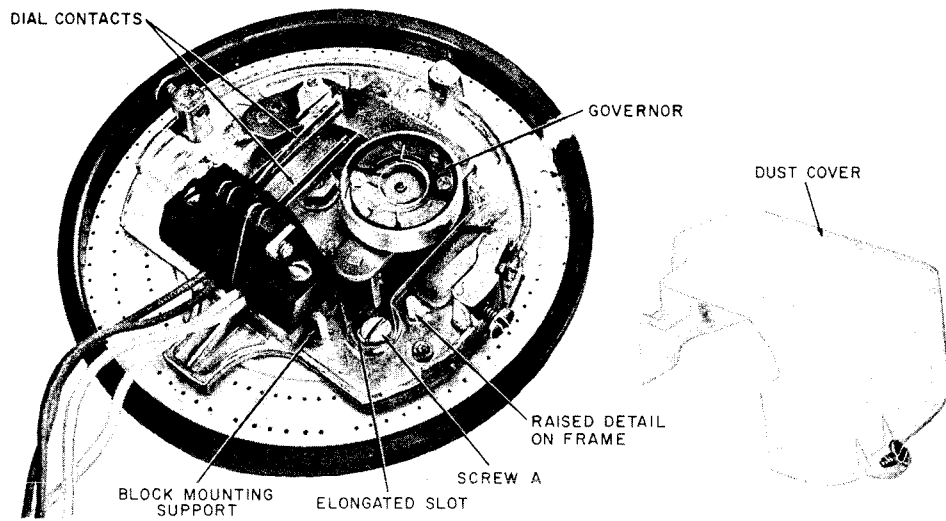


Fig. 26—7-Type Dial, Dust Cover Removed

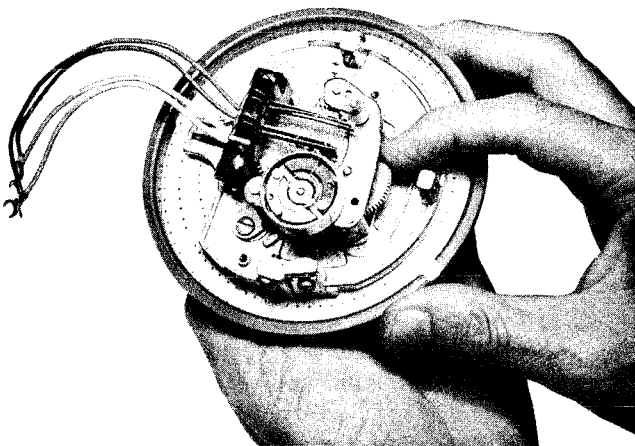


Fig. 27—Holding Intermediate Gear Immobile

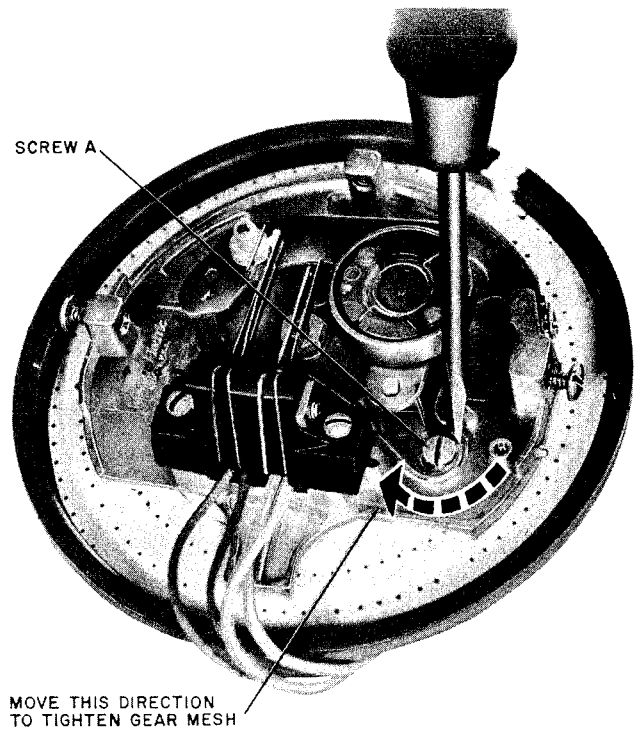
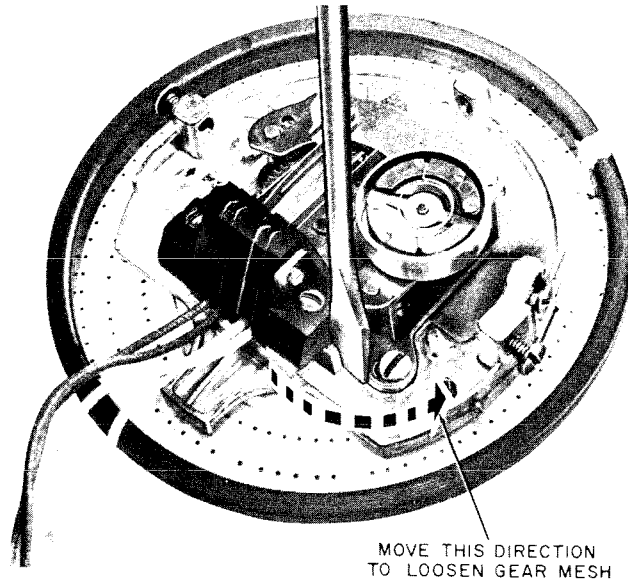


Fig. 28—Using Screwdriver to Tighten Gear Mesh



**Fig. 29—Using Screwdriver to Loosen Gear Mesh**



**STATION DIALS**  
**9-TYPE**  
**IDENTIFICATION AND MAINTENANCE**

**1. GENERAL**

**1.001** This addendum supplements Section 501-162-101, Issue 5.

**1.002** This addendum is issued to add information on Low Torque Dials for the handicapped.

**1.02** A low torque dial is available for use by handicapped persons. The dial is the same as the standard 9-type dial except the motor spring pretensions have been reduced to provide minimal torque. It may be obtained by adding "Low Torque Dial" to the ordering information for the standard 9-type dial.

The following change applies to Part 1 of this section:

(a) 1.02--added



## STATION DIALS

### 9-TYPE

### IDENTIFICATION AND MAINTENANCE

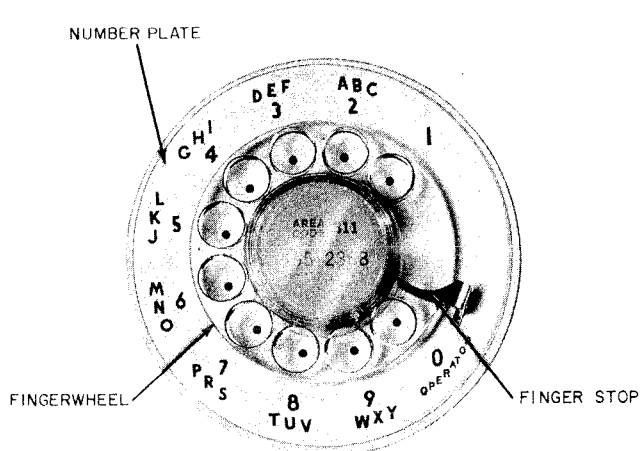


Fig. 1 — 9-Type Dial, Front View

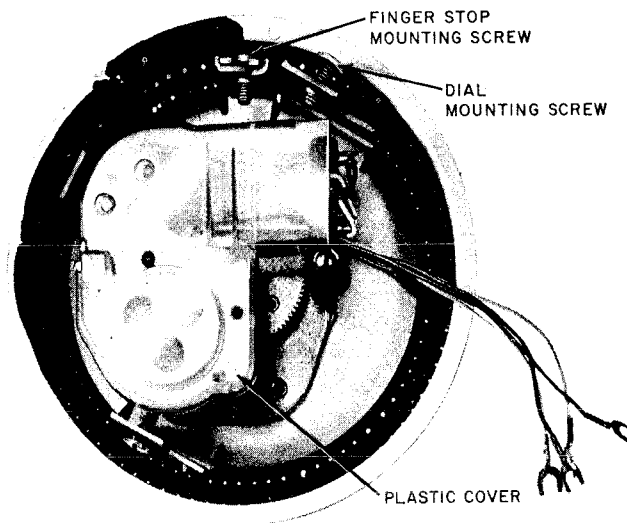


Fig. 2 — 9-Type Dial, Rear View

#### 1. GENERAL

1.01 This section is reissued to:

- Revise illustrations
- Revise text

#### 2. PURPOSE

To provide a direct replacement for 7-type dials.

#### 3. ORDERING GUIDE

- Refer to Table A for components

**TABLE A\***  
**COMPONENT ORDERING GUIDE**

REPLACEABLE COMPONENTS	DIAL						
	9C	9H	9K	9L	9M	9N	9P
Cover, Plastic	P-11E300	P-11E300	P-11E300	P-11E300	P-11E300	P-21F157	P-11E300
Plate, Clamp	P-44E348	P-44E348	P-44E348	P-44E348	P-44E348	P-44E348	P-44E348
Plate, Number	P-82D400†	P-82D400†	P-82D500†	P-82D600†	P-82D400†	P-83D400†	P-82D400†
Stop, Finger	P-44E351	P-44E351	P-44E351	P-44E351	P-44E351	P-44E351	P-44E351
Wheel, Finger	P-11E007	P-11E007	P-11E007	P-11E007	P-11E007	P-11E007	P-11E007

\*Refer to Table B for color selection.

†Add suffix for desired color.

## 4. COLOR

**TABLE B**  
**COLOR ORDERING GUIDE\***

COLOR	DIAL						
	9C-	9H-	9K-	9L-	9M-	9N-	9P-
Black —03	•	•	•	•	•	•	•
Ivory —50	•	•					
Moss Green —51	•	•					
Red —53	•	•					
Pastel Yellow —56	•	•					
White —58	•	•	•			•	
Rose Pink —59	•	•					
Lt. Beige —60	•	•					
Lt. Gray —61	•	•				•	
Aqua Blue —62	•	•					
Turquoise —64	•	•					

\*Refer to Section 500-120-100 for promoted colors.

## 5. APPLICATION

**TABLE C**

DIAL	SCHEMATIC FIG.	PULSES PER SECOND	REPLACES	USE
9C	3A	10	7A, 7C, 7D	General station sets. With colored sets or illuminated dial sets designed for 2-post mounting.
9H	3B	10	7E, 7G, 7H	Has two pair of off-normal contacts designed for speaker-phone systems. Also used on 532-, 533-, 535-, and 536-type telephone sets.
9K	3B	10	7K	Modular telephone panels
9L	3B	10	7L	Data set 101A. 691A subscriber set.
9M	3A	10	—	525-type telephone sets.
9N	3B	10	—	568N telephone set. 817A1 data auxiliary set.
9P	3C	10	—	529B telephone set.







Fig. 4 — Removing Plastic Fingerwheel

**6.02 To replace fingerwheel:**

- (1) Place fingerwheel over clamp with "0" hole directly over digit 9, making sure fingerwheel depressions are properly positioned on prongs of clamp plate.
- (2) Rotate fingerwheel in counterclockwise direction until clamp spring snaps into notch on underside of fingerwheel (Fig. 5).

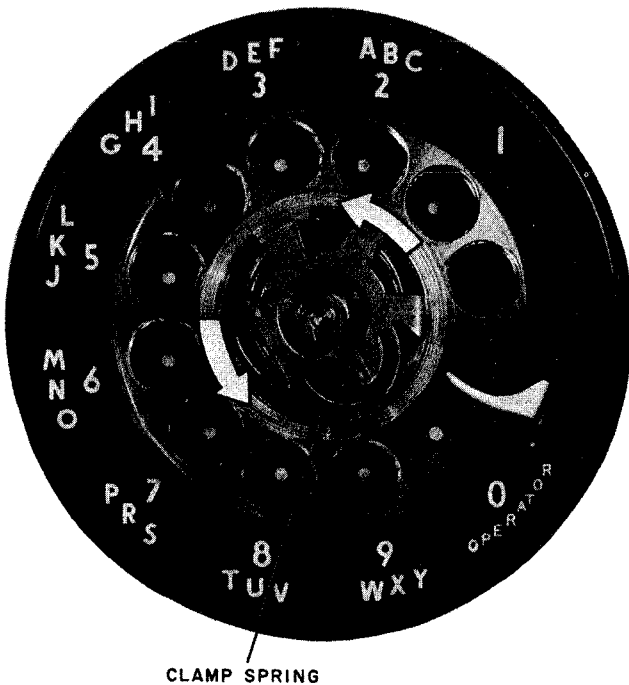


Fig. 5 — Replacing Plastic Fingerwheel

**NUMBER PLATE**

**6.03 To remove number plate:**

- (1) Remove fingerwheel (see 6.01).
- (2) Remove finger stop by loosening finger stop mounting screw.



*Exercise caution to prevent screwdriver from slipping and damaging clamp plate assembly.*

- (3) Insert tip of screwdriver blade into one of the three slots on the lock ring (Fig. 6).

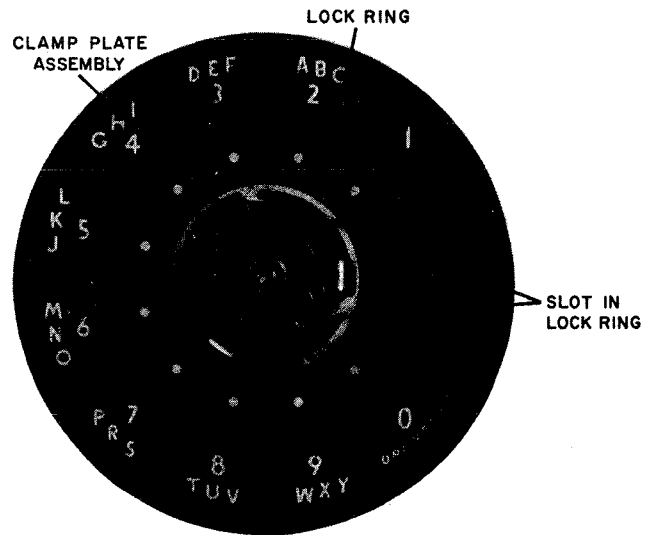


Fig. 6 — Fingerwheel and Finger Stop Removed to Show Lock Ring

- (4) Rotate lock ring as shown in Fig. 7 until it is free.
- (5) Raise lock ring until it is just under the clamp plate and slide toward the numeral 4 until the upper end of the ring can be lifted over the clamp plate (Fig. 8). Slide ring toward numeral 9 to remove.
- (6) Lift off number plate.

**6.04 To replace number plate:**

- (1) Reverse procedures in 6.03.

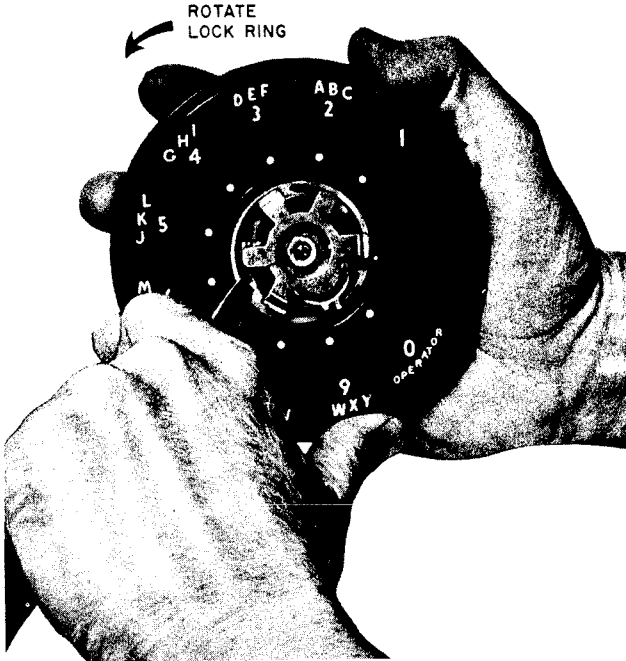


Fig. 7 — Lock Ring Removal



Fig. 8 — Lock Ring in Extreme Forward Position for Removal



## STATION DIALS

### 10-TYPE

### IDENTIFICATION AND MAINTENANCE

#### 1. GENERAL

**1.01** The 10-type dial is a space saver rotary dial intended for use as a component of the 220A hand telephone set used with the TRIMLINE® telephone set.

**1.02** This section is reissued to delete information on replacement of the fingerwheel, finger stop, number plate, and number card. Field maintenance of these parts is not recommended. If these parts are damaged or the dial is inoperative, replace the hand telephone set. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. IDENTIFICATION

**2.01** The 10-type dial (Fig. 1 and 2) has a plastic 2-3/8 inch diameter fingerwheel having finger holes on a 10-1/3 division spacing instead of the standard 12 division spacing of the 5- through 9-type dials.

**2.02** The 10-type dial has a movable finger stop which moves through an arc of 52 degrees during dialing and returns to its normal position at the end of rundown.

**2.03** The dial number plate is of clear plastic with characters embossed on the underside. The number plate can be illuminated by edge lighting for night viewing.

**2.04** The pulsing mechanism is similar to the 8-type dial, however, no shunt contact springs are provided for off-normal switching.

#### 3. MAINTENANCE

**Caution:** Do not attempt to remove the fingerwheel, finger stop, number plate, and number card. Replace the handset if any of these items are damaged or marred.

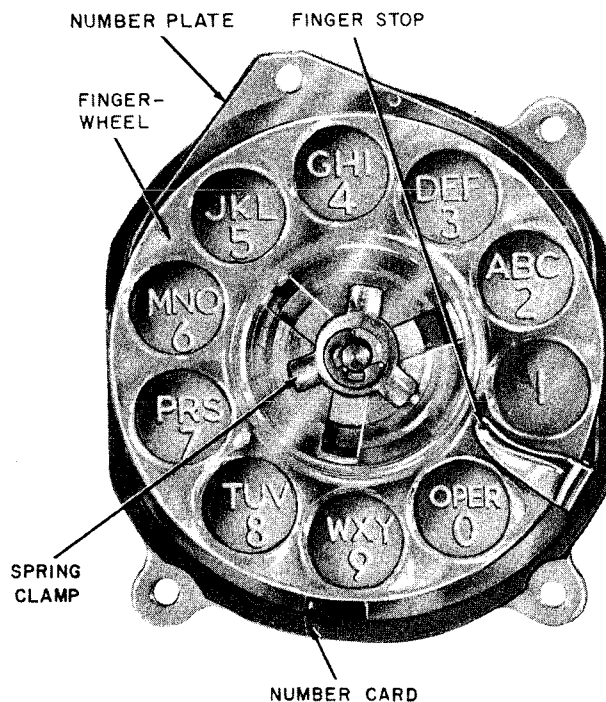


Fig. 1—10A Dial, Front View

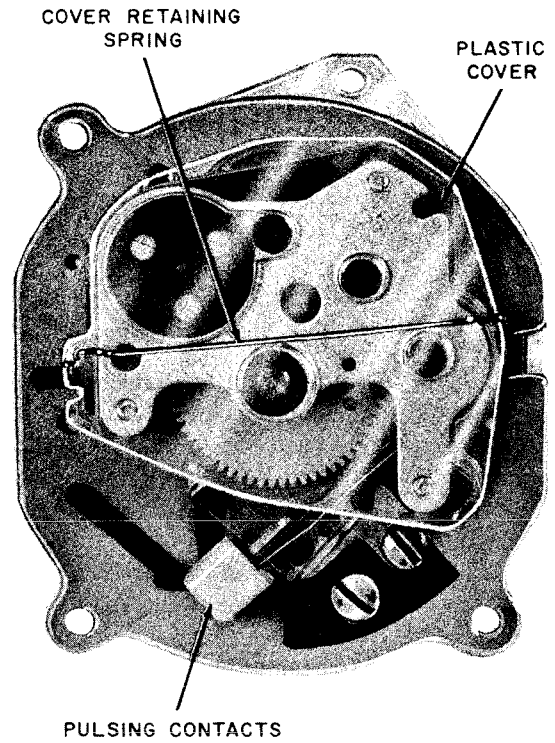
**The dial can unwind and become inoperative in the process of replacing the above items.**

- (a) The dial shall operate smoothly without slipping or skipping pulses. Check by operating dial several times. Replace handset if the dial fails this requirement or is suspected of giving wrong numbers.
- (b) No provisions are made for field adjustment of dial speed or dial gear mesh. Replace handset if improper dial speed or gear mesh is suspected.
- (c) The finger stop should operate smoothly with the fingerwheel.

**SECTION 501-162-102**

- (d) Do not lubricate any part of the dial.
- (e) Exterior parts of the dial may be wiped with a dry KS-2423 cloth.

**Note:** The hub cover (P-88E0— add desired color suffix) is a component of the telephone set, not the dial, and must be ordered separately.



**Fig. 2—10A Dial, Rear View**

**STATION DIALS**  
**TOUCH-TONE TYPE**  
**SELECTION**

**1. GENERAL**

**1.01** Tables A (dials and adjuncts) and B (card dialers and adjuncts) list the various TOUCH-TONE<sup>®</sup> dials and their intended use.

Detailed information may be found in the referenced identification section.

TABLE A  
DIALS

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
22B3	—	1616-type CALL DIRECTOR®	Has two special service pushbuttons marked P (priority) and SG (special grade)	501-164-102
22C3	—	Master and maintenance control centers of No. 1 and 101 ESS	Dial is keyed remotely by automatic test frame to provide frequencies for testing, also used for normal dialing	
22D3	—	2626A1 telephone set, 904E data test center, 10C telegraph test board, attendant circuit for M35 teletypewriter, master control center 4-wire ESS	Similar to 22C3 except for minor variations in the common switch	
22E3	—	SCAN, 1616-type CALL DIRECTOR, 3-type speakerphone	Has leads for polarity guard, surge protector, amplified handsets and 2/4 wire telephone sets	*
25A1	—	General purpose 1500-type telephone sets	Has standard common switch. Cannot be used with speakerphone	501-164-105
25A3 (MD)	25W3			
25B3 (MD)	25Y3	General purpose 1500-type telephone sets arranged for speakerphone	Similar to 25A3 (MD) dial but has an expanded common switch and additional leads	
25D3 (MD)	25M3 (MD)	26B dial (MD)	Similar to 25A3 (MD) dial but has expanded common switch and additional leads to card dialer	
25E3	—	1A2, 2A2, and 1235G coin telephones	Similar to 25A3 (MD) dial but has modified circuit for use with coin telephones	
25F1	—	Attendants console in WADS	Similar to 25A1 but has an expanded common switch and a modified circuit board	
25G1	—	26C dial	Similar to 25F1 but has additional leads to card dialer	
25H4 (MD)	25P4	1702-type telephone set		
25J3	—	1B5A and 2B7A-type telephone console in 757 PBX	Has expanded common switch providing additional functions necessary (for use with 757A PBX)	
25K3 (MD)	25S3	552 and 555 PBXs	Plug ended — to mount on switchboard, a 50A dial mounting must be used	



**TABLE A**  
**DIALS (Cont)**

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
25L3	—	1234G coin collector	Similar to 25A3 (MD) dial but has modified circuit for use with coin collectors	501-164-105
25M3 (MD)	25R3	26D dial (MD)	Similar to 25D3 (MD) but with minor common switch wiring changes and additional leads to card dialer	
25N3 (MD)	25T3	26E (MD) dial in 557A and 557B PBX	Plug ended to mount in PBX card dialer	
25P4	—	1702-type telephone set	Similar to 25H4 (MD) with extra leads for polarity guard, surge protector, amplified handsets, and 2/4 wire telephone sets	
25R3	—	26F dial	Similar to 25M3 (MD) with extra leads for polarity guard, surge protector, amplified handsets, and 2/4 wire telephone sets	
25S3	—	552 and 555 PBXs	Plug ended — to mount on switchboard, a 50A dial mounting must be used	
25T3	—	26G dial in 557A and 557B PBX	Plug ended to mount in PBX card dialer	
25U3	—	1671A type telephone set (CALL-A-MATIC®)	Spade tip leads connect to telephone circuit and plug ended to connect to 51A dial	
25W3	—	General purpose 1500-type telephone sets	Similar to 25A3 (MD) with extra leads for polarity guard, surge protector, amplified handsets, and 2/4 wire telephone sets	
25Y3	—	General purpose 1500-type telephone sets arranged for speakerphone	Similar to 25B3 (MD) with extra leads for polarity guard, surge protector, amplified handsets, and 2/4-wire telephone sets	
35A3A	—	General purpose 2500 series telephone sets	Has leads for polarity guard, surge protector, amplified handsets, and 2/4-wire telephone sets	
35B3 (MD)	35C3A	1035B3 (MD) dial, 3-type speakerphone systems		
35C3A	—	1035C3A dial, 2504B, 2558, 2568HP, 2684, and 2685 type telephone sets, 3-type speakerphone	Has leads for polarity guard, surge protector, amplified handsets, and 2/4-wire telephone sets	
35D3A	—	36E dial, 1036E dial, 3-type speakerphone		

TABLE A  
DIALS (Cont)

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
35E4A	—	11G and 11H apparatus units, 2712-type telephone sets, telephone sets using 4010D network or equivalent	Has leads for polarity guard, surge protector, amplified handsets, and 2/4-wire telephone sets. Can be illuminated by lamp in associated telephone set.	
35F3A	—	1B- and 2B-type telephone consoles		
35G3A	—	1A2 and 2A2 coin telephones		
35H3A	—	PBX	Similar to 25S3 but has two additional special service buttons and requires a 50-type dial mounting.	501-164-115
35J3A	—	36-type dial for PBX	Similar to 25T3 but has two additional special service buttons.	
35K3A	—	2671-type telephone set, 3-type speakerphone		
35L3A	—	36H dial		*
35M3 MD	35D3A	36D dial (MD) 3-type speakerphone	Similar to 35D3A except for extra leads and for parallel operation of common switch functions.	501-164-115
35N1A	—	33- and 35-type teletypewriter		
35N3A	—		Similar to 25F1 but has two additional special service buttons.	
35P1A	—	36J dial in 33- and 35-type teletypewriter	Same as 35 N1A except marked for "number-letter" dialing.	*
35P3A	—	36K dial in DATA-PHONE service provided by 33- and 35-type teletypewriters	Similar to 25G1 but has two additional special service buttons.	
66A3A	—	3568HT, 3640A1A, 3641A1A telephone sets for AUTOVON, also in standard telephone circuits using 425E or equivalent networks	Same as 35P1A except marked for "number-letter" dialing.	
66A4B	—	For AUTOVON where an illuminated dial is required, also in standard telephone circuits using 425A or equivalent networks	Provides switching facilities for use with speakerphone.	501-164-123
66B3A	—	67A dial for AUTOVON telephone circuits using 425E or equivalent network		

**TABLE A**  
**DIALS (Cont)**

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
66B4B	—	67B dial for AUTOVON, also in standard telephone circuits using 425E or equivalent networks	Similar to 66B3A except illuminated	501-164-123
66C3A	—	Dial Restoration Panel for AUTOVON, also in standard telephone circuit using 425E or equivalent network	Provides switching facilities for use with speaker-phone	
66D3A	—	AUTOVON PBX	Requires 50B dial mounting	501-165-180
66D4B	—		Similar to 66D3A except illuminated	
80B2A	—	1220A hand telephone set		
82A2A	—	2220B hand telephone set		*

**DIAL ADJUNCTS**

1025A3 (MD)	1025W3	4A key equipment, rotary dial 211-type hand telephone set		501-164-128
1025W3	—			
1035B3 (MD)	1035C3A	With regular subscriber set for Digital Inquiry-Voice Answer Service	Provided with 35B3 (MD) dial and polarity guard, permits end-to-end signaling where CO is not equipped to handle TOUCH-TONE	501-164-130
1035C3A	—			

\*Not in current section reference.

TABLE B  
CARD DIALERS

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
26B (MD)	26D (MD)	1622-type telephone sets	Combination of 25D3 (MD) dial and card reading mechanism, provides switching facilities for use with 3A speakerphone	
26C	—	Attendant console of 33- and 35-type teletypewriters	Combination of 25G1 dial and card reading mechanism, current models have 3-pole single-throw switch to enable manual dialing when card is in stop position	
26D (MD)	26F		Combination of 25M3 (MD) dial and card reading mechanism, polarity guard cannot be used when dial is connected to speakerphone	501-164-106
26F	—	1660-, 1662-, 1663-, and 1664-type telephone sets	Combination of 25R3 dial and card reading mechanism, has 3-pole, single-throw switch to enable manual dialing when card is in stop position, polarity guard can be used when dial is connected to speakerphone	
26G	—	557A and 557B PBX	Combination of 25T3 dial and card reading mechanism, leads terminate in a KS-19088, List 5 plug, has 3-pole, single-throw switch to enable manual dialing when card is in stop position, polarity guard can be used	
36D (MD)	36E	1036D dial	Combination of 35M3 (MD) dial and card reading mechanism. Manual dialing when card is in stop position on models manufactured after Oct. '66	501-164-116
36E	—	1036E dial, 2260-, 2262, 2663-, and 2664-type telephone sets	Combination of 35D3A dial and card reading mechanism. Manual dialing when card is in stop position, can be used with speakerphone and polarity guard	
36H	—	804P3 data auxiliary set	Combination of 35L3A dial and card reading mechanism. Manual dialing when card is in stop position. Dial and card reader are not mechanically connected. A MB5 relay functions as a common switch during card dialing.	*

**TABLE B**  
**CARD DIALERS (Cont)**

DIAL	REPLACED BY	INTENDED USE	REMARKS	SECTION REFERENCE
36J	—		Combination of 35P1A dial and card reading mechanism. Similar to 26C but has two additional special service buttons.	
36K	—	33- and 35-type teletypewriter	Combination of 35P3A dial and card reading mechanism. Same as 36J except marked for "number-letter" dialing.	*
36L	—	557A and 557B PBX	Combination of 35J3A dial and card reading mechanism. Similar to 26G but has two additional buttons.	
67A	—	3666A1A telephone set	Combination of 66B3A dial and card reading mechanism, can be used with speakerphone	
67B	—	3666A1B telephone set	Combination of 66B4B dial and card reading mechanism, illuminated by two 53A lamps	501-164-124
<b>CARD DIALER ADJUNCTS</b>				
1036D (MD)	1036E	For use with subscribers regular rotary dial telephone set, provides end-to-end signaling when CO is not equipped to handle TOUCH-TONE calls	36D (MD) dial mounted in housing.	501-164-131
1036E	—		Provided with a 36E dial and polarity guard, permits operation of telephone set and adjunct with 3-type speakerphone	

\*Not in current section reference.



## HANDSETS

### G1, G2, G3, G4, AND G5 TYPES

#### IDENTIFICATION, MAINTENANCE, AND CONNECTIONS

#### 1. GENERAL

1.01 This section is reissued to:

- Include G3AA, G3AB, and G3AC handsets
- Change type of receiver units in Tables A, B, and C
- Delete types of receiver and transmitter units from Fig. 6 through 18
- Add Fig. 19

#### 2. IDENTIFICATION

2.01 The G-series handset (Fig. 1) consists of a molded handle, receiver unit, transmitter unit, transmitter cup, receiver and transmitter caps, and a handset cord.

2.02 An R as the last letter of a handset code indicates that the handset is equipped with a retractile (spring) cord. Later model codes do not include the R but are equipped with retractile cords.

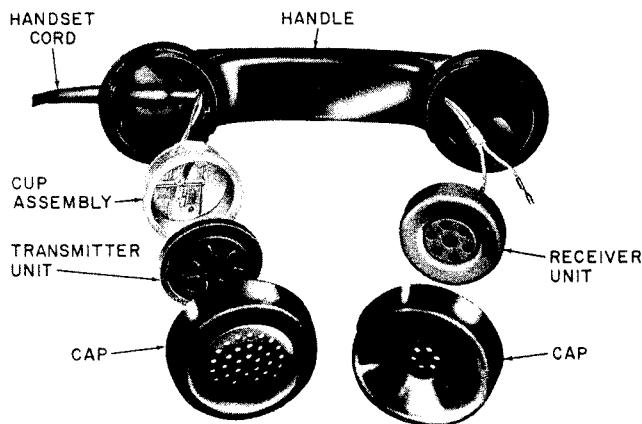


Fig. 1—G Series Handset

2.03 Early G-series handsets were equipped with cord retainer parts in the transmitter cavity (Fig. 2). Current G-series handsets are equipped with transmitter cups having the cord retainer molded on the cup (Fig. 3). The two types of cord retainer arrangements are not interchangeable.

2.04 A P-26E836 waterproof membrane assembly, which fits over the transmitter and is a part of the G3S and G3T handsets, may be installed in any G-series handset. When this cover is used, it is necessary to install a special P-87C700 transmitter cap (Fig. 4).

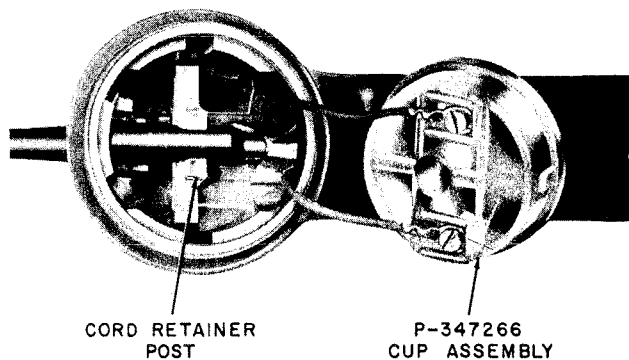


Fig. 2—Early G Series Handset

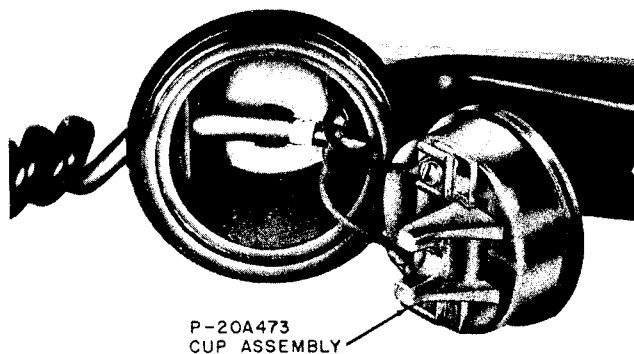


Fig. 3—Current G Series Handset

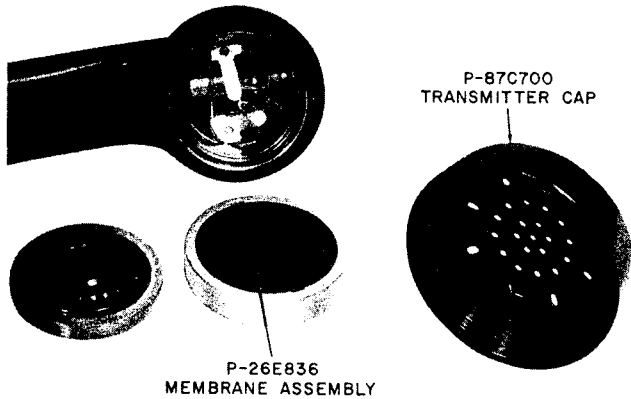


Fig. 4—Waterproof Transmitter Assembly

**G1-TYPE**

**2.05** The G1-type handsets are available in black (-3) only.

**2.06** Weighted G1-type handsets are used on older modified coin collectors. The handsets are weighted by installing an RS-9099 weight in the transmitter cavity. The modified coin collectors are identified by the letter N following the type number.

**2.07** Table A lists the G1-type handsets with component parts and intended uses. Reference to the appropriate connection diagram is also given.

**2.08** Maintenance of G1-type handsets consists of replacing cracked or broken caps, defective transmitter and receiver units, and replacing defective handset cords.

**2.09** To replace handset cord proceed as follows:

- (1) Remove receiver and transmitter units, disconnect cord tips, remove cotton acoustical barrier, and pull defective cord outward through hole in handle.
- (2) Pass free conductors of handset end of new cord through hole in handle.
- (3) Advance cord through hole into transmitter bowl by turning it with a threading motion until grommet is in proper position.

*Note:* Because of an occasional snug fit it may be necessary, after advancing cord through hole, to grasp it firmly by groove on grommet with a pair of long-nose pliers. Use pliers as a lever inside bowl to pull grommet into position.

- (4) Fold a piece of fairly stiff wire back onto itself to form a long fishing tool. Insert the closed end of the tool into the handle through the receiver well. Push fish wire into handle until closed end protrudes into the transmitter bowl.

**TABLE A**

**G1-TYPE HANDSETS**

HANSET (See Note)	CORD	TRMTR UNIT	CONNECTION DIAGRAM	USED WITH
G1AR	H4CJ	T1	Fig. 7	500-series telephone sets
G1DR	H4BL		Fig. 8	PBX system order turrets
G1FR	H4BN-3		Fig. 7	Telephone sets, 570-types
G1G*	H4CG	T2	Fig. 7	Coin collectors equipped with armored cords
G1J	H4CS	T1		525A and 525B telephone sets

\*Manufacture Discontinued (MD).

*Note:* All G1-type handsets are equipped with the following parts:

- P-339616 handle
- P-80A203 receiver cap
- P-80A103 transmitter cap
- U3 receiver unit



- (5) Place ends of receiver conductors through loop of fish wire and feed conductors into handle while pulling wire through to receiver well.
- (6) Connect cord leads to transmitter cup and to receiver. Using the transmitter cup, anchor the cord and replace the transmitter and transmitter cap.
- (7) Insert the cotton acoustical barrier and dress the excess receiver leads into the receiver well. Replace the receiver and receiver cap.

**Note:** Acoustical barrier should not extend into receiver well.

- 2.10** If a G1-type handset is defective and must be replaced, use a comparable G3-type as the replacement.

#### **G2-TYPE**

- 2.11** The G2-type are push-to-talk or push-to-listen handsets which are equipped with a pushbar switch in the handle.
- 2.12** G2-type handsets are rated MD and have been replaced by the G5-type.
- 2.13** Repair or adjustment of pushbar contacts or springs should not be made in the field. The G2-type handsets having defective switches should be replaced by a comparable G5-type.

#### **G3-TYPE**

- 2.14** The G3-type handsets are available in standard telephone colors. See section covering telephone apparatus color.
- 2.15** Table B lists the G3-type handsets with component parts and intended uses. Reference to appropriate connection diagram is also given.
- 2.16** The G3BR, G3CR, and G3DR handsets are equipped with U4 receiver units for use in systems requiring receivers with higher impedance (600 ohms).
- 2.17** G3FR, M, P, R, S, and T handsets are intended for use on coin collectors. Some coin collectors are equipped with armored handset cords. The G3S and G3T handsets are also equipped with a waterproof transmitter cover for use on outdoor coin collectors (Fig. 4).

- 2.18** The G3-type handsets equipped with armored cords for use with coin collectors (G3P, R, S, and T handsets) are sealed units. Receiver and transmitter caps are cemented to the handle to prevent loss of units and the receiver is equipped with a security guard. If the sealed handset or cord require replacing, replace handset and cord as a unit.

- 2.19** Maintenance of G3-type handsets consists of replacing cracked or broken caps, replacing defective receiver or transmitter units, and replacing frayed or damaged cords (except for sealed units).

- 2.20** To replace handset cord (except armored cords) see 2.09.

#### **G4-TYPE**

- 2.21** The G4AR and G4B handsets consist of T1 transmitter units, U3 receiver units, and H4CJ cords mounted on a handle having two holes for mounting a shoulder rest (Fig. 5). The shoulder rest is a shipped loose item and can be installed to fit either the left or right shoulder. The G4-type handset can be used as a replacement for G3-type handsets where a shoulder rest is desired. Connection Fig. 7 applies for G4-type handsets.

- 2.22** The G4AR handset is available in black only and is rated MD. The G4B handset replaces G4AR and is available in standard telephone color. The P-88C100 shoulder rest (G4B-type) is available in color also. The last two digits of the part number should reflect the color desired. See section covering telephone apparatus color.

- 2.23** A new molded pad, P-19B931, is available as a replacement for the two piece pad on G4B handset shoulder rests. The new pad is lighter in weight and of a contrasting gray color to be used with all standard handset colors. Current production G4B handsets will incorporate the new pad.

- 2.24** Maintenance of G4-type handsets consists of replacing cracked or broken caps, defective receiver and transmitter units, and worn, frayed, or damaged cords. Damaged or broken shoulder supports and worn or discolored pads should be replaced.

- 2.25** To replace handset cord of G4-type handset see 2.09.

TABLE B

## G3-TYPE HANDSETS

HANDSET (Notes)	CORD	TRMTR UNIT	TRMTR CAP	RCVR UNIT	CONNECTION DIAGRAM	USED WITH				
G3AA	H4CS	T1	P-80A100	U3	7	525A and 525B telephone sets				
G3AB	H4BL				8	PBX system order turrets				
G3AC	H4BN				7	570-type-telephone sets				
G3AR	H4CJ or H4CL			U4	U3	Fig. 7	500, 600, 700 series telephone sets			
G3BR							Command Post Alerting Network (COPAN)			
G3CR	H4BL or H4CU					Fig. 9	610-type telephone sets; 700 series key equipment			
G3DR							Fig. 8	112A key equipment		
G3FR	H4CP					U3	U3	Fig. 7	Coin collector with spring cord	
G3K	None								750 type telephone sets; 3A cord reels	
G3L	H4CU							Fig. 9	Key mountings, 420 to 426 and 430 to 432 types	
G3M	H4CW								2A coin telephone	
G3P	H4CY							Fig. 7	1A coin telephone with armored cord	
G3R	H4DA								Coin collectors using armored cords	
G3S	H4CY								Waterproof transmitter cover and armored cord for 1A coin telephone	
G3T	H4DA	Waterproof transmitter cover and armored cord for coin collectors								
G3Y	H4CJ	T1	P-80A100						Fig. 10	2568HP telephone set

**Note 1:** All G3-type handsets are equipped with the following components:

- P-80A000 handle
- P-80A200 receiver cap

**Note 2:** When ordering handsets, handles, caps, or cords refer to the section on color for proper codes and availability.

## G5-TYPE

**2.26** The G5-type handsets (Fig. 6) are equipped with a pushbar switch located in the handle. The pushbar switch is wired for push-to-talk, push-to-listen, or to control an external function.

**2.27** Table C lists the G5-type handsets with component parts and intended uses. Reference to connection diagrams are also included.

**2.28** The G5ER and G5KR handsets are available in standard telephone colors. Other G5-type handsets are available in black only with the exception of special use units, such as G5GR, G5HR, G5LR, G5MR, G5PR, and G5RR.

**2.29** The G5-type handsets replace the G2-type which are rated MD.

**2.30** Maintenance of G5-type handsets is limited to replacement of cracked or broken caps, defective receiver or transmitter units, or frayed, worn, or damaged cords. Do not attempt field maintenance of pushbar switches or spring contacts.

**2.31** To replace handset cord of G5-type handset:

- (1) Remove receiver and transmitter units, disconnect cord tips at receiver, transmitter, and switch, and remove cotton acoustical barrier.

**Note:** It may be necessary to temporarily remove the pushbar switch to remove and install cords.

(2) Tie a sufficient length of strong cord or string to the receiver cord tips of the old cord and pull cord from handle, feeding the string through the handle to the transmitter bowl.

**Note:** If pushbar switch has been removed a wire fish tool can be used to fish receiver leads through handle.

(3) Insert the free conductors of the handset end of the new cord through the hole in the handle. Advance cord into transmitter bowl until grommet is properly seated. See note in 2.09(3).

(4) Using the string, tie the receiver leads together close to the spade tips. Feed the receiver leads into the handle using the string to guide the leads past the pushbar switch into the receiver well.

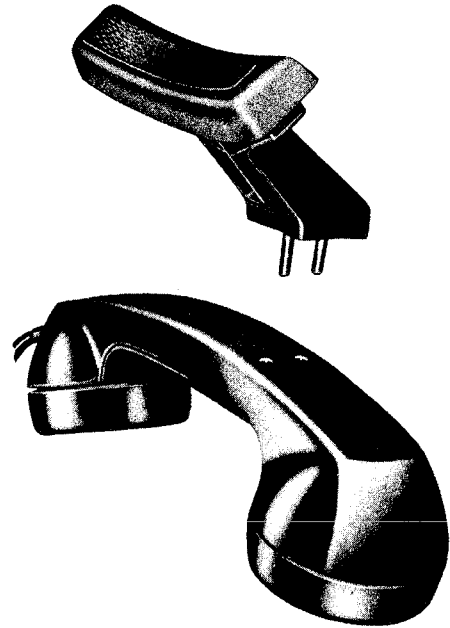


Fig. 5—G4-Type Handset Showing Shoulder Rest Assembly

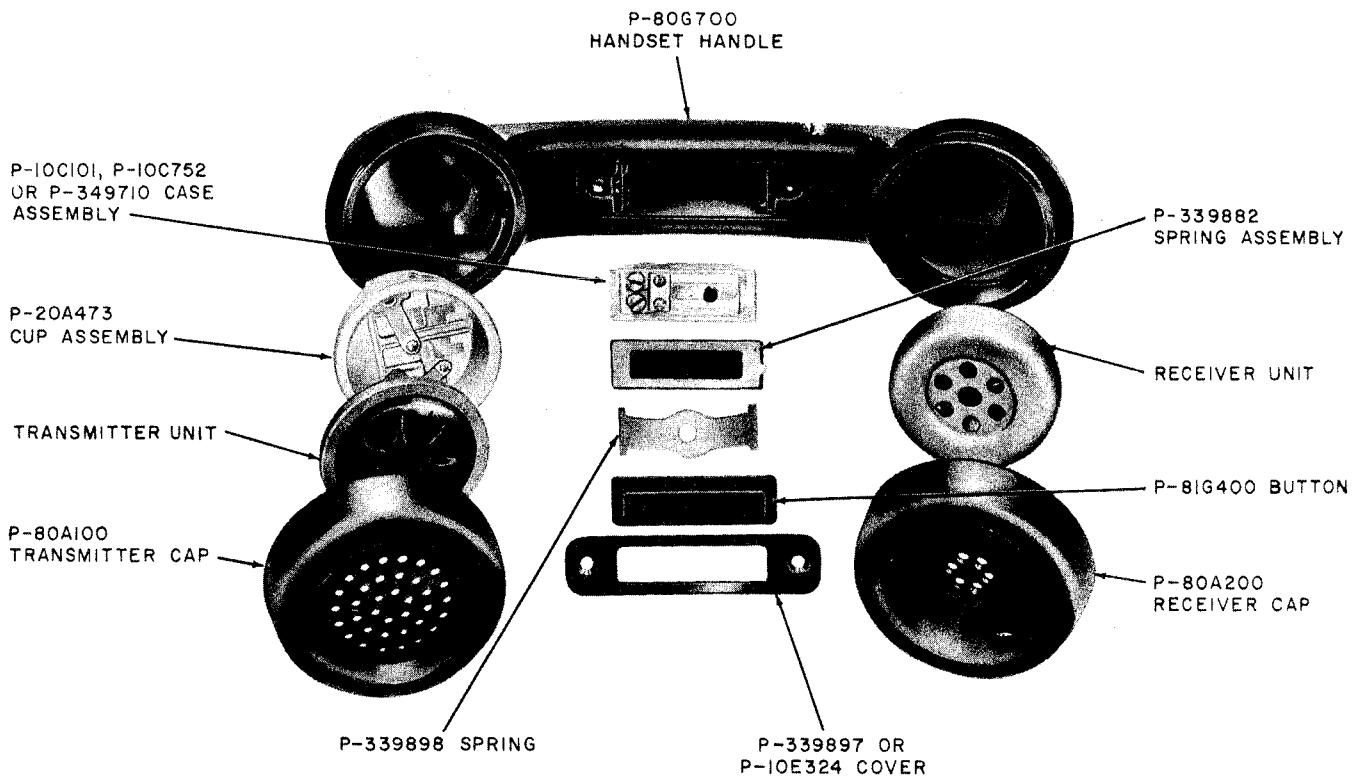


Fig. 6—G5-Type Handset Assembly

**TABLE C**  
**G5-TYPE HANDSETS**

HANDSET (Notes)	CORD	RCVR UNIT	CONNECTION DIAGRAM	USED WITH
G5AR	H5AB	U3	Fig. 11	Control unit, 47A-3, for MD and MC mobile radio telephones
G5BR	H6C		Fig. 19	4-wire circuits and loudspeaker paging
G5CR	H4CM	U4	Fig. 13	FAA and private line systems
G5ER	H5P	U3	Fig. 14	535-type telephone set in noisy location
G5FR	H4BM		Fig. 15	Bendix MRT9 radio pack set
G5GR	H4CJ	U4	Fig. 13	2- and 4-wire private line stations
G5HR	H5P		Fig. 16	102-type key equipment
G5JR	H6F		Fig. 12	No. 300 switching system
G5KR	H6E	U3	Fig. 19	2A Farm interphone
G5LR	H6F	U4	Fig. 17	617-type telephone set
G5MR	H4CU		Fig. 13	Command Post Alerting Network (COPAN)
G5NR	H5Y	U3	Fig. 11	Air-ground base station
G5PR	H6E	U4	Fig. 19	625-type telephone set
G5RR	H4CJ		Fig. 18	596E telephone set

**Note 1:** All G5-type handsets are equipped with the following:

- P-80G700 handle
- P-80A100 transmitter cap
- Pushbar switch assembly
- T1 transmitter
- P-80A200 receiver cap

**Note 2:** When ordering handsets, handles, caps, or cords, refer to section on color for proper codes and availability.

(5) Connect cord leads to the transmitter cup, pushbar switch, and receiver unit. Using the transmitter cup, anchor the cord and replace transmitter and transmitter cap.

(6) Insert the cotton acoustical barrier and dress the excess receiver leads into the receiver well. Replace the receiver and receiver cap.

(7) Dress excess switch leads into handle and replace pushbar switch.

### 3. MAINTENANCE

**3.01** Handles, caps, and grids may be cleaned by wiping with a clean cloth moistened with water.



**Do not use cleaning fluids or antirust compounds on transmitter, receiver units, or other component parts of handset. Discoloration or tarnish on the silver-plated contact surfaces is not objectionable and no attempt should be made to remove it.**

**3.02** Use care when cleaning colored handsets to avoid marring the finish. Replace handset if cleaning does not result in a satisfactory appearance.

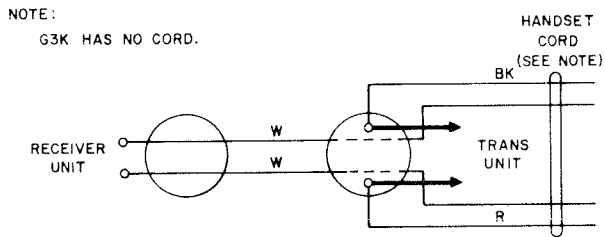
**3.03** Replace cut, worn, cracked, or badly frayed cords. Connections should be checked for tightness at terminals.

**3.04** Locking devices for G-type handsets are not available. If necessary, for security reasons, caps may be cemented to the G-type handles. Use N-170 cement (Armstrong Corp. Co.) or Pliobond cement. The application shall consist of coating the handle threads from the top of the base over an area 1/2-inch in length in two opposite places. The caps shall then be tightened by hand.

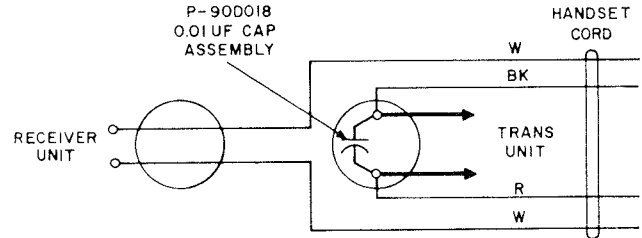
Additional tightening may be applied using a 514-type tool, but apply no more than 1/2 turn.

**4. CONNECTIONS**

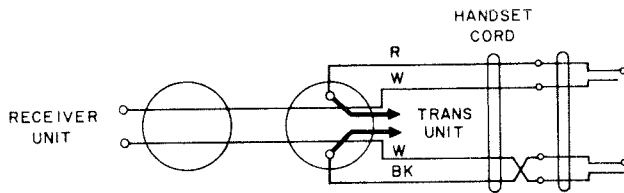
**4.01** Fig. 7 through Fig. 19 show internal connections for the G-series handsets. See Tables A, B, and C for types of receiver and transmitter units.



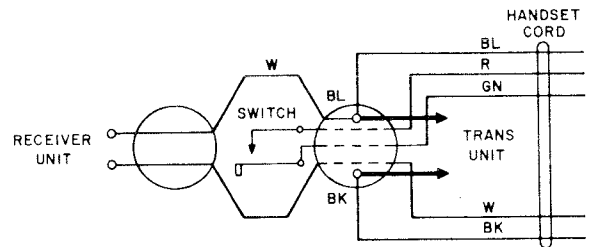
**Fig. 7—G1AR, G1FR, G1G, G1J, G3AR, G3BR, G3FR, G3K, G3M, G3P, G3R, G3S, G3T, G4AR, G4B, G3AA, and G3AC Handsets**



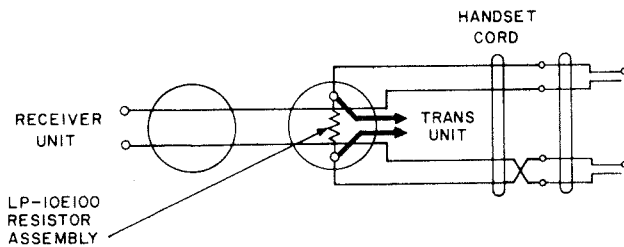
**Fig. 10—G3Y Handset**



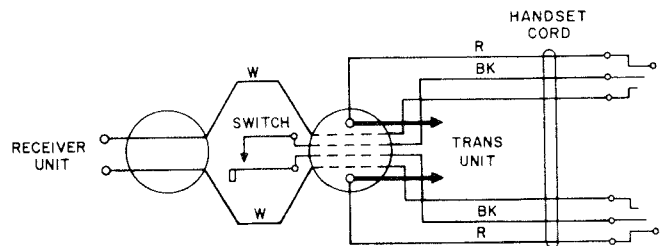
**Fig. 8—G1DR, G3DR, and G3AB Handsets**



**Fig. 11—G5AR and G5NR Handsets**



**Fig. 9—G3CR and G3L Handsets**



**Fig. 12—G5JR Handset**

SECTION 501-210-102

NOTE:  
CORD PLUG IS NOT PROVIDED  
ON G5GR HANDSETS.

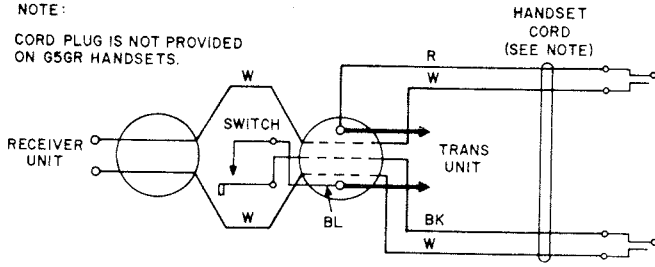


Fig. 13—G5CR, G5GR, and G5MR Handsets

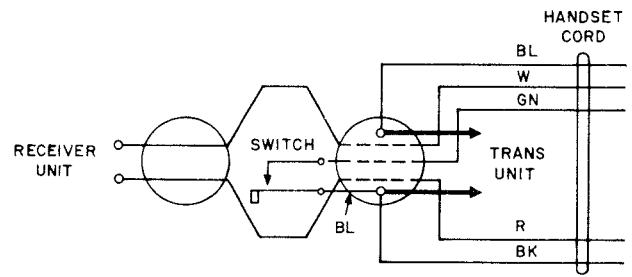


Fig. 16—G5HR Handset

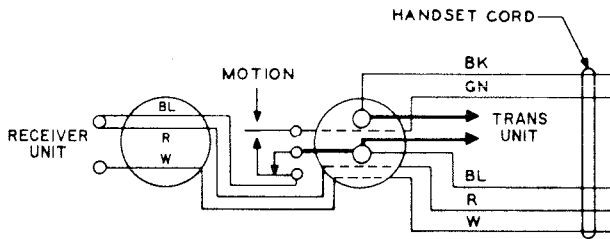


Fig. 14—G2ER and G5ER Handsets

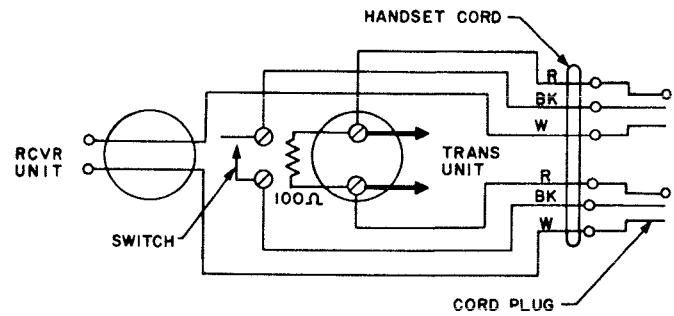


Fig. 17—G5LR Handset

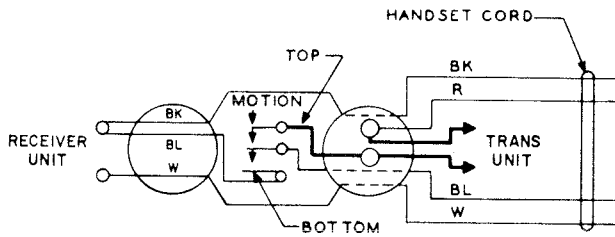


Fig. 15—G2FR and G5FR Handsets

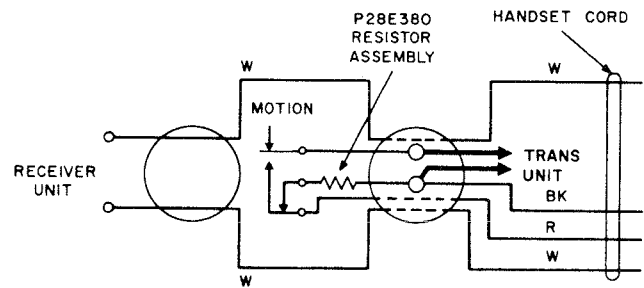


Fig. 18—G5RR Handset

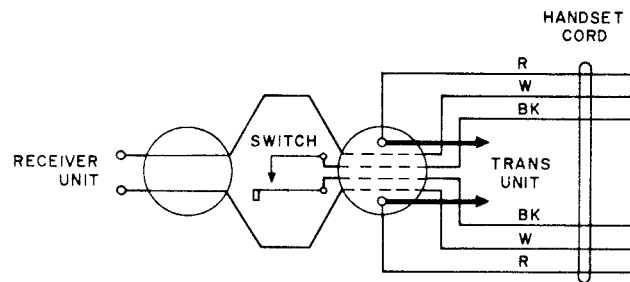


Fig. 19—G5BR, G5KR, and G5PR Handsets

## HANDSET G12A

### IDENTIFICATION, CONNECTIONS, AND MAINTENANCE

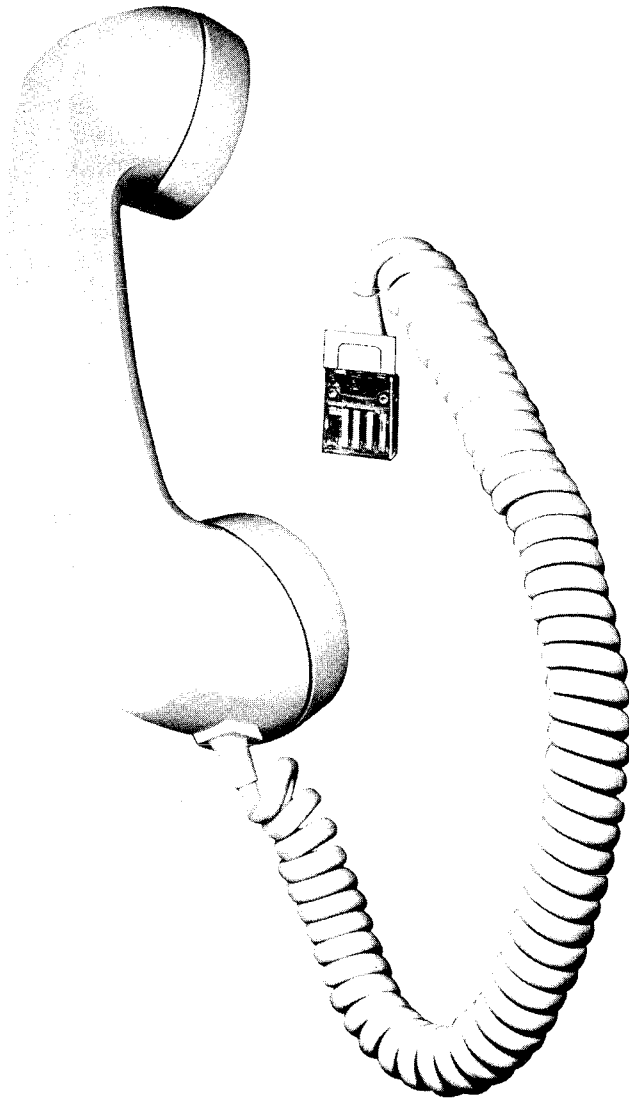


Fig. 1 — G12A Handset with Handset Cord Connected

#### 1. IDENTIFICATION

##### (a) Purpose

- To provide a handset that will accept a plug-in type handset cord.

##### (b) Application

- To be used with telephone sets designed to accept plug ended handsets.

##### (c) Ordering Guide

Set, Hand, G12A- (\*) (H4DB cord must be ordered separately.)

##### Replaceable Components

- P-80A1(\*) Transmitter Cap
- P-80A2(\*) Receiver Cap
- Unit, Transmitter, T1
- Unit, Receiver, U3

\*Complete identification of this item by adding the color suffix desired. See Table A.

##### (d) Design Features (Fig. 2)

- Standard G-type handset circuit with T1 transmitter and U3 receiver
- Equipped with a receptacle type transmitter cup which receives the handset cord plug

#### 2. CONNECTIONS

(a) Connect the G12A handset to the associated telephone set by plugging the handset cord into the jacks on each component. The telephone set grommet of the H4DB cord has squared corners while the grommet of the handset plug is tapered. Be sure the spring clips lock in place.

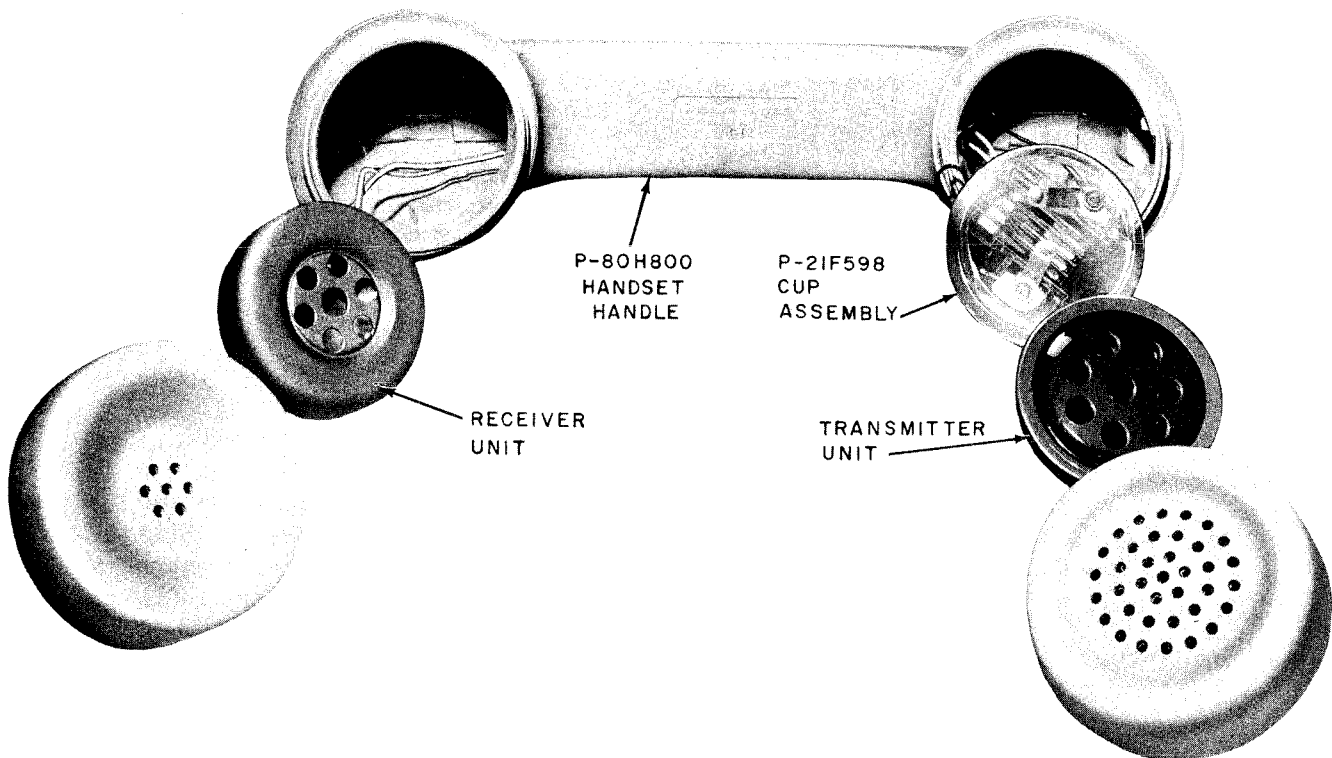
(b) See Fig. 3 for internal connections of the G12A handset.

**TABLE A**  
**COLOR ORDERING GUIDE**

COLOR*	HANDSET	TRANS. CAP	REC. CAP	CORD†
Black	G12A-3	P-18A103	P-80A203	H4DB-3
Ivory	G12A-50	P-80A150	P-80A250	H4DB-50
Green	G12A-51	P-80A151	P-80A251	H4DB-51
Red	G12A-53	P-80A153	P-80A253	H4DB-53
Yellow	G12A-56	P-80A156	P-80A256	H4DB-56
White	G12A-58	P-80A158	P-80A258	H4DB-58
Rose Pink	G12A-59	P-80A159	P-80A259	H4DB-59
Light Beige	G12A-60	P-80A160	P-80A260	H4DB-60
Light Gray	G12A-61	P-80A161	P-80A261	H4DB-61
Aqua Blue	G12A-62	P-80A162	P-80A262	H4DB-62
Turquoise	G12A-64	P-80A164	P-80A264	H4DB-64

\* Refer to Section 500-120-100 for promoted colors.

† Order separately.



**Fig. 2 — G12A Handset, Assembly**



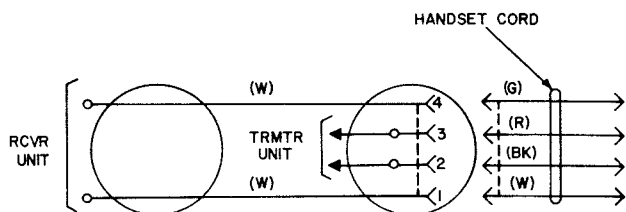


Fig. 3 — G12A Handset, Internal Connections

### 3. MAINTENANCE

(a) Maintenance of the G12A handset consists of the following:

- Replacing cracked or broken receiver and transmitter caps.
- Replacing defective receiver and transmitter units.
- Replacing defective cords.
- Cleaning handset with water-dampened cloth.



*Do not use cleaning fluids or antirust compounds on handset components.*

(b) To replace handset cord:

- (1) Use KS-16750, List 3 releaser or equivalent.

- (2) Insert tool in slot above body of plug (Fig. 4).
- (3) Apply pressure against spring clip toward body of plug.
- (4) When spring has been compressed, pull plug out of jack.
- (5) Connect new cord as outlined in Part 2(a).

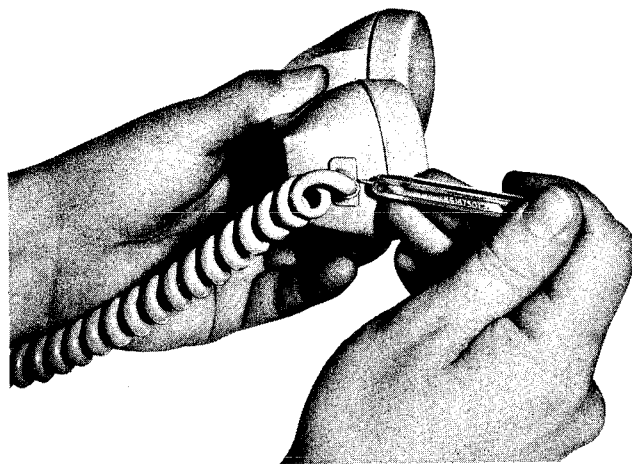


Fig. 4 — Removing Handset Cord from G12A Handset



**HANDSETS (AMPLIFIER)**  
**G6, G7, AND G8 TYPES**  
**IDENTIFICATION, MAINTENANCE, CONNECTIONS, AND SCHEMATICS**

**1. GENERAL**

**1.01** This section incorporates information on amplifier-type handsets formerly found in Sections 501-210-100 and 501-210-300.

**1.02** Amplifier-type handsets are available in standard telephone colors for use as replacement handsets on 500, 600, and 700 series telephone sets, and their TOUCH-TONE® equivalents, used by persons with impaired hearing (G6-type), weak speech (G7-type), or persons in noisy locations (G8-type).

**2. IDENTIFICATION**

**2.01** These handsets consist of P-80G700 handles into which are assembled U1 receiver units, T1 transmitter units, transistorized amplifier units, volume control potentiometer assemblies, and retractile (spring) cords. The P-80A100 transmitter caps and P-80A200 receiver caps complete the assembly.

**G6-TYPE (IMPAIRED HEARING)**

**2.02** The G6-type handset is equipped with a receiver amplifier unit and is intended for use by persons with impaired hearing. The volume control potentiometer in the center of the handle adjusts the loudness setting of the receiver so that the handset may be used by persons with normal hearing as well as persons with impaired hearing.

**2.03** The G6AR handset, rated Manufacture Discontinued (MD), consists of a printed circuit receiver board, transmitter board, and a potentiometer assembly mounted in the handle. Internal connections are made by a flexible circuit strip and plug-in connectors (Fig. 1).

**2.04** A single stage transistorized amplifier is located on the receiver board and amplifies the received signal. A polarity guard circuit, mounted on the transmitter board, assures proper polarity of the dc voltage supplied to the amplifier.

**2.05** An H4CT cord is used to provide connections between the handset and the associated telephone set. The cord is connected to screw-type terminals on the transmitter board.

**2.06** The G6B handset (Fig. 2) replaces the G6AR. The transistorized amplifier and polarity guard units are located on a printed circuit board in the receiver end of the handle. The amplifier, potentiometer assembly, and H4CT cord connect to a terminal board located in the transmitter cavity.

**2.07** Maintenance of G6-type handsets is limited to replacement of cracked or broken receiver and transmitter caps, replacement of T1 transmitter units, and replacement of handset cord. See 3.05 for cord replacement procedures.

**G7-TYPE (WEAK SPEECH)**

**2.08** The G7AR handset (Fig. 3) is equipped with a transistorized transmitter amplifier intended for use by persons with weak speech. The potentiometer in the handle controls the level of the transmitter output.

**2.09** Internal connections are made by a flexible circuit strip and plug-in connectors. The H4CT cord connects to a terminal board located in the transmitter cavity.

**2.10** Maintenance of G7AR handsets is limited to replacement of cracked or broken receiver and transmitter caps, replacing defective T1 transmitter units, and replacement of the handset cord. See 3.05 for cord replacement procedures.

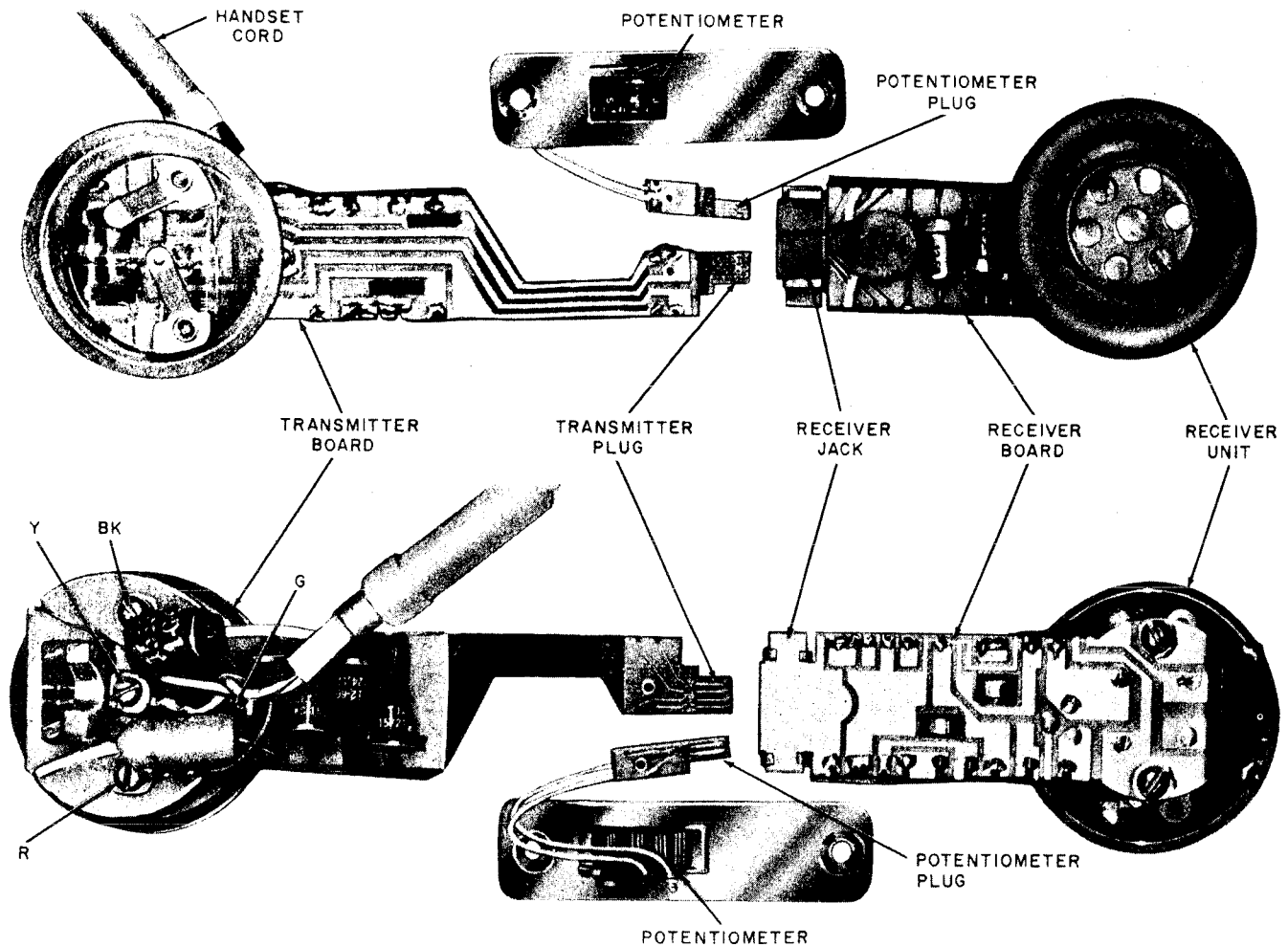


Fig. 1 — G6AR Handset (MD), Internal Assembly

**G8-TYPE (NOISY LOCATIONS)**

**2.11** The G8-type handset is equipped with a transistorized receiver amplifier and a push-to-listen switch and is intended for use in noisy locations. The push-to-listen switch, when operated, decreases the transmitter output and increases the gain of the receiver amplifier.

**2.12** The G8A handset, rated (MD), consists of the amplifier assembly mounted on the receiver board, a polarity guard and terminal board mounted on the transmitter cup, and a volume

control potentiometer and push-to-listen switch assembly mounted in the handle (Fig. 4).

**2.13** Internal connections are made by a flexible circuit strip and plug-in connectors. The H4CT cord connects to the terminal board in the transmitter cavity.

**2.14** The G8B handset replaces the G8A. The transistorized amplifier and polarity guard units are mounted on a printed circuit board located in the receiver end of the handle.

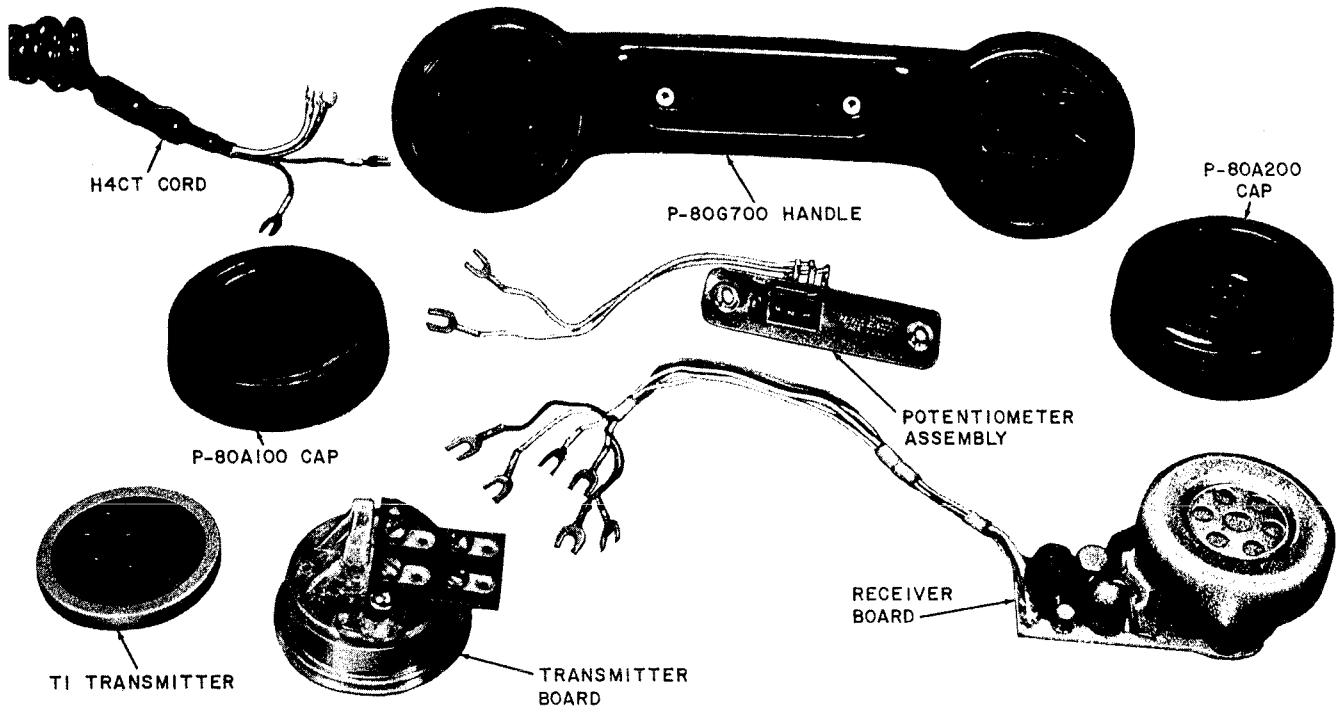


Fig. 2 — G6B Handset, Assembly

**2.15** The printed circuit board, push-to-listen switch—potentiometer assembly, and the H4CT cord connect by spade-tipped leads to a terminal board located in the transmitter end of the handle.

**2.16** Maintenance of G8-type handsets is limited to replacement of cracked or broken receiver and transmitter caps, replacing defective T1 transmitter units and replacement of handset cord. See 3.05 for cord replacement procedures.

### 3. MAINTENANCE

**3.01** Field maintenance of amplifier-type handsets is limited to replacement of transmitter units, caps, and handset cords. Do not attempt field maintenance of printed circuit components.

**3.02** Handles, caps, and grids may be cleaned by wiping with a clean cloth moistened with water.



*Do not use cleaning fluids or antirust compounds on transmitter or receiver units or other component parts of handset. Discoloration or tarnish on the silverplated contact surfaces is not objectionable and no attempt should be made to remove it.*

**3.03** Use care when cleaning handsets to avoid marring the finish. Replace handset if cleaning does not result in a satisfactory appearance.

**3.04** Replace cut, cracked, worn, or badly frayed cords. Connections should be checked for tightness.

**3.05** The H4CT handset cord furnished with G6-, G7-, and G8-type handsets is not available for field use. If the original cord requires replacement, modify and install an H4CJ cord as follows:

- (1) Carefully remove outer plastic covering on two white conductors with diagonal pliers.

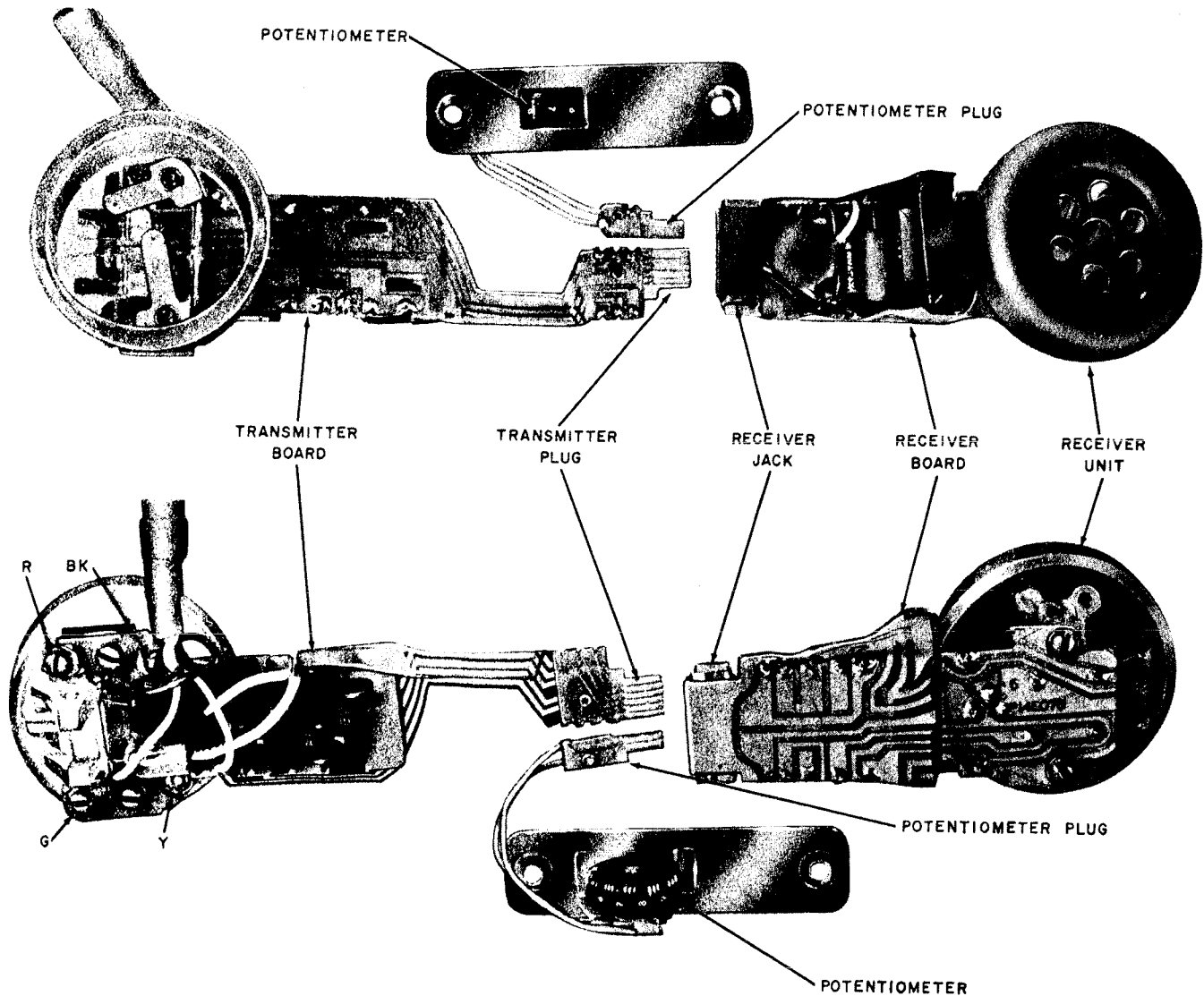


Fig. 3 — G7AR Handset, Internal Assembly

(2) Tone out and identify one white conductor. For identifying purposes, loose knots may be tied in each end of this conductor, designating it green. The other white conductor then becomes yellow.

(3) Loop and tie or tape the excess length of white conductors to approximate length of red and black conductors (Fig. 5).

(4) Insert conductors in transmitter bowl carefully so as not to disrupt the printed board circuit.

**3.06** Amplified rotary dial clicks in the receiver of G6- or G8-type handsets may be eliminated by replacing the dial with one having an extra set of off-normal contacts. Use the spare contacts on the dial to short-circuit (during dialing) the handset cord leads terminated to the B and GN punchings of the telephone set network.

**4. CONNECTIONS**

**4.01** When connecting amplifier-type handsets to rotary dial equipped telephone sets, connect the red and black leads to the terminals

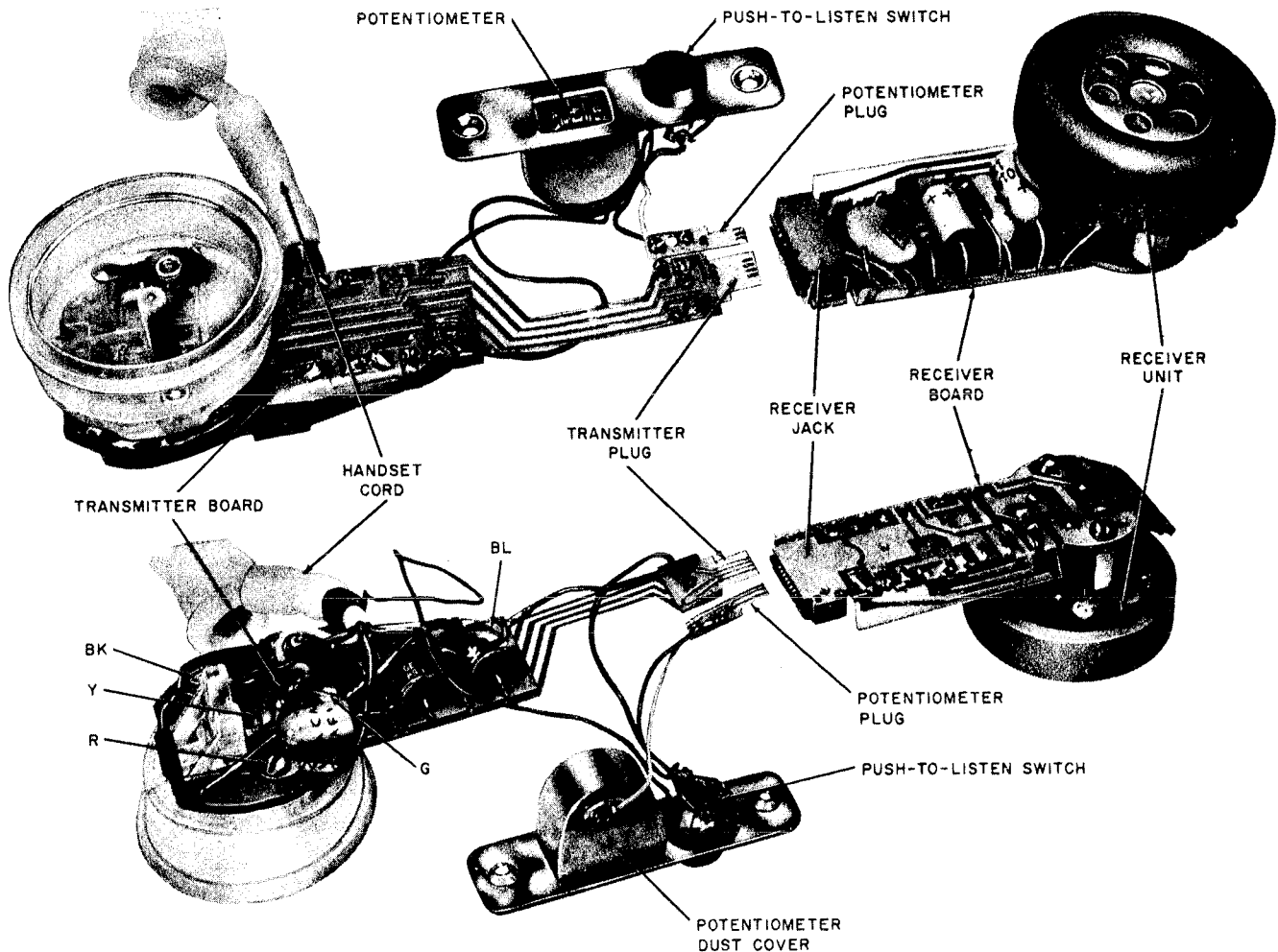


Fig. 4 — G8A Handset (MD), Internal Assembly

from which the red and black leads of the replaced handset were removed. Connect the yellow and green leads to the terminals from which the white leads were removed. See section covering connections of the particular telephone set being modified.

**Note:** The yellow and green leads connect directly or indirectly to the R and GN punchings, respectively, of the network.

**4.02** Test the handset through the full range of volume control. Reverse the yellow and green leads and retest. Connect the leads in the manner that results in normal amplification.

**4.03** When connecting G6- and G8-type handsets to telephone sets equipped with TOUCH-TONE dials, the dial must provide common switch contact arrangements which will prevent dial sidetone amplification by the handset amplifier. If the set contains a 25A3, 25B3, or 25H4 dial, install a 25W3, 25Y3, or 25P4, respectively, and connect dial and handset as shown in Table A.

**4.04** When connecting G6- or G8-type handsets to 1660-series telephone sets equipped with 26B or 26D card dialers, install a 26F card dialer and connect dialer and handset as shown in Table A.

**TABLE A**  
**TOUCH-TONE DIAL AND HANDSET CONNECTIONS**

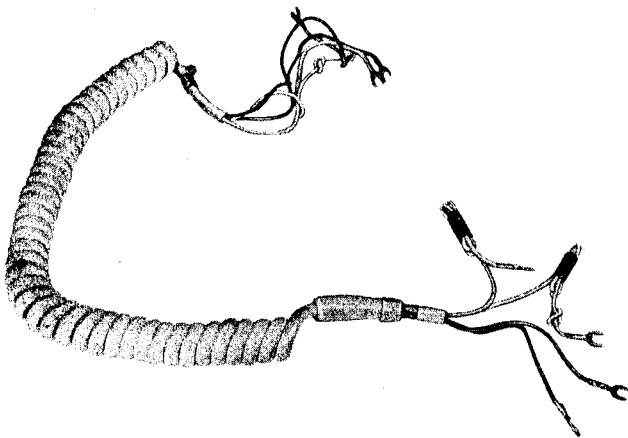
COMPONENT	LEAD	CONNECT TO
25W3, 25Y3, 25P4 Dial or 26F Card Dialer	G	Tip side of line (Note 1)
	BK	RR terminal of network
	R-G	R terminal of network
	W-BL	Green handset lead (Note 1)
	W	GN terminal of network
	R	Red handset lead (Note 1)
	BL	B terminal of network
	O-BK	C terminal of network
	V	IR speakerphone lead (Note 1)
	O	T1 speakerphone lead (Note 1)
	G-W	C terminal of network (Note 2)
S-BK	RR terminal of network (Note 2)	
G6- or G8-Type Handset	Y	R terminal of network
	G	White dial lead (Note 1)
	R	Red dial lead (Note 1)
	BK	B terminal of network
Line Switch	R	R terminal of network
	BK	Green handset lead (Note 1)

**Note 1:** Connect these leads to spare terminals on network, terminal board, or key terminal as required.

**Note 2:** These leads are from card dialer rotary exciter switch.

**5. SCHEMATICS**

**5.01** Fig. 6 through 10 show schematic diagrams of the amplifier type handsets.



**Fig. 5 — H4CJ Cord, Modified**



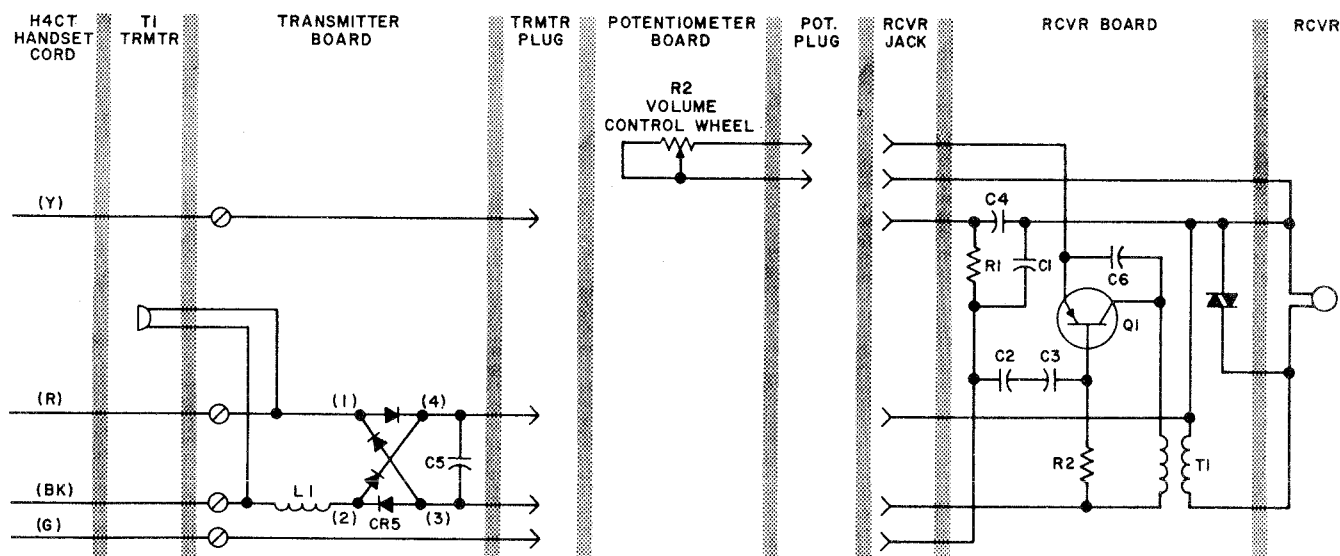


Fig. 6 — G6AR Handset (MD), Schematic

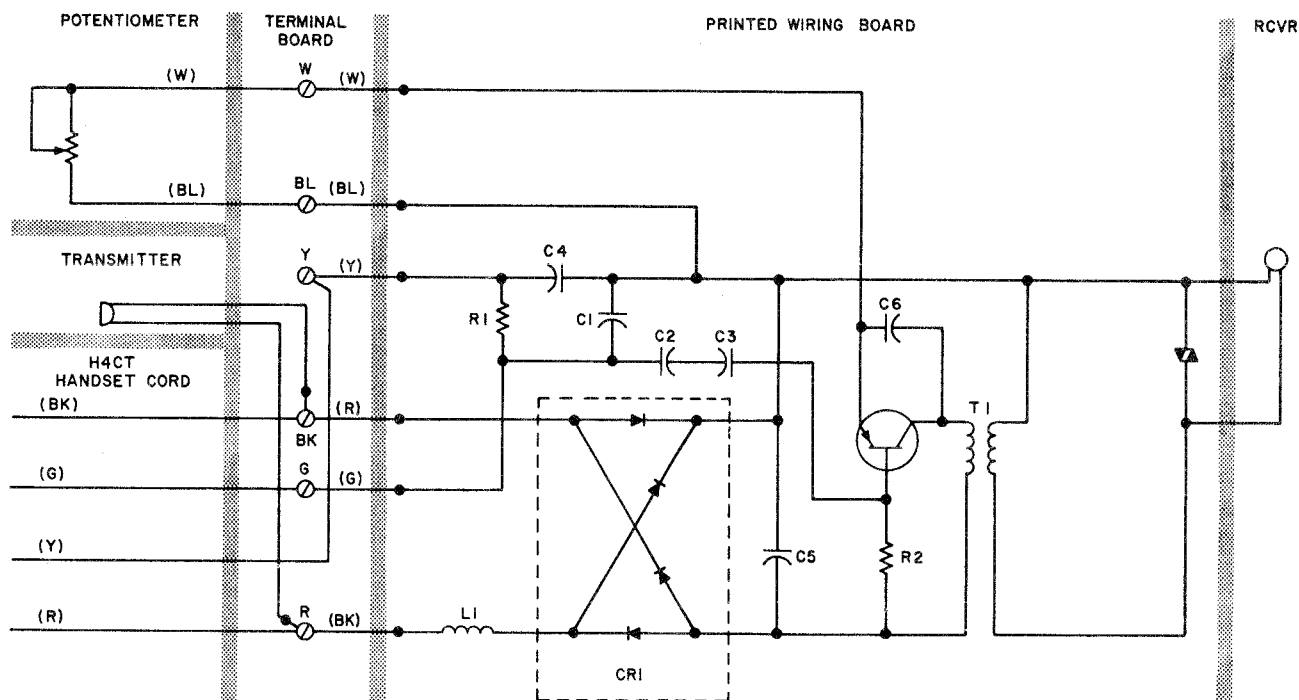


Fig. 7 — G6B Handset, Schematic

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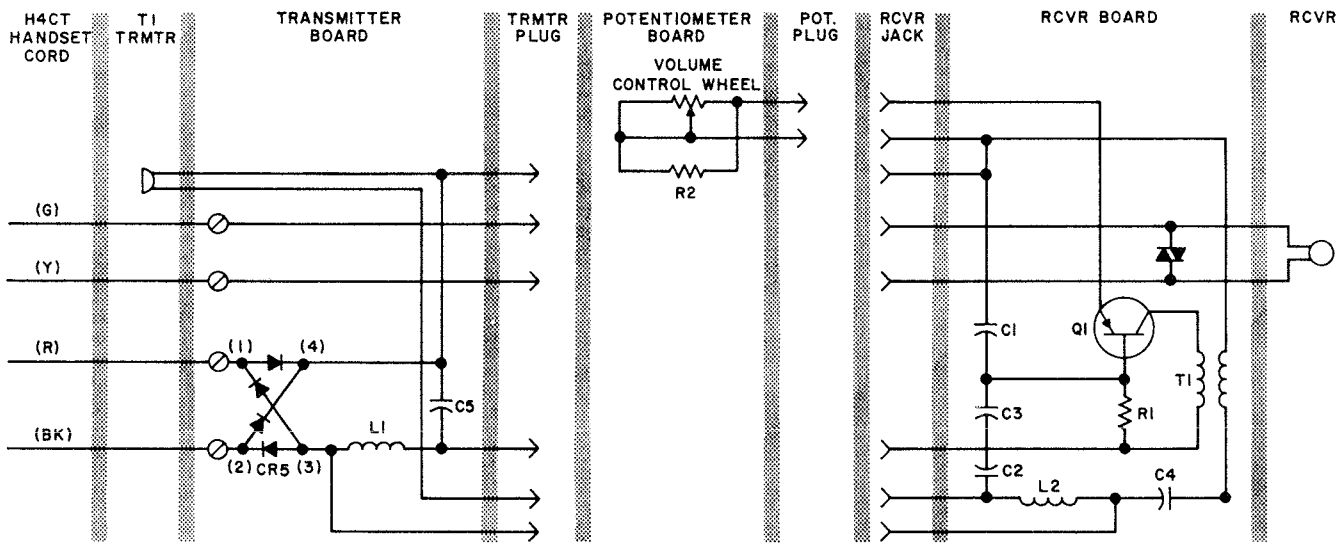


Fig. 8 — G7AR Handset, Schematic

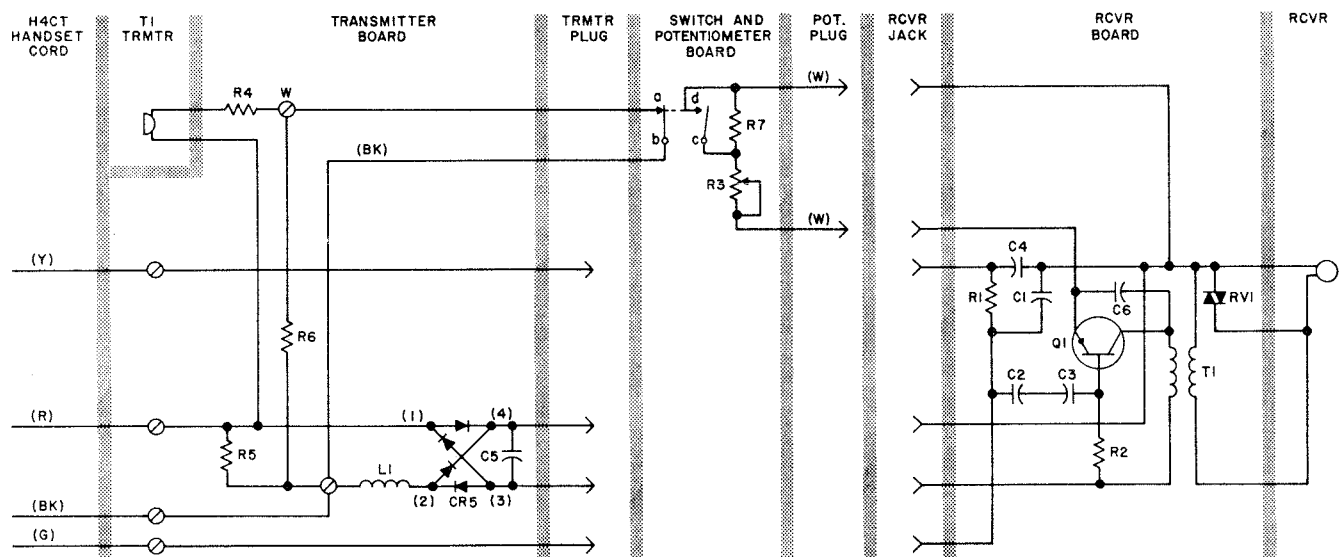


Fig. 9 — G8A Handset (MD), Schematic

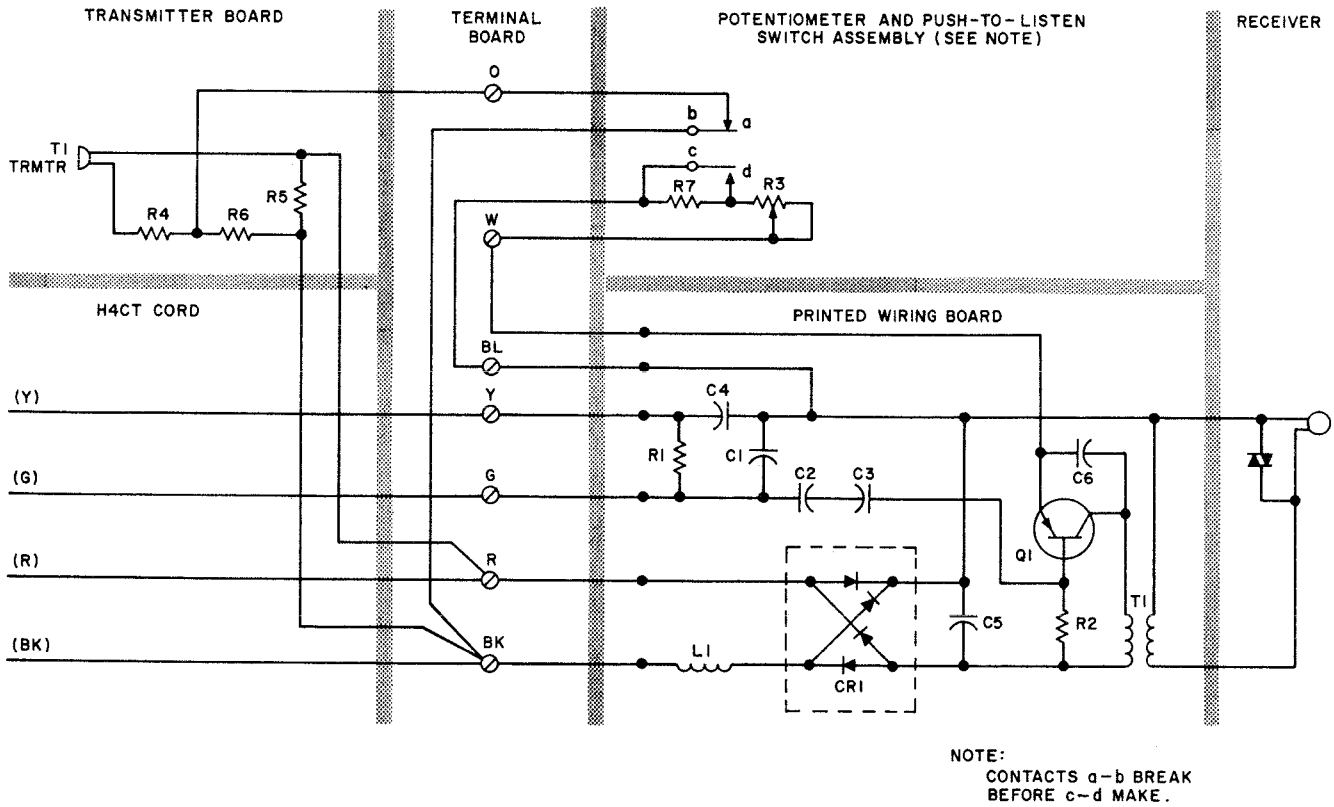


Fig. 10— G8B Handset, Schematic



## RINGERS

### GENERAL MAINTENANCE AND RINGING TESTS

#### 1.00 INTRODUCTION

This section covers the recommended general procedures, tests, and methods to be followed when inspecting, testing, and maintaining ringers and loud ringing bells, excluding auxiliary signals. More detailed maintenance information is given in other sections covering B, C, and numbered-type ringers.

#### 2.00 GENERAL

**2.01** All loud ringing bells and loose ringers, good or defective, should be carried in a suitable protective container.

**2.02** The use of proper inspection, testing, and maintenance procedures on all station visits will reduce the number of subsequent customer trouble reports.

**2.03** It is important that gong distinctiveness be given due consideration on all station visits, especially at locations where a number of lines with associated ringers are installed and the customer is apt to encounter difficulty in distinguishing the various rings.

**2.04** In cases of customers having impaired hearing, it may be necessary to try a number of gong combinations and gong attachments to obtain satisfactory results. Types of gongs and attachments will be found in the sections covering maintenance for the type of ringer involved.

**2.05** The armature, pivots, and armature stops shall not be treated with a corrosion or moisture inhibitor.

#### 3.00 CLEANING

For proper operation, the ringer must be free of dirt, dust, grease, and any foreign particles. To properly clean a ringer or loud ringing bell, proceed as follows:

- Employ a No. 7 sash tool, or equivalent, for brushing out dirt. If extensive cleaning is required, detach ringer.
- Cleaning paper such as KS-7187 or KS-7188 which is 1/2 and 1/4 inch wide, respectively, and 2-1/2 inches long shall be used to clean points of contact, such as between the armature or armature stop pins and pole faces. Use a clean piece of paper for each operation.
- On C-type ringers, *always brush toward the gongs* when cleaning the airgap between the armature and inner and outer pole pieces, and between the armature and the permanent magnet.

**Caution:** *On C4A ringers in particular, care shall be exercised when cleaning the airgap between the outer pole piece and the armature so as not to distort the thin reed which is a part of the armature hinge.*

- On numbered-type ringers and B-type ringers, brush dirt away from the armature.
- Magnetic particles may be removed with Scotch tape or a telephone company equivalent.

**TABLE A**  
**OUTLINE OF WORK OPERATIONS**

Work Operations	Visit				
	Service Order			Repair	
Sequence Items	Refer to Appropriate section for	Sets from Shop or Storeroom	Sets Re-used or Reconnected	No Ringer Trouble Reported or Suspected	Where Trouble is Located or Suspected in Ringer
1. Check line and ringer connections and poling of ringer.	Connections	Yes	Yes	Yes	Yes
2. Check type of gong arrangements when two or more ringers are near enough to require distinctive tones.	All Types	Yes	Yes	Yes	Yes
3. Check for presence of armature stop spring or chromium-plated armature.	Numbered Type	Yes	Yes	Yes	Yes
4. If there is evidence of sticking, clean contact surfaces between stop screw and armature, or stroke-limiting arm and yoke, and between armature and pole faces.	General Maintenance		Yes	Yes	Yes
5. Check pivot screw adjustment.	All Types	Subsets Only	Yes	Yes	Yes
6. Check airgap adjustment.	All Types	Subsets Only	Yes	Yes	Yes
7. Check for loose gongs and gong adjustment.	All Types	Subsets Only		Yes	Yes
8. Check position of cords and wiring to see that they do not interfere with ringer operation.		Subsets Only	Yes	Yes	Yes
9. Check biasing spring for condition and type.	Numbered Type	Yes	Yes	Yes	Yes
10. Set biasing spring position and make tests for bell tapping.	All Types	Subsets Only	Yes	Yes	Yes
11. Make tests for cross ringing.	All Types				Yes
12. Make ringing tests.	Local Instructions	Yes	Yes	Yes	Yes
13. Check ringing signal with customer to see that it is satisfactory. Make any adjustments or changes required.*	All Types	Yes	Yes	Yes	Yes
14. Check extension ringers and ringers at extension stations the same as main stations.†	All Types	Yes	Yes	Yes	Yes

\* If the armature stroke is readjusted in any of the ringing tests, repeat Sequence Items 6 through 14.

† When a low-impedance ringer is added to or removed from a series bridge, repeat Sequence Items 9 through 14 at other ringers in the bridge.

#### 4.00 OUTLINE OF WORK OPERATIONS

4.01 The operations preferably should be performed in the order shown in Table A. If a ringer or loud ringing bell cannot be adjusted to meet all tests, it should be replaced.

4.02 Upon completion of work operations, the necessary ringing tests shall be made in accordance with 5.00. On all test calls made from the customer's premises, make certain the bells do not tap. If any of the ringer requirements cannot be met, replace the ringer.

#### 5.00 RINGING TESTS

5.01 Methods for obtaining ringing tests will vary with different central offices. Some dial central offices have specific ringing test equipment, others use

reverting call switches; still others have the equipment built into the regular connector. Local practices shall be followed to obtain ringing tests.

- In manual central office areas, request the operator to ring the station number under test.
- At PBX extension stations which may be arranged for night connections, test for ringing from central office with night connection as regularly set up in addition to ringing test from PBX.

5.02 All rings received on test should be clear and steady. If the ringing does not meet requirements, the ringers shall be adjusted according to the section covering ringer maintenance for the type ringer in use.

5.03 Ringing and margin tests for manual stations being prepared for cutover to dial are normally set up by the local cutover committee.





## F1A RINGER

### 1. GENERAL

**1.01** This section contains identification, installation, maintenance, and connection information for the BELL CHIME ringer (Fig. 1 and 2).

**1.02** This section is reissued to add information on how to secure the connecting block end of a general purpose set mounting cord when the cord is terminated in the F1A ringer.

**1.03** Due to extensive changes, marginal arrows have been omitted.

### 2. DESCRIPTION

**2.01** The F1A ringer is a single coil, high impedance ringer with a 2 position bias spring adjustment. The component parts, shown in Fig. 3, are as follows:

(a) A die cast base for mounting components; also providing cord clamps for telephone set mounting cord.

(b) Armature and coil assembly similar to C-type ringers.

(c) A 498A network containing necessary electrical circuit elements and provides a 7-terminal connecting block.

(d) Control lever and switch assembly for selecting either a CHIME, a LOUD ring, or a LOW ring.

(e) Interrupter switch assembly operated by movement of clapper rod to control chime operation. (Earlier model ringers have a 4-leaf spring assembly; later models have 3-leaf spring assembly as shown in Fig. 4.)

(f) A stop bar (Fig. 3) to prevent cover from touching gong assemblies.

**2.02** The plastic cover (Fig. 2) is not supplied with the F1A ringer. Order separately as follows:

- Cover 125A-50 (Ivory)
- Cover 125A-63 (Gold)

**2.03** The F1A ringer is installed when covered by a service order. Typical installation include:

- Centrally located BELL CHIME ringer
- Extension ringer
- Ringer for 701B (PRINCESS) telephone set
- Loud ringer (substitute for indoor 592A subscriber set)

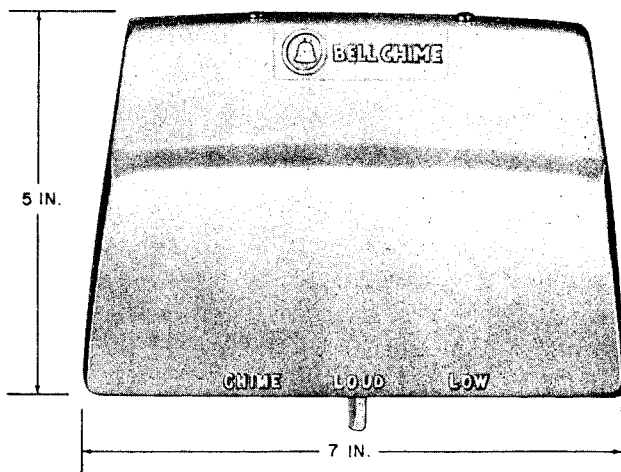


Fig. 1 — F1A Ringer With 125A Cover in Place

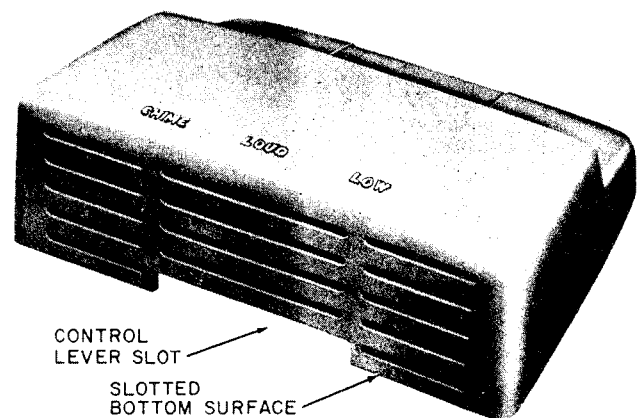


Fig. 2 — 125A Cover

**SECTION 501-252-100**

**2.04** This ringer may be connected with the following classes of service:

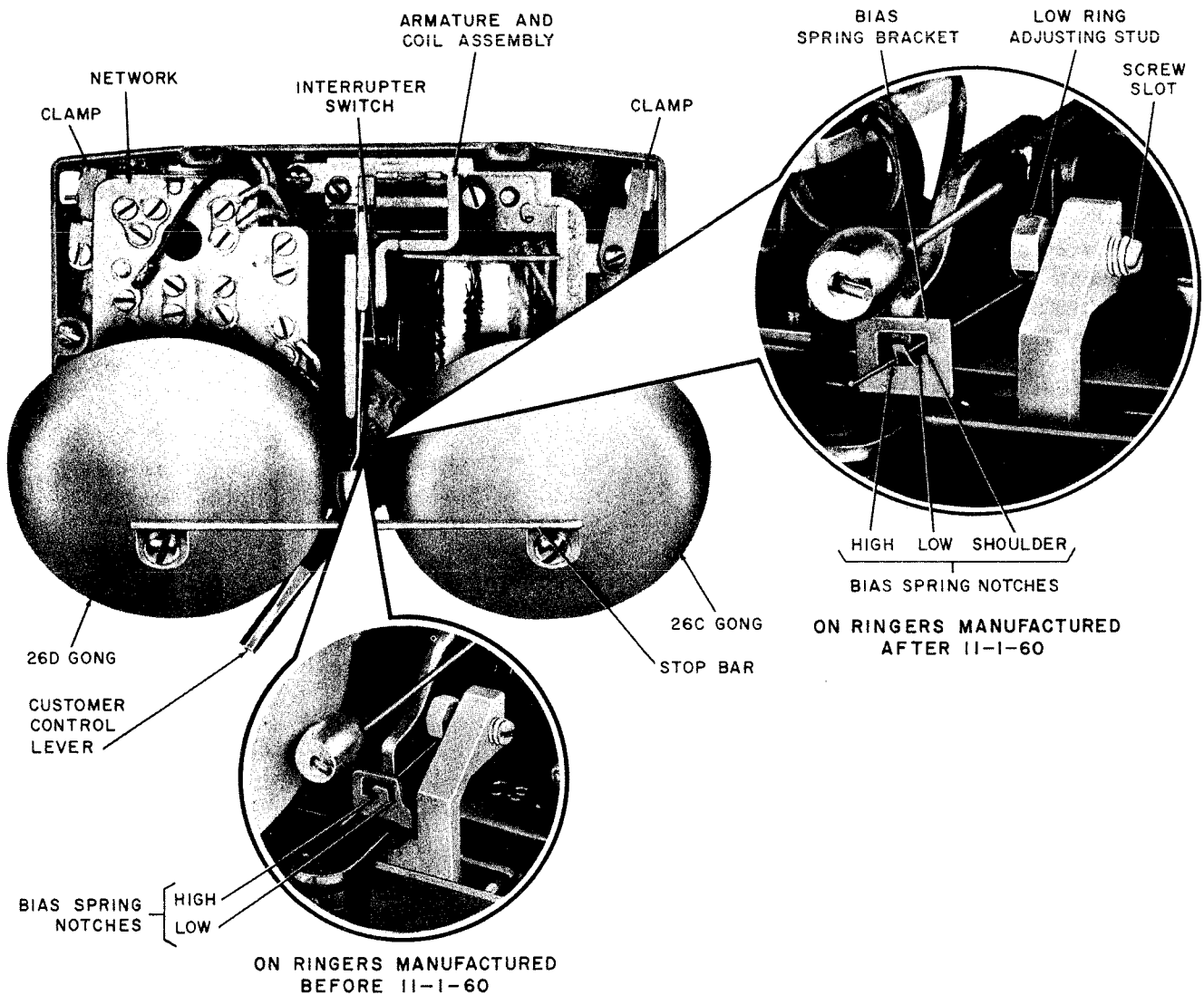
- Individual flat and message rate
- 2-party flat and message rate
- Regular PBX stations

**2.05** The F1A ringer is not to be used with cold cathode tube or diode-type ringing bridges for the following classes of service:

- 4-party selective
- 8-party semiselective

**2.06** In areas where inductive interference requires cold cathode tube-type ringing bridges, the F1A ringer may be connected as shown in the connection practices on ringer and relay type subscriber sets-polarized ringing.

**2.07** Since the customer may experience difficulty distinguishing rings in the CHIME position, do not use the F1A ringer with the following code ringing services:



**Fig. 3 — F1A Ringer, Components**

- Nonselective party lines
- Divided code ringing

**3. INSTALLATION**

**3.01** Suggest a location so customer can hear CHIME or LOW ring in largest area of residence. The F1A ringer will usually provide satisfactory coverage when centrally located on an inside partition about 5 feet above the floor keeping the control level accessible to the customer.

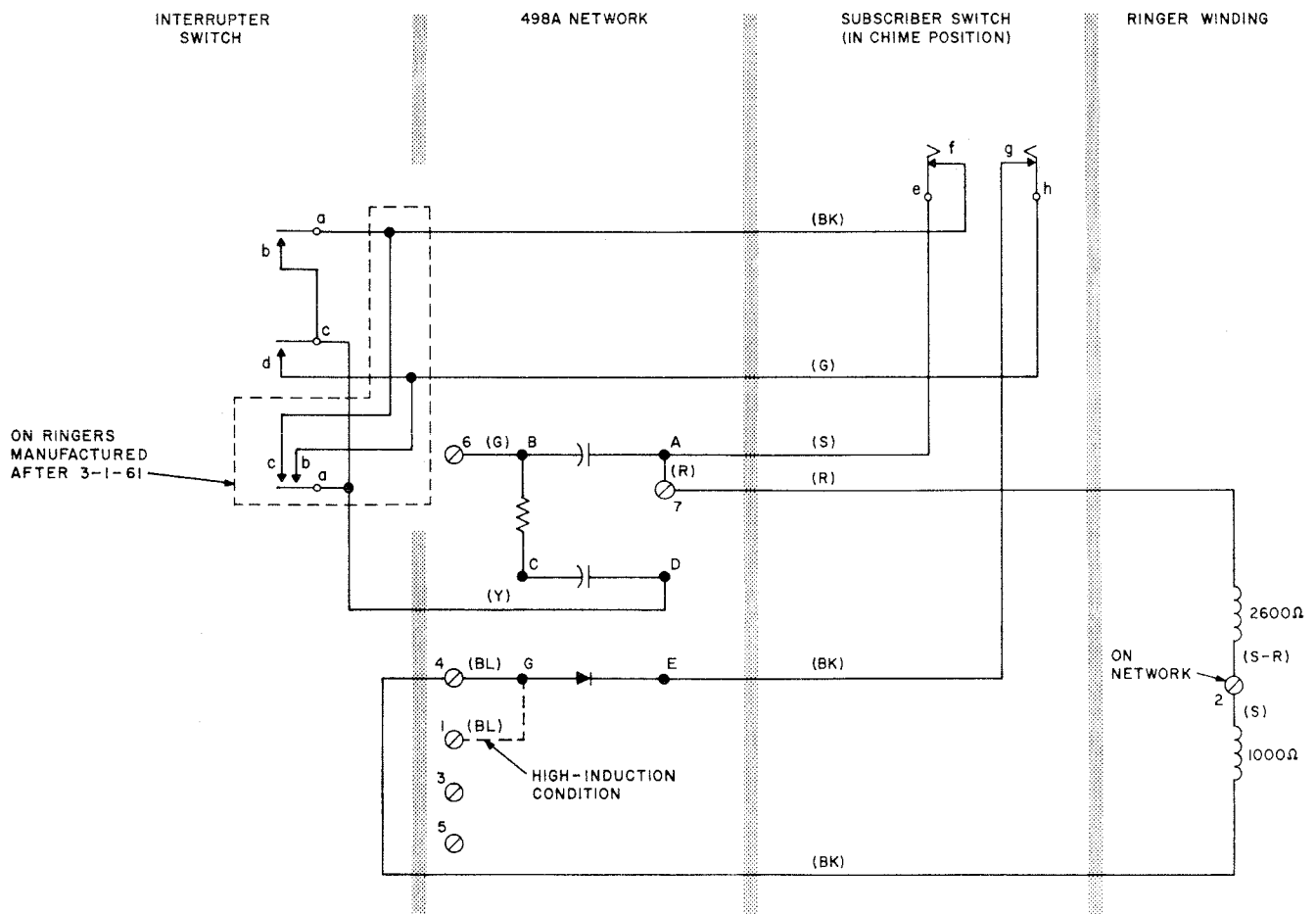
**3.02** Ringer locations shall allow space for tightening cover screws on top and adjusting the low ring stud on the right side.

**3.03** Standard ringing bridge limitations apply to the use of this high impedance ringer.



*Remove the F1A ringer from shipping carton with care and handle ringer prior to installation with equal care to avoid changing adjustment of interrupter switch assembly. (See Fig. 3.) Keep the F1A ringer in a plastic bag in shipping carton prior to installation. When F1A ringer is removed from shipping carton to be installed, do not leave plastic bag where it is accessible to children. DESTROY PLASTIC BAG IMMEDIATELY. Handle the F1A ringer by using stop bar attached to the two gongs.*

**3.04** Fasten directly to wall surface with two fasteners. Select length of fastener to provide secure mounting with particular wall material.



**Fig. 4 — F1A Ringer, Schematic**

**SECTION 501-252-100**

- (a) Use No. 8 RH wood screws when fastening to wood, wood studs, or lath.
- (b) Use wall screw anchors on wall surfaces of hollow construction.

**3.05** For selection refer to the section entitled Attachments, Fasteners, and Methods for Running Inside Wire and Cable.

**3.06** Inside wire may enter ringer from back, bottom, or either side (See Fig. 5 and 6.)

**3.07** When inside wire enters ringer from bottom or back, mounting cord from telephone set may be brought into either end of the ringer. When inside wire enters from one end and set cord enters from opposite end, secure set cord ringer with clamps provided.

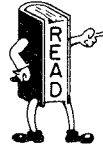
**CAUTION:** *On earlier models of the F1A ringer, the interrupter switch assembly was not mounted separately. Loosening the left clamp screw may allow the component plate to shift, changing the position of the interrupter switch. On later models of the F1A ringer (Fig. 3), the rack arm may become displaced from under the 26C gong plate preventing movement of the ringer control lever to either the LOUD or CHIME position. Use care to prevent these conditions when loosening the left clamp screw and fully tighten clamp screw when the set cord is installed.*

**3.08** The mounting cords of most telephone sets, other than the 701-type, have short leads at the connecting block end. The cord-stay clamp in the F1A ringer will not keep a pull-strain off the spade tip connections on cords with short leads. To prevent spade tip connection failures in the F1A ringer when using cords with short leads perform one of the following:

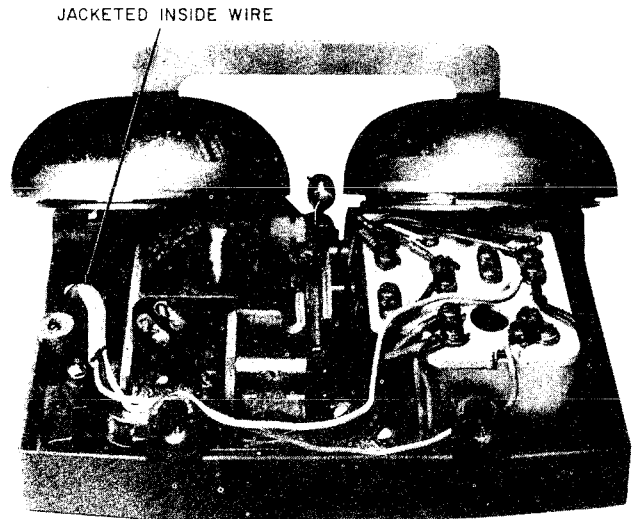
- (a) Install a 42-type connecting block using inside wire between the block and the F1A ringer. Terminate the cord in the connecting block.
- (b) Put several wraps of friction tape around the cord a few inches from the stay band. This provides a grommet which should take up the stress against the cord-stay clamp if the cord is pulled.

**3.09** Adjust volume of low ring by moving adjusting stud (Fig. 3) right or left; use a small screwdriver in slotted end, located beneath

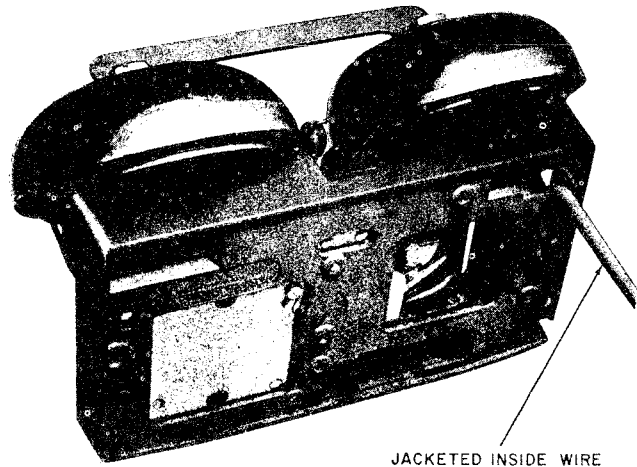
right gong. Be sure that rack arm does not snag on gong plate.



*Be sure to acquaint customer with location and use of ringer control lever.*



**Fig. 5 — F1A Ringer, Top View, Showing Jacketed Inside Wire Entering Through Rear**



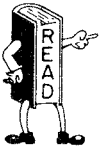
**Fig. 6 — F1A Ringer, Rear View, Showing Jacketed Inside Wire Entering Through Rear**

**TABLE A**  
**BIAS SPRING POSITION**

CLASS OF SERVICE		BIAS SPRING NOTCH	REMARKS
Bridged Ringing Service	Individual Flat, Message Rate and PBX Stations	High	The bias spring may be placed in low notch when double tap is experienced in CHIME position or when operation is not satisfactory with bias spring in high notch. If repositioning bias spring results in dial tap or poor operation, check ringer as outlined in Part 6.
Grounded Ringing Service	2-party Flat and Message Rates	High	

#### 4. BIAS SPRING POSITION

**4.01** The ringer is shipped with bias spring in high (left) notch. Table A indicates proper position of bias spring for various classes of service. (See Fig. 3.)



*Correct bias spring tension has been set at factory. Do not bend bias spring.*

**4.02** After completing work, obtain a ringing test in all three positions of subscriber switch. Obtain tests according to local instructions. Check for bell taps while dialing.

**CAUTION:** *Proper poling of the F1A ringer is very important to avoid double-tap in the CHIME position and bell taps while dialing.*

**4.03** The biasing spring bracket has been changed on later models of the F1A ringer. (See Fig. 3.)



*On later type brackets, bias spring must never be placed on shoulder located to right of low notch.*

#### 5. MAINTENANCE

**5.01** On a maintenance visit where ringer fails to operate properly, proceed as follows:

- (1) Check airgap at armature for dirt or foreign material and clean if necessary.
- (2) Make sure all connections are tight and **correct**.
- (3) See that all wires are dressed so that they do not interfere with operation of the ringer.
- (4) Clean interrupter switch assembly contacts when required, by carefully burnishing with a 265C tool.



*Care must be taken to avoid changing adjustment of spring gap and spring tension of interrupter switch.*

**5.02** If ringer rings properly but armature sticks in operated position when subscriber switch is in CHIME position, replace ringer.

**5.03** If ringer rings with customer control lever in CHIME position, proceed as follows:

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- (1) Shift network mounting plate until interrupter switch stud just touches clapper rod.
- (2) If step (1) results in double-tap, shift component plate back slightly toward original position.
- (3) If step (1) or (2) does not eliminate trouble, replace ringer.

*Note:* On earlier models of the F1A ringer the interrupter switch was mounted to the network mounting bracket. On later models the interrupter switch is mounted separately to the ringer base and steps (1), (2), and (3) will not apply.

**6. CONNECTIONS**

**6.01** When tip party identification is required, it must be obtained through the ringer associated with each station. The connections are

shown in the section for particular telephone set used.

**6.02** If tip party identification is required and customer does not wish telephone set associated with F1A ringer to ring:

- (a) F1A ringer should not be used to tip party identification.
- (b) F1A ringer should be connected as normal tip party ringer.
- (c) Telephone set should be connected for tip party identification with the ringer silenced as described in the section related to set.

**6.03** Table B gives connections for the F1A ringer. A circuit drawing is shown in Fig. 4.

**TABLE B  
LINE AND RINGER CONNECTIONS FOR F1A RINGER**

WIRE OR LEAD			INDIVIDUAL OR BRIDGED	RING PARTY	TIP* PARTY
Inside Wire	Ring	R	6	6	1
	Tip	G	4	1	6
	GRD	Y	—	4	4
Ringer		R	7	7	7
		S-R	2	2	2
		S	2	2	2
		BK	4	4	4
Network Straps	G	BL	4	4†	4†
	A	R	7	7	7
	B	G	6	6	6

\* See 6.01 and 6.02

† Place BL strap on (1) whenever severe induction noise is encountered.

## RINGERS — L1A

### IDENTIFICATION, INSTALLATION, MAINTENANCE, AND CONNECTIONS

#### 1. GENERAL

**1.01** The L1A ringer uses a C4A ringer coil and is subject to the same circuit arrangements and limitations as the C4A ringer.

#### 2. IDENTIFICATION

**2.01** The L1A ringer is a single-coil, high impedance, loud ringing signal for indoor or outdoor use. The ringer has a 2-position bias spring and consists of the components as shown on Fig. 1 and 2.

**2.02** The ringer has mounting facilities and space provided for the installation of a 425A or 426A electron tube (Fig. 3). The tubes are used for selective multiparty line ringing or when there is evidence of inductive interference (Table A). For the maintenance and mounting instructions of these tubes, refer to the section entitled Electron Tubes.

#### 3. INSTALLATION

**3.01** Select a location that will permit customer to hear ringer.

**3.02** Mount ringer in a vertical position with gongs at top.

**3.03** If location is indoors, ringer may be fastened directly to wall surface with two fasteners as follows:

- (a) For fastening to wood, use No. 8 RH wood screws.
- (b) For hollow wall construction, use B wall screw anchors.
- (c) For concrete and masonry surfaces, use C plastic anchors.

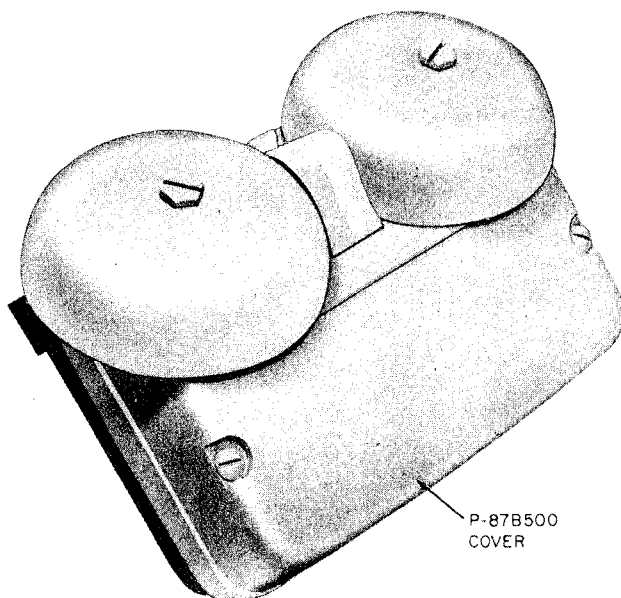


Fig. 1 — L1A Ringer (Assembled)

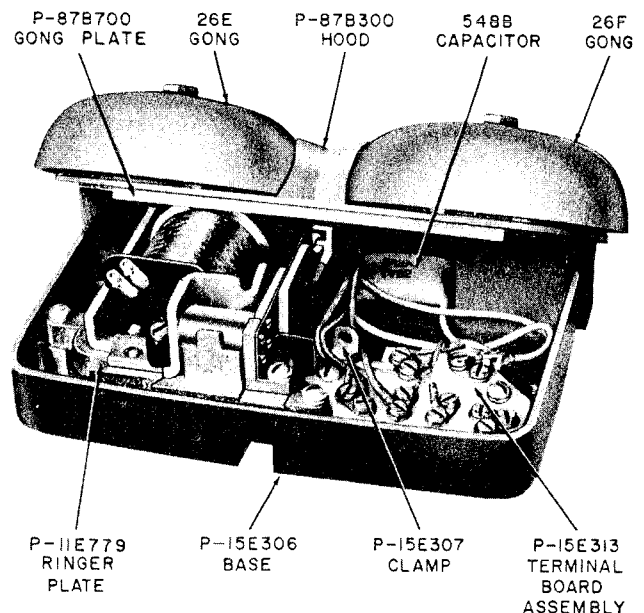


Fig. 2 — L1A Ringer, Components

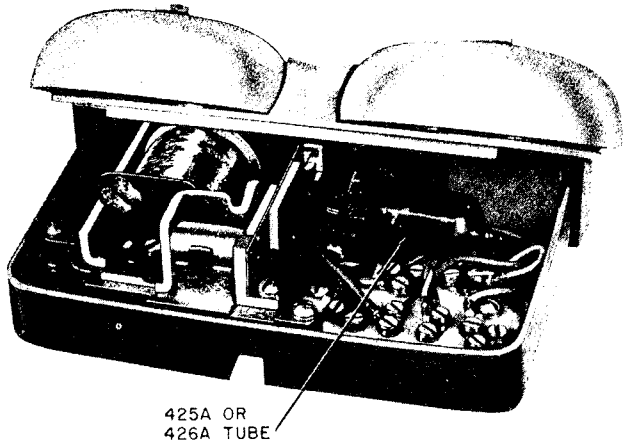


Fig. 3 — L1A Ringer with 425A or 426A Tube

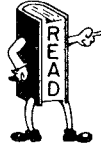
**3.04** When mounting ringer outdoors, use a 181A-49 backboard. This backboard comes equipped with two RH self-tapping screws for mounting L1A ringer. For mounting 181A-49 backboard, refer to section on installation of backboards.

**3.05** Wire may enter ringer from top, bottom, or back.

**4. MAINTENANCE**

**4.01** If ringer fails to operate properly, check the following:

- (a) All leads should be dressed away from clapper and armature.
- (b) Armature air gap should be free of dirt and foreign material.
- (c) All terminal connections should be tight and correctly terminated.
- (d) Biasing spring should not touch or rub pole piece and should be in correct notch.



*Correct biasing spring tension has been set at factory. Do not bend biasing spring. Spring can be moved to either notch as required.*

**Note:** See section on maintenance of C-type ringers for proper bias spring position on a particular class of service.

(e) Clapper should have perceptible to 1/32 inch clearance from 26F gong when armature is nonoperated. With armature operated, clearance should be perceptible to 1/32 inch between clapper and 26E gong. Gongs are on an eccentric pivot and may be rotated to meet this requirement.

(f) If ringer still does not operate properly, replace ringer.

**5. CONNECTIONS**

**5.01** See Fig. 4 and Table A for line and ringer connections.



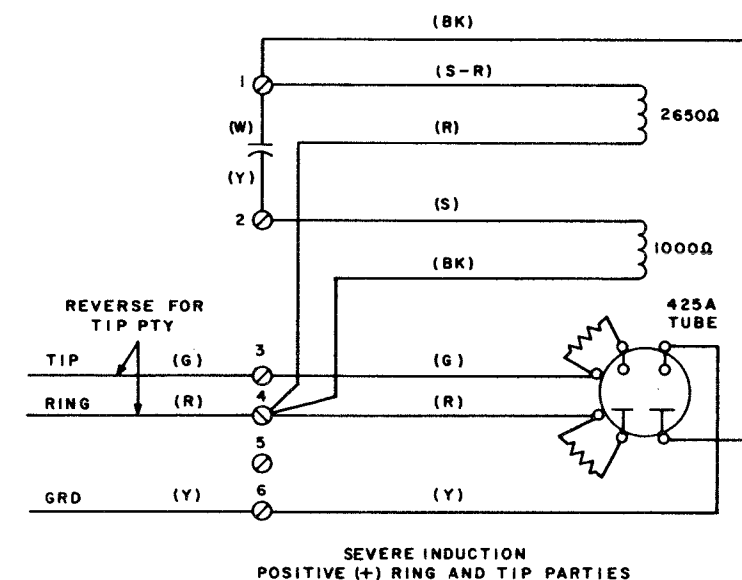
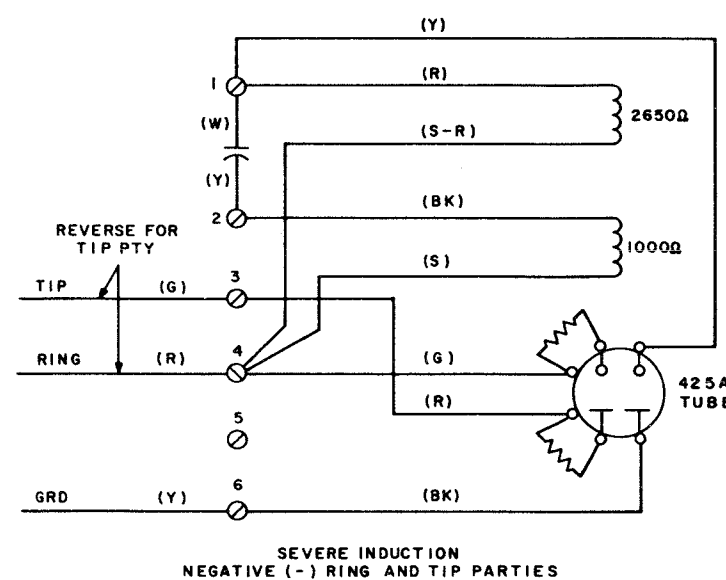
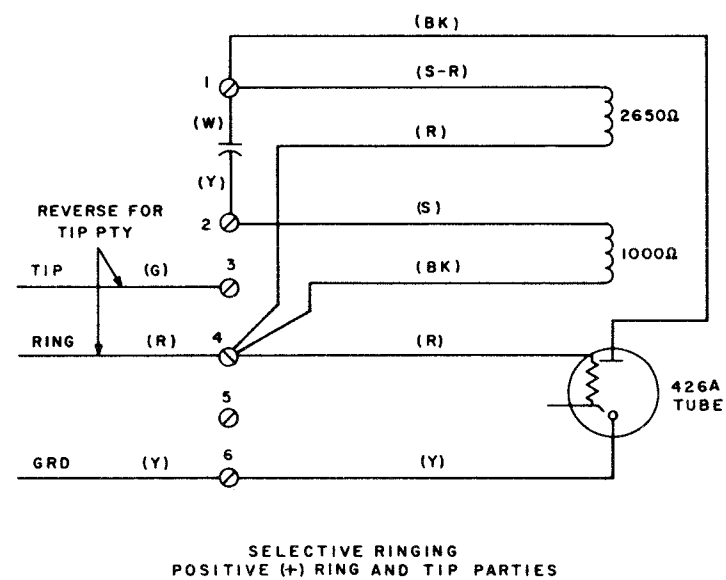
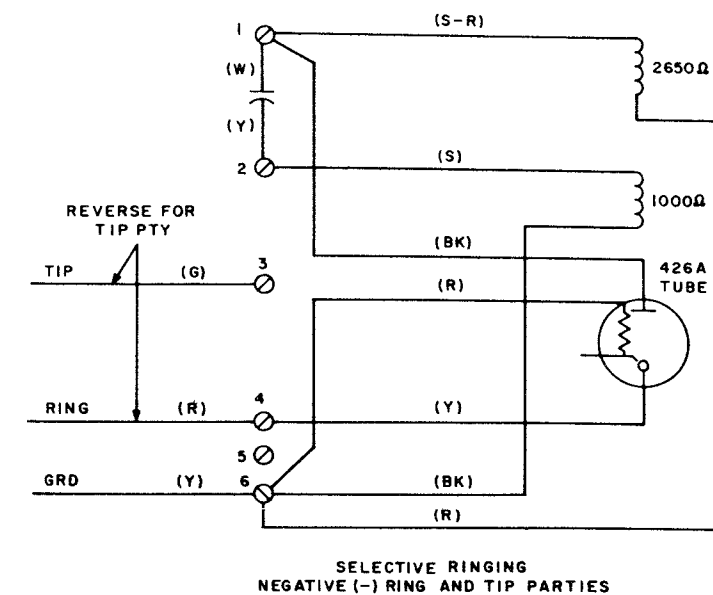
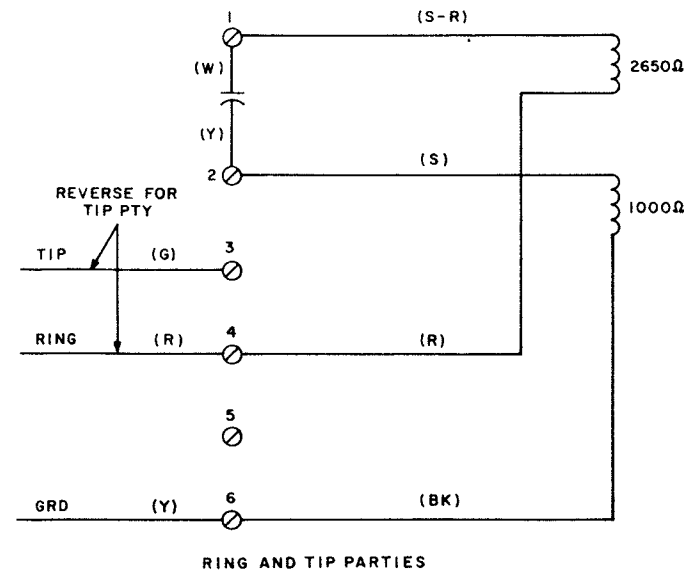
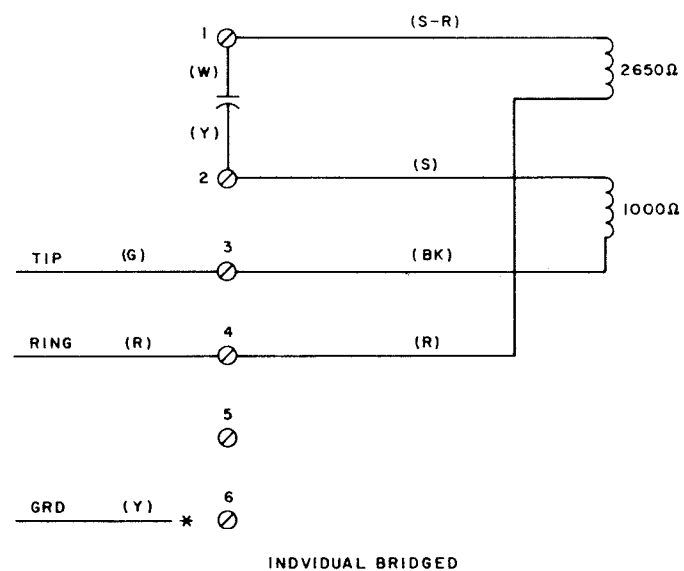
TABLE A  
LINE, RINGER, AND TUBE CONNECTIONS

	INDIVIDUAL BRIDGED	2-PARTY		SELECTIVE RINGING AND AVERAGE INDUCTION (UP TO 30 VOLTS) *				SEVERE INDUCTION (30 TO 80 VOLTS) *			
		RING	TIP	(-) RING PARTIES (1-5)	(-) TIP PARTIES (2-6)	(+ ) RING PARTIES (3-7)	(+ ) TIP PARTIES (4-8)	(-) RING PARTIES (1-5)	(-) TIP PARTIES (2-6)	(+ ) RING PARTIES (3-7)	(+ ) TIP PARTIES (4-8)
INSIDE WIRE	RING R	4	3	4	3	4	3	4	3	4	3
	TIP G	3	4	3	4	3	4	3	4	3	4
	GRD Y	6	6	6	6	6	6	6	6	6	6
RINGER	R	4	4	6	6	4	4	1	1	4	4
	S-R	1	1	1	1	1	1	4	4	1	1
	S	2	2	2	2	2	2	4	4	2	2
CAPACITOR	BK	3	6	6	6	4	4	2	2	4	4
	W	1	1	1	1	1	1	1	1	1	1
	Y	2	2	2	2	2	2	2	2	2	2
426A TUBE *	R			6	6	4	4				
	BK			1	1	1	1				
	Y			4	4	6	6				
426A TUBE SEVERE † INDUCTION	R			3	3						
	BK			1	1						
	Y			4	4						
425A TUBE *	R							3	3	4	4
	BK							6	6	1	1
	Y							1	1	6	6
	G							4	4	3	3

\* Use negative party connections when capacitor type grounded ringing must be replaced with tube type ringing due to inductive noise.

† The three element 426A tube can be used to combat severe inductive noise (30 to 80 volts) on negative parties only. It cannot be used on positive parties.





NOTE:  
ANI CONNECTIONS ARE NOT SHOWN. RINGERS IN SETS OR 1635A  
INDUCTORS SHOULD BE USED FOR IDENTIFICATION PURPOSES.  
\* INSULATE AND STORE.

Fig. 4 — L1A Ringer, Connections



## TELEPHONE SETS AND ASSOCIATED STATION APPARATUS

### SELECTION OF INDOOR LOCATIONS

#### 1. GENERAL

1.01 This section serves as a guide in planning the location of telephone sets and associated station apparatus as follows:

- For general indoor use.
- At normal temperatures.
- In a nonexplosive atmosphere.
- At dry locations.

1.02 This section is reissued to state that telephone apparatus equipped with plastic covers should not be installed in locations where there is a possibility that surrounding temperatures will reach 150 degrees F. This could cause warping or deformation of the plastic.

1.03 Whenever service is provided in other than the above indoor locations, use special sets and follow special procedures as covered in other sections.

#### 2. LOCATION

2.01 Install the telephone apparatus in the location chosen by the customer. It may be helpful to point out that some locations are not conducive to concealed wiring or proper maintenance. Give consideration to ability to hear the ring throughout the premises.

2.02 From a maintenance viewpoint, avoid locations where the room noise is likely to cause customer complaints of "Can't hear" or "Can't be heard." However, if no quieter location is available, review the section on apparatus for use at noisy locations. In addition, apparatus should be accessible for maintenance and free from accidental mechanical damage or receiver-off-hook trouble.

2.03 If the customer, after being acquainted with these facts, insists upon a location which is undesirable from a maintenance viewpoint, refer the matter to a supervisor.

2.04 Where the appearance of the completed installation may have a bearing on customer choice of location, inform the customer as to where it may be necessary to have holes drilled, and where wire or cable will be placed and exposed.

2.05 Discourage locations on finely finished surfaces such as:

- Marble.
- Expensive wood paneling.
- Ceramic or glass tile.

*Note:* The customer should make arrangements to have holes drilled for the above surfaces.

**SECTION 502-120-200**

**2.06** To avoid inductive noise, do not place telephone apparatus near fluorescent light units.

**2.07** Consider the use of available conduit facilities when planning station apparatus locations, and point out to the customer the advantages of concealing wire in conduit.

**2.08** Available niches and shelves may be used. Table A gives necessary dimensions of shelves.

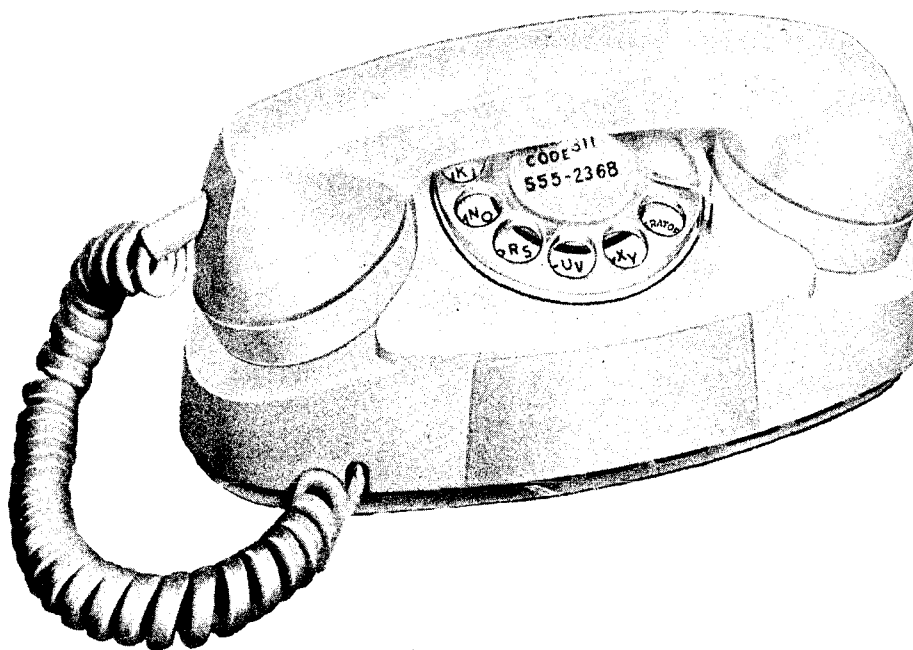
**2.09** The subscriber set may be mounted in a wall cabinet provided for that purpose. Be sure the set is mounted in the proper position. Adjust signal to satisfy the customer.

**2.10** When the customer desires a telephone in a dimly lit location, a set with a dial light such as the 700 type (Fig. 1) may be desirable.

**TABLE A**  
**SHELF DIMENSIONS**

Type Set	Depth	Width
	inches	inches
202	6	12
300	8	12
500*	9-1/2	12
5300	8-1/2	12
540	10	12
560*	10	12
700*	5	12

\* The TOUCH-TONE versions of these sets require the same shelf dimensions.



**Fig. 1 – 700-Type Telephone Set**

**3. LOCATING ON DESKS OR TABLES**

**3.01** When locating a connecting block or subscriber set on a desk or table, consider which hand the customer uses to hold the handset.

**3.02** Inspect desk for special wiring facilities which may be provided by the manufacturer, such as built-in brackets for mounting connecting blocks, subscriber sets with bakelite covers, or knock-out discs with rubber grommets for telephone set mounting cord.

**3.03** Where no special provisions are made for mounting connecting block or subscriber set, select a location as follows:

**Connecting Block**

- (a) Locate on one of the outer panels just below the top of the desk. A practical objective is to place the connecting block high enough to hold the cord off the floor. Consider, where necessary, the use of a spring mounting cord.

**Subscriber Set**

- (a) On the side of the pedestal of desk near the top, inside the knee well, and away from leg area of customer.
- (b) On the underside of a table.
- (c) Near the top, on the left or right side of a desk or table.

**Convenience**

- (a) This location will permit the station set to be moved to practically any position on desk or table top.

**Maintenance**

- (a) The cord will not be subjected to damage by being stepped on or crushed, or by floor cleaning operations such as sweeping, mopping, or waxing. There will be less chance of the station set being accidentally pulled off the desk or table.

**4. BATHROOM LOCATIONS**

**4.01** Whenever possible, install a wall set in these locations.

**4.02** If a wall set installation is not feasible, a desk set may be installed subject to the following conditions:

- (a) The telephone set cannot be brought into the bathtub or shower.
- (b) The telephone set cannot rest on the edge of the bathtub.

**4.03** If a jack is installed in the bathroom, it must be located so the preceding requirements will be met.

**5. WALL AND HANG-UP TYPE HAND TELEPHONE SETS**

**5.01** Place telephone set at a height most suitable for the customer. Generally, the determining factor will be whether the customer will stand or sit while using the equipment.





STATION SETS  
SELECTING OUTDOOR LOCATIONS  
PATIOS AND SWIMMING POOLS

1.00 INTRODUCTION

This section covers general information and procedures pertaining to selecting outdoor locations for telephone apparatus at patios or swimming pools.

2.00 GENERAL

2.01 Placing wire, cable, and protectors for telephone apparatus at patios and swimming pools should be on the same basis as for permanent buildings.

2.02 Makeshift pole lines, insufficient clearances, etc, must be avoided.

IN NO CASE SHALL CORDS  
BE LONG ENOUGH TO REACH  
POOL.

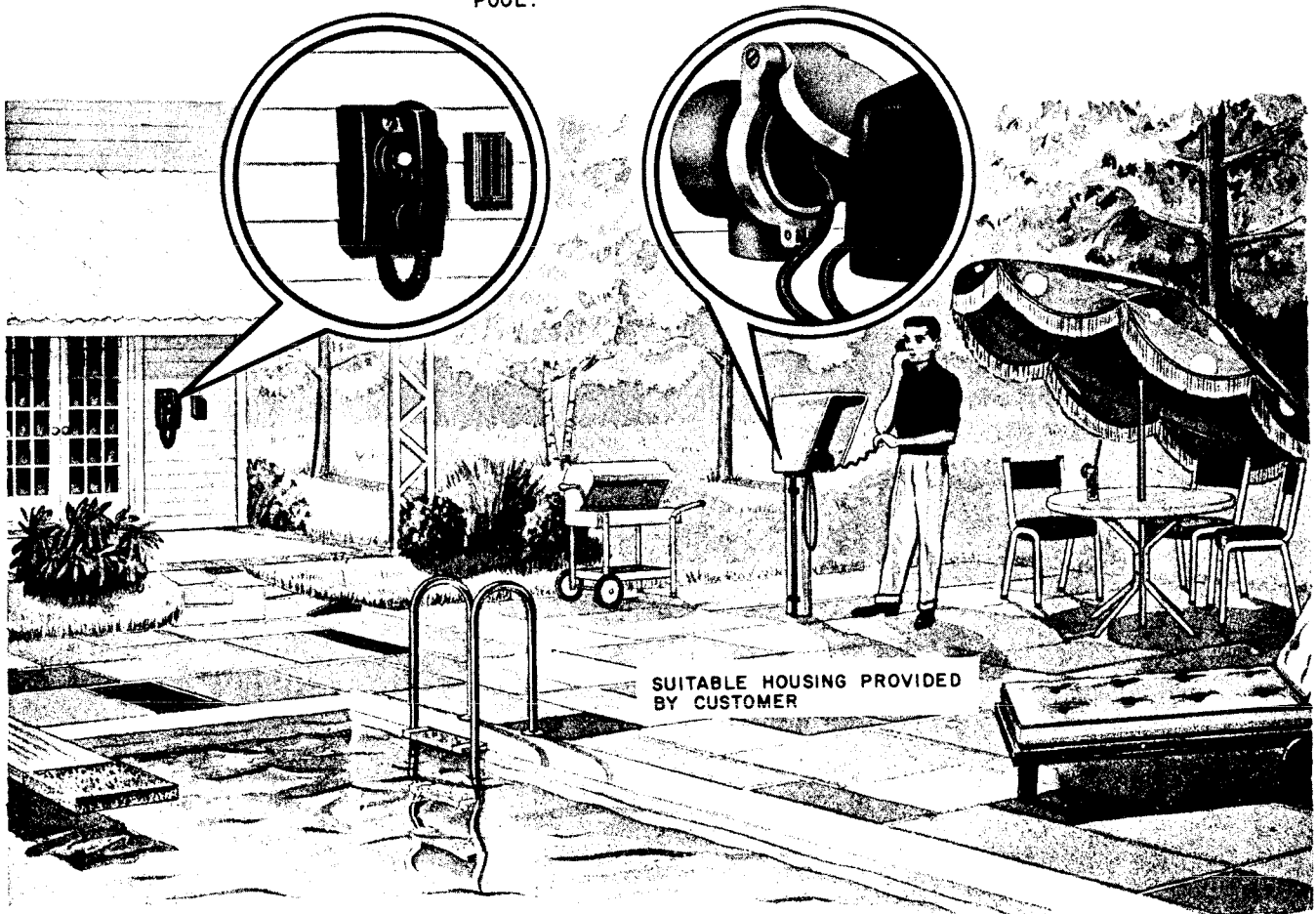


Fig. 1 — Recommended Installation of Pool and Patio Telephone



*Avoid placing wires over swimming pools or diving boards.*

**2.03** Conduit or ditch for underground wire or cable distribution will be provided by the customer. The same separations between telephone and power should be observed as is required for ordinary buried service.



*Proper grounding procedures are very important. See the section entitled Protectors and Signaling Grounds.*

### **3.00 INSTALLATION**

**3.01** Telephone apparatus shall only be installed in a weatherproof box or sheltered area. A suitable location or box shall be provided by the customer and approved prior to installation.

*Caution:* Under no circumstances shall telephone apparatus cords be long enough to reach a swimming pool. The customer should be so advised preceding the installation. Trench or conduit runs to telephone locations can then be planned accordingly. See Fig. 1 for typical recommended installations.

**3.02** Waterproof jacks and covers shall be used at all outdoor locations. See the section entitled Jacks and Plugs.



*Customer must be cautioned to bring portable telephone apparatus indoors at night or doing inclement weather. Moisture may damage telephone apparatus, and may also cause service failure on the entire line.*

## SUBSCRIBER SETS

### LOUD RINGING BELLS

#### INSTALLATION

#### 1. GENERAL

1.01 This section covers installation of loud ringing bells for indoor and outdoor locations.

1.02 It is reissued to:

- Change title.
- Include information on new apparatus.

#### 392-Type Subscriber Sets

1.03 The 392-type subscriber set is equipped with two No. 28A 6-inch steel galvanized gongs. The 392-type subscriber set is superseded by the 592-type subscriber set.

#### 592-Type Subscriber Sets

1.04 The 592-type subscriber set is equipped with two 3-inch 26B brass, black finished gongs. The 592-type subscriber set is superseded by the L1A ringer.

#### L1A Ringer

1.05 The L1A ringer is equipped with one 26E gong and one 26F gong.

#### 2. INSTALLATION

2.01 Prior to installation consider:

#### AUDIBILITY

- (a) Select a location where volume of sound will be best distributed and wherever practicable, place set at least 10 feet above ground.

- (b) The sound output of the 392-type subscriber set is regulated by gong adjustments.

- (c) To increase the sound output of the 592-type subscriber set, replace the standard 3-inch 26B gongs with 4-inch 42A gongs and brackets.

- (d) See section on L1A ringers for adjustment of gongs for maximum sound output.

- (e) Mounting holes for the 169A backboard are located on and 1 inch to either side of the vertical center line of the backboard.

- (f) Mount the L1A ringer with a 181A backboard (Fig. 5). Two RH self-tapping screws are furnished with the backboard.

- (g) Mount L1A ringer in a vertical position with gongs at top.

#### 3. MOUNTING

##### Indoor

3.01 Backboards are not generally required for mounting subscriber sets and should not be used unless it will facilitate the installation or where a more secure mounting is required, such as on uneven surfaces.

3.02 When walls are uneven:

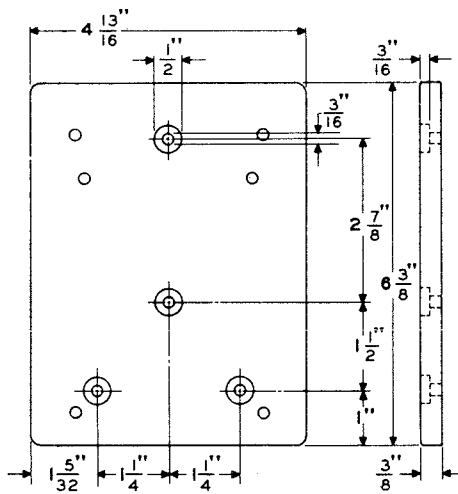
- (a) Shim backboards and use screws 1/2 inch longer than specified in Table A.

- (b) When required, the 171A wood backboard (Fig. 1) is used to attach the 592-type subscriber set.

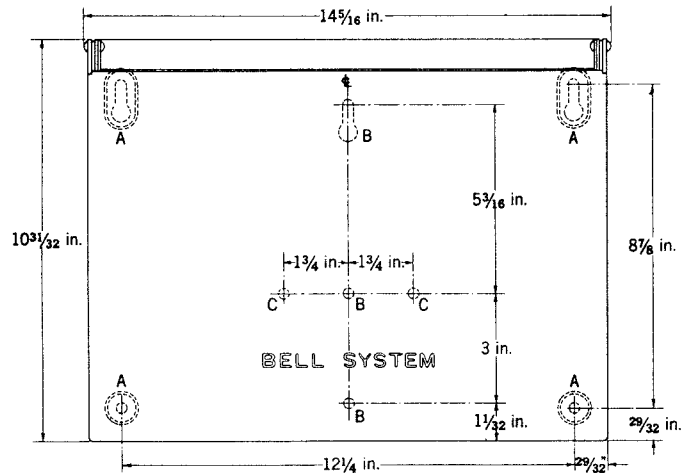
**TABLE A**  
**MOUNTING THE 171A BACKBOARD**

Surface	Quantity	Fastener
Hardwood	4	1 in., No. 8 RH Blued Wood Screws
Softwood	4	1-1/4 in., No. 8 RH Blued Wood Screws
Plaster on Masonry Block	3	2 in., No. 8 RH Blued Wood Screws in 6-8 x 3/4 in. Screw Anchors
Masonry	4	1-1/2 in., No. 8 RH Blued Wood Screws in 6-8 x 3/4 in. Screw Anchors
Metal	3	12-24 x 9/16 in. RH Galvanized Iron Machine Screws
Hollow Tile, Metal Lath	2	1/8 x 4 in. BH Toggle Bolts (cut off excess length)
Corrugated Metal	2	1 in., No. 8 RH Self-tapping Screws

*Note:* Use same fasteners to mount 592-type subscriber sets to wood surfaces.

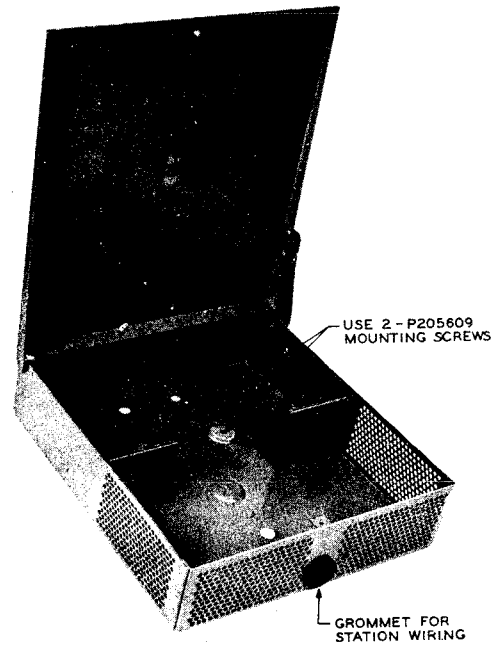


**Fig. 1 – 171A Backboard**



**Fig. 2 – 159A Backboard**

- (c) A 9- by 12- by 3/4-inch hardwood backboard may be used to mount the 392-type subscriber set.
- (d) The L1A ringer is fastened directly to wall surface with two fasteners.
- (e) Obtain customer permission before attaching subscriber sets or backboards to finely finished surfaces.



**Fig. 3 – 169A Backboard**

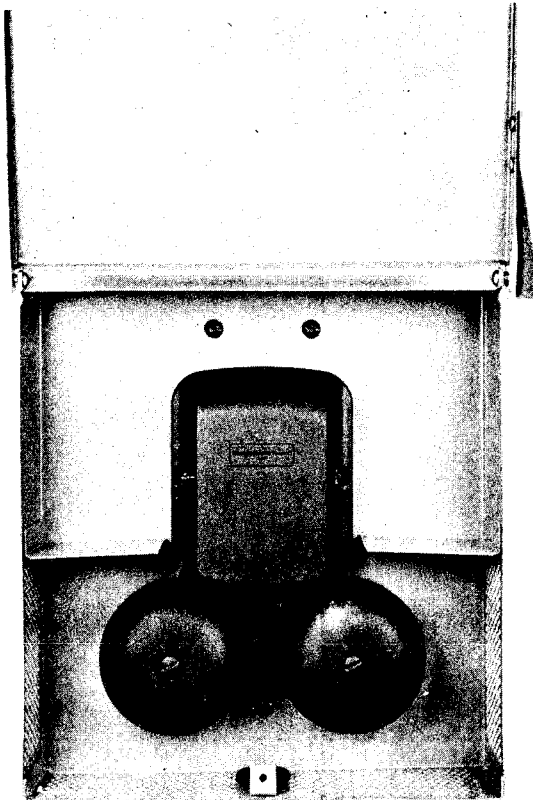
**Outdoor**

**3.02** Locate subscriber sets where workman and equipment will not be exposed to injury or damage.

**3.03** Install subscriber sets in enclosed steel backboards.

**3.04** When exposed to the weather:

- (a) Mount the 392-type subscriber set with a 159A backboard (Fig. 2, Table B). Two P-160406 12-24 by 9/16-inch RH machine screws are furnished with the backboard.
- (b) Mount the 592-type subscriber set with a 169A backboard (Fig. 3 and 4). Two P-205609 8-32 by 5/8-inch RH brass machine screws are furnished with the backboard.



**Fig. 4 -- 592-Type Subscriber Set Mounted**

**TABLE B**

**MOUNTING THE 159A BACKBOARD**

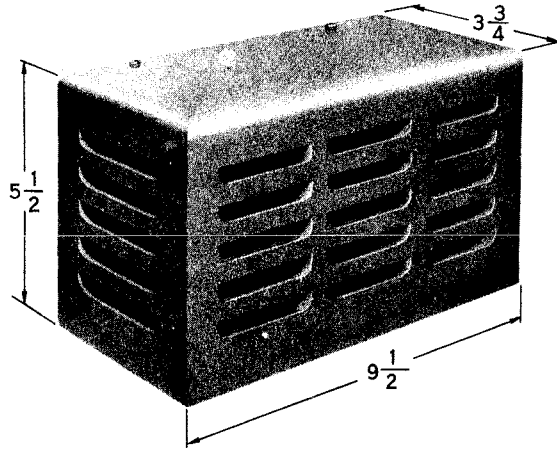
Surface	Quantity	Fastener
Wood	4	1 in., No. 14 RH Galvanized Wood Screws. (Use knock-out holes A.)
Wood Poles (see note)	2	1 in., No. 14 RH Galvanized Wood Screws in upper and lower knock-out holes B.
	2	1-1/2 in., No. 14 RH Galvanized Wood Screws in knock-out holes C.
Plastered Surfaces having Wood Studs	3	1 in., No. 14 RH Galvanized Wood Screws. (Use knock-out holes B and place screws in studding.)
Unfinished Masonry	4	1 in., No. 14 RH Galvanized Wood Screws in 10-14 x 1 in. Screw Anchors. (Use knock-out holes A.)
Finished Masonry	4	2 in., No. 14 RH Galvanized Wood Screws in 10-14 x 1 in. Screw Anchors. (Use knock-out holes A.)
Hollow Tile, Metal Lath, Corrugated Metal	4	3/16 x 4 in. BH Toggle Bolts. (Use knock-out holes A. Cut off excess bolt length.)
Solid Metal (see note)	3	12-24 x 9/16 in. RH Iron Machine Screws. (Use upper knock-out hole B and knock-out holes C.)

*Note:* If C knockout holes are not provided, drill at location shown in Fig. 2 with 9/32-inch drill. Fasteners through knockout holes should be brought up snug without forcing to avoid distorting backboard and throwing tapped mounting holes for the 392-type subscriber set out of alignment.

**SECTION 502-200-200**

(c) Where practicable, use three of the same fasteners shown in Table B to attach the 169A backboard.

(d) Where use of the bottom mounting hole in the 169A backboard is not practicable, place fastener through the small knockout hole provided near center of backboard.



**Fig. 5 – 181A-49 Backboard for Mounting L1A Ringer**

## HAND TELEPHONE SET—220A, 1220A, AND 2220B

### IDENTIFICATION, INSTALLATION, MAINTENANCE, AND CONNECTIONS

#### 1. GENERAL

1.01 This section is reissued to:

- Include 2220B hand telephone set
- Add H5AD (message waiting lamp) handset cord, D5AL and D5AN mounting cords (associated apparatus or equipment)
- Show handset cords are ordered separately
- Remove reference to dials, networks, receiver units, and transmitter units as being replaceable components
- Include test procedure for hand telephone set

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. IDENTIFICATION

2.01 The 220A (Fig. 1), 1220A, and 2220B (Fig. 2) hand telephone sets are components of the dial-in-handset TRIMLINE® telephone sets. The hand telephone set is a complete telephone set except for the handset cord and the ringer and line switch which are housed in a telephone base.

#### ORDERING GUIDE

Set, Telephone, Hand, 220A-\*

Set, Telephone, Hand, 1220A-\*

Set, Telephone, Hand, 2220B-\*

(a) **Replaceable Common Components:**

- Lamp, 53B
- P-25E803, Number Card Retainer

- P-28E320, Light Seal

- Form, E5002A (number card)

(b) **Associated Apparatus or Equipment:** (order separately)

- Cord, Handset, H4DB-\*
- Cord, Handset, H5AA-\*
- Cord, Handset, H5AD-\* (Equipped with message waiting lamp)
- AC1-\* Telephone Base
- AD1-\* Telephone Base
- Cord, Mounting, D5AL-\*(AD1 Base)
- Cord, Mounting, D5AN-\*(AD1 Base, retractable)
- 2012A Transformer (for other suitable transformers, see section on transformers)

(c) **Customer Instruction Booklet:**

- GN-2426 (220A)
- GN-2433 (1220A)
- GN-2441 (2220B)

\*Refer to Table A for color selection.

#### 3. INSTALLATION

(a) **Planning**—When planning the installation of a hand telephone set together with its companion base, consider the following:

- Safety for yourself, customer, and maintenance personnel.
- Location—A 120V, 60 Hz power receptacle must be available, not under the control of

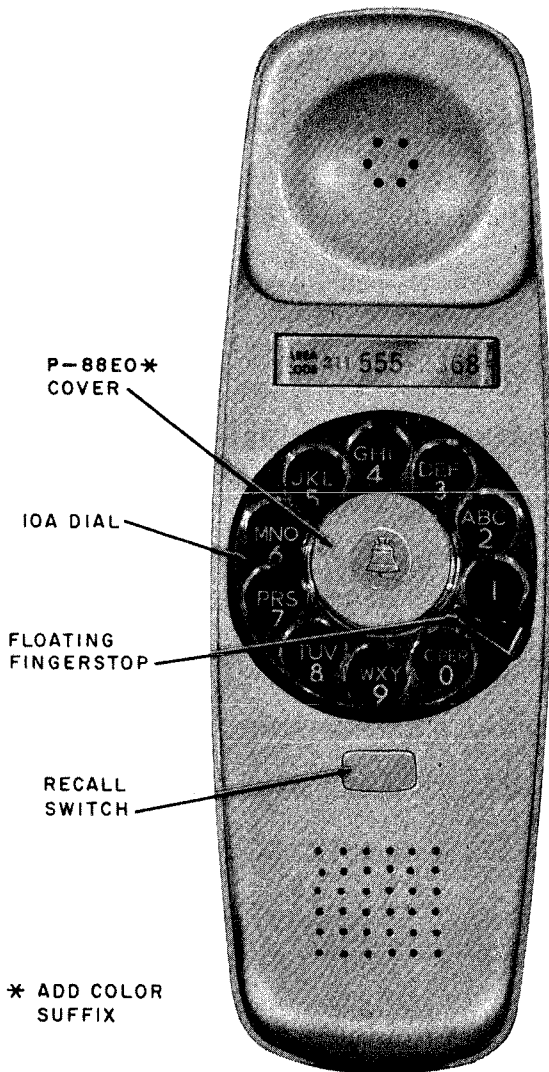
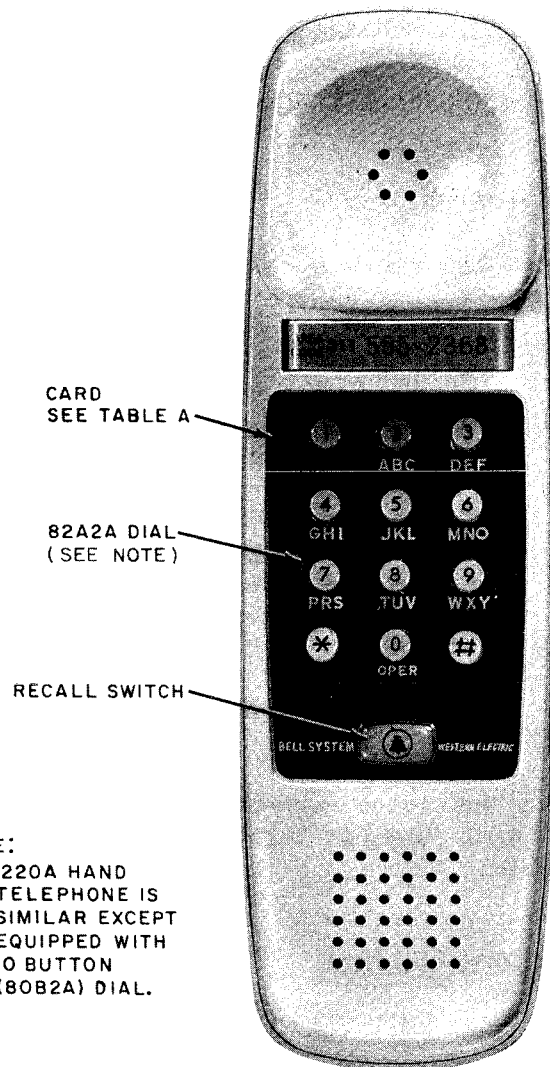


Fig. 1—220A Hand Telephone Set



NOTE:  
1220A HAND TELEPHONE IS SIMILAR EXCEPT EQUIPPED WITH IO BUTTON (80B2A) DIAL.

Fig. 2—2220B Hand Telephone Set

a switch, that can be used for the transformer to provide power for the dial light.

- Distance between associated equipment or apparatus.
- General appearance of installation.

(b) **Installing**

- (1) Connect the 220A, 1220A, or 2220B hand telephone set to a telephone base by plugging an H4DB cord (Fig. 3) or H5AA (tip

party lines) into the jacks on each component. The cord must be ordered separately.

- (2) If tip party identification is required, an H5AA cord must be used. Check under number card window to see that screw used in tip party identification switch is tightened down. The absence of a screw or screw hole in the identification switch position (Fig. 4) indicates that the connection has been made in the network at the factory. The H4DB and H5AA handset cords are available in 5-1/2, 9-, and 13-foot lengths.



TABLE A  
COLOR SELECTION AND PIECE PART INFORMATION\*

HAND TELEPHONE AND DIAL HUB COVER†		DIAL FACE CARD (1220 AND 2220)		
STANDARD COLOR	SUFFIX	COLOR	PIECE PART NO. (1220A ONLY)	PIECE PART NO (2220B ONLY)
Black	-03	Slate	P-22F570	P-22F967
Ivory	-50	Cinnamon Brown	P-22F571	P-22F968
Green	-51	Dark Jade Gray	P-22F572	P-22F969
Red	-53	Burgundy	P-22F573	P-22F970
Yellow	-56	Gold	P-22F574	P-22F971
White	-58	Slate	P-22F570	P-22F967
Rose Pink	-59	Rose	P-22F575	P-22F972
Lt. Beige	-60	Sandalwood	P-22F576	P-22F973
Lt. Gray	-61	Slate	P-22F570	P-22F967
Aqua Blue	-62	Peacock Blue	P-22F577	P-22F974
Turquoise	-64	Turquoise Green	P-22F578	P-22F975

\* Refer to Section 500-120-100 for promoted colors

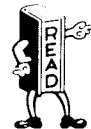
† 220A hand telephone set only

(3) If message waiting lamp feature is required, an H5AD cord must be used. The lamp equipped end of the cord plugs into the hand telephone set. It is available in 5-1/2 foot length only.



*If it is necessary to use an H5AA cord for other than tip party identification service, disconnect the (BL) ringer lead from B terminal on the terminal board in the base, insulate and store.*

(4) The 220A, 1220A, and 2220B hand telephone sets are factory equipped with 53B dial lamps; power for lamps is supplied by a 2012A transformer or any other transformer where more than one dial light set is installed (see section of transformers). **DO NOT USE 2012B TRANSFORMER.**



*The illumination of the dial diminishes with increased cord lengths. In installations where the illumination is considered inadequate, the 53B lamp may be replaced by a 53A, if the lamp power is supplied by a 2012A transformer and the combined lengths of mounting and handset cords exceed 15 feet. Refer to Part 4, Maintenance, for dial lamp replacement.*

- (5) When the hand telephone set is used in conjunction with a key telephone system, the dial lamp can be powered by the 101G or equivalent power supply component of the key system apparatus. In this case, the 53B dial lamp must be replaced with the 53A lamp and the 10V ac tap on transformer used.
- (6) Install Form E-5002A (number card) in space provided above the dial. Use

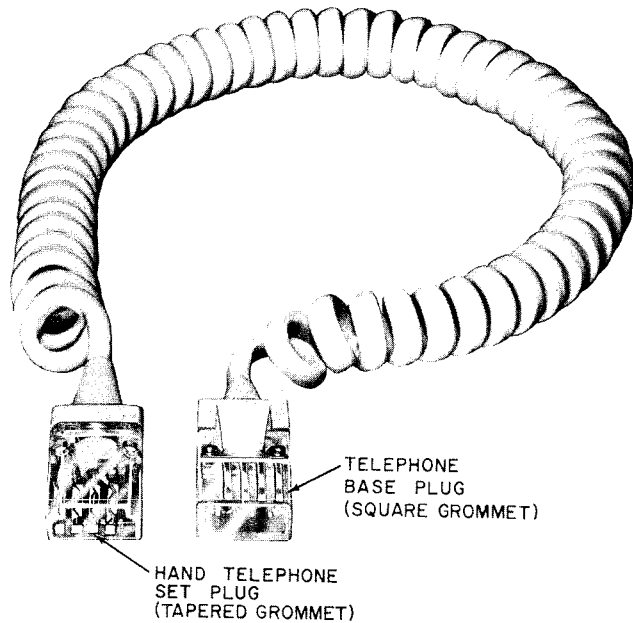


Fig. 3—H4DB Cord

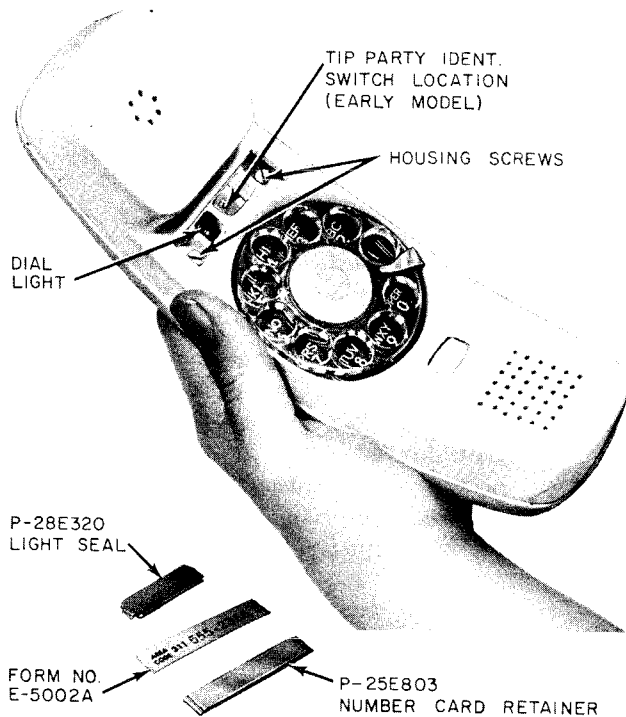


Fig. 4—220A Hand Telephone Set, Number Card Removed

KS-16750L2 releaser to remove number card holder. Replace holder by inserting one end in the recess. Put light pressure on the other end to cause a slight outward bow and snap into recess.

**INSTRUCTING THE CUSTOMER**

(a) **Recall Switch (Fig. 1 and 2):** Point out recall switch and explain advantages of switch. Example: If a person receives busy tone at conclusion of dialing a number, he may depress the recall switch for a few seconds; then release. Dial tone will again be heard. This is done in place of depressing line switch plunger on the telephone base.

**Caution:** *If the recall switch is depressed during conversation or dialing, Central Office equipment may be disconnected.*

(b) **“Floating” Finger Stop (220A only)**

- Demonstrate finger stop by dialing a digit. Then depress recall switch.

**Note:** When demonstrating finger stop, be guided by local instructions in choosing digits to dial. Some digits (i. e., 1 or 9) may be used as special access numbers for services such as DDD in ANI offices.

- To prevent dialing errors, every digit dialed requires rotation of fingerwheel until finger is stopped.

(c) **ACI Telephone Base:** Show customer how to place 220A, 1220A, or 2220B hand telephone set in waiting position as shown in Fig. 5.

**4. MAINTENANCE**

**4.01** In areas where RF suppression is required, replace the hand telephone set with a set that has been modified by the local distributing house. Modified sets will not be recoded but will be stamped “**RF Suppressed See 500-150-100**”. Stamp is located adjacent to handset cord jack where the set code is stamped.

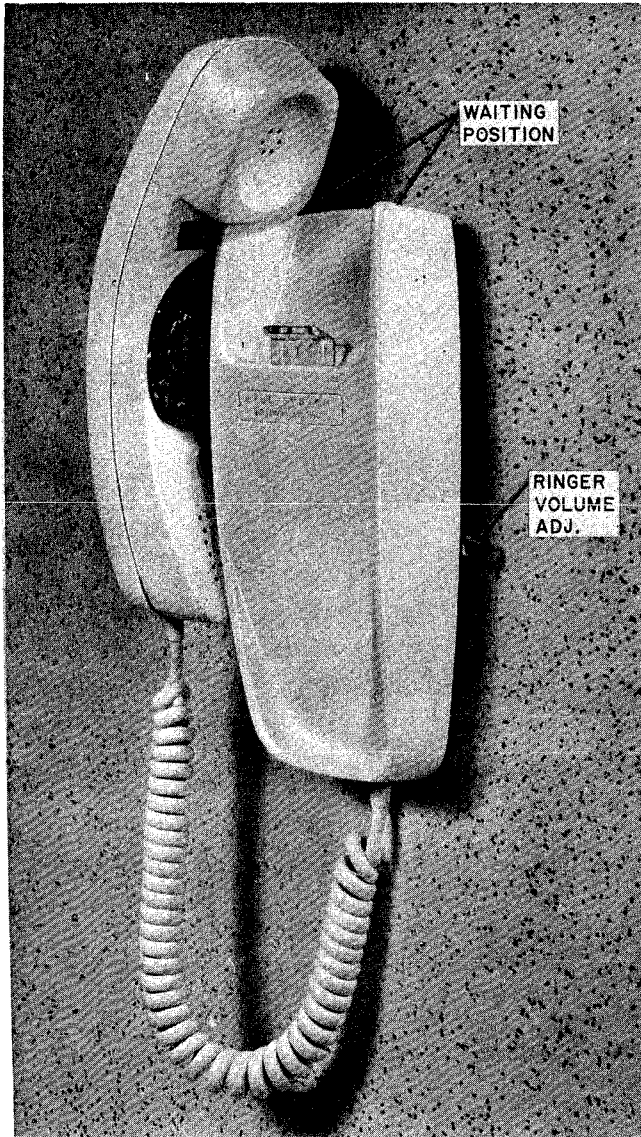


Fig. 5—220A Hand Telephone Set in Waiting Position on AC1 Telephone Base

4.02 Field maintenance of the 220A, 1220A, and 2220B hand telephone sets is limited to the following:

- Dial lamp
- P-25E803 number card retainer
- P-28E320 light seal
- Form E-5002A number card
- Handset Cords

4.03 Replace defective dial lamp and handset cord as follows:

- (a) **Dial Lamp:** To replace a defective dial lamp (Fig. 6), use 553A tool. To gain access to the lamp, remove number card retainer, number card, and light-seal plate.
- (b) **Handset Cord:** To replace a plug ended handset cord (Fig. 7), use a KS-16750L2 releaser. Insert tool in space provided and apply pressure against spring clip toward body of plug. When spring clip has been depressed, pull plug out of jack.

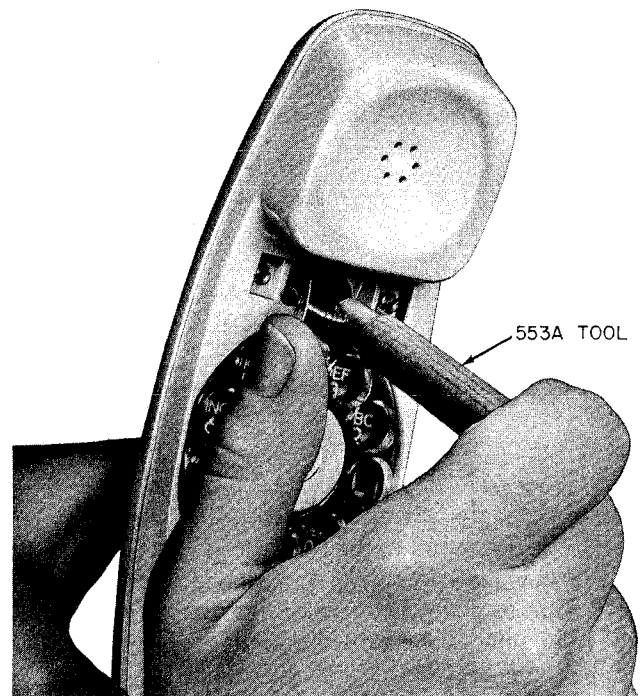
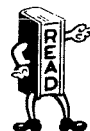


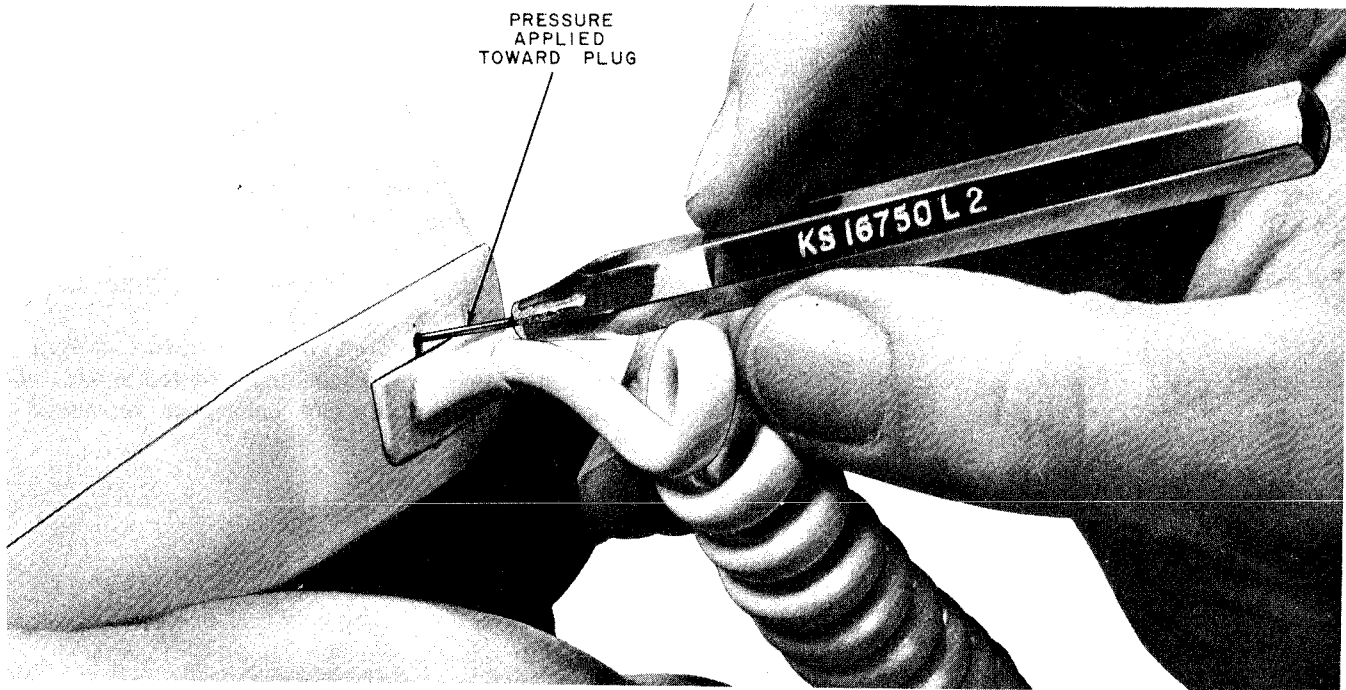
Fig. 6—Replacing Dial Lamp



*If transmission troubles are experienced or the dial is inoperative, replace the hand telephone set.*

4.04 To test hand telephone set proceed as follows:

- (a) Make sure all connections are correct and secure, and line polarity for TOUCH-TONE®



**Fig. 7—Removing Cord From 220A Hand Telephone Set**

dials in 1220A or 2220B is correct. (See Section 502-321-400).

(b) Listen to set receiver for presence of dial tone.

(1) If dial tone is heard, dial any digit or digits prescribed by local instructions to break dial tone. If dial tone can be broken, depress and release recall button. After second dial tone is obtained, call the local ringer test circuit for TOUCH-TONE dials and test each button of the dial as required by local test procedures. If dial fails test, replace complete hand telephone set.

(2) If dial tone is not heard, in set receiver, connect dial hand test set at connecting

block. If dial tone is heard with test set, remove the handset cord at the hand telephone set and move the test set leads to the (G) and (R) conductors at the cord plug. If dial tone is now heard, replace the hand telephone set. If dial tone is not heard, test both handset cord and telephone set base.

## 5. CONNECTION INDEX

Fig. 8—220A Hand Telephone Set—Wiring Diagram

Fig. 9—1220A or 2220B Hand Telephone Set—Wiring Diagram

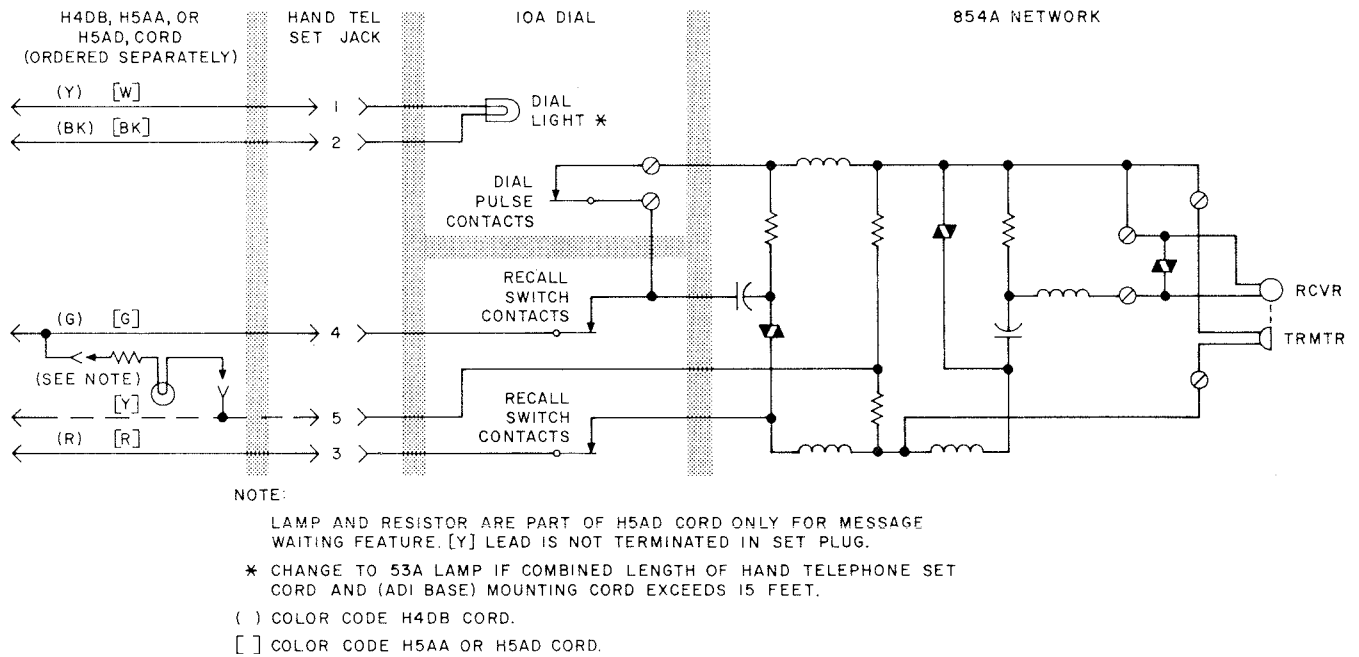
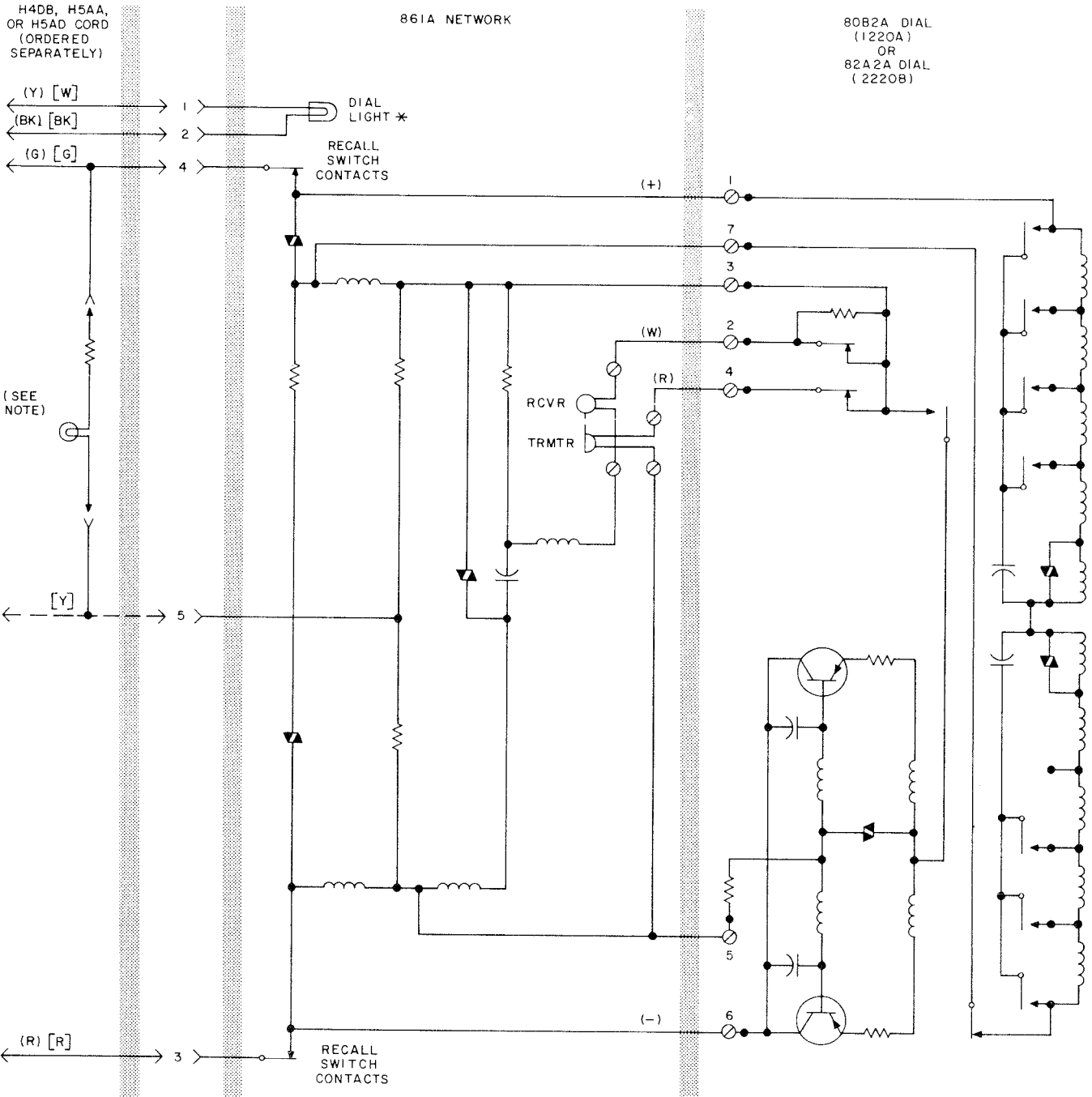


Fig. 8—220A Hand Telephone Set—Wiring Diagram

SECTION 502-320-100



NOTE:  
 LAMP AND RESISTOR ARE PART OF H5AD CORD ONLY FOR MESSAGE WAITING FEATURE. [Y] LEAD IS NOT TERMINATED IN SET PLUG.  
 \* CHANGE TO 53A LAMP IF COMBINED LENGTH OF HAND TELEPHONE SET CORD AND (ADI BASE) MOUNTING CORD EXCEEDS 15 FEET.  
 ( ) COLOR CODE H4DB CORD  
 [ ] COLOR CODE H5AA OR H5AD CORD

Fig. 9—1220A or 2220B Hand Telephone Set—Wiring Diagram

## TELEPHONE BASES

### AC1 AND AD1

#### IDENTIFICATION, INSTALLATION, AND MAINTENANCE

##### 1. GENERAL

1.01 This section is reissued to:

- Add 2220B Hand Telephone Set
- Add P-90D231 Polarity Guard Assembly
- Add D5AN Mounting Cord (AD1 Base)
- Change reference to 165B Adapter (AD1 Base)

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

##### 2. IDENTIFICATION

2.01 The AC1 telephone base (Fig. 1) mounts on a flat vertical surface while the AD1 (Fig. 2) may be placed on a flat horizontal surface.

2.02 Either of these telephone bases may be used in conjunction with a 220A, 1220A, or 2220B hand telephone set to make up a complete telephone set.

2.03 For other information on the 220A, 1220A, or 2220B hand telephone set, refer to Section 502-320-100.

##### ORDERING GUIDE

Base, Telephone, AC1-\*

Base, Telephone, AD1-\*

##### (a) *Replaceable Components*

- Adapter, 165A (includes P-28E424 resonator and adapter mounting screws) AC1 base

- Adapter, 165B (includes P-28E424 resonator and adapter mounting screws) early AD1 Base

- P-28E261 Base (AC1)

- P-28E351 Base (AD1)

- P-82E8\* Cover

- P-82E2\* Housing and Plunger Assembly (AC1)

- P-82E4\* Housing Assembly (AD1)

- P-22F438 Resonator Assembly, (AD1 Base current production)

- Ringer, P1A

##### (b) *Associated Apparatus or Equipment (order separately)*

- Cord, Mounting, D5AL-\* (5 feet-6 inches, 9 or 13 feet) AD1 base

- Transformer 2012A or equivalent

##### (c) *Optional Apparatus or Equipment (ordered separately)*

- Cord, Mounting, D5AN-\* (5 feet-6 inches, 9 or 13 feet retractable) AD1 base. Use in place of D5AL cord when specified on customer service order.

\*Refer to Table A for color selection.

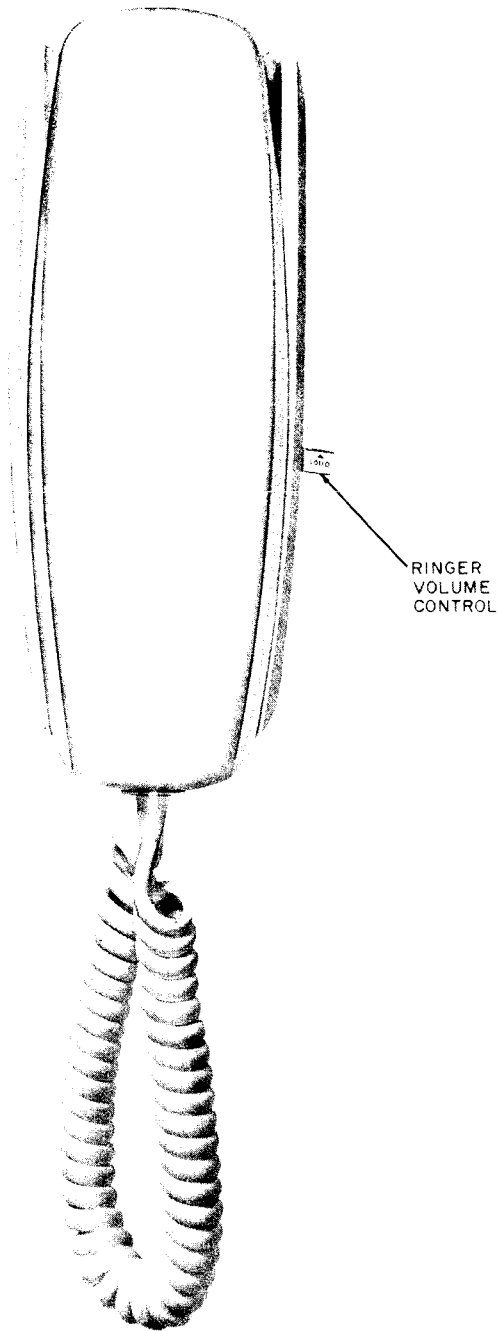


Fig. 1—AC1 Telephone Base With 220A Hand Telephone Set



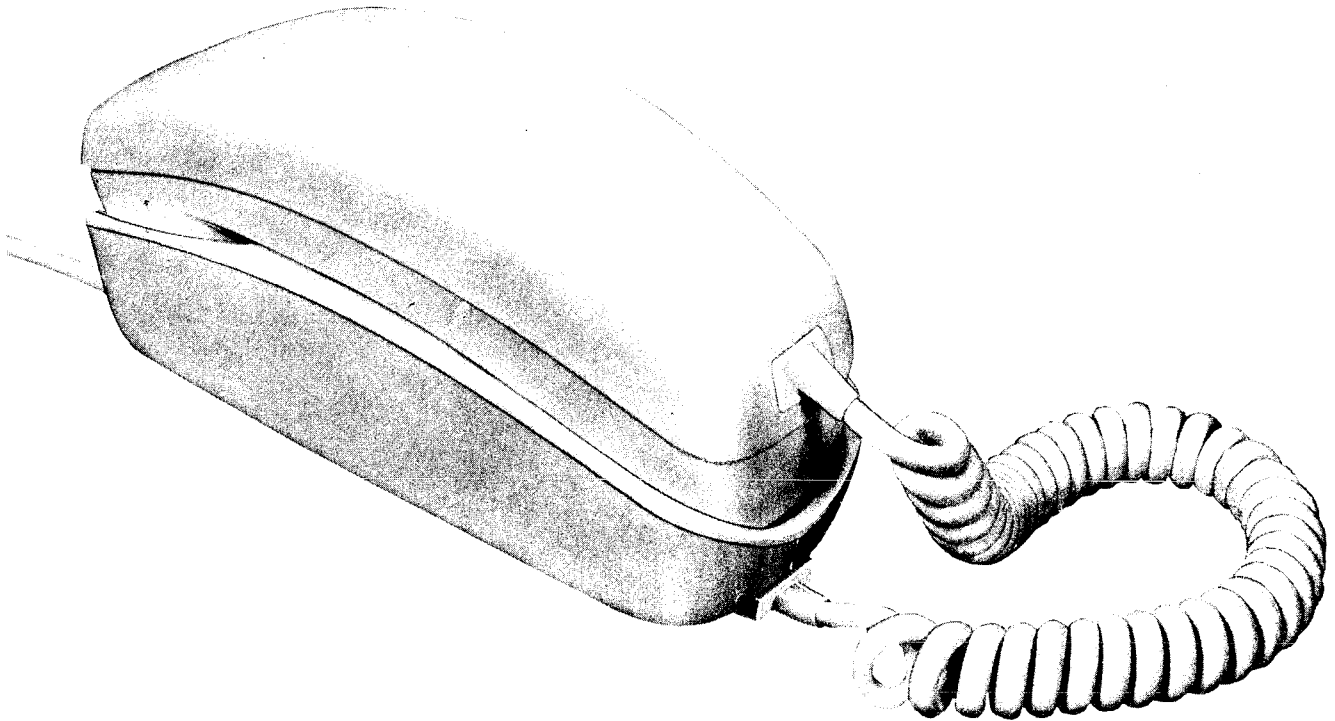


Fig. 2—AD1 Telephone Base With 1220A Hand Telephone Set

COLOR

TABLE A  
COLOR ORDERING GUIDE

STANDARD COLOR*	SUFFIX
Black	—03
Ivory	—50
Green	—51
Red	—53
Yellow	—56
White	—58
Rose Pink	—59
Lt. Beige	—60
Lt. Gray	—61
Aqua Blue	—62
Turquoise	—64

\*Refer to Section 500-120-100 for promoted colors.

**DESIGN FEATURES**

- Factory-wired for individual and 2-party service
- Adjustable ringer volume control
- AC1 base (for vertical mounting) - jack equipped to receive plug-ended handset cord
- AD1 base (for horizontal mounting) - jack equipped to receive plug-ended handset and mounting cords
- A lead control (optional)
- 4-party full selective or 8-party semiselective ringing by adding 426N diode (optional)

**APPLICATION**

- CO or PBX lines
- 1A1, 1A2, and 6A key telephone system (optional)

**3. INSTALLATION**

(a) *Planning*

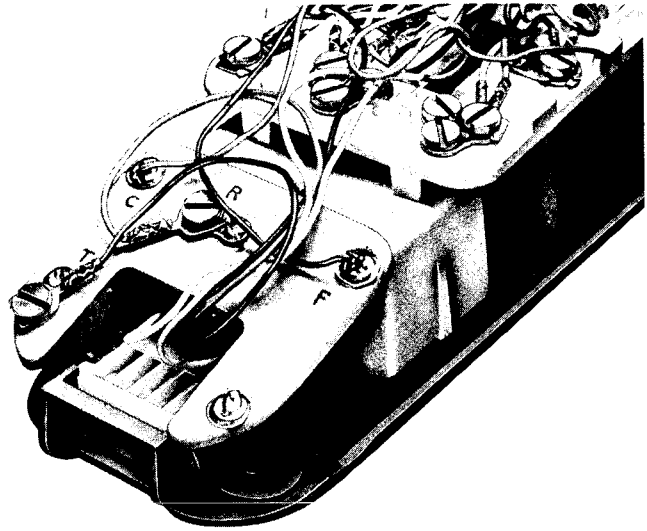
- Safety for yourself, customer, and maintenance personnel
- Location - desk, table, wall, etc.
- Availability of power outlet for hand telephone set dial light transformer
- Space requirements
- General appearance of installation

(b) *Installing*



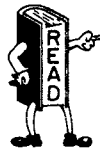
***Polarity Guard should only be installed when instructed by local administrative practices or procedures for end-to-end signaling purposes when battery and ground reversals are encountered (Fig. 3).***

- (1) Where a single dial light is involved, use a 2012A transformer. Select a 105-120 volt ac receptacle not controlled by a switch.



**Fig. 3—P-90D231 Polarity Guard Assembly, Installed**

Use a 2A clamp to secure transformer to the outlet. Where two or more dial light sets are installed, refer to the section on station transformers for use with multiple installations.



***DO NOT USE A 2012B TRANSFORMER—Use 2012A or equivalent transformer supplying voltage for the 6.3V dial lamp.***

- (2) For proper illumination of the dial the length of wire between the transformer and telephone set should not exceed 250 feet of inside wire.
- (3) Ringing and/or identification ground, where required, is common to the lamp circuit. Damage to the transformer may result if there is sufficient ground potential difference between power and telephone grounds. Refer to appropriate section on bonding to power grounds in Division 460.
- (4) A typical AC1 and AD1 telephone base installation including the hand telephone set, is shown in Fig. 4 and 5.
- (5) The plastic housings of the AC1 and AD1 bases are secured by captive housing screws located behind the P-82E800 cover (Fig. 6 and 7). To remove the housing from either base assembly use a KS-16750 type

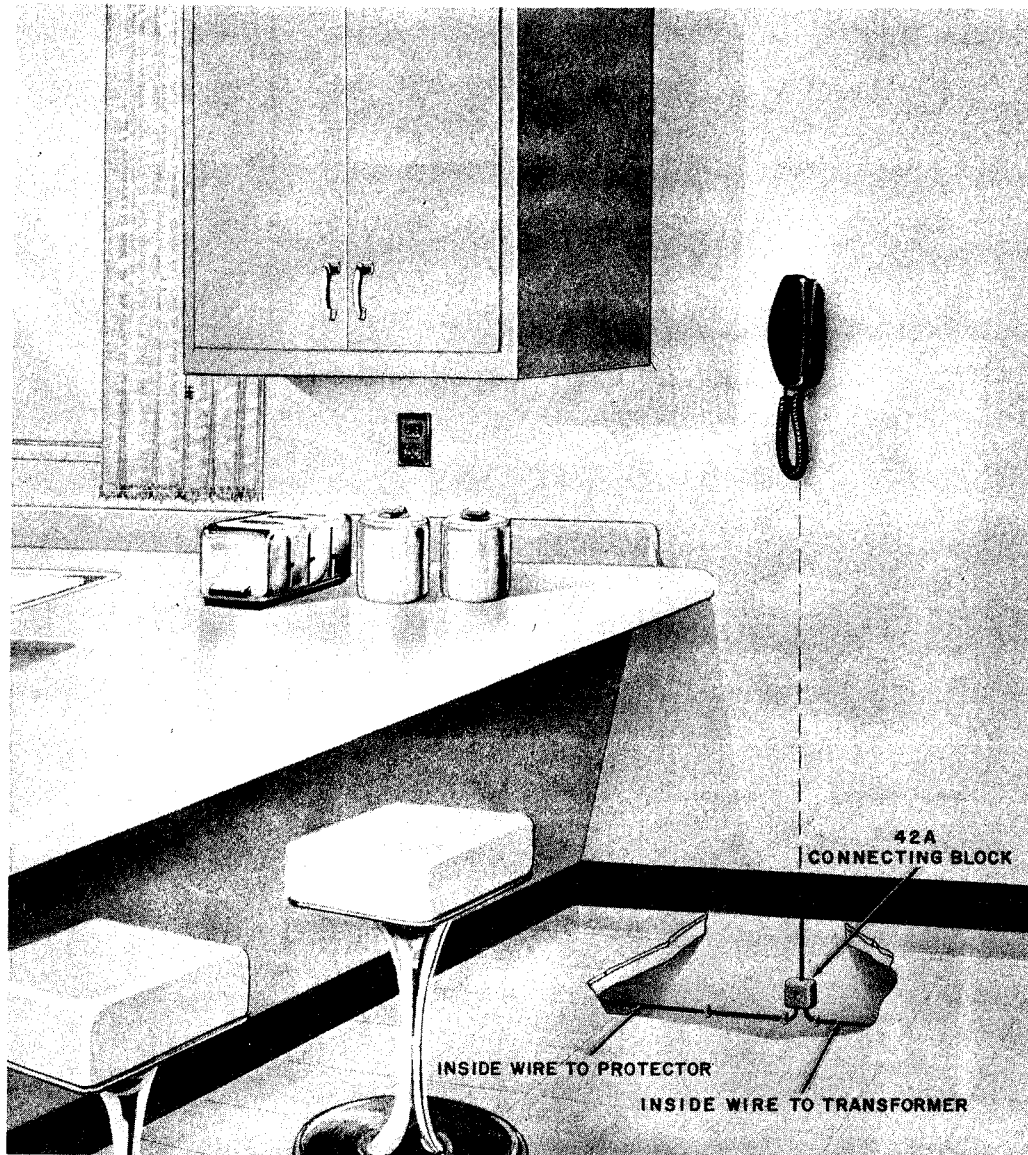


Fig. 4—Typical Installation of AC1 Telephone Base With 220A Hand Telephone Set

releaser or equivalent to remove the P-82E800 cover (Fig. 8). **Be careful not to damage the housing.** Loosen the two captive screws, which are now exposed, and lift the housing off.

(6) A 426N diode (Fig. 9) must be installed in either the AC1 or AD1 base assembly when connecting for 4-party full selective or 8-party semiselective ringing. The two leads from the diode are designated No. 1 and No. 2. Lead No. 1 extends from the flanged (gold) base of the diode; lead No. 2 extends from

the housing tip of the diode. Place the diode in the opening provided in the terminal board (Fig. 9). Dress the leads to the appropriate terminal board terminals, refer to Section 502-321-400 for connections.

(7) Where extreme noise induction conditions exist, the 426N diode will not be used. Instead, a cold-cathode tube or a ringer isolator installed on a 74A connecting block may be used. See section on inductive noise and Section 502-321-400 for connections.



Fig. 5—Typical Installation Of AD1 Telephone Base With 220A Hand Telephone Set

(c) AC1 Base (Wall)

- (1) Remove housing from base assembly and install base in accordance with standard

installation procedures. See appropriate connection figure for connections.

**Note:** The AC1 base may be mounted directly to a firm vertical surface. If necessary, use

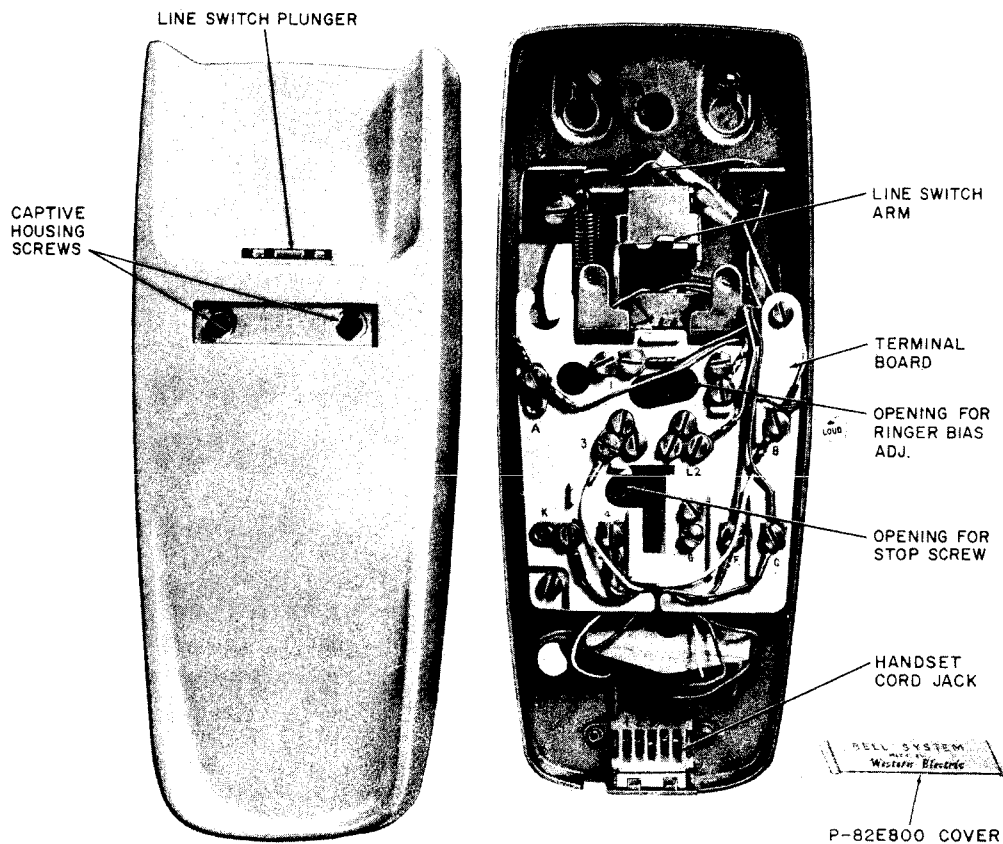


Fig. 6—Interior Of AC1 Telephone Base

a 155-type adapter or 182-type backboard. Refer to appropriate section in Division 463 for additional information on adapters and backboards.

(2) When inside wire to the AC1 (wall) telephone base is exposed, terminate the line and transformer wiring at a common bridging point, such as a 42A connecting block (Fig. 4). Run one quad station wire from the connecting block to the telephone base. Wiring may enter from the opening at the bottom, top, or through the backplate.

(3) In cases where an inside wire is already in place through a wall, an exposed wire run may be necessary between the dial light transformer and the base.

(4) To replace the housing on the base, expose the line switch plunger and hold in place while the housing is placed on the backplate.

The plunger can then be released so it will rest properly on the line switch arm of the base assembly. Tighten the captive housing screws and replace the P-82E800 cover.

#### (d) AD1 Base (Desk)

(1) When installing an AD1 telephone base, terminate the line and transformer wiring at a common bridging point, such as a 42A connecting block (Fig. 5). Connect the spade-tipped leads of a D5AL (Fig. 10) or D5AN mounting cord at the bridging point, as shown in Section 502-321-400.

(2) Insert the plug end of the D5AL or D5AN mounting cord (Fig. 11) into the jack located on the underside of the base assembly. **Make sure that the spring clip of the plug snaps into place to secure the plug.** Lay the cord in the cord channel and slide the cord retainer over the cord.

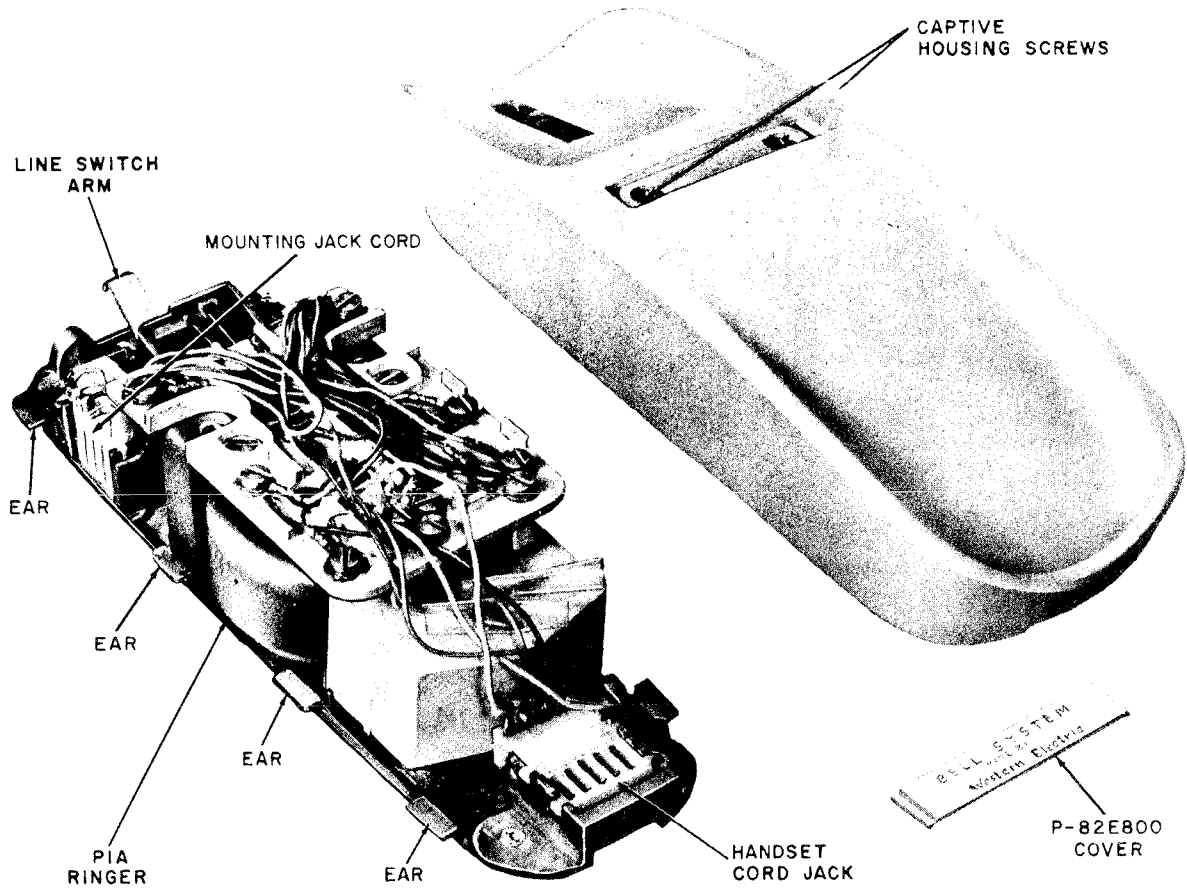


Fig. 7—Interior Of AD1 Telephone Base (Current Production)

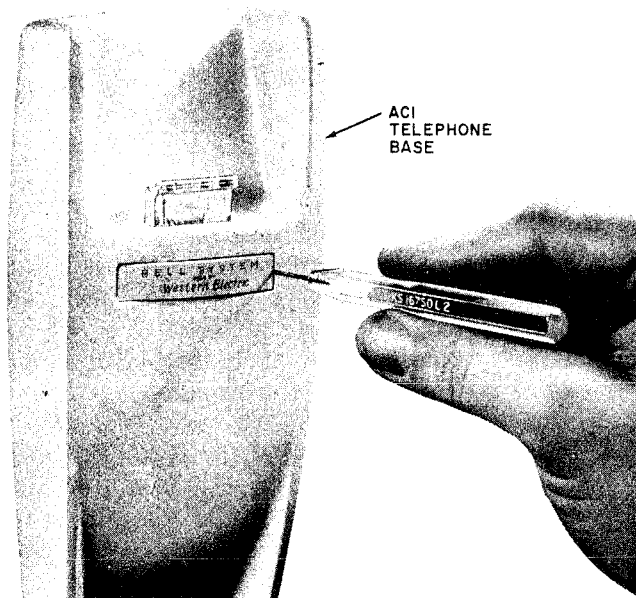


Fig. 8—Removing P-82E800 Cover

(3) To remove the D5AL or D5AN mounting cord from the AD1 base (Fig. 12), use a KS-16750 type releser or equivalent to slide the cord retainer from the channel. Lift the cord from the channel. Place the tool in the space provided (at side of plug) and apply pressure against the spring clip toward the body of the plug. When the spring clip has been depressed, pull the plug out of the jack.

(4) To replace the housing on the base the housing must clear the ears (Fig. 7) on the base in order to seat properly. Tighten the captive housing screws and replace the P-82E800 cover.

(e) *Portable Installation (AD1 Base)*

(1) For portable installations of the AD1 telephone base, terminate the line and transformer wiring to 550A jacks or equivalent.

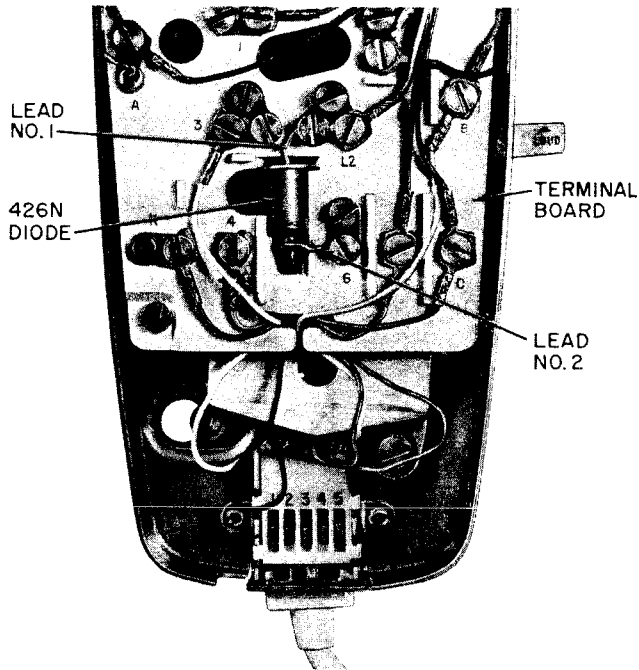


Fig. 9—426N Diode Installed

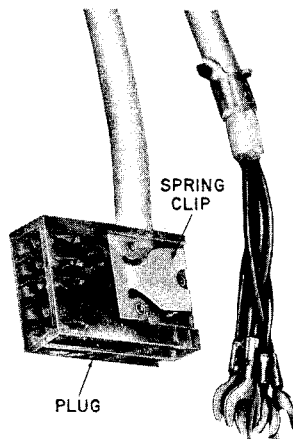


Fig. 10—D5AL Mounting Cord

**Note:** For portable installations when only one portable telephone set is equipped with a dial light, one 2012A transformer may be connected to two or more jacks. When more than one portable telephone set with dial light is installed, refer to section on station transformers for selection of proper power source.

- (2) Connect the spade-tipped leads of the D5AL or D5AN mounting cord to a 505A plug. Connect other end of mounting cord to AD1 base in normal manner.



**On 2-party tip stations requiring ground identification, be sure that the jacks and plugs are installed in accordance with the section on jacks and plugs.**

#### (f) **Hand Telephone Set Cord Installation and Removal**

- (1) Insert hand telephone set cord plug (square grommet end) into jack of AC1 or AD1 base, **make sure that the spring snaps into place to secure the plug.**
- (2) When removing the hand telephone set cord from an AC1 or AD1 telephone base, use a KS-16750 type releaser or equivalent to release the spring clip (Fig. 13). Place the tool in the space provided and apply pressure against the spring clip toward the body of the plug, pull the plug out of the jack.

## 4. MAINTENANCE

**4.01** Maintenance of the AC1 and AD1 telephone bases is limited to ringer bias adjustment, burnishing or adjusting contacts, and replacement of defective components.

**4.02** For adjustments and ringer cutoff feature of the P1A ringer, refer to Section 501-259-101.

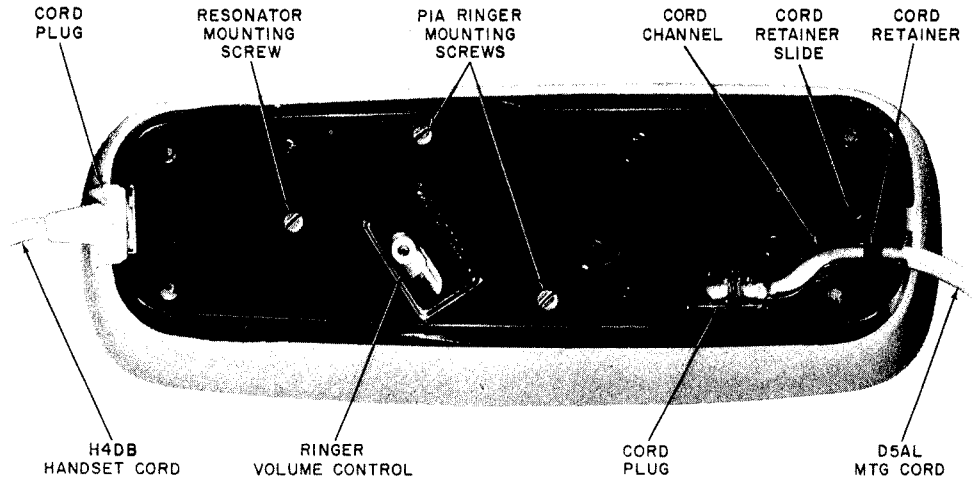


Fig. 11—Underside Of AD1 Telephone Base (Current Production)



Fig. 12—Removing Mounting Cord From AD1 telephone Base

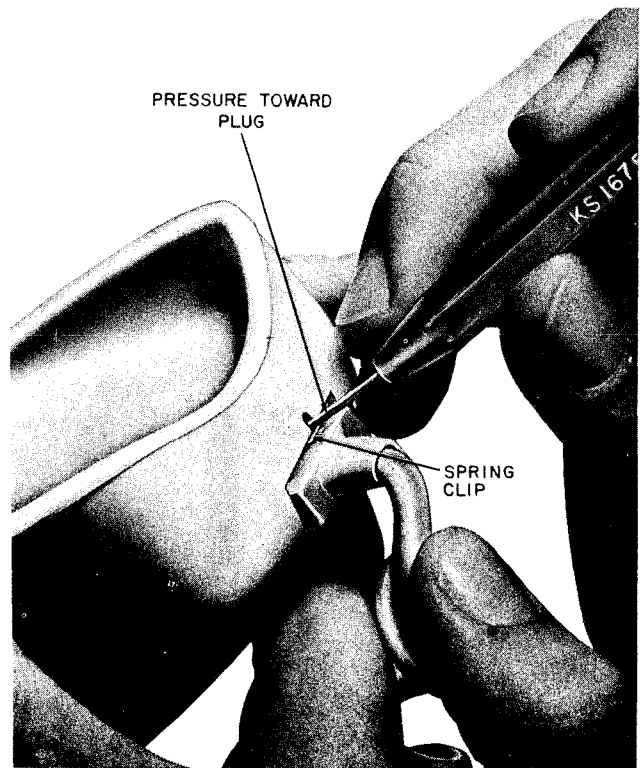


Fig. 13—Removing Handset Cord From AD1 Telephone Base

4.03 To replace a defective P1A ringer, perform the following:

- (1) Disconnect the ringer leads.



- (2) Remove the terminal board mounting screws.
- (3) Remove ringer mounting screws from underside of AD1 base (Fig. 11).

**Note:** In current production AD1 bases, ringer and resonator are mounted directly to base. In AC1 and early production AD1 bases, the ringer and resonator are secured to a mounting adapter which must be removed from the base to gain access to the ringer mounting screws.

- (4) Replace defective ringer with new ringer.

- (5) On the AC1 base (wall), engage the ringer volume control with the adjusting lever before fastening the ringer mounting adapter to the base.

- (6) Reposition and fasten the terminal board, and connect new ringer leads.

## 5. WIRING DIAGRAM INDEX

Fig. 14—AC1 Telephone Base, Wiring Diagram

Fig. 15—AD1 Telephone Base, Wiring Diagram

SECTION 502-321-100

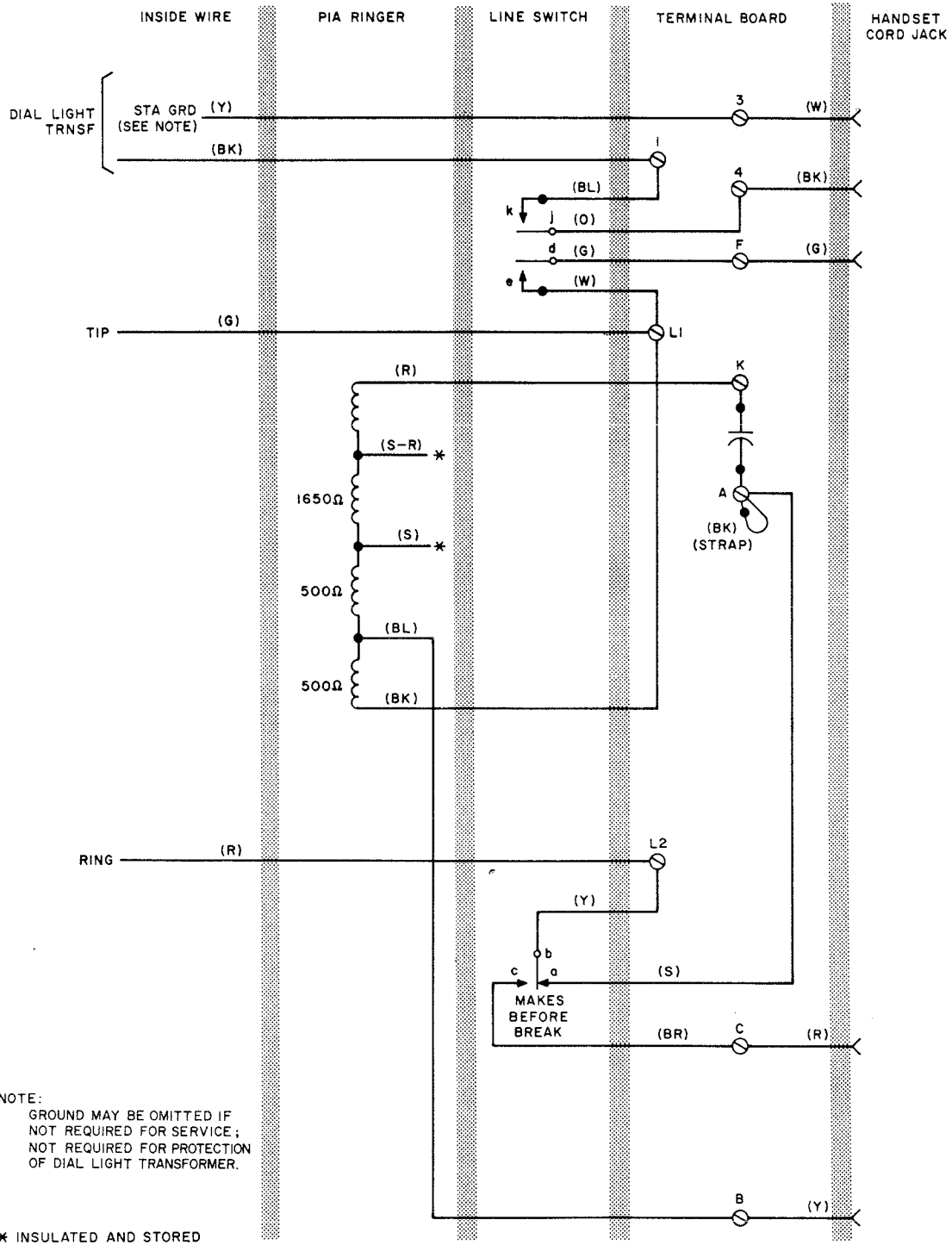


Fig. 14—AC1 Telephone Base, Wiring Diagram





## HAND TELEPHONE SETS — 220A, 1220A, AND 2220B TELEPHONE BASES — AC1 AND AD1



### CONNECTIONS

#### 1. GENERAL

1.01 This section is reissued to:

- Add 2220B Hand Telephone Set
- Add P-90D231 Polarity Guard Assembly
- Add D5AN Mounting Cord (AD1 Base)
- Add 426N Diode (Fig. 1)
- Revise Tables

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. CONNECTION INDEX

Table A — AC1 (Wall) Telephone Base Connections For Individual and 2-Party Service

Table B — AD1 (Desk) Telephone Base Connections For Individual and 2-Party Service

Table C — Conversion For Use With 1A1, 1A2, and 6A KTS

Table D — P-90D231 Polarity Guard Assembly Connections (AC1 or AD1 Telephone Base)

Table E — Connections For 4-Party Full Selective or 8-Party Semiselective Ringing Using 426N Diode

Fig. 2 — 220A Hand Telephone Set, Connections

Fig. 3 — 1220A and 2220B Hand Telephone Set, Connections

Fig. 4 — AC1 Telephone Base, Connections

Fig. 5 — AD1 Telephone Base, Connections

Fig. 6 — AC1 and AD1 Telephone Bases, Connections For 1A1, 1A2, and 6A Key Telephone Systems

Fig. 7 — 74A Connecting Block and Ringer, Connections For Extreme Inductance Interference

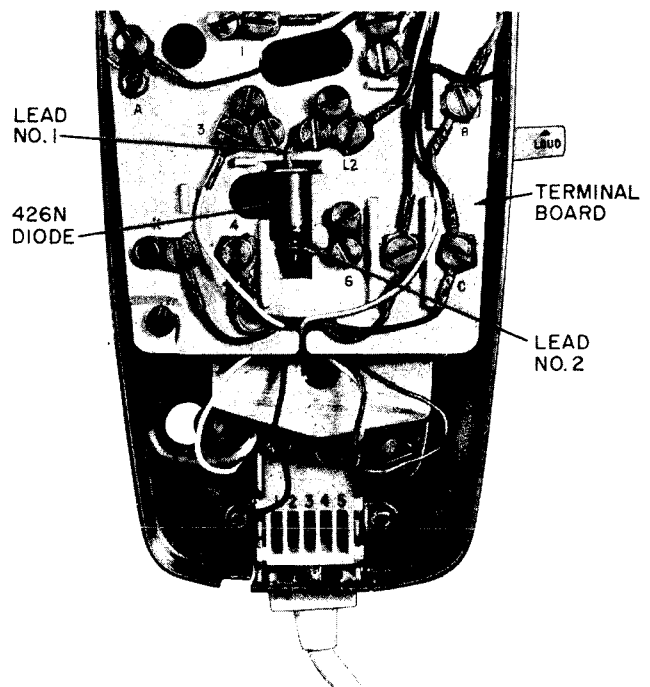


Fig. 1 — 426N Diode, Installed

**TABLE A**  
**AC1 (WALL) TELEPHONE BASE CONNECTIONS FOR**  
**INDIVIDUAL AND 2-PARTY SERVICE**

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY	TIP PARTY	
					NO IDENT GROUND	WITH IDENT GROUND (NOTE 1)
Inside Wire	Ring	R	L2	L2	L1	L1
	Tip	G	L1	L1	L2	L2
	GRD	Y	3	3	3	3
	TRNSF	BK	1	1	1	1
Ringer Leads (Note 2)		R	K	K	K	K
		BK	L1	3	3	3
		BL	B	B	B	B
Handset Cord Jack (1220A and 2220B only)		R	C	C	F	F
		G	F	F	C	C

**Notes:**

1. Same connections used for either 1000 or 2650 ohm Central Offices. For tip party identifying ground — 1000Ω or 2650Ω use H5AA cord.
2. To permanently silence ringer; move (R) ringer lead from K to G on terminal board. For tip party identification (BK) ringer lead must remain on 3 of terminal board.

**TABLE B**  
**AD1 (DESK) TELEPHONE BASE CONNECTIONS FOR**  
**INDIVIDUAL AND 2-PARTY SERVICE**

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY	TIP PARTY	
					NO IDENT GROUND	WITH IDENT GROUND (NOTE 1)
Inside Wire at Conn Block	Ring	R	R	R	R	R
	Tip	G	G	G	G	G
	GRD	Y	Y	Y	Y	Y
	TRNSF	R	Y	Y	Y	Y
		G	B	B	B	B
Mtg Cord at Conn Block	R	R	R	G	G	
	G	G	G	R	R	
	Y	G	Y	Y	Y	
	BK	B	B	B	B	
	W	Y	Y	Y	Y	
Mtg Cord in Tel Base	R	L2	L2	L2	L2	
	G	L1	L1	L1	L1	
	Y	G	G	G	G	
	BK	1	1	1	1	
	W	3	3	3	3	
Ringer Leads (Note 2)	R	K	K	K	K	
	BK	G	G	G	G	
	BL	B	B	B	B	
Handset Cord Jack (1220A and 2220B only)	R	C	C	F	F	
	G	F	F	C	C	

**Notes:**

1. Same connections used for either 1000 or 2650 ohm Central Offices. For tip party identifying ground — 1000 $\Omega$  or 2650 $\Omega$  use H5AA cord.
2. To permanently silence ringer; move (R) ringer lead from K to G on terminal board. For tip party identification (BK) ringer lead must remain on G of terminal board.

**TABLE C**  
**CONVERSION FOR USE WITH 1A1,**  
**1A2, AND 6A KTS**

LEAD		COLOR	TERMINAL BOARD	
			FROM	TO
Line Switch		BR	C	G
		S	A	L2
		Y	L2	3
Ringer	AC1	BK	L1	C
	AD1	BK	G	C
Mtg Cord or IW		R	L2	C
Capacitor Strap		BK	A	L1

**TABLE D**  
**P-90D231 POLARITY GUARD ASSEMBLY**  
**CONNECTIONS (AC1 OR AD1 TELEPHONE BASE)**

WIRE OR LEAD	COLOR	REMOVE FROM	CONNECT TO	
		TERMINAL BOARD	POLARITY GUARD ASSEMBLY	TERMINAL BOARD
Handset Cord Jack	R	C	Term. R	
	G	F	Term. T	
Polarity Guard Assembly	R			C
	G			F

*Note:* For use with 1220A and 2220B hand telephone set when specified by local instructions for end-to-end signaling installations.



**TABLE E**  
**CONNECTIONS FOR 4-PARTY FULL SELECTIVE OR 8-PARTY SEMISELECTIVE RINGING USING 426N DIODE**

PARTY		LEADS OR COLOR	-RING	-TIP	+RING	+TIP		
Line Wire Conn at Conn Block	Ring	R	R	R	R	R		
	Tip	G	G	G	G	G		
	GRD	Y	Y	Y	Y	Y		
Dial Light Transformer Leads		1	Y	Y	Y	Y		
		2	B	B	B	B		
Mtg Cord at Conn Block		R	R	G	R	G		
		G	G	R	G	R		
		Y	Y	Y	Y	Y		
		W	Y	Y	Y	Y		
		BK	B	B	B	B		
Mtg Cord or Inside Wire at Term. Board		R	L2	L2	L1*	L2	L2	L1*
		G	L1	L1	L2*	L1	L1	L2*
		Y	3	3	3	3	3	
		W	3	3	3	3	3	
		BK	1	1	1	1	1	
426N Diode †		①	L2	L2	3	3		
		②	G	G	G	G		
Ringer Leads		BK	K	K	K	K		
		R	3	3	L2	L2		
		S	‡	‡	‡	‡		
		S-R	G	G	G	G		
		BL	B	B	B	B		
Strap From A		BK	3	3	L2	L2		
Line Switch		S	‡	‡	‡	‡		

\* Connections for AC1 base (Wall)

‡ ① Flanged (Gold) base installed in enlarged part of opening, see Fig. 1.

② Knob end (housing tip).

‡ Insulate and store.

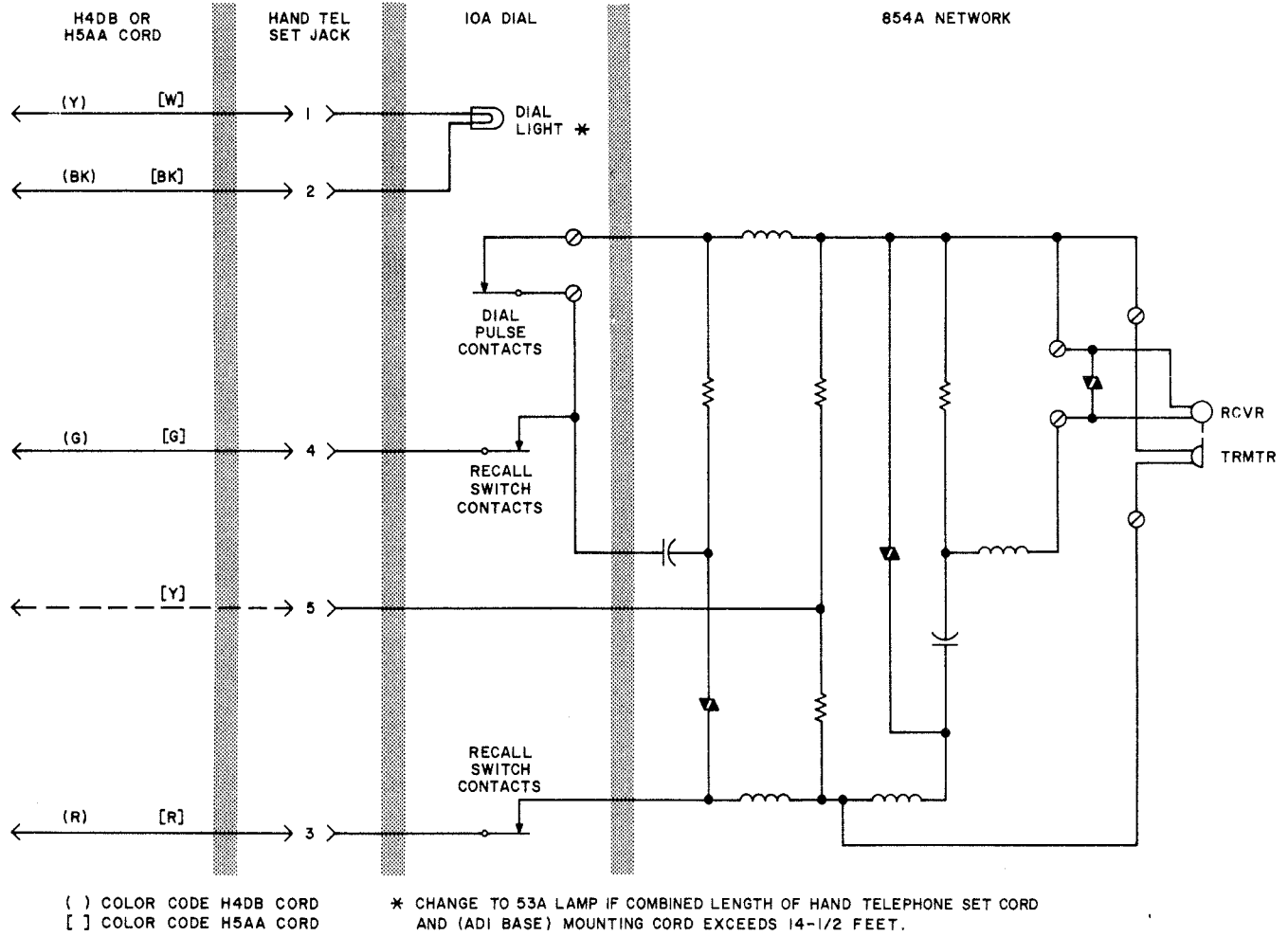
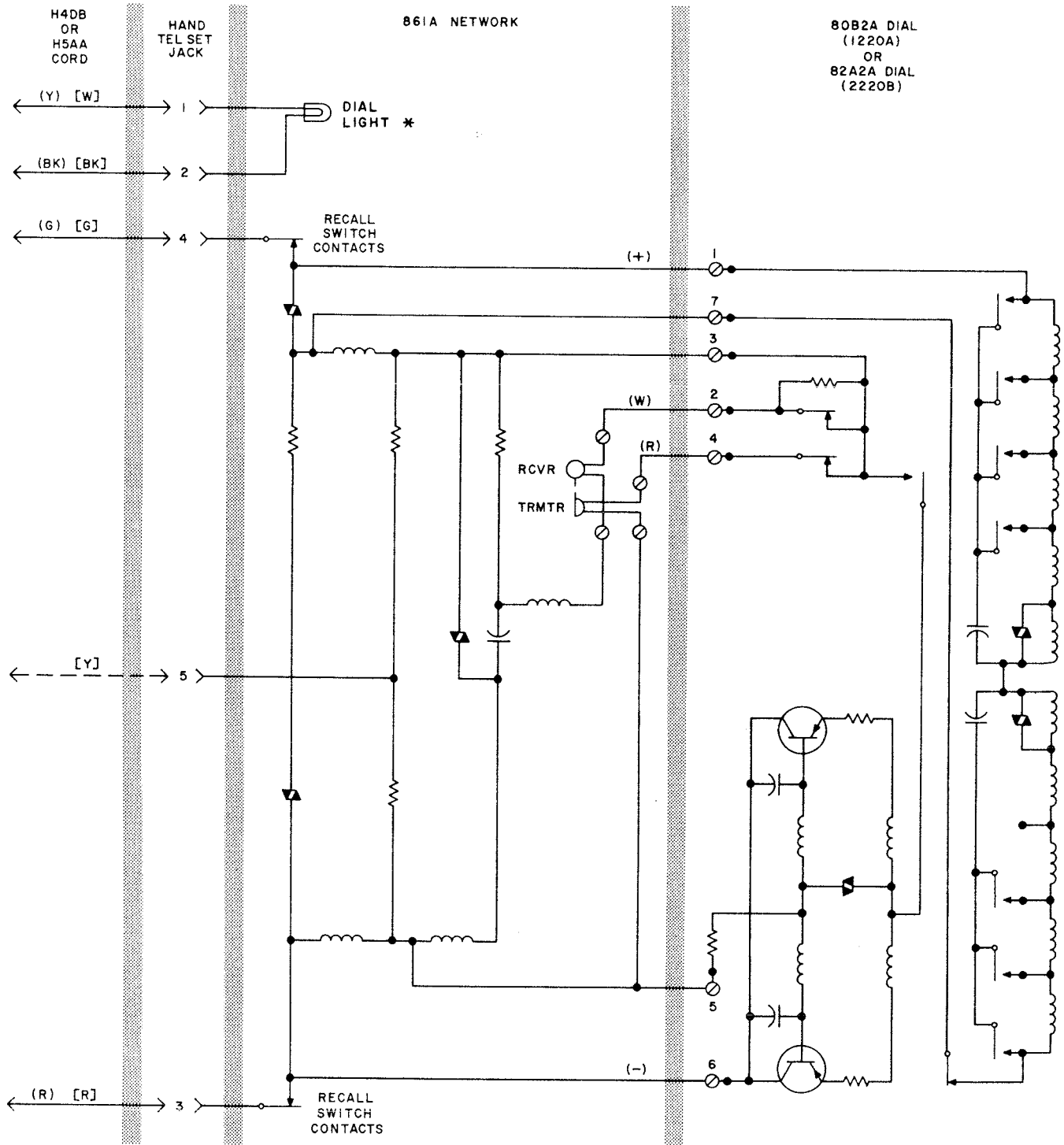


Fig. 2 — 220A Hand Telephone Set, Connections



( ) COLOR CODE H4DB CORD  
 [ ] COLOR CODE H5AA CORD

\* CHANGE TO 53A LAMP IF COMBINED LENGTH OF HAND TELEPHONE SET CORD AND (ADI BASE) MOUNTING CORD EXCEEDS 14-1/2 FEET

Fig. 3 — 1220A and 2220B Hand Telephone Set, Connections

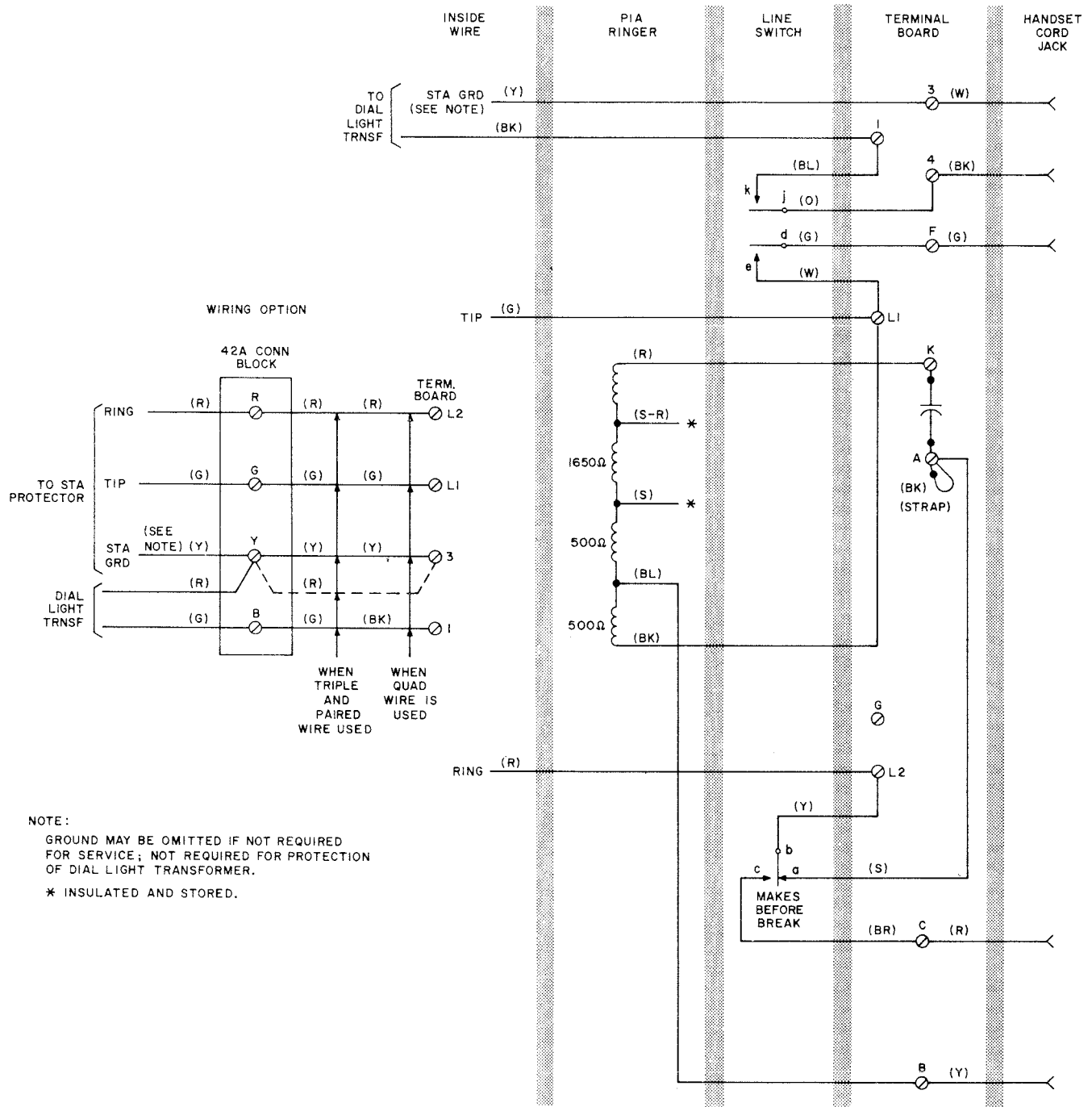
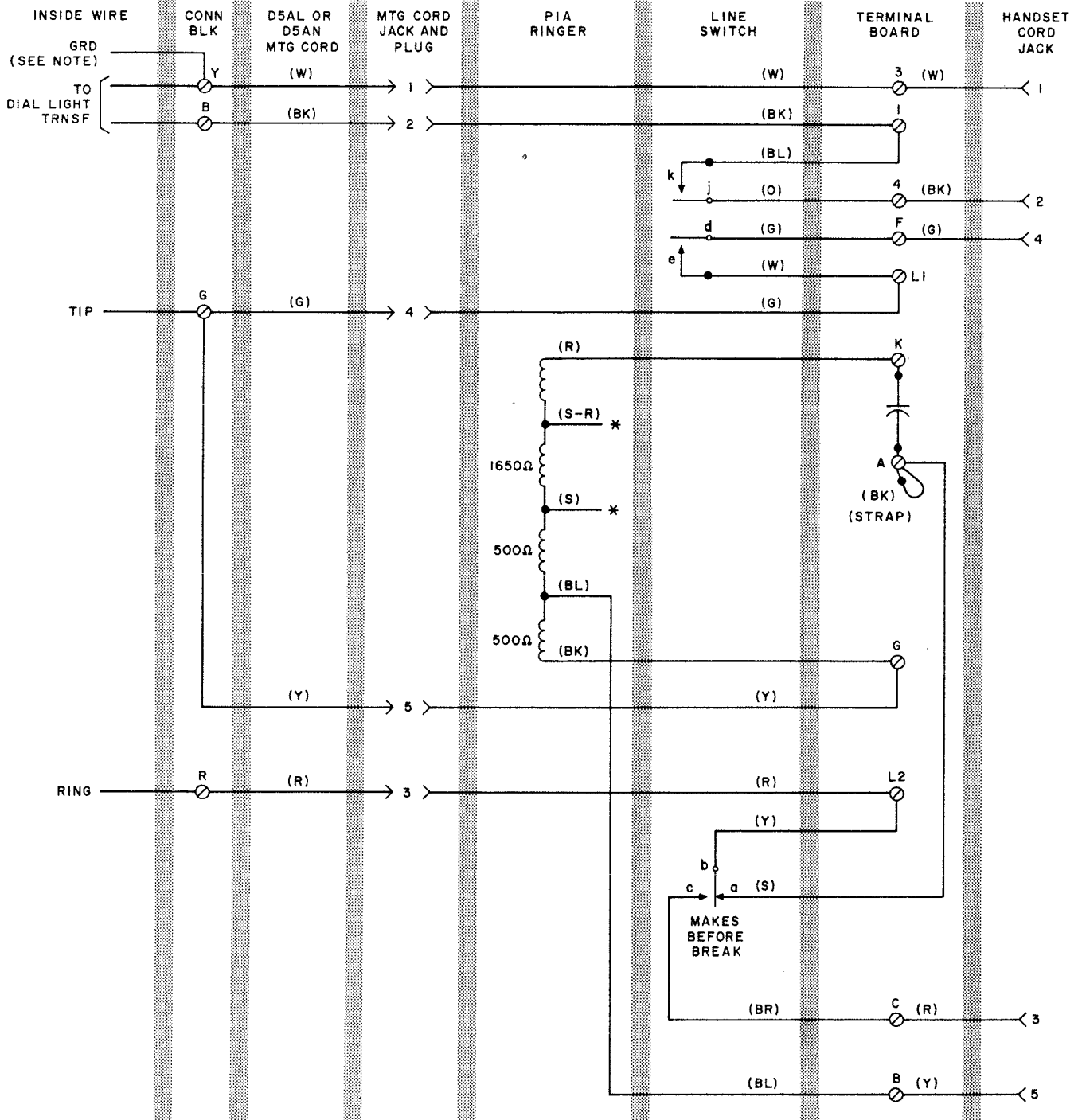


Fig. 4 — AC1 Telephone Base, Connections

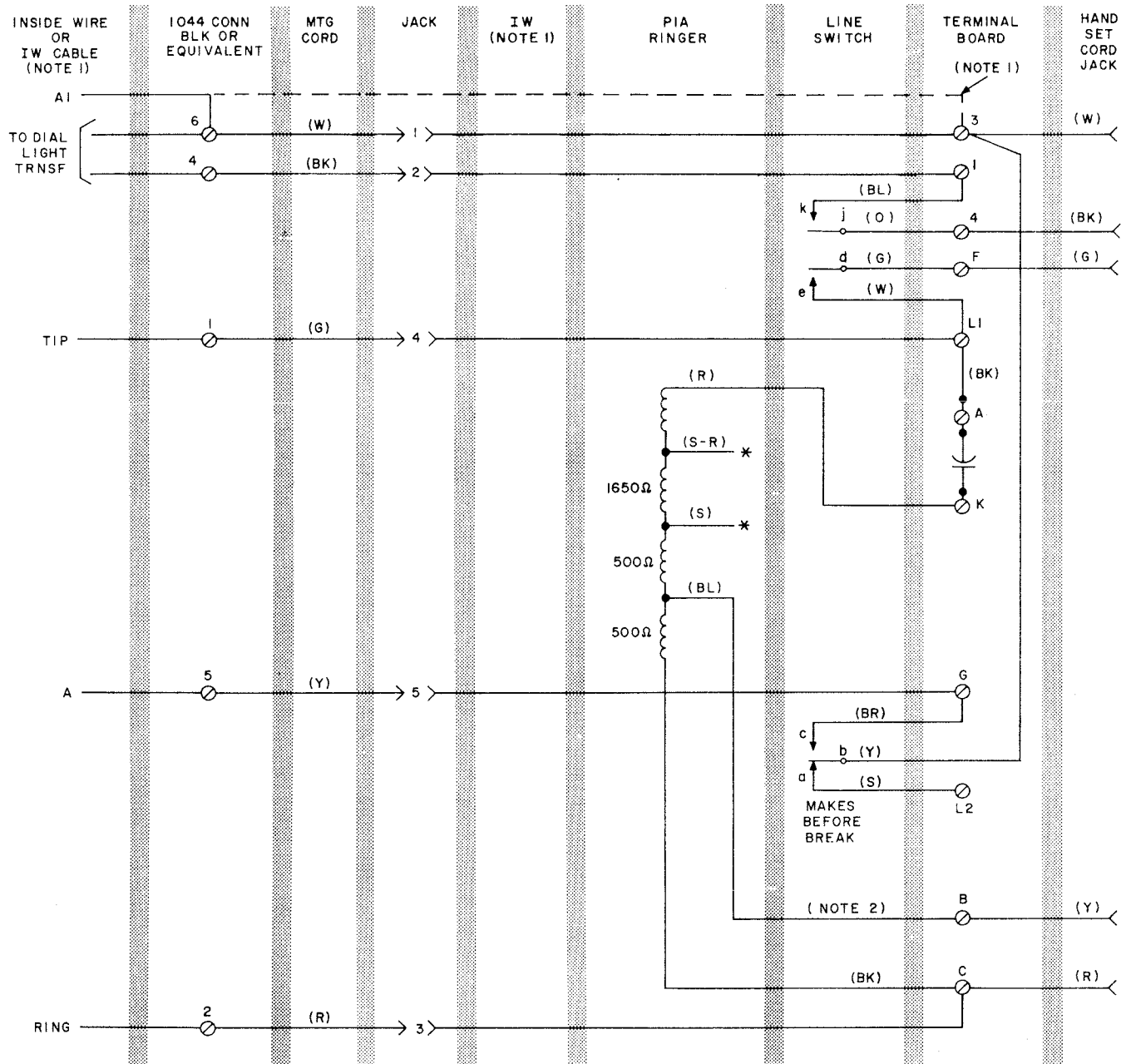


NOTE:  
 GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE; NOT REQUIRED FOR PROTECTION OF DIAL LIGHT TRANSFORMER.

\* INSULATED AND STORED.

Fig. 5 — AD1 Telephone Base, Connections

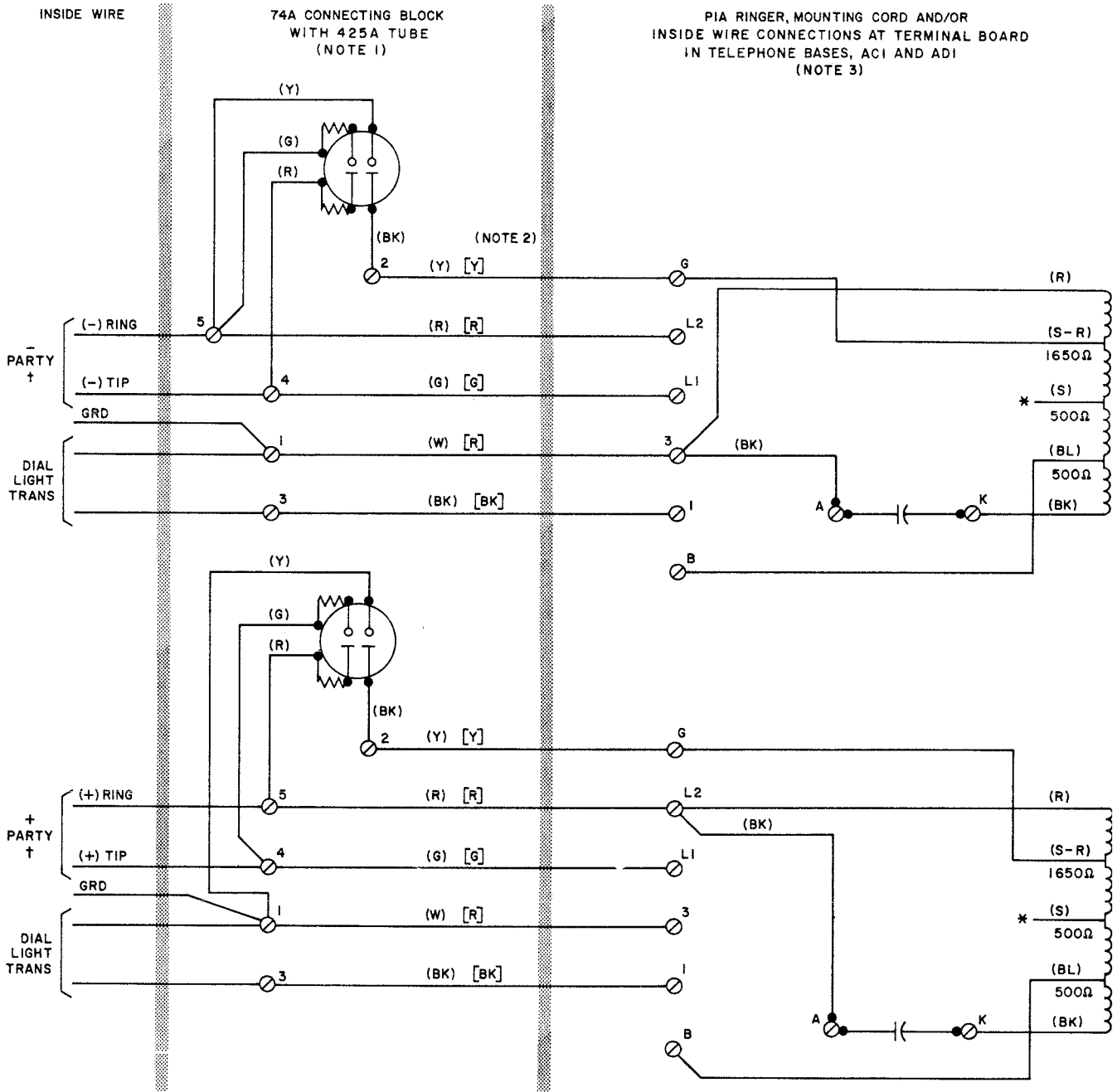
SECTION 502-321-400



NOTES:

1. RUN INSIDE WIRE DIRECTLY TO TERMINAL BOARD WHEN AC1 BASE IS USED AND TO CONNECTING BLOCK WHEN AD1 BASE IS USED.
  2. DISCONNECT (BL) LEAD FROM TERMINAL B WHEN H5AA CORD IS USED, INSULATE AND STORE.
- \* INSULATED AND STORED.

Fig. 6 — AC1 and AD1 Telephone Bases, Connections For 1A1, 1A2, and 6A Key Telephone Systems



- NOTES:
- 1. FIVE CONDUCTORS REQUIRED BETWEEN 74A CONNECTING BLOCK AND TELEPHONE SET
  - 2. TWO INSIDE WIRES ARE REQUIRED; ONE QUAD AND ONE PAIRED OR TWO TRIPLES.
  - 3. DISCONNECT (S) LINE SWITCH LEAD FROM A OF TERMINAL BOARD, INSULATE AND STORE.
- ( ) - MOUNTING CORD CONDUCTORS  
 [ ] - INSIDE WIRE CONDUCTORS  
 \* - INSULATED AND STORED.  
 † - FOR TIP STATION - REVERSE RING AND TIP LEADS AT CONNECTING BLOCK.

Fig. 7 - 74A Connecting Block and Ringer, Connections For Extreme Inductance Interference





**TELEPHONE SETS**  
**500, 501, 554, AND 556 TYPES**  
**IDENTIFICATION, INSTALLATION, AND MAINTENANCE**

**1. GENERAL**

**1.001** This addendum supplements Section 502-510-100, Issue 6.

**1.002** This addendum is reissued to revise MD information on telephone sets and revise mounting information for wall telephone sets.

**2. IDENTIFICATION**

The following changes apply to Part 2 of the section.

(a) Table A—revised

**3. INSTALLATION**

The following changes apply to Part 3 of the section.

(a) (b)—revised

(b) Mounting Wall Sets

- Several holes are provided in the baseplate for more flexibility in mounting to minimize backboard use.
- Early production sets have a baseplate which does not provide the proper hole arrangement for fastening directly to conduit outlet boxes, 157A adapter, 63A or KS-19407L1 prewire brackets.
- Refer to Section 463-130-200 for information on fasteners suitable for mounting wall-type sets directly to wall surfaces.

TABLE A  
TELEPHONE SET COMPONENT PARTS

SET	CODE	COMPONENT							
		DIAL	APP BLK§	NET	RINGER	HANDSET	MTG CORD	ELECTRON TUBE	HOUSING ASSY
500	A/B*	9C†	95C	425A¶	C4A††	G1A or G3A	D3BN		P-80D200
	C/D			425E**					P-80D500
	E/F						D4BJ		P-80E100
	H*						D3BN		P-80D200
	J/K*		95C	425A			D4BJ		P-80E100
	L/M						D10P		P-80D200
	P*						D4BJ		P-80E300
	R/S		9H‡	95C					P-81K000
	U*		9C†						P-80E100
	W			95C					
Y									
501	A/B*	9C†	95C	425A¶	C4A††	G1A or G3A	D3BN	426A	P-80D200
	C/D			425E**					P-80D500
	F								P-80D200
	J/K*		95C	425A					P-80E100
	P*						D4BJ		P-80E300
	U*								
554	A/B								
556	A/B		95C		C4A			426A	P-80F400

\* MD

¶ Includes 311A equalizer

† Replaces 7C or 7D dial

\*\* Replaces 425B network

‡ Replaces 7G or 7H dial

†† Early models had C2A ringer

‡ Replaces 95A or 95B apparatus blank

‡‡ Early models had C3A ringer

**TELEPHONE SETS**  
**500, 501, 554, AND 556 TYPES**  
**IDENTIFICATION, INSTALLATION, AND MAINTENANCE**

**1. GENERAL**

**1.01** This section is reissued to:

- Remove information on TOUCH-TONE<sup>®</sup> telephone sets.
- Include maintenance information formerly found in Section 502-510-300, Issue 3.
- Add the 95C apparatus blank.
- Change housing assembly part numbers.
- Revise method of replacing defective ringing capacitor.
- Place all MD information in Table A.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

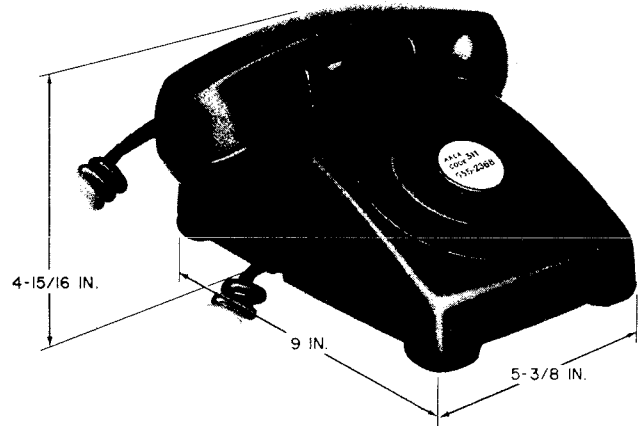
**1.02** Uses of these telephone sets may be found in the station set sections pertaining to selection for general and specific uses.

**1.03** Selection of station apparatus for 1A, 1A1, and 1A2 key telephone systems is covered in the connections section for the particular telephone set.

**1.04** Code numbers such as 500C/D cover both manual and dial versions, respectively, of the same type telephone set to permit converting to either type without changing the code number stamped on the base. The letter **R** was added to the code number at one time to indicate the set was equipped with a retractile handset cord.

**2. IDENTIFICATION**

**2.01 Purpose** — The 500-, 501-, 554-, and 556-type telephone sets are single line sets for use in common battery areas, manual or dial.



**Fig. 1 — 500A, C, E, J, L, R, or 501A, C, J Telephone Set**



**Fig. 2 — 500B, D, F, K, M, S, or 501B, D, K Telephone Set**

**2.02 Ordering Guide** — All parts of the set enclosed by the housing mount on the metal base. The network and line switch are riveted to the base and are not replaceable. Table A lists components of these sets.

**TABLE A**  
**TELEPHONE SET COMPONENT PARTS**

SET	CODE	COMPONENT							
		DIAL	APP BLK§	NET	RINGER	HANDSET	MTG CORD	ELECTRON TUBE	HOUSING ASSY
500	A/B*	9C†	95C	425A¶	C4A††	G1A or G3A	D3BN		P-80D200
	C/D			425E**					P-80D500
	E/F*								P-80E100
	H*		95C	425A			D3BN		P-80D200
	J/K*						D4BJ		P-80E100
	L/M						D10P		P-80D200
	P*		95C	425E**			D4BJ		P-80E300
	R/S								P-81K000
	U*								P-80E100
	W								
	Y								
501	A/B*	9C†	95C	425A¶	C4A††	G1A or G3A	D3BN	426A	P-80D200
	C/D			425E**					P-80D500
	F*								P-80D200
	J/K*		95C	425A			D4PJ		P-80E100
	P*								P-80E300
	U*			425E**					
554	A/B		95C		C4A			P-80F400	
556	A/B						426A		

\* MD

¶ Includes 311A equalizer

† Replaces 7C or 7D dial

\*\* Replaces 425B network

‡ Replaces 7G or 7H dial

†† Early models had C2A ringer

‡ Replaces 95A or 95B apparatus blank

†† Early models had C3A ringer



Fig. 3 — 500H, P, or 501P Telephone Set



Fig. 4 — 500U or 501U Telephone Set



Fig. 5 — 500W/Y Telephone Set

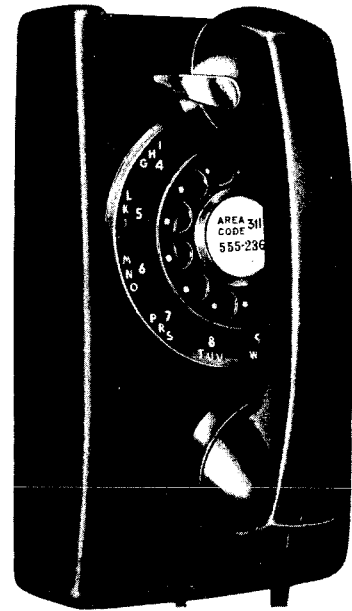


Fig. 6 — 554B or 556B Telephone Set

**2.03 Color** — These sets are available in all standard colors as indicated in Section 500-120-100. Components available in color include the dial or apparatus blank, handset, mounting cord, and housing. Components other than the housing must have the code completed by adding the desired color suffix. The housing P- number must have the desired color suffix substituted for its last two digits.

**2.04 Design Features** — 501-type telephone sets are identical to a similarly coded 500-type set except for the addition of a 3-element, cold-cathode, gas-filled tube, coded 426A.

(a) **500A/B, C/D, J/K, and 501A/B, C/D, J/K**

- Basic single-line sets.
- Early model sets *without* equalizers are stamped with the letter **T** above the code number on the base.

(b) **500E/F and 501F**

- Equipped with P-19A411 plunger switch (Fig. 7) to avoid interference with dialing or talking of another customer on a party line.

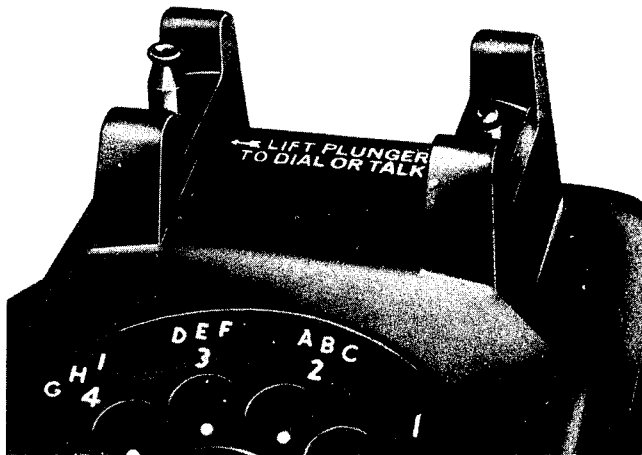


Fig. 7 — 500F or 501F Telephone Set, Plunger Switch

- With set off hook, only the receiver is bridged on the line as a monitor until the plunger switch is lifted to connect the talking and dialing circuits.

(c) **500L/M**

- Supplied wired for 1A1 or 1A2 key telephone systems.
- Equipped with 4-conductor mounting cord which may be required for a separate ringing circuit.
- Earlier sets which were converted for 1A1 or 1A2 key telephone system use will have an asterisk (\*) stamped on the base after the code number.

(d) **500H, P, and 501P**

- Includes GE46 dial illuminating lamp which operates when the handset is lifted.
- A 6-8 volt ac or dc power source must be provided.

(e) **500U and 501U**

- Equipped with 584C key, a GE46 lamp, and a resistor to provide dial-light/night-light feature. When key is in ON position, lamp operates at reduced brilliance for night light.

- When handset is lifted off hook, lamp lights at full brilliance.
- A 6-8 volt ac or dc power source must be provided.

(f) **500R/S** — Factory-wired for speakerphone.

(g) **500W/Y** — Equipped with a KS-19572L1 neon lamp to provide message waiting service.

(h) **554A/B and 556A/B**

- These sets are standard, single-line, wall mounted telephone sets. The 556A/B is the same as the 554A/B except for the addition of a 426A tube.
- With wiring modifications, 554A/B sets are suitable for A lead control.

3. INSTALLATION

(a) **Housings**

- 500- and 501-type sets — housings are secured to the base by two P-44E734 captive screws (Fig. 8).

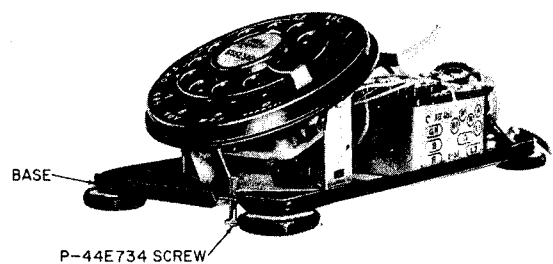
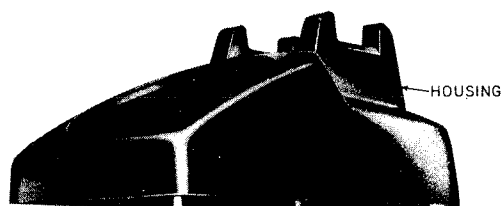


Fig. 8 — 500-Type Telephone Set, Housing Assembly

- 554- and 556-type sets — designed as handset hanger (Fig. 9).

(1) Removal

- Push inward on tab of snap fastener (Fig. 10) located in handset cord slot.
- Lift lower part of housing outward and upward, releasing snap fastener, and disengaging latch opening assembly (Fig. 10 and 11).

(2) Replacement

- Slip housing over handset hook and dial and engage latch spring assembly (Fig. 12).
- Press firmly on lower part of housing to engage snap fastener and catch.

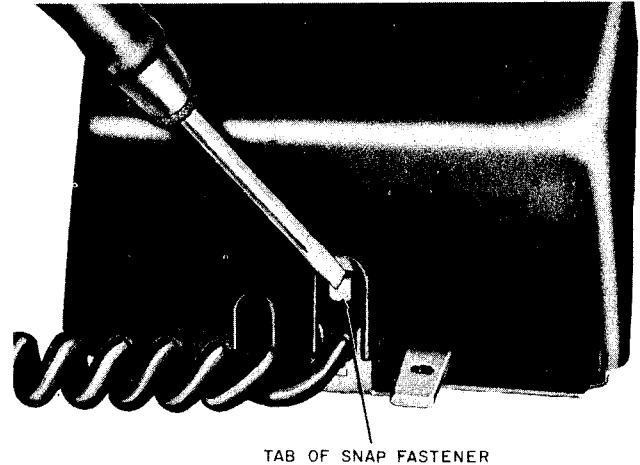


Fig. 10 — Wall Telephone Set Housing Removal

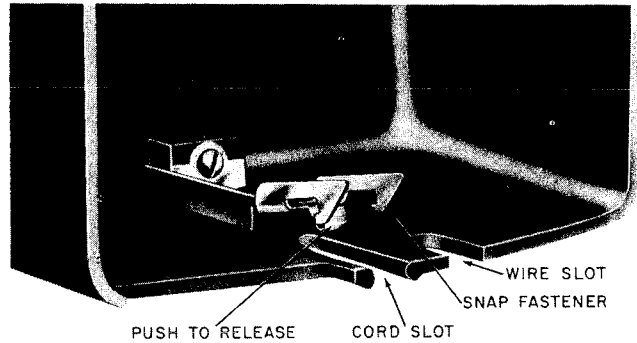


Fig. 11 — Wall Telephone Set Housing Interior

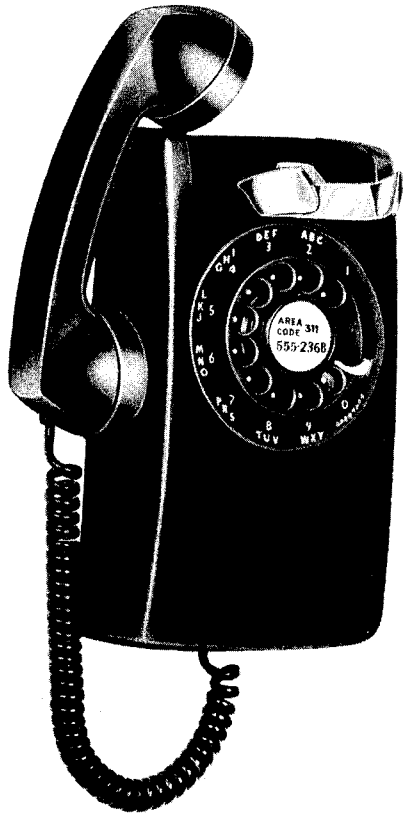


Fig. 9 — 554- or 556-Type Telephone Set, Handset Rest Position

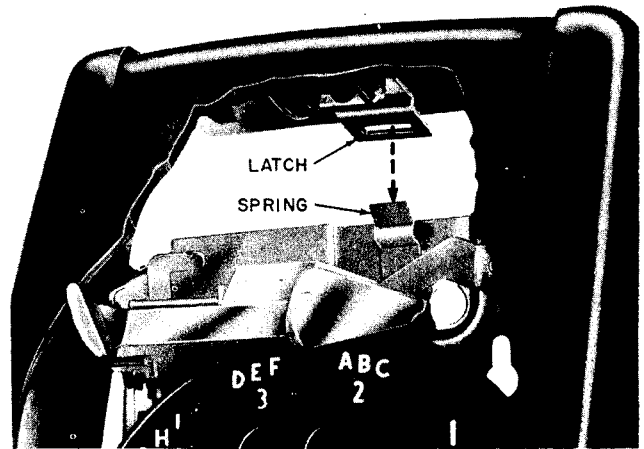
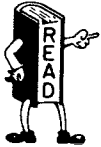


Fig. 12 — Replacing Wall Telephone Set Housing

(b) *Mounting Wall Sets*

- Several holes are provided in the baseplate for more flexibility in mounting to minimize backboard use.
- Can be mounted directly over a conduit outlet box.

(c) *Mounting Cords*



*Spade tips or skinned wires should contact only the terminal to which the connection is made. Electrical contact with the metal tab of the network housing may cause the exposed dial finger stop or handset hook on wall sets to become energized with ringing voltage or dc line voltage.*

- Dress cord leads to avoid interference with moving parts and ringer gongs.
- 9-, 13-, and 25-foot extra length mounting cords (3- or 4-conductor only) are installed by:
  - (1) Remove ringer mounting screw (Fig. 13).
  - (2) Insert cord stay under ringer frame.
  - (3) Reinsert mounting screw.
  - (4) Position cord grommet so that cord is protected where it enters set.

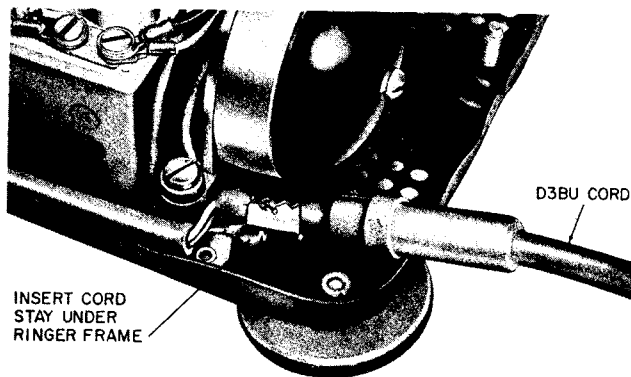


Fig. 13 — Installing Extra Length Cord

(d) *Apparatus Blanks*

- (1) 95A — Used only on sets with three-point dial mountings (Fig. 14).
- (2) 95B (Fig. 15)
  - Can be used in all sets (Fig. 16, 17, and 18).
  - Bracket must be inverted in wall sets.
- (3) 95C
  - Same external appearance as 95B (Fig. 15).
  - Install by fitting on dial mounting bracket and replacing housing (Fig. 19 and 20).

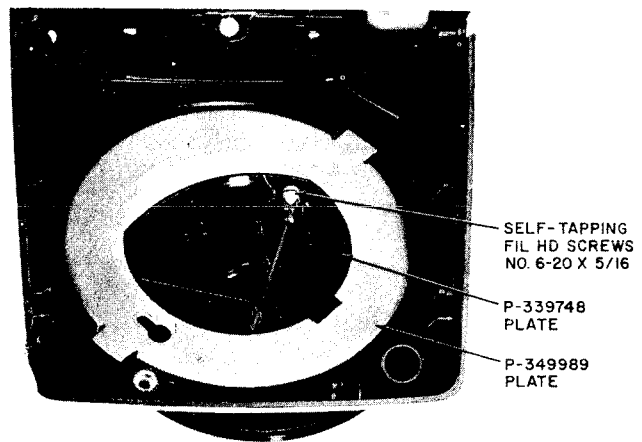


Fig. 14 — 500-Type Telephone Set With 95A Apparatus Blank



Fig. 15 — 500-Type Telephone Set With 95B or 95C Apparatus Blank, Exterior



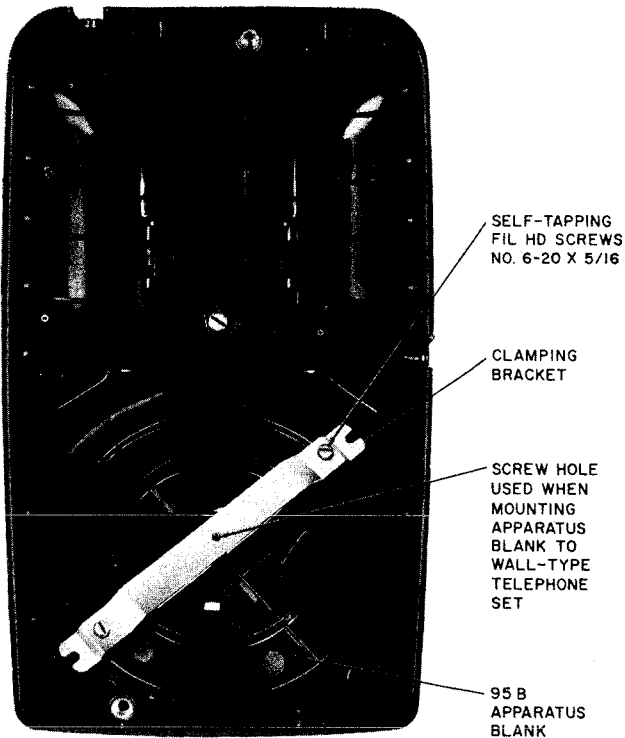


Fig. 16 — 500- and 501-Type Telephone Set With 95B Apparatus Blank, Interior

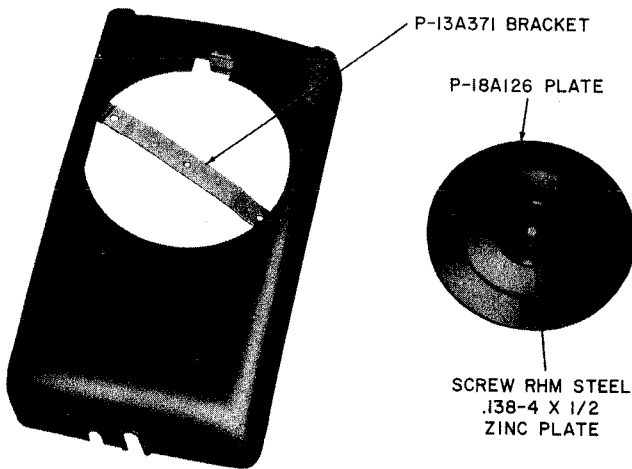


Fig. 17 — 554- or 556-Type Telephone Set With 95B Apparatus Blank

(e) *Ringer*

- Mounted to base with two P-43A456 washer-head mounting screws in rubber grommets.

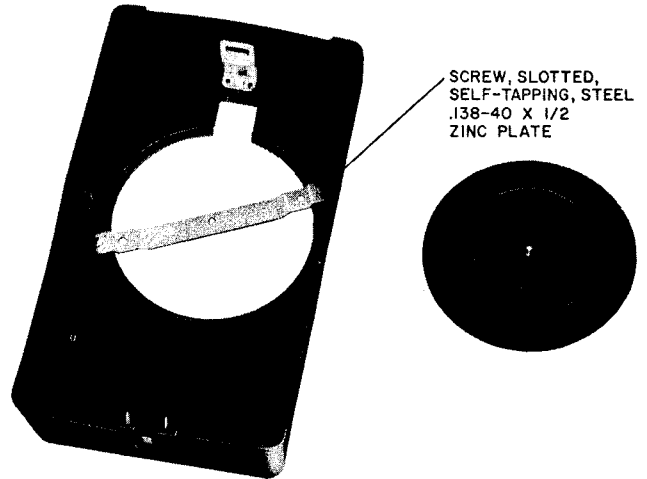


Fig. 18 — 554- or 556-Type Telephone Set With 95B Apparatus Blank, Interior

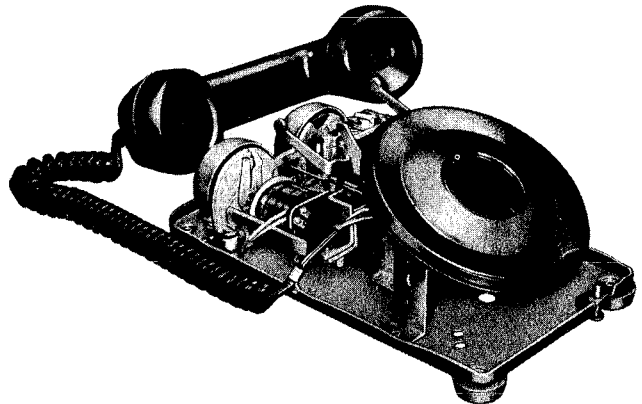


Fig. 19 — 95C Apparatus Blank on Dial Mounting Bracket in 500- or 501-Type Telephone Set

- Ringer off position can be provided, when authorized locally, by bending back ringer stop spring to provide a fifth position (OFF) on the ringer volume control.

(f) *Handsets* — the G1- or G3-type handsets in these sets may be replaced by a G6AR (MD) or G6B handset for impaired hearing, a G7AR for weak speech, or a G8A (MD) or G8B for noisy locations. Refer to section covering handsets for additional information.

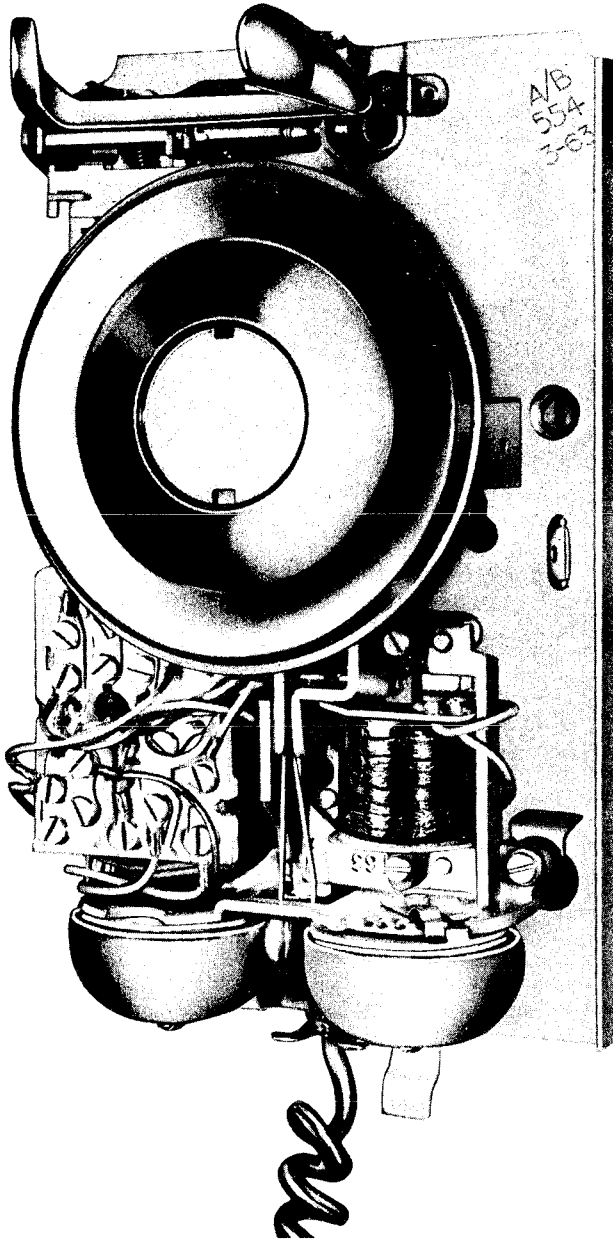


Fig. 20 — 95C Apparatus Blank on Dial Mounting Bracket in 554A/B Telephone Set

**4. MAINTENANCE**

**4.01** Inspect exterior and interior of the sets for obvious defects such as loose, displaced, or broken parts. Check also for obstruction of moving parts or the presence of foreign matter that may interfere with the proper operation of the set.

**4.02** Check line and ground terminations before determining trouble causes from Table B.

**4.03 Electrical Maintenance**

(a) **Tube Assembly**

- 425A, 4-element tube may be substituted for 426A to care for cases of excessive power induction. See section on inductive noise.
- Tube assembly is held to base of set with single screw (Fig. 21).

(b) **Ringing Capacitor** — an externally mounted 548A capacitor may be used to replace an open or shorted ringing capacitor in the 425-type network. To replace network capacitor:

- (1) Select either of network terminals A or K to which only one lead is connected.
- (2) Remove this lead and connect to one lead of 548A capacitor with a D-161488 connector and insulating sleeve.
- (3) Connect other lead of 548A capacitor to remaining network terminal K or A (Fig. 22).

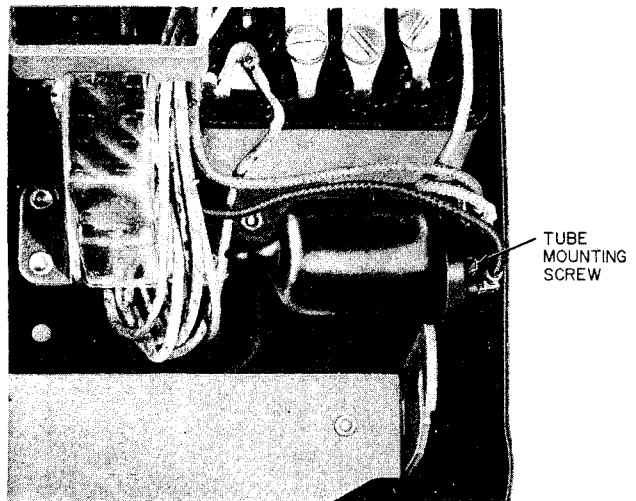


Fig. 21 — 501-Type Telephone Set, Tube Assembly

TABLE B

## TROUBLES, PROBABLE CAUSES, AND CORRECTIVE MEASURES

TROUBLE	PROBABLE CAUSE	CORRECTIVE MEASURE
Bell Does Not Ring	Ringer disconnected or incorrectly wired in set.	Connect correctly.
	Volume control wheel in cut-off position.	Move control wheel to ring position.
	Open winding.	Replace ringer.
	Metal particles in armature gap.	Remove with Scotch tape or approved equivalent.
	Open tube.	Short-circuit yellow and black tube leads. If ringer operates when ringing voltage of correct polarity is applied, replace tube.
	Faulty capacitor.	Replace with 548A capacitor.
Bell Too Loud	Volume control wheel in wrong position.	Move control wheel to softer position and advise customer on proper use.
Bell Too Soft	Volume control wheel in wrong position	Move control wheel to louder position and advise customer on proper use.
	Set on sound-absorbent material.	Place set on hard surface.
	Cord touching gong.	Dress cord properly.
Bell Taps While Dialing or Operating Switch	Incorrect wiring.	Check mounting cord and ringer connections.
	Loose gong.	Tighten screw as required.
Bell Rings When Other Party Is Called: Cross Ring or False Ring	Incorrect wiring.	Check mounting cord and ringer connections.
	Biasing tension too low.	Place bias spring in high tension notch. If ringer still cross-rings, replace ringer.
Bell Keeps Ringing When Handset Is Removed	Open handset cord or dial pulse contacts.	Replace handset cord or dial.
	Defective network or open set wiring.	Replace set.
	Line contacts on switch do not close.	Check switch cover and ears. Ears should fit into notches.
No Dial Tone or Set Dead	Open mounting cord or handset cord.	Replace cord.
	Defective receiver unit or varistor shorted.	Replace receiver unit.
	Dial pulse contacts open or off-normal shunt contacts closed.	Replace dial.

TABLE B (Cont)

## TROUBLES, PROBABLE CAUSES, AND CORRECTIVE MEASURES

TROUBLE	PROBABLE CAUSE	CORRECTIVE MEASURE
No Dial Tone or Set Dead	Open induction coil.	Replace telephone set.
	Switch contacts do not operate.	Check switch cover for proper installation.
Cannot Break Dial Tone	Dial pulse contacts do not open.	Replace dial.
	Dial filter capacitor shorted.	Replace telephone set.
Loud Clicks While Dialing	Dial off-normal shunt contacts do not close.	Replace dial.
Cannot Hear	Open or shorted receiver unit or handset cord.	Replace receiver unit or handset cord.
	Dial off-normal shunt contacts closed.	Replace dial.
	Open induction coil or network.	Replace telephone set.
	Switch receiver contacts do not open.	Check switch cover for interference.
Cannot Be Heard	Defective transmitter or open handset cord.	Replace transmitter or handset cord.
High Sidetone	Defective sidetone balancing network.	Replace telephone set.
Dial Lamp Does Not Light	Lamp burned out.	Replace lamp.
	Transformer plug is out of receptacle.	Replace plug.
	Defective transformer.	Replace transformer.
	No power at ac receptacle.	Check with customer for possible blown fuse or for a power-control switch.

## 4.04 Mechanical Maintenance

(a) *Plungers*

- Should move freely throughout entire travel without binding or squeaking.
- Accessible when handhold cover is removed (Fig. 23).

- Clean with KS-2423 cloth moistened with KS-7860 petroleum spirits and lubricate with a No. 2 or softer graphite pencil.
- Replace housing if plungers do not move freely after cleaning and lubricating.

(b) *Operating Bracket Switch Assembly*

- Should function throughout entire travel without binding or squeaking.

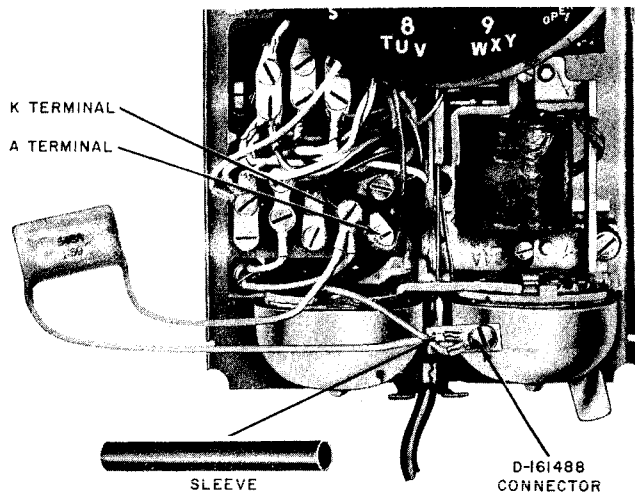


Fig. 22 — Replacing Capacitor



Fig. 23 — Removing Handhold Cover

Clean bosses on operating bracket arms, spring anchor points, operating bracket, and shaft bearing points with KS-2423 cloth moistened in KS-7860 petroleum spirits and lubricate bearing surfaces with a No. 2 or softer graphite pencil (Fig. 24 and 25).

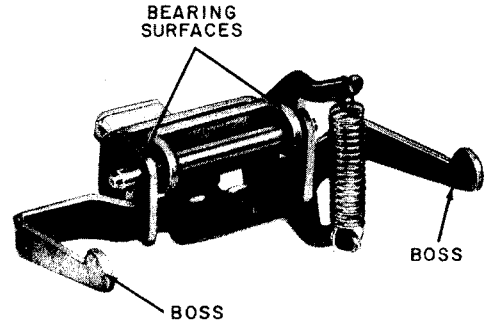


Fig. 24 — Operating Bracket Switch Assembly, 500- and 501-Type Telephone Sets

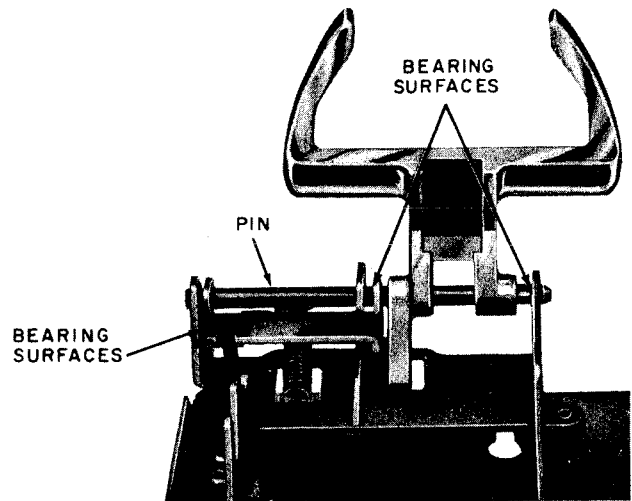


Fig. 25 — Handset Hook Assembly, 554- and 556-Type Telephone Sets

(c) *Switch Contacts*

(1) Line Switch

- Remove line switch cover by depressing slides between thumb and index finger and tilting cover up and away from mounting (Fig. 26).
- Clean contacts with 265C tool.

(2) 584C Key (500U and 501U telephone sets only) — clean contacts of key with 265C tool.

(d) **584C Key** (500U and 501U telephone sets only) — P-484725 knob may be replaced by removing P-356367 setscrew (use jeweler's screwdriver) and lifting knob off shaft (Fig. 27).

(e) **Dial Light** — to remove, turn lamp cap and lamp counterclockwise (Fig. 28) and lift out.

(f) **Lamp Cap Retainer Ring**

- 500W/Y telephone sets can be equipped with a P-14E582 retainer ring (Fig. 29) to prevent pilferage of the lamp cap assembly.

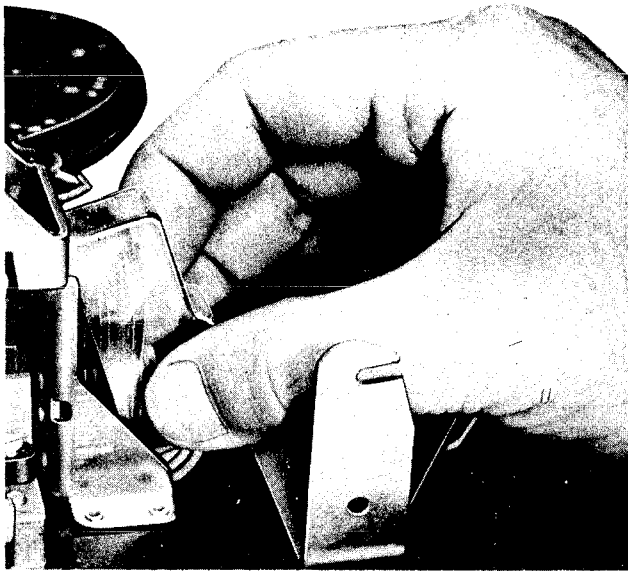


Fig. 26 — Removing Line Switch Cover

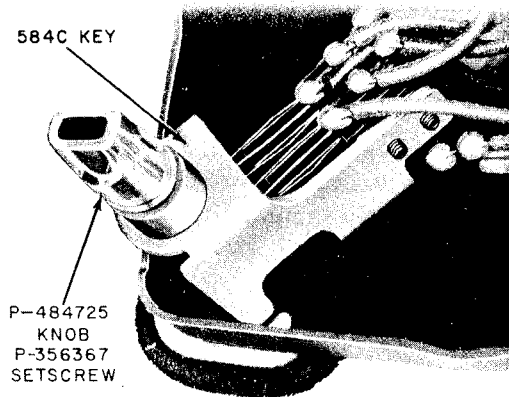


Fig. 27 — 584C Key

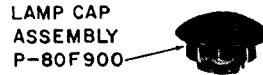


Fig. 28 — Lamp Assembly, 500H/P Telephone Sets

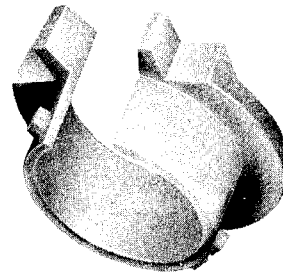
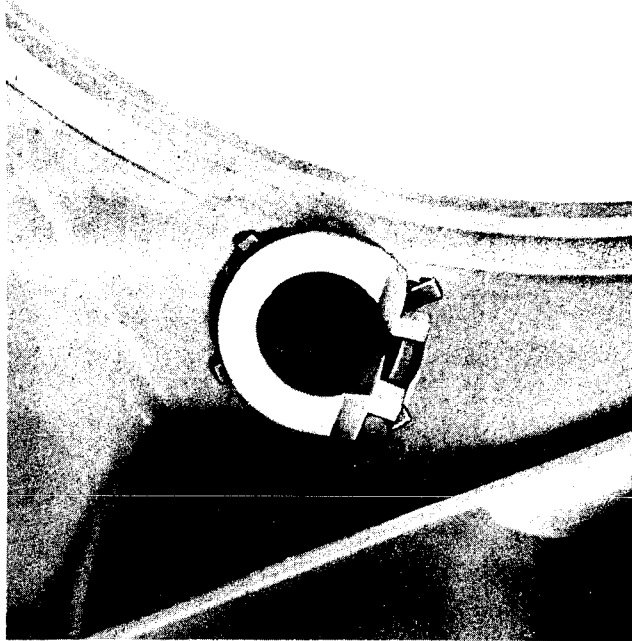


Fig. 29 — P-14E582 Retainer Ring

- Install retainer ring as follows:
  - (1) Remove set housing with lamp cap in place.
  - (2) Press two tabs of retainer ring together.
  - (3) Insert retainer ring into lamp cap so that retainer ring engaging pins fit into lamp cap slots (Fig. 30).
  - (4) This prevents normal rotation and removal of the lamp cap.

(g) **Other Components** — for maintenance of handsets, dials, and ringers refer to the sections covering these components.

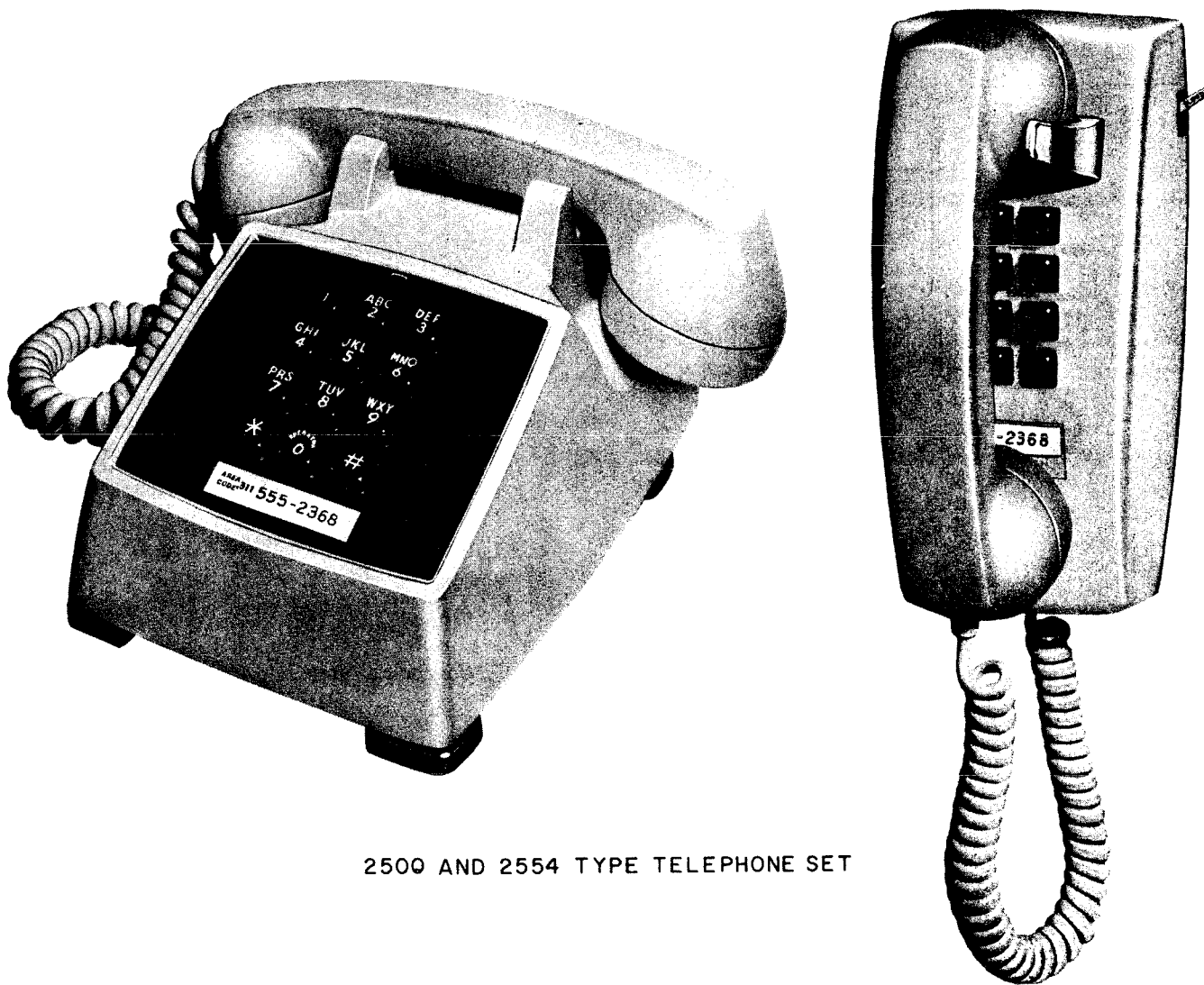


**Fig. 30 — Retainer Ring Mounting in Set Housing**





**TELEPHONE SETS**  
**2500 AND 2554 TYPES**  
**IDENTIFICATION, INSTALLATION, AND MAINTENANCE**



2500 AND 2554 TYPE TELEPHONE SET

Fig. 1—2500 and 2554 Type Telephone Sets

**1. IDENTIFICATION**

**PURPOSE**

General purpose wall- and desk-type telephone sets equipped with a 12-button TOUCH-TONE® dial.

**ORDERING GUIDE**

- Set, Telephone 2500D-\*
- Set, Telephone 2500M-\*
- Set, Telephone 2500S-\*

**SECTION 502-510-121**

Set, Telephone 2500Y-\*

Set, Telephone 2554B-\*

\* Refer to Table A for colors.

**COLOR**

**TABLE A**  
**COLOR ORDERING GUIDE\***

TEL SET, MTG CORD, HOUSING, HANDSET COLOR		COORDINATED FACEPLATE† COLOR	
Black	-03	Charcoal	-70
Ivory	-50	Muted Ivory	-80
Moss Green	-51	Lt. Green	-71
Red	-53	Muted Red	-69
Pastel Yellow	-56	Lt. Yellow	-72
White	-58	Lt. Gray	-73
Rose Pink	-59	Muted Pink	-74
Lt. Beige	-60	Muted Beige	-75
Lt. Gray	-61	Charcoal	-70
Aqua Blue	-62	Muted Blue	-76
Turquoise	-64	Muted Turquoise	-77

\* Refer to Section 500-120-100 for promoted colors.

† Faceplates of same color as housing may be ordered separately (optional).

**DESIGN FEATURES AND APPLICATION**

- (a) 2500D and 2554B telephone sets are general purpose desk- and wall-type sets, respectively, for use in PBX, individual and party line service, and special service connections.
- (b) 2500M telephone set provides an A lead control circuit or bridged ringer for use in 1A1 or 1A2 key telephone systems and 507A and 507B PBX attendant stations.
- (c) 2500S telephone set provides connections for 3A speakerphone.
- (d) 2500Y telephone set provides a message waiting feature.

**OPTIONAL FEATURES**

*End-to-end signaling*—requires installation of guard assembly (see Table B)

**2. INSTALLATION**

Refer to Sections 502-120-201 and 463-130-200 for installation and mounting information.

**3. MAINTENANCE**

- (a) *Replaceable Apparatus* (Refer to Table B for component ordering guide.)
- (b) Component parts should be maintained in accordance with section covering the item.
- (c) To remove housing on 2554-type telephone set:
  - (1) Remove number card and number card holder with KS-16750L2 releaser.
  - (2) Loosen captive screws located beneath number card.
  - (3) Remove housing.
  - (4) To replace housing, reverse procedure.
- (d) Plungers, operating bracket switch and switch hook shall move freely without binding or squeaking.
  - Clean with KS-2423 cloth moistened with KS-7860 petroleum spirits.
  - Lubricate plungers and bearing surfaces with No. 2 or softer graphite pencil.
- (e) Clean switch hook contacts when required with a 265C tool.
  - Replace set if other trouble exists in the switch hook assembly.

**TABLE B**  
**COMPONENT ORDERING GUIDE\***

REPLACEABLE COMPONENTS	TELEPHONE SET				
	2500D	2500M	2500S	2500Y	2554B
Cord, Mounting	D3BN	D4BJ	D10P	D3BN	
Dial	35A3A	35A3A	35C3A	35A3A	35A3A
Housing	P-83A300	P-83A300	P-83A300	P-83A300	P-82H600
Plate, Face, Assembly	P-86D500†	P-86D500†	P-86D500†	P-86D600†	
Retainer, Card	P-25E803	P-25E803	P-25E803	P-25E803	P-25E803
Ringer	C4A	C4A	C4A	C4A	P1A
Set, Hand	G3AR	G3AR	G3AR	G3AR	G3AR
OPTIONAL					
Cord, Mounting‡	D3BU			D3BU	
Guard Assembly	P-90D052	P-90D052	P-90D052	P-90D052	P-90D053

\* Refer to Table A for color selection.

† Includes P-25E803 card retainer

‡ Heavy duty, replaces D3BN in 9-, 13-, and 25-foot lengths.



TELEPHONE SETS—500A, B AND 501A, B

COMMON BATTERY — CONNECTIONS

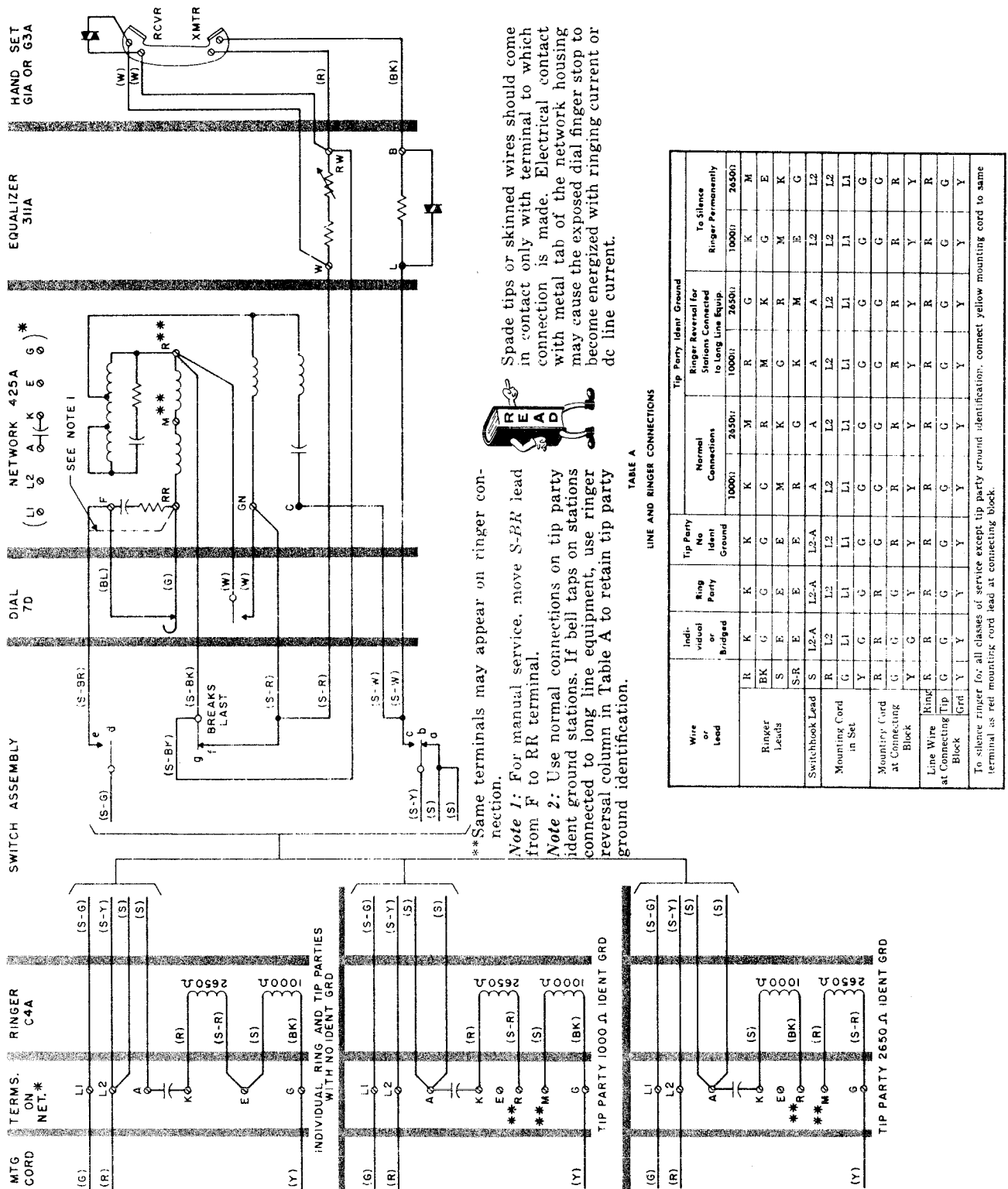


Fig. 1 — 500A, B Telephone Set

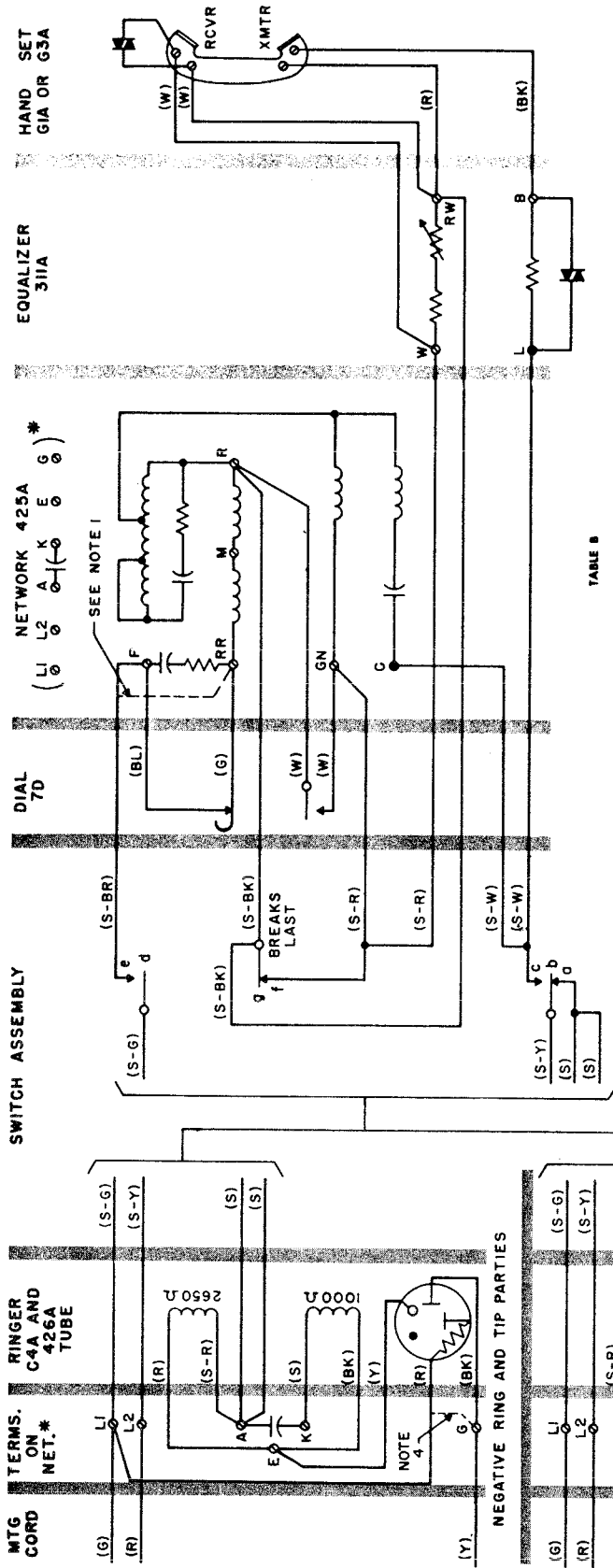


TABLE B  
LINE, RINGER, AND TUBE CONNECTIONS

Wire or Lead	Negative (-) Parties			Positive (+) Parties		
	1-5 Ring	2-4 Tip	3-7 Ring	4-8 Tip		
Ringer Leads See Note 2	R	E	A	A		
	BK	E	K	K		
	S	K	E	E		
	S-R	A	E	E		
Switchhook lead	S	A	A	A		
	R	L1 or G	A	A		
426A Tube (3-Element) See Notes 3 and 4	BK	G	E	E		
	Y	E	G	G		
	R	L2	L2	L2		
Mounting cord in set	G	L1	L1	L1		
	Y	G	G	G		
	R	R	R	R		
Mounting cord at connecting block	G	G	G	G		
	Y	Y	Y	Y		
	R	R	R	R		
Line wire at connecting block	R	R	R	R		
	G	G	G	G		
	Y	Y	Y	Y		
4-Element Electron Tube Connections to Reduce Inductive Noise						
425A Tube (4-Element) See Note 3	R	L1	L1	A		
	G	A	L1	L1		
	BK	G	E	E		
	Y	E	G	G		

Fig. 2 - 501A, B Telephone Set

**Note 1:** For manual service, move S-BR lead from F to RR terminal.  
**Note 2:** To silence ringer permanently: Connect yellow mounting cord lead to same terminal as red mounting cord lead at connecting block.  
**Note 3:** For additional information concerning inductive interference, refer to section entitled Inductive Noise.  
**Note 4:** For negative stations in offices without ANI, R lead from 426A tube may be connected to G if ringer operation is marginal.

## TELEPHONE SETS 500C/D AND 501C/D CONNECTIONS

### 1. GENERAL

1.01 This section is reissued to:

- Show 425E network as replacement for 425B (MD) network.
- Delete information on 425A electron tube.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

### 2. CONNECTIONS

2.01 The 500C/D telephone set is factory-wired for individual bridged or ring party service.

2.02 The 501C/D telephone set contains a 426A three element electron tube and is factory-wired for use in 4-party selective or 8-party semiselective ringing service. For information on the 425A four

element electron tube, refer to the section covering inductive noise.



*Spade tips or skinned wires should come in contact only with terminal to which connection is made. Electrical contact with metal housing of network may cause the exposed dial finger stop to become energized with ringing current or dc line current.*

### 2.03 Connection Index

Table A—500C/D Telephone Set, Line and Ringer Connections

Table B—501C/D Telephone Set, Line, Ringer and Tube Connections

Fig. 1—500C/D Telephone Set, Connections

Fig. 2—501C/D Telephone Set, Connections

**TABLE A**  
**500C/D TELEPHONE SET**  
**LINE AND RINGER CONNECTIONS**

WIRE OR LEAD	COLOR	INDIVIDUAL OR BRIDGED	RING PARTY	TIP PARTY NO IDENT GROUND	TIP PARTY IDENT GROUND			
					NORMAL CONNECTION		RINGER REVERSAL WHEN CONNECTED TO LONG LINE EQUIP.	
					1000Ω	2650Ω	1000Ω	2650Ω
Ringer Leads	R	L2	L2	L2	K	B	B	G
	BK	G	G	G	G	B	B	K
	S	K	K	K	B	K	G	B
	S-R	A	A	A	B	G	K	B
Switch Hook Lead	S	L2	L2	L2	A	A	A	A
Mounting Cord in Set	R	L2	L2	L2	L2	L2	L2	L2
	G	L1	L1	L1	L1	L1	L1	L1
	Y	G	G	G	G	G	G	G
Mounting Cord at Connecting Block	R	R	R	G	G	G	G	G
	G	G	G	R	R	R	R	R
	Y	G	Y	Y	Y	Y	Y	Y
Line Wire at Connecting Block	Ring	R	R	R	R	R	R	R
	Tip	G	G	G	G	G	G	G
	Grd	Y	Y	Y	Y	Y	Y	Y

\* If bell taps on stations connected to long line equipment, use these connections to retain tip party ground identification.

**Note:** To silence ringer permanently:

- (a) For all classes of service except tip party identification ground; remove the (R) ringer lead from **L2** of network and insulate and store.
- (b) For tip party with 1000 ohms identification ground; remove (R) ringer lead from **K** of network and insulate and store.
- (c) For tip party with 2650 ohms identification ground; remove the (S) ringer lead from **K** of network and insulate and store.

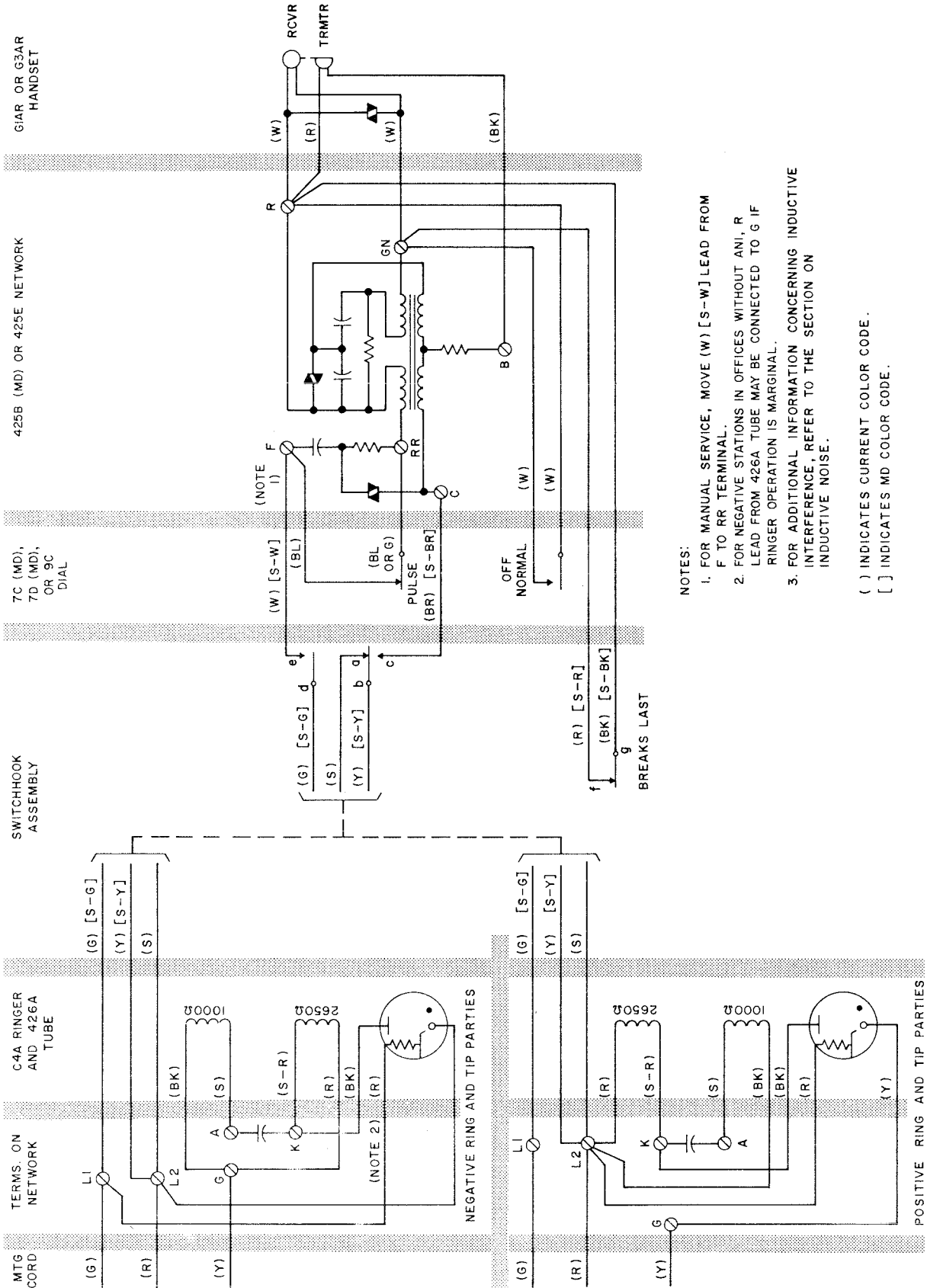


**TABLE B**  
**501C/D TELEPHONE SET**  
**LINE, RINGER, AND TUBE CONNECTIONS**

WIRE OR LEAD	COLOR	NEGATIVE (-) PARTIES		POSITIVE (+) PARTIES	
		1-5	2-6	3-7	4-8
		RING	TIP	RING	TIP
Ringer Leads	R	G	G	L2	L2
	BK	G	G	L2	L2
	S	A	A	A	A
	S-R	K	K	K	K
Switch Hook Leads	S	L2	L2	L2	L2
426A Tube	R	L1 or G	L1 or G	L2	L2
	BK	K	K	K	K
	Y	L2	L2	G	G
Mounting Cord in Set	R	L2	L2	L2	L2
	G	L1	L1	L1	L1
	Y	G	G	G	G
Mounting Cord at Connecting Block	R	R	G	R	G
	G	G	R	G	R
	Y	Y	Y	Y	Y
Line Wire at Connecting Block	Ring	R	R	R	R
	Tip	G	G	G	G
	Grd	Y	Y	Y	Y

**Note:** To silence ringer permanently, connect yellow mounting cord lead to same terminal as red mounting cord lead at the connecting block.





NOTES:

1. FOR MANUAL SERVICE, MOVE (W) [S-W] LEAD FROM F TO RR TERMINAL.
2. FOR NEGATIVE STATIONS IN OFFICES WITHOUT ANI, R LEAD FROM 426A TUBE MAY BE CONNECTED TO G IF RINGER OPERATION IS MARGINAL.
3. FOR ADDITIONAL INFORMATION CONCERNING INDUCTIVE INTERFERENCE, REFER TO THE SECTION ON INDUCTIVE NOISE.

( ) INDICATES CURRENT COLOR CODE.  
 [ ] INDICATES MD COLOR CODE.

Fig. 2—501C/D Telephone Set, Connections





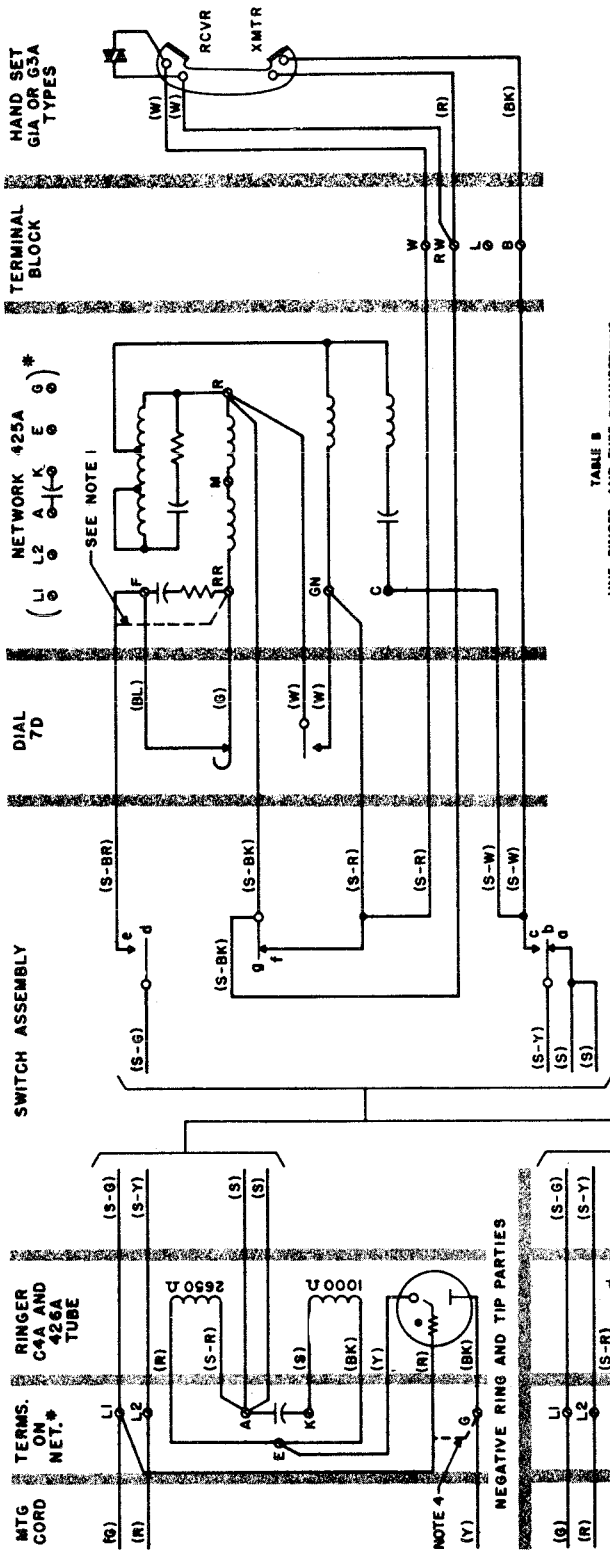


TABLE B  
LINE, RINGER, AND TUBE CONNECTIONS

Wire or Lead	Negative (-) Parties			Positive (+) Parties		
	1-5	2-6	3-7	4-8	Tip	Ring
Ringer Leads See Note 2	R	E	A	A	A	A
	BK	E	F	K	K	K
	S	K	K	E	E	E
	S-R	A	A	E	E	E
Switchhook Lead	S	A	A	A	A	A
426A Tube (3-Element) See Notes 3 and 4	R	L1 or G	L1 or G	A	A	A
	BK	G	G	E	E	E
Mounting Cord in Set	Y	E	E	G	G	G
	R	L2	L2	L2	L2	L2
	G	L1	L1	L1	L1	L1
	Y	G4	G	G	G	G
Mounting Cord at Connecting Block	R	R	R	R	R	R
	G	G	G	G	G	G
Line Wire at (Connecting Block)	Ring	Y	Y	Y	Y	Y
	Tip	R	R	R	R	R
	Grd	G	G	G	G	G
4-Element Electron Tube Connections to Reduce Inductive Noise						
425A Tube (4-Element) See Note 3	R	L1	L1	A	A	A
	G	A	A	L1	L1	L1
	BK	G	G	E	E	E
	Y	E	E	G	G	G

**Note 1:** S-BR switch lead is connected to F terminal in dial sets and to RR terminal in manual sets.

**Note 2:** To silence ringer permanently: Connect yellow mounting cord lead to same terminal as red mounting cord lead at connecting block.

**Note 3:** For additional information concerning inductive interference, refer to section entitled Inductive Noise.

**Note 4:** For negative stations in offices without ANI, R lead from 426A tube may be connected to G if ringer operation is marginal.

Fig. 2 - 501J, K Telephone Set, Connections

TELEPHONE SETS—500U AND 501U

(ILLUMINATED DIAL AND NIGHT LIGHT) — COMMON BATTERY — CONNECTIONS

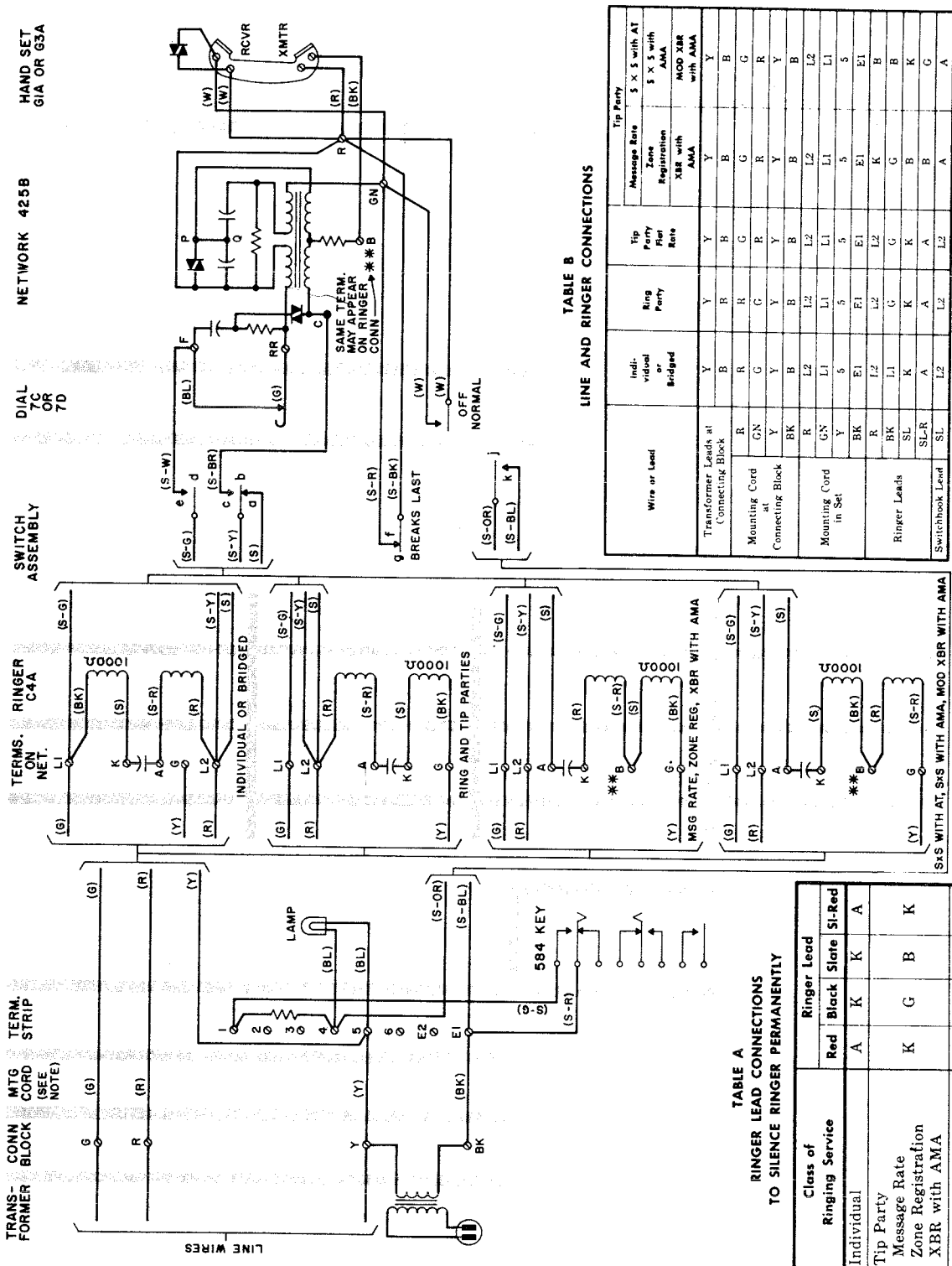


TABLE B  
LINE AND RINGER CONNECTIONS

Wire or Lead	Individual or Bridged	Ring Party	Tip Party	Message Rate	Tip Party
Transformer Leads at Connecting Block	Y	Y	Y	Y	Y
Mounting Cord at Connecting Block	B	R	B	B	B
Mounting Cord in Set	R	R	R	R	R
Ringer Leads	GN	G	G	G	G
Switchhook Lead	Y	Y	Y	Y	Y
	BK	B	B	B	B
	R	L2	L2	L2	L2
	GN	L1	L1	L1	L1
	Y	5	5	5	5
	BK	E1	E1	E1	E1
	R	L2	L2	L2	L2
	BK	L1	L1	L1	L1
	SL	K	K	K	K
	SL-R	A	A	A	A
	SL	L2	L2	L2	L2
		A	A	A	A

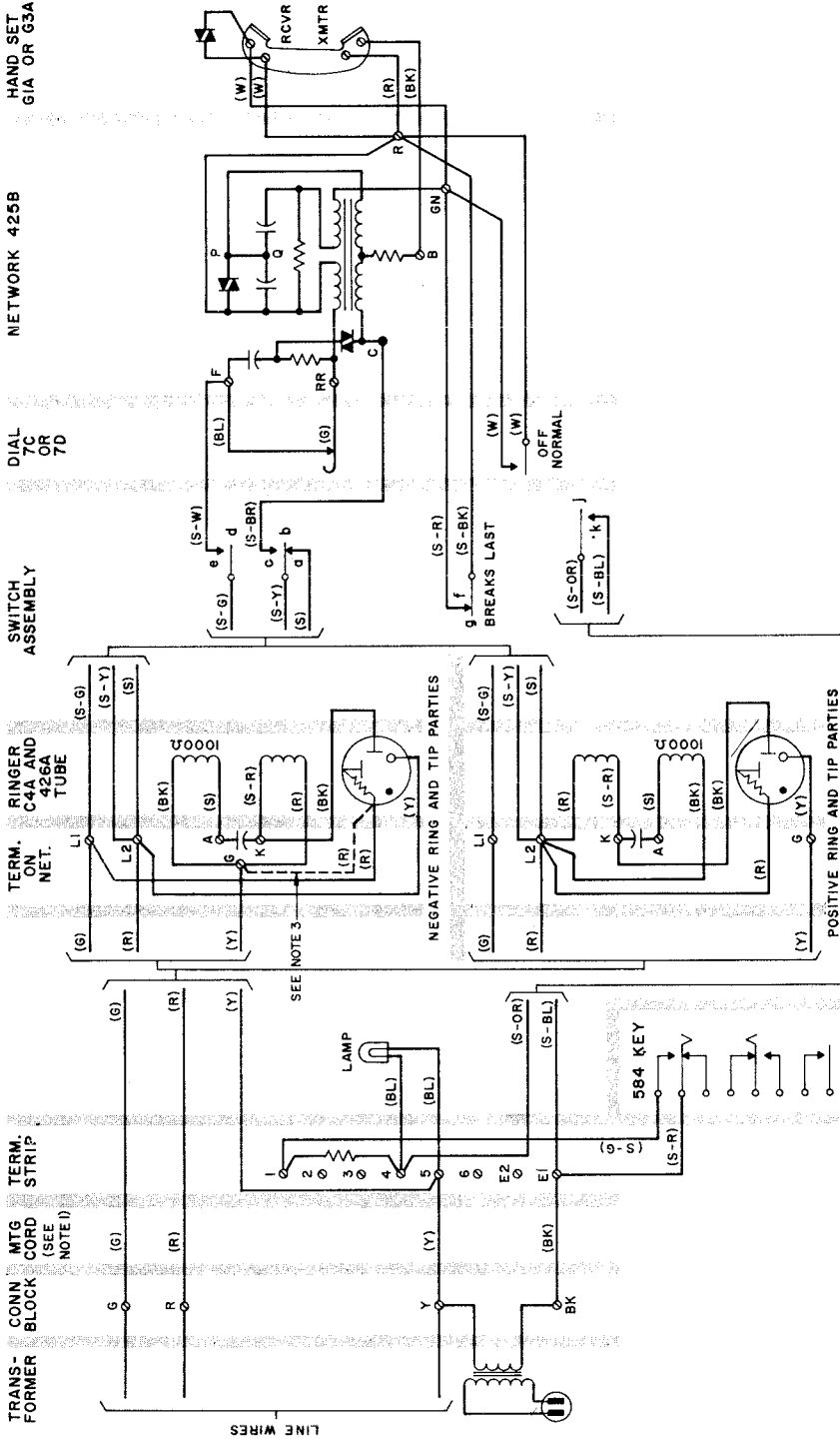
TABLE A  
RINGER LEAD CONNECTIONS TO SILENCE RINGER PERMANENTLY

Class of Ringing Service	Ringer Lead		
	Red	Black	Sl-Red
Individual	A	K	A
Tip Party	K	G	K
Message Rate			
Zone Registration			
XBR with AMA			
Tip Party	B	K	G
SXS with AT			
SXS with AMA			
MOD XBR with AMA			

For all classes of service except those listed above:  
Connect yellow strap to terminal 6 instead of terminal 5 on terminal strip.

Note: Do not use 25-foot mounting cord because the added resistance may be too high for adequate illumination of lamp.

Fig. 1 — 500U Telephone Set



**TABLE D**  
LINE, RINGER, AND TUBE CONNECTIONS

Wire or Lead	Negative (-) Parties		Positive (+) Parties	
	Ring	Tip	Ring	Tip
Transformer Leads at Connecting Block	Y	Y	Y	Y
Mounting Cord at Connecting Block	R	B	B	B
	GN	R	R	G
Mounting Cord in Set	BK	Y	Y	Y
	R	B	B	B
Ringer Leads (See Note 2)	R	L2	L2	L2
	GN	L1	L1	L1
Tube Leads	Y	5	5	5
	BK	E1	E1	E1
Tube Leads	R	L1	L1	L2
	BK	G	G	L2
Tube Leads	SL-R	A	A	A
	R	K	K	K
Tube Leads	BK	C	C	L2
	Y	L2	L2	G

**Note 1:** Do not use 25-foot mounting cord because the added resistance may be too high for adequate illumination of lamp.

**Note 2:** To silence ringer permanently, connect yellow strap to terminal 6 instead of terminal 5 on terminal strip.

**Note 3:** If not equipped for ANI, R lead may be connected to ground if ringing is marginal.

**TABLE C**  
INDUCTIVE INTERFERENCE REDUCTION TUBE LEAD CONNECTIONS

Lead	Negative (-) Ring or Tip Parties		Positive (+) Ring or Tip Parties	
	Average Induction	Severe Induction	Average or Severe Induction	
425A Tube	R	L1	L2	L2
	GN	L2	L1	L1
	BK	K	K	K
426A Tube	Y	L2	G	G
	R	L1		
426A Tube	BK	K		
	Y	L2		

**Fig. 2 - 501U Telephone Set**



## TELEPHONE SETS — 2500D CONNECTIONS

### 1. CONNECTION INDEX

Table A — P-90D052 Guard Assembly Connections

Table B — Line and Ringer Connections

Fig. 1 — 2500D Telephone Set Connections

**TABLE A**  
**P-90D052 GUARD ASSEMBLY CONNECTIONS**

WIRE OR LEAD		REMOVE FROM	CONNECT TO
Dial	(BK)	RR Net.	T of Guard Assembly
Line Switch	(BR)	C Net.	S of Guard Assembly
Guard Assembly	(G)		Term. RR Net.
	(W)		Term. C Net.

**TABLE B**  
**LINE AND RINGER CONNECTIONS**

WIRE OR LEAD			INDIV OR BRIDGED	RING PARTY	TIP PARTY		
					NO IDENT. GROUND	IDENT. GROUND	
						1000Ω	2650Ω
Mtg. Cord at Conn Block	Tip	G	G	G	R	R	
	Gnd	Y	G	Y	Y	Y	
	Ring	R	R	R	R	G	
Ringer Leads		R			L1	K	B
		S-R				B	G
		S				B	K
		BK				G	B
Line Switch Leads		S				A	A
		W				C	C
		BR				F	F

**Note:** To silence ringer permanently:

- (a) For all classes except identification ground insulate and store (BK) ringer lead.
- (b) For 1000Ω gnd — insulate and store (S-R) ringer lead.
- (c) For 2650Ω gnd — insulate and store (BK) ringer lead.



## TELEPHONE SETS – 2554B CONNECTIONS

### 1. CONNECTION INDEX

Table A — P-90D053 Guard Assembly Connections

Table B — Line and Ringer Connections

Table C — Modification for Use With 1A1 or 1A2 Key Telephone System Line

Fig. 1 — 2554B Telephone Set, Connections

Fig. 2 — 2554B Telephone Set, Connections for 1A1 or 1A2 Key Telephone Systems

TABLE A

P-90D053 GUARD ASSEMBLY CONNECTIONS

WIRE OR LEAD		REMOVE FROM	CONNECT TO
Dial	(BK)	RR Net.	T of Guard Assembly
Line Switch	(BR)	C Net.	S of Guard Assembly
Guard Assembly	(G)		Term. RR Net.
	(W)		Term. C Net.

TABLE B

LINE AND RINGER CONNECTIONS

WIRE OR LEAD			INDIV. OR BRIDGED	RING PARTY	TIP PARTY		
					NO IDENT. GROUND	IDENT. GRD.	
						1000Ω	2650Ω
Inside Wire	Tip	(G)	1	1	2	2	2
	Ring	(R)	2	2	1	1	1
	Grd	(Y)		3	3	3	3
Ringer Leads	(BK)		1	3	3	3	3
	(BL)		*	*	*	*	*
	(S)		*	*	*	B	*
	(S-R)		*	*	*	*	B
	(R)		K	K	K	K	K
Line Switch	(W)		F	F	C	C	C
	(S)		A	A	A	A	A
	(BR)		C	C	F	F	F

\*Insulate and store.

**Notes:** To silence ringer permanently:

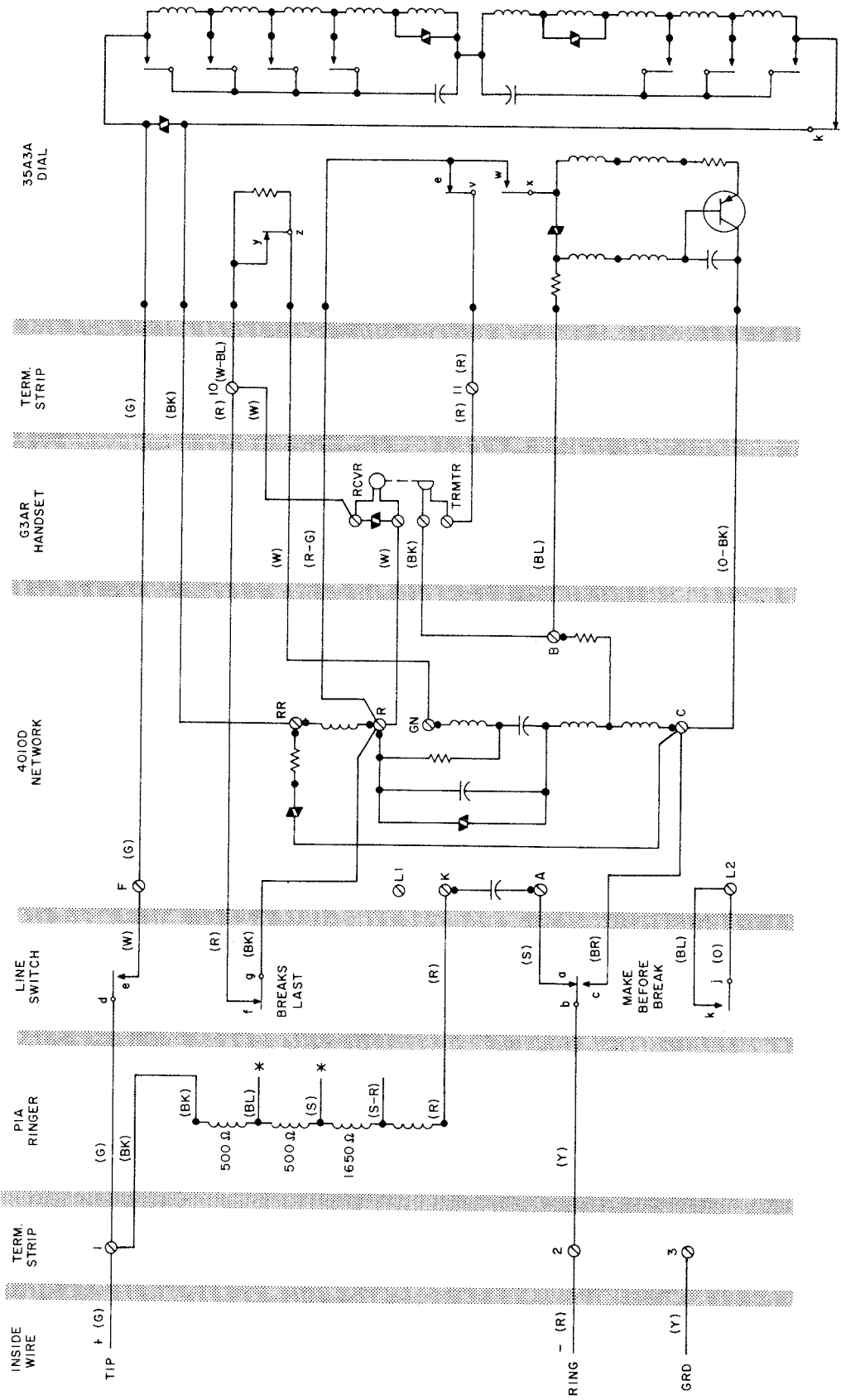
1. For all classes except identification ground insulate and store (BK) ringer lead.
2. For tip party with 1000 ohm or 2650 ohm identification ground remove, insulate, and store the (R) ringer lead at K of the network.

TABLE C

MODIFICATION FOR USE WITH 1A1 OR 1A2 KEY TELEPHONE SYSTEM LINE

WIRE OR LEAD		REMOVE FROM		CONNECT TO		INSULATE AND STORE
		TERM. STRIP	NET.	TERM. STRIP	NET.	
Line Switch	(S)		A			•
	(Y)	2			L2	
	(BR)		C	3		
Place M1W Cord or Strap				2 ←	→ A	
P1A	(R)		K	R1	Ringer Lead using D-161488* Connector	
Ringer	(BK)	1		B1		
Inside Wire	(G) Tip			1		
	(R) Ring			2		
	(BK) A				L2	
	(Y) A1			3		
	R1			(R)	Ringer Lead using D-161488* Connector	
	B1			(BK)		

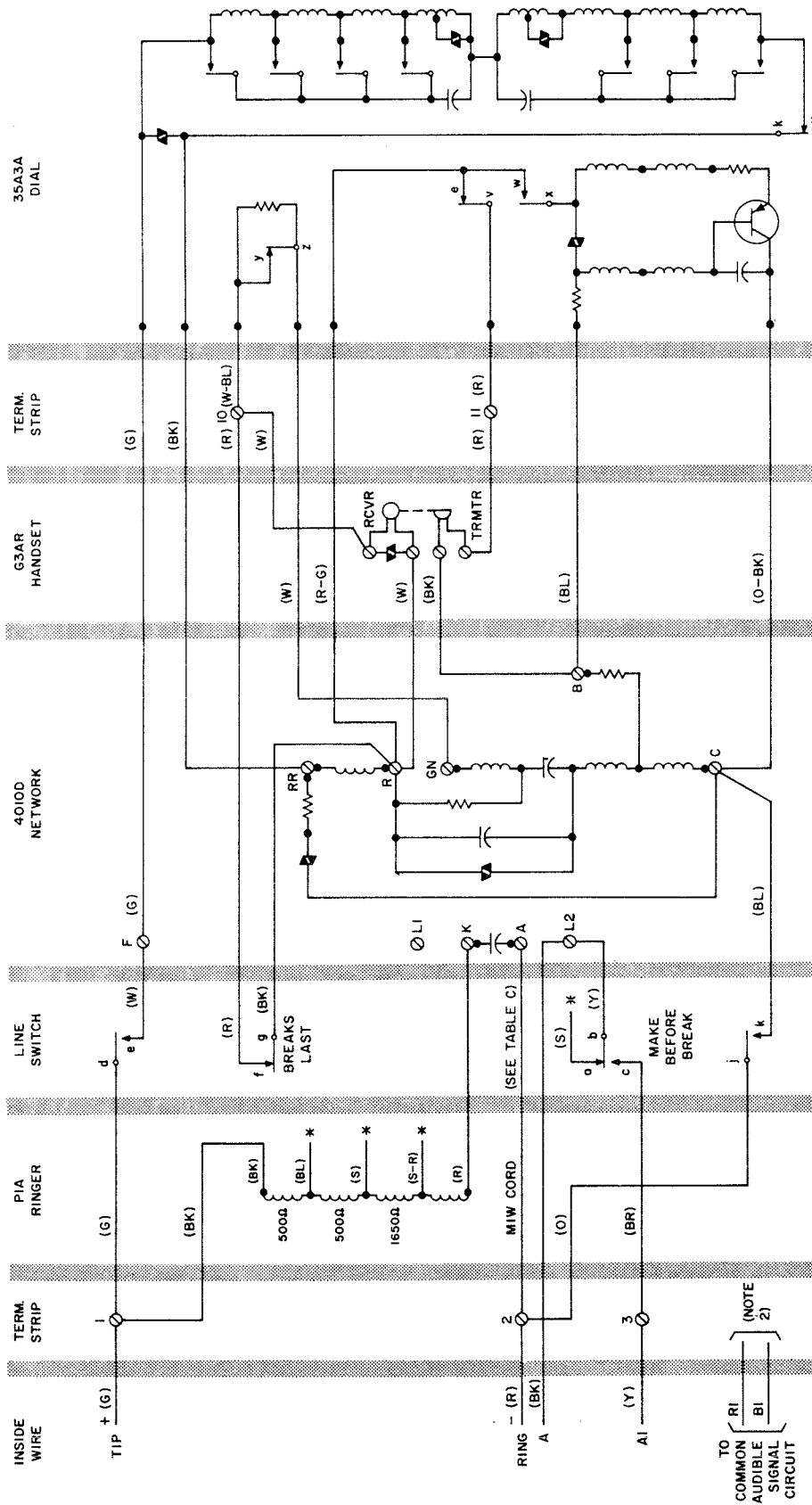
\*See Note 2, Fig. 2.



NOTE: WHEN A POLARITY GUARD IS REQUIRED ORDER SEPARATELY AS A P-900053 GUARD ASSEMBLY AND CONNECT IN ACCORDANCE WITH TABLE A.

\* INSULATED AND STORED

Fig. 1 — 2554B Telephone Set, Connections



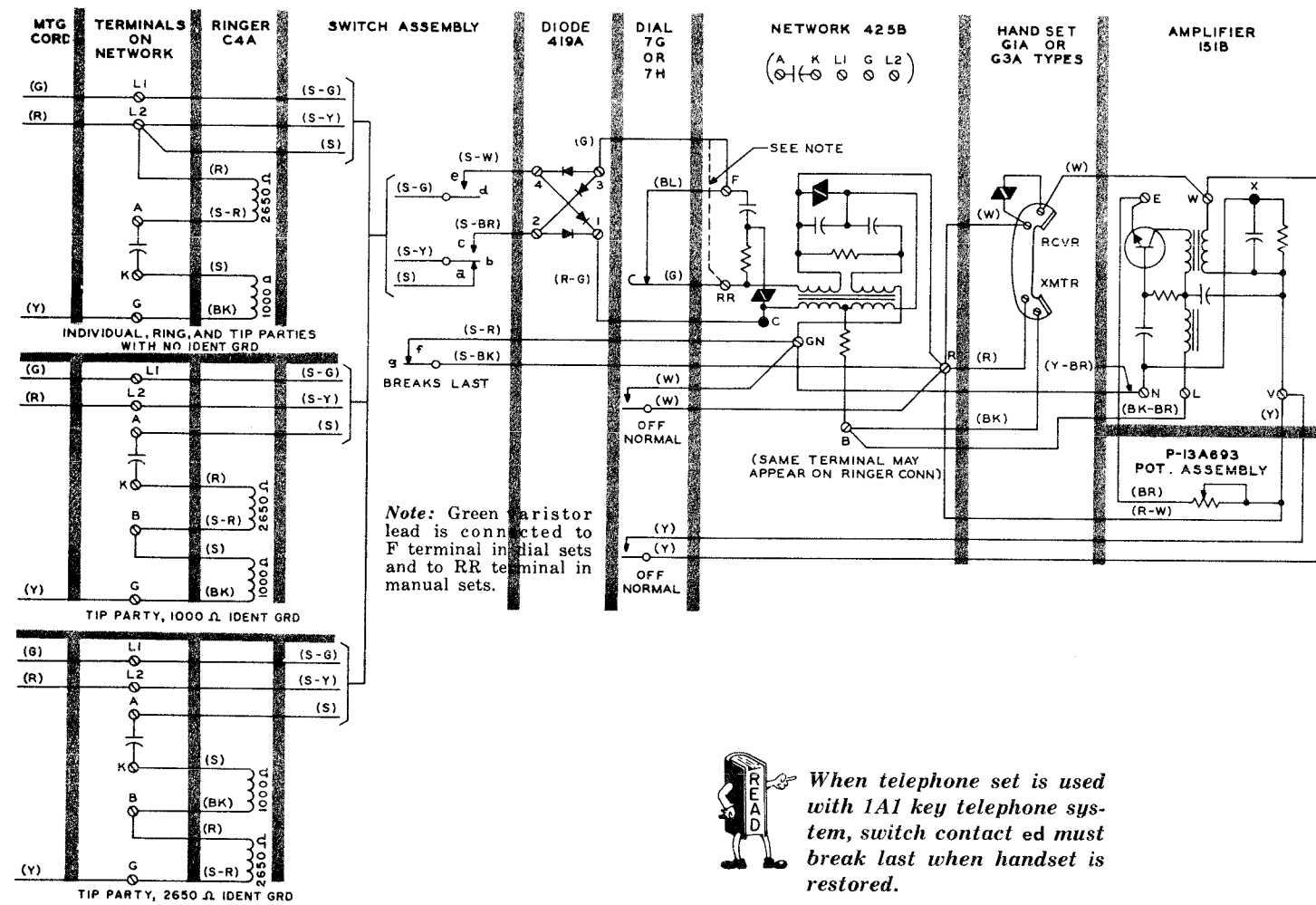
- NOTES:
1. TO PREVENT FALSE HOLD CONDITION WHEN HANDSET IS RESTORED, LINE SWITCH CONTACTS 46 MUST BREAK BEFORE 26 BREAKS.
  2. USE D-161488 CONNECTORS TO CONNECT RI AND BI LEADS TO RINGER WHEN COMMON RINGER IS REQUIRED (SEE TABLE C).
  3. WHEN A POLARITY GUARD IS REQUIRED, ORDER SEPARATELY AS A P-900053 GUARD ASSEMBLY AND CONNECT IN ACCORDANCE WITH TABLE A.
- \* INSULATED AND STORED.

TO COMMON AUDIBLE SIGNAL CIRCUIT

RI (NOTE 2)

BI

Fig. 2 — 2554B Telephone Set, Connections for 1A1 or 1A2 Key Telephone Systems



**When telephone set is used with 1A1 key telephone system, switch contact ed must break last when handset is restored.**

Fig. 1 — 532A, B Telephone Set

TABLE A  
RINGER LEAD CONNECTIONS  
TO SILENCE RINGER PERMANENTLY

Tip Party Identifying Ground	Ringer Lead			
	ohms	Red	Black	Slate S-Red
1000	K	G	B	K
2650	B	K	K	G

For all classes of service except those listed above and 1A1 key telephone system:  
 Connect yellow mounting cord lead to same terminal as red mounting cord lead at connecting block.

For 1A1 key telephone system connect red and black ringer leads on L2 terminal of 425B network.

TABLE B  
LINE AND RINGER CONNECTIONS

Wire or Lead	Individual or Bridged*	1A1 Key Tel Syst†	Ring Party	No Ident Grd	Tip Party Identifying Ground	
					ohms	
					1000	2650
Mounting Cord in Set	R	L2	L2	L2	L2	L2
	G	L1	4	L1	L1	L1
	Y	G	G	G	G	G
	BK	L1	L1	L1	L1	L1
Ringer Leads	R	L2	L2	L2	K	B
	BK	G	4	G	G	B
	S	K	K	K	B	K
	S-R	A	A	A	B	G
Switchhook Leads	S	L2	L2	L2	A	A
	S-W	4	G	4	4	4
Mounting Cord at Connecting Block	R	R	R	R	G	G
	G	G	G	G	R	R
	Y	G	Y	Y	Y	Y
	BK		B			
Line Wire at Connecting Block	RING	R	R	R	R	R
	TIP	G	G	G	G	G
	GRD or A1	Y	Y	Y	Y	Y
	A	BK		B		

\* Not recommended for use with 1A key telephone system on long loops.  
 † Place 4-conductor mounting cord.

TELEPHONE SETS—532A, B AND 533A, B  
(AMPLIFIER SETS FOR IMPAIRED HEARING) — COMMON BATTERY  
CONNECTIONS



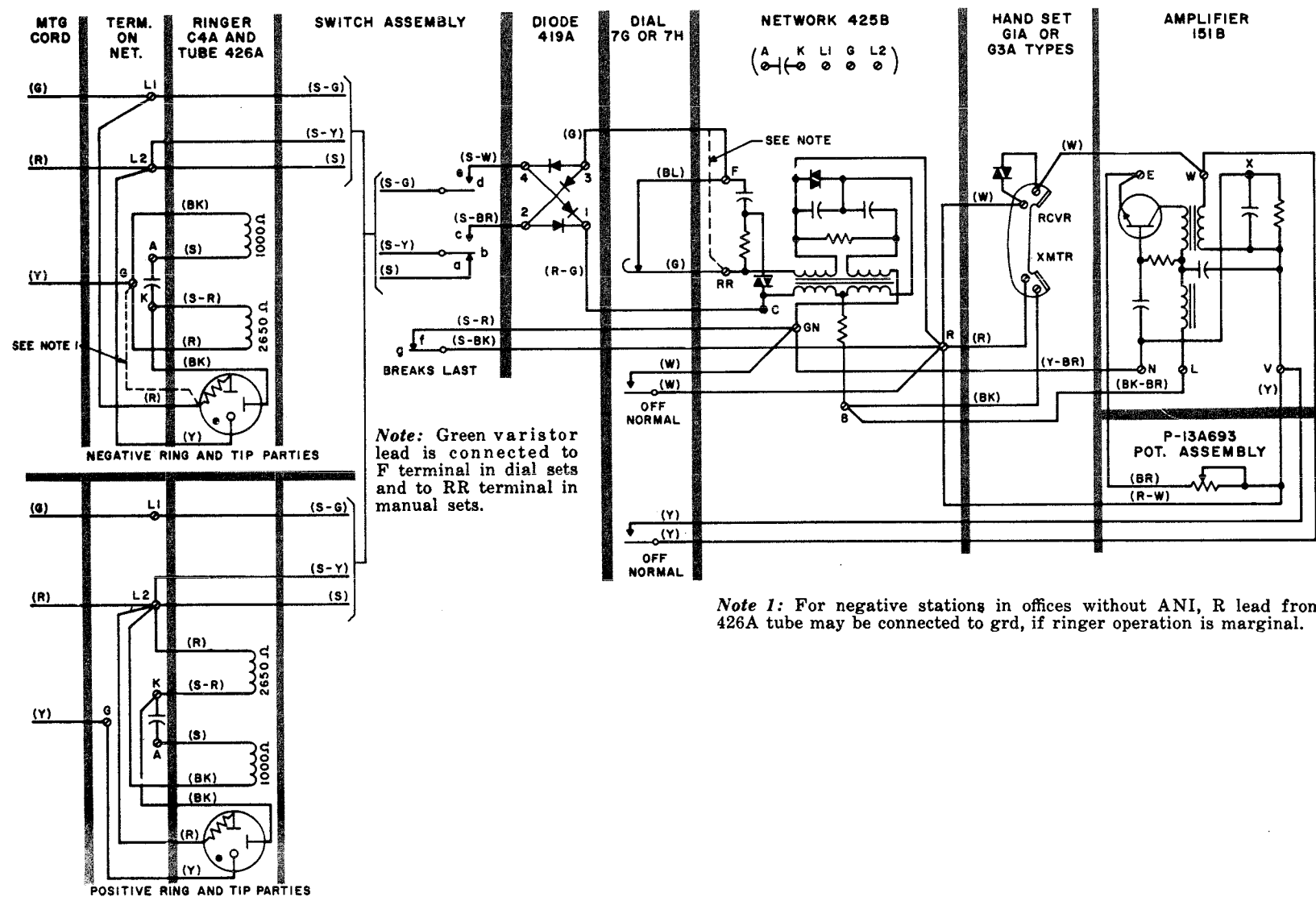


TABLE C  
LINE AND RINGER CONNECTIONS

Wire or Lead		Negative (-) Parties		Positive (+) Parties	
		Ring	Tip	Ring	Tip
Mounting Cord in Set	R	L2	L2	L2	L2
	G	L1	L1	L1	L1
	Y	G	G	G	G
Ringer Leads	R	G	G	L2	L2
	BK	G	G	L2	L2
	S	A	A	A	A
	S-R	K	K	K	K
Tube Leads	R	L1	L1	L2	L2
	BK	K	K	K	K
	Y	L2	L2	G	G
Mounting Cord at Connecting Block	R	R	G	R	G
	G	G	R	G	R
	Y	Y	Y	Y	Y
Line Wire at Connecting Block	R	R	R	R	R
	G	G	G	G	G
	Y	Y	Y	Y	Y

\* To silence ringer permanently, connect yellow mounting cord lead to same terminal as red mounting cord lead at connecting block.

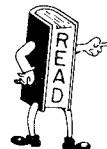
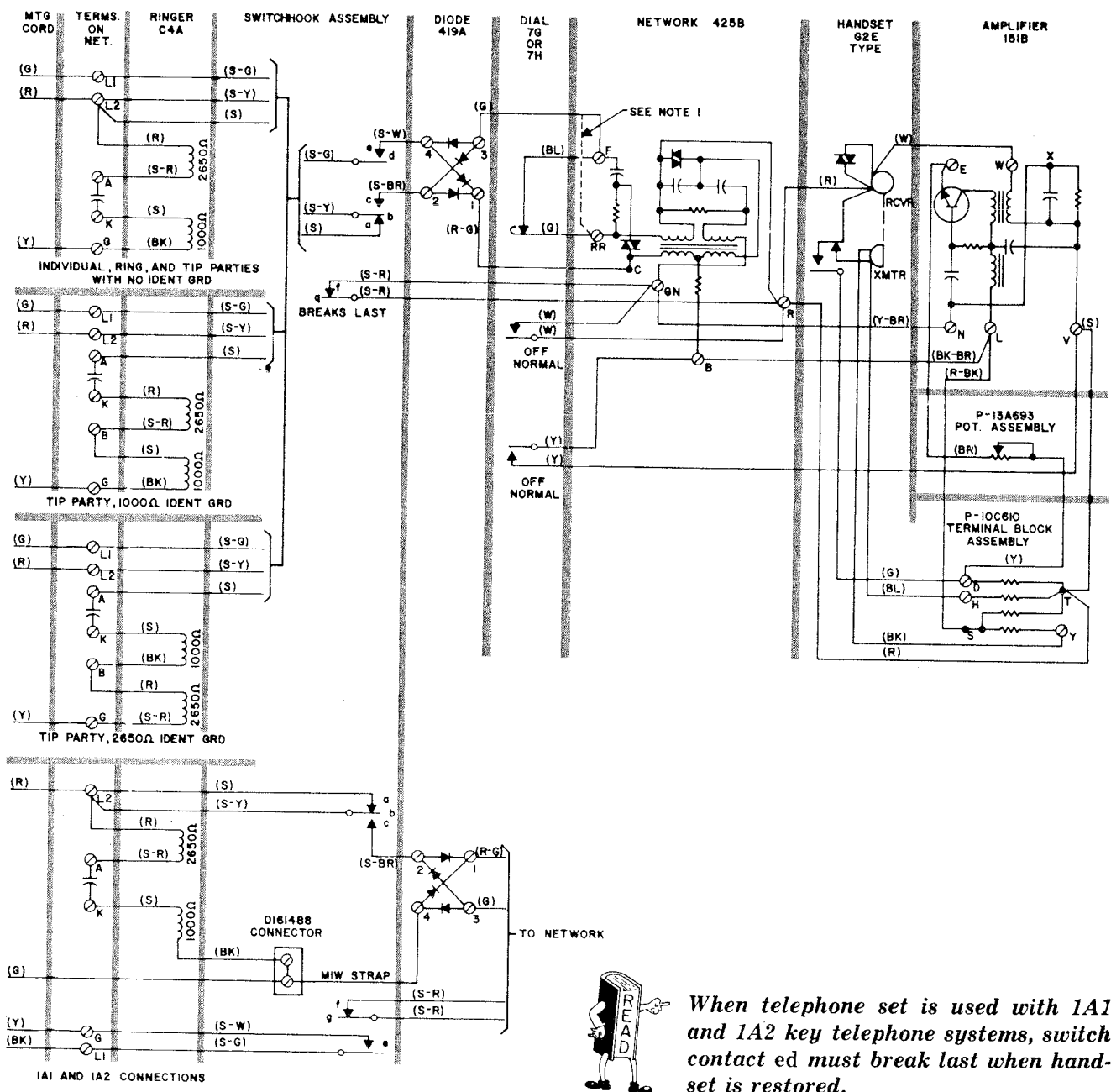
TABLE D  
INDUCTIVE INTERFERENCE REDUCTION  
TUBE LEAD CONNECTIONS

Lead		Negative (-) Ring or Tip Parties	Positive (+) Ring or Tip Parties
		Severe Induction	Average or Severe Induction
425A Tube	R	L1	L2
	G	L2	L1
	BK	K	K
	Y	L2	G
426A Tube	R		
	BK		
	Y		

Fig. 2-533A, B Telephone Set



TELEPHONE SETS—535 TYPE  
CONNECTIONS



When telephone set is used with 1A1 and 1A2 key telephone systems, switch contact ed must break last when hand-set is restored.

Fig. 1 — 535A and B Telephone Sets, Circuit Diagram

TABLE A  
LINE AND RINGER CONNECTIONS

Wire or Lead	Indiv or Bridged	1A1 or 1A2 Key Tel Sys	Ring Party	Tip Party No Ident Grd	Tip Party Identification Ground					
					Normal Connections		Ringer Rev When Conn To Long Line Equip.		To Silence Ringer Permanently (See Note)	
					1000 ohms	2650 ohms	1000 ohms	2650 ohms	1000 ohms	2650 ohms
Ringer Leads	R	L2	L2	L2	K	B	B	G	K	B
	BK	G	4	G	G	B	B	K	G	K
	S	K	K	K	B	G	B	B	B	K
Switchhook Leads	S-R	A	A	A	B	G	K	B	K	G
	S	L2	L2	L2	A	A	A	A	L2	L2
Mounting Cord in Set *	S-W	4	G	4	4	4	4	4	4	4
	R	L2	L2	L2	L2	L2	L2	L2	L2	L2
	G	L1	4	L1	L1	L1	L1	L1	L1	L1
Mounting Cord at Connecting Block	Y	G	G	G	G	G	G	G	G	G
	BK	—	L1	—	—	—	—	—	—	—
	R	R	R	R	G	G	G	G	G	G
Line Wire at Conn Block	G	G	G	R	R	R	R	R	R	R
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	BK	—	BK	—	—	—	—	—	—	—
Ring Tip Grd or A1	R	R	R	R	R	R	R	R	R	R
	G	G	G	G	G	G	G	G	G	G
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
A	BK	—	—	—	—	—	—	—	—	—

Note: To silence the ringer for all classes of service, except ground identified tip party, connect R ringer lead to K terminal on the network.  
\* For 1A1 or 1A2 KTS, replace D3BN mounting cord with a D4BJ mounting cord.

## TELEPHONE SETS

### 701, 702, 711, 712, AND 713 TYPES

#### IDENTIFICATION, INSTALLATION, AND MAINTENANCE

##### 1. GENERAL

1.01 This section covers PRINCESS<sup>®</sup> telephone sets equipped with rotary dials (Fig. 1).

1.02 Information contained in this section was formerly found in Section 502-710-100, 502-710-200, and 502-710-300 which have been canceled.

##### 2. IDENTIFICATION

2.01 These sets are equipped with a concealed lamp which illuminates the dial when the handset is removed. This lamp also serves as a night light under control of a slide switch located in the base at rear of set (Fig. 2).

2.02 Table A lists the major components of 700-series PRINCESS telephone sets.

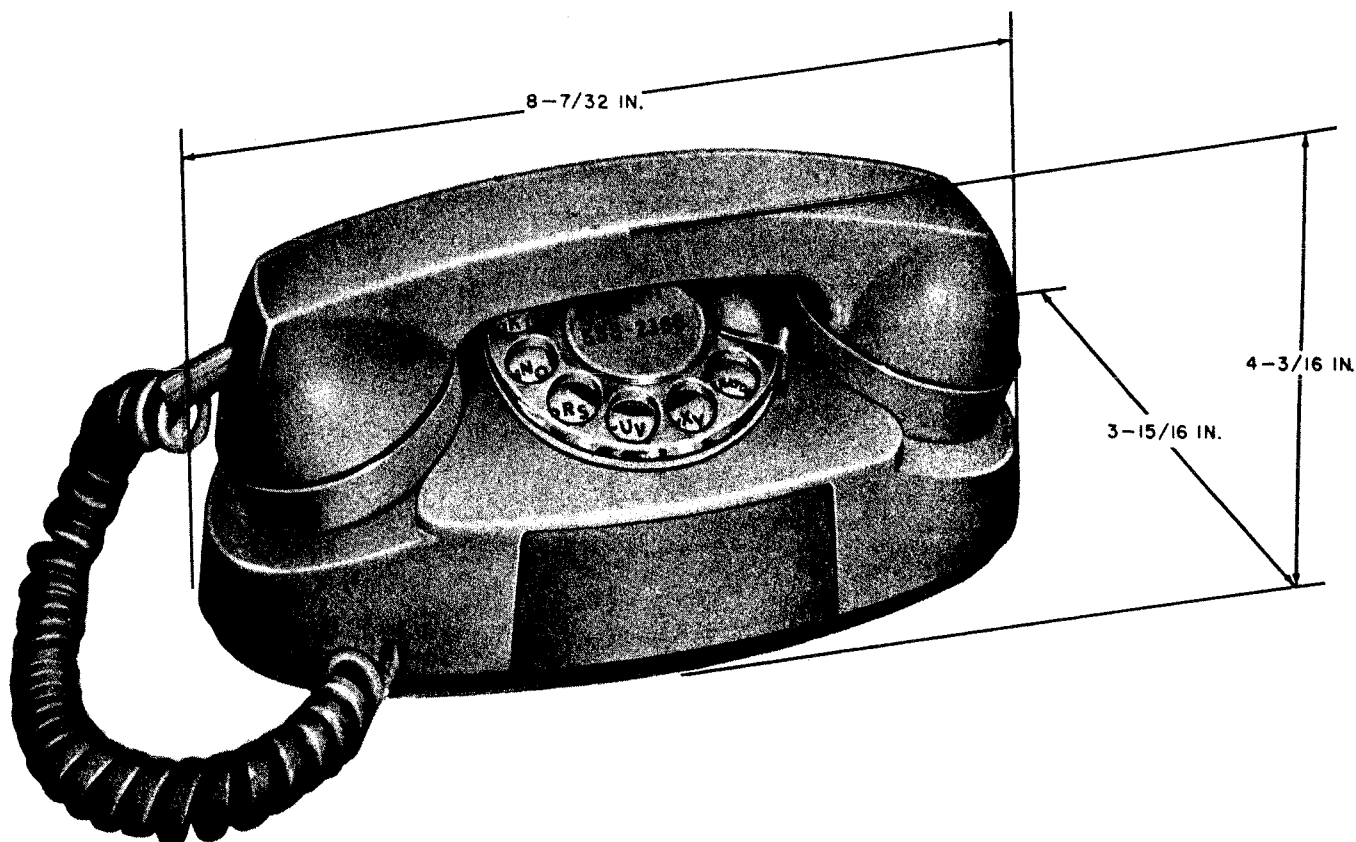


Fig. 1 — 700-Series Telephone Set

**TABLE A**  
**COMPONENTS AND FEATURES — 700-SERIES PRINCESS STYLE TELEPHONE SET**

TYPE SET	HOUSING*	MOUNTING CORD	NETWORK	INTERNAL RINGING	MESSAGE WAITING LAMP	USED WITH 1A KTS	USED WITH 1A1, 1A2 KTS
701B(MD)	P-81M200	D6AB	495A	No	No	Yes	Yes
701D(MD)	P-81P200	D6AB	495A	No	KS-16893L1	Yes	No
702B	P-89A800	D5AK	4010B	Yes	No	Yes	Yes
702D	P-89A900	D5AK	4010B	Yes	KS-16893L1	Yes	No
711B(MD)	P-81K300	D14H or D14L	495A	No	No	No	No
712B	P-89C300	D14L	4010B	No	No	Yes	Yes
713B	P-86C300	D6AF	4010B	No	No	Yes	No

**TABLE A (Cont)**  
**COMPONENTS AND FEATURES — 700-SERIES PRINCESS STYLE TELEPHONE SET**

TYPE SET	3-TYPE SPEAKER-PHONE	1A HOME INTERPHONE	2A FARM INTERPHONE	EQUIPPED WITH EXCLUSION SWITCH	EQUIP. WITH HOLD KEY
701B(MD)	No	No	No	No	No
701D(MD)	No	No	No	No	No
702B	Yes	No	No	No	No
702D	No	No	No	No	No
711B(MD)	Yes	Yes	Yes	Yes	No
712B	Yes	Yes	Yes	Yes	Yes
713B	No	No	No		Yes

**Note:** The following components are common to all 700-series PRINCESS telephone sets:

- Dial 8A
- Dial lamp, KS-19387 (GE259); order by KS number
- Dial lamp, socket, KS-19240, L2
- Handset, G3AR
- Handset cord, H4CJ

\* The last two digits of housing part number must be replaced by the code number which corresponds to the color desired; (i.e.,) P-81M258 white housing. See section covering telephone apparatus color.

**2.03** These sets are available in standard telephone colors. Refer to Section 500-120-100 for promoted and nonpromoted colors.

#### 701-TYPE TELEPHONE SET

**2.04** The 701-type telephone sets (Fig. 3) are rated Manufacture Discontinued (MD).

**2.05** The 701B and 701D telephone sets are not equipped with an internal ringer. When

a ringer is required, an E1-type external ringer may be used.

**2.06** The 701B sets are factory wired for individual line or 2-party flat rate service. Internal wiring changes must be made when other services are to be provided. See sections covering telephone set connections.

**2.07** 701B telephone sets may be used with the following services:

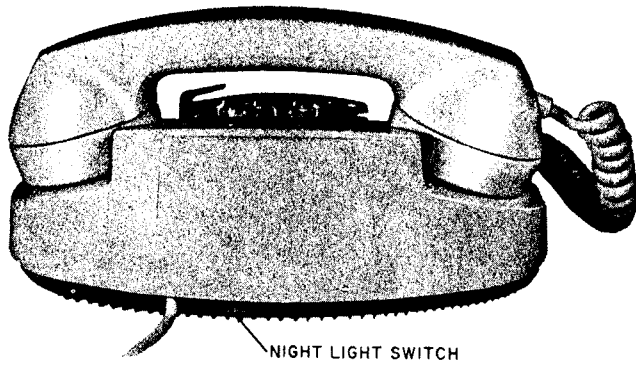


Fig. 2 — 700-Series Telephone Set, Rear View

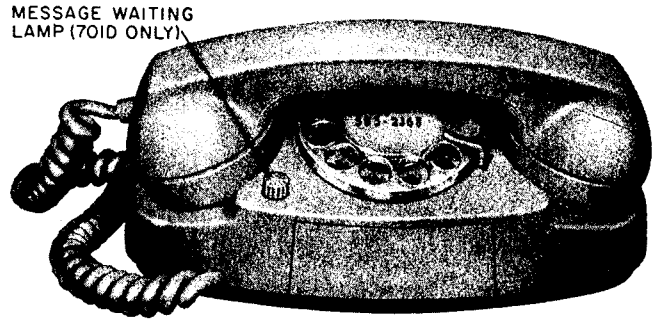


Fig. 3 — 701-Type Telephone Set

- 4-party selective and 8-party semiselective service
- 1A1 and 1A2 key telephone systems
- 3-type speakerphone system

2.08 The 701D telephone set is equipped with a message waiting lamp (see Fig. 3). This set is intended for use with PBX which provides message waiting feature.

**702-TYPE TELEPHONE SET**

2.09 The 702-type telephone sets (Fig. 4) are similar to the 701-type except that an internal ringer (M1A) is provided.

2.10 The 702B and 702D telephone sets replace the 701B and 701D sets, respectively.

**711B TELEPHONE SET**

2.11 The 711B telephone set is rated Manufacture Discontinued (MD).

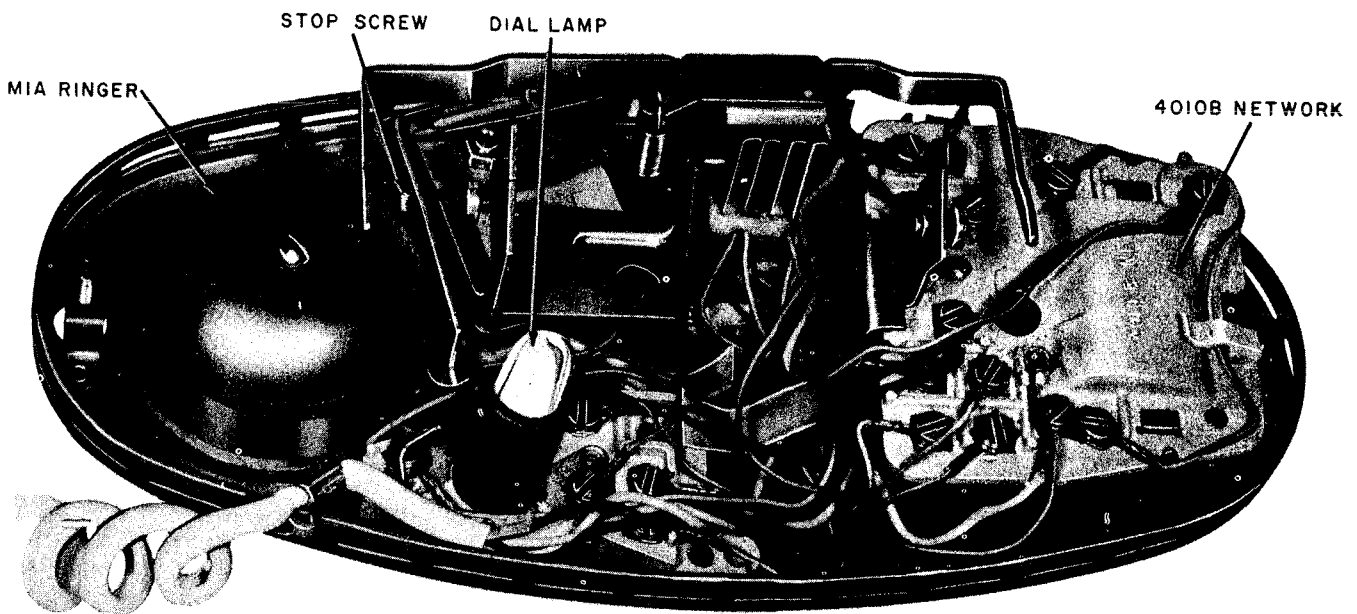


Fig. 4 — 702-Type Telephone Set, Dial and Housing Removed

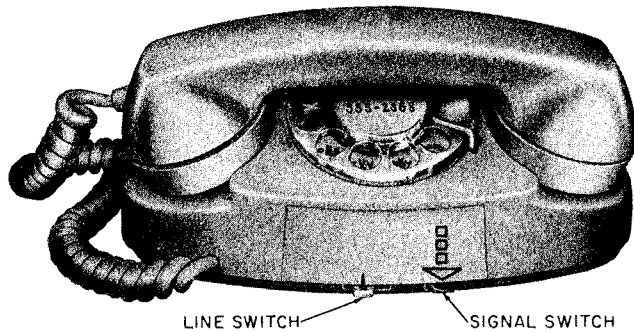


Fig. 5 — 711B (MD) Telephone Set

2.12 The 711B telephone set (Fig. 5) is not equipped with an internal ringer. When a ringer is required, an E1-type external ringer may be used.

2.13 The 711B telephone set is equipped with a slide switch for line selection and a switch (push-to-operate) for signaling.

2.14 This set is factory wired for 2-line pickup, exclusion, and signaling. The exclusion feature is operated by raising the left switch hook plunger.

2.15 This set may also be used with the following services:

- 1A HOME INTERPHONE system
- 2A FARM INTERPHONE system
- 3-type speakerphone system

2.16 This set is not equipped for "A" lead control and cannot be used with 1A1 or 1A2 key telephone systems.

#### 712B TELEPHONE SET

2.17 The 712B telephone set (Fig. 6) is not equipped with an internal ringer. When a ringer is required, an E1-type external ringer may be used.

2.18 This set is equipped with a 638A key for line selection and signaling. Line selection is accomplished by turning the key and signaling by depressing the key.

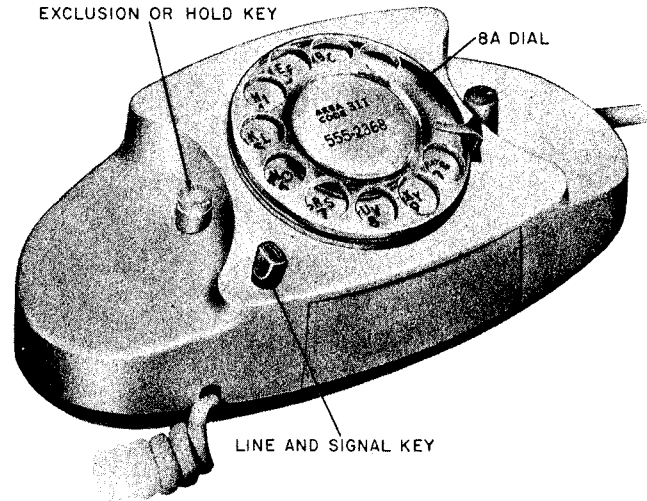


Fig. 6 — 712B Telephone Set — Without Handset

2.19 An exclusion or hold key is included and is operated by raising the left switch hook plunger.

2.20 The 712B telephone set is factory wired for 1A HOME INTERPHONE and is initially intended for use with the following services:

- 1A, 1A1, and 1A2 key telephone systems
- 2A FARM INTERPHONE system
- 3-type speakerphone system

#### 713B TELEPHONE SET

2.21 The 713B telephone set is not equipped with an internal ringer. When a ringer is required, an E1-type external ringer may be used.

2.22 The 713B telephone set is a 2-line set similar in appearance to the 712B telephone set. This set is equipped with a 638C key which permits selection of either of two CO lines and when used in conjunction with the hold key, permits mechanically holding the nonselected line. This is accomplished by manually raising the left-hand plunger before operating the turn key.

2.23 The 638C key has a pushbutton element for signaling which is furnished not wired,



but can be wired in by changing the mounting cord.

2.24 This set is initially intended for use with 2-line residential nonkey system use.

### 3. INSTALLATION

3.01 Insofar as possible, be guided by the customer's wishes in placing apparatus. Consider the following:

- Safety for yourself, customer, and maintenance personnel.
- Availability of power outlet for transformer.
- Location of telephone set so ringer volume is adequate for area.
- General appearance of installation.

### DIAL LIGHT TRANSFORMER

3.02 Select a 105-120 volt ac receptacle that is on a circuit not controlled by a switch. A 2012A transformer should be used with each telephone set. A 2A clamp is available to secure this transformer to the service outlet. For multiple installations, see section covering station transformers.

3.03 For proper illumination of the dial, the length of the wire between the transformer and the telephone set should not exceed 250 feet of standard inside wire. *Do not use a 25-foot mounting cord because of added resistance.*

### RINGER

3.04 When an external ringer is required, install an E1-type with each 701-, 711-, 712-, or 713-type telephone set (see Fig. 7).

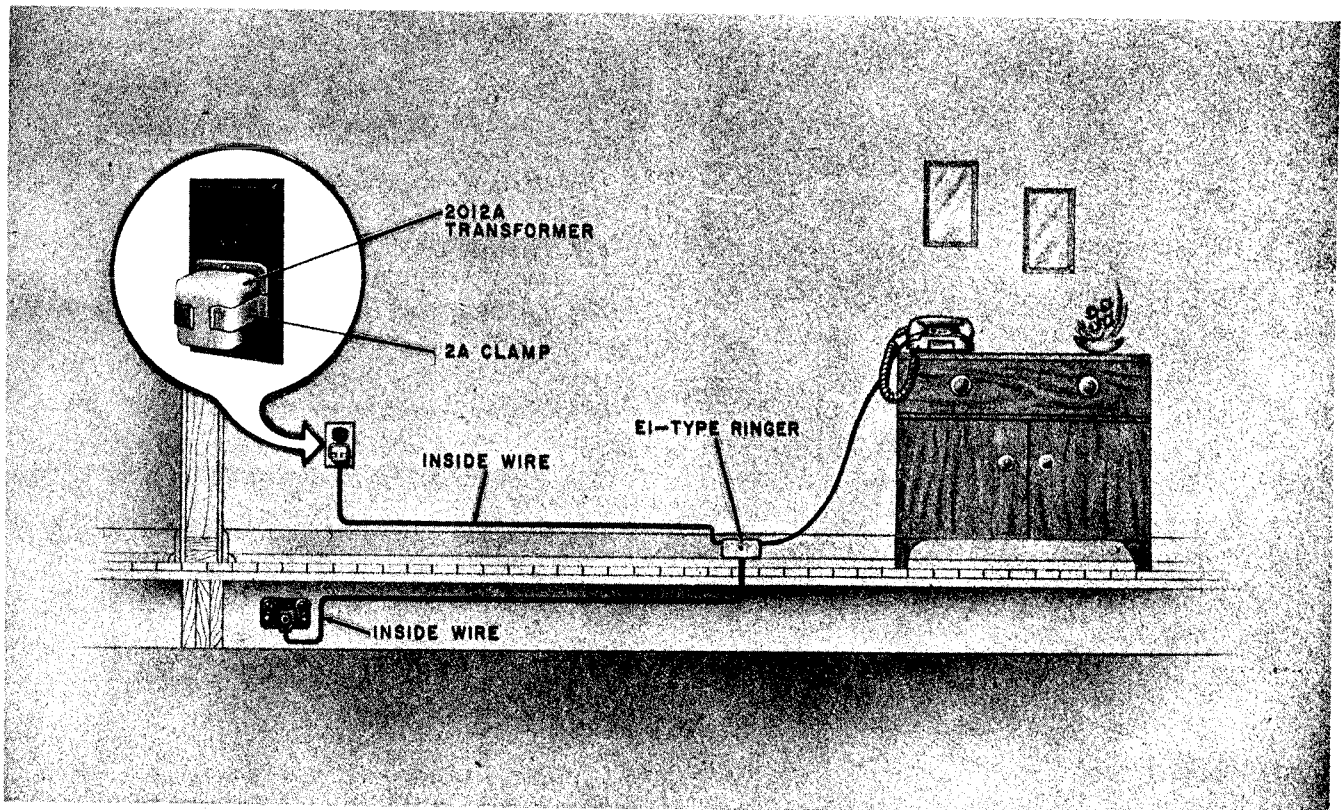


Fig. 7 — Typical Installation of 701-Type Telephone Set

## SECTION 502-710-101

**3.05** When no ringer is used, the mounting cord of a telephone set should be terminated on a connecting block or plug.

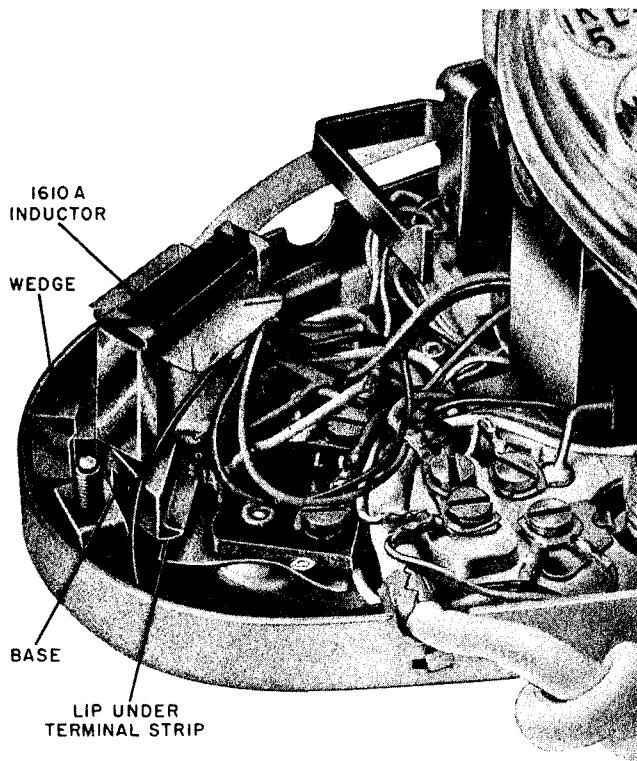
### INDUCTORS

**3.06** A 1610A or 1635A inductor must be installed in the base of the 701B telephone set when ringer is not used and tip party identification is required.

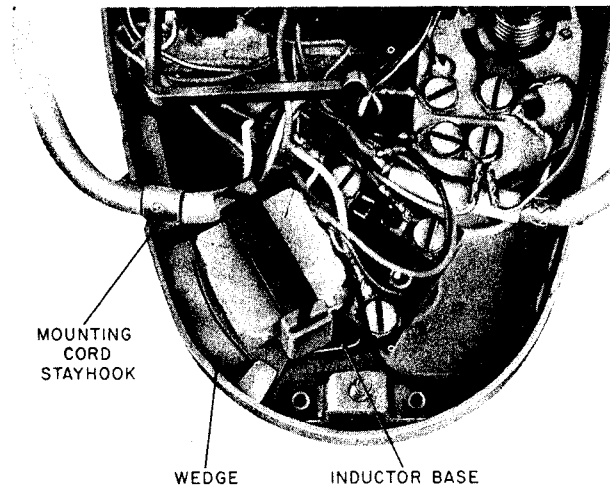
**3.07** The 1610A inductor has been replaced by the 1635A inductor to allow space for the P-15E719 weight when required.

**3.08** Install the 1610A inductor (ordered separately) as follows:

- (1) Remove housing from telephone set.
- (2) Loosen dial and mounting cord stay hook, lay aside.
- (3) Install inductor as shown in Fig. 8 and 9.



**Fig. 8 — Location of 1610A Inductor**



**Fig. 9 — Top View, Location of Wedge**

- (4) Insert wedge in position (Fig. 9).
- (5) Connect inductor between terminals B of network and 3 of terminal board.
- (6) Replace mounting cord stay hook, dial, and housing.

**3.09** Install the 1635A inductor (ordered separately) as follows:

- (1) Remove housing from telephone set.
- (2) Loosen dial and lay it aside.
- (3) Remove left screw from dial mounting bracket.
- (4) Install inductor as shown in Fig. 10.
- (5) Replace screw in dial mounting bracket.
- (6) Connect inductor between terminals B of network and 3 of terminal board.
- (7) Replace dial and housing.

### D-179924 KIT OF PARTS

**3.10** A D-179924 Kit of Parts containing a weight, spring, and insulator is available to reduce sliding while dialing the 701-type telephone set placed on a highly polished surface.

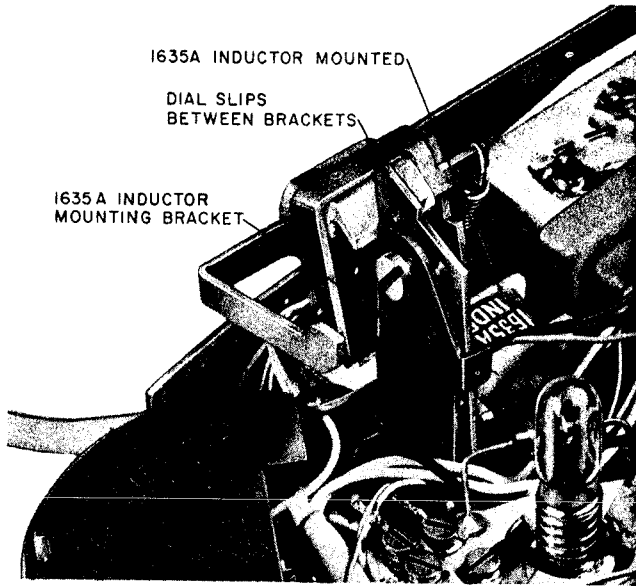


Fig. 10 — 1635A Inductor Mounted in 701B Telephone Set

### 3.11 Install D-179924 Kit of Parts as follows:

- (1) Remove telephone set housing.
- (2) Dress all leads to prevent wiring from being caught between weight and base of set.
- (3) Install P-25E307 insulator as shown in Fig. 11.
- (4) Install P-15E719 weight and P-24E510 spring retainer as shown in Fig. 12.
- (5) Replace telephone set housing.

### COLD-CATHODE TUBE

3.12 If 4-party selective or 8-party semiselective service is desired, a 425A or 426A cold-cathode tube may be ordered and installed in base of 701B or 702B telephone set as follows (see Fig. 13):

- (1) Remove telephone set housing.
- (2) Remove dial.
- (3) Remove and discard the mounting screw furnished as part of the electron tube.

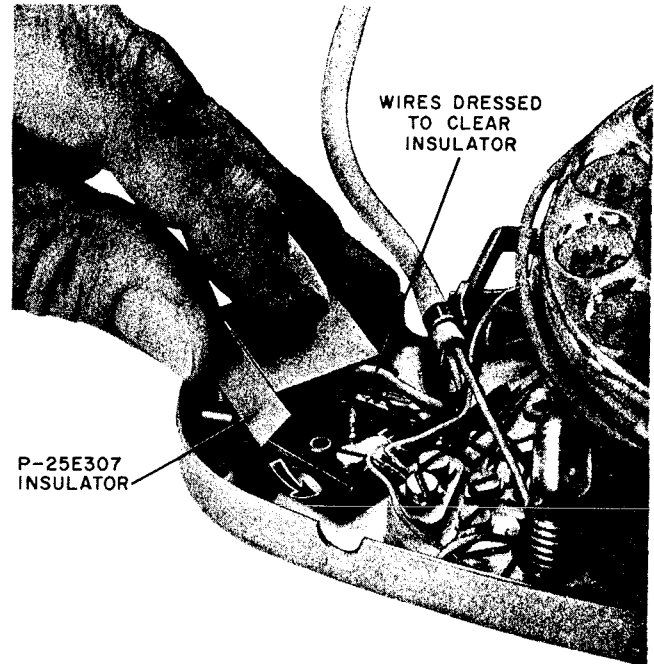


Fig. 11 — Placing Insulator Over Terminal

- (4) Install and connect tube as shown in Sections 502-710-400 and 402-710-403.
- (5) Replace dial and housing.

3.13 If the 711-, 712-, and 713-type telephone sets are to be used with 4-party selective or 8-party semiselective ringing, it is necessary to mount the 425A or 426A tube in a subscriber set.

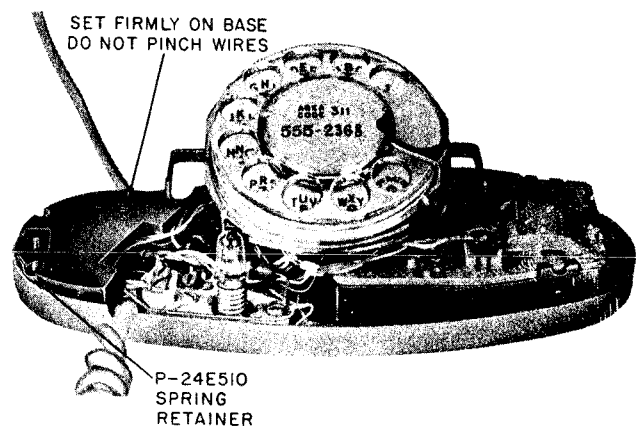


Fig. 12 — Location of P-24E510 Spring Retainer and P-15E719 Weight

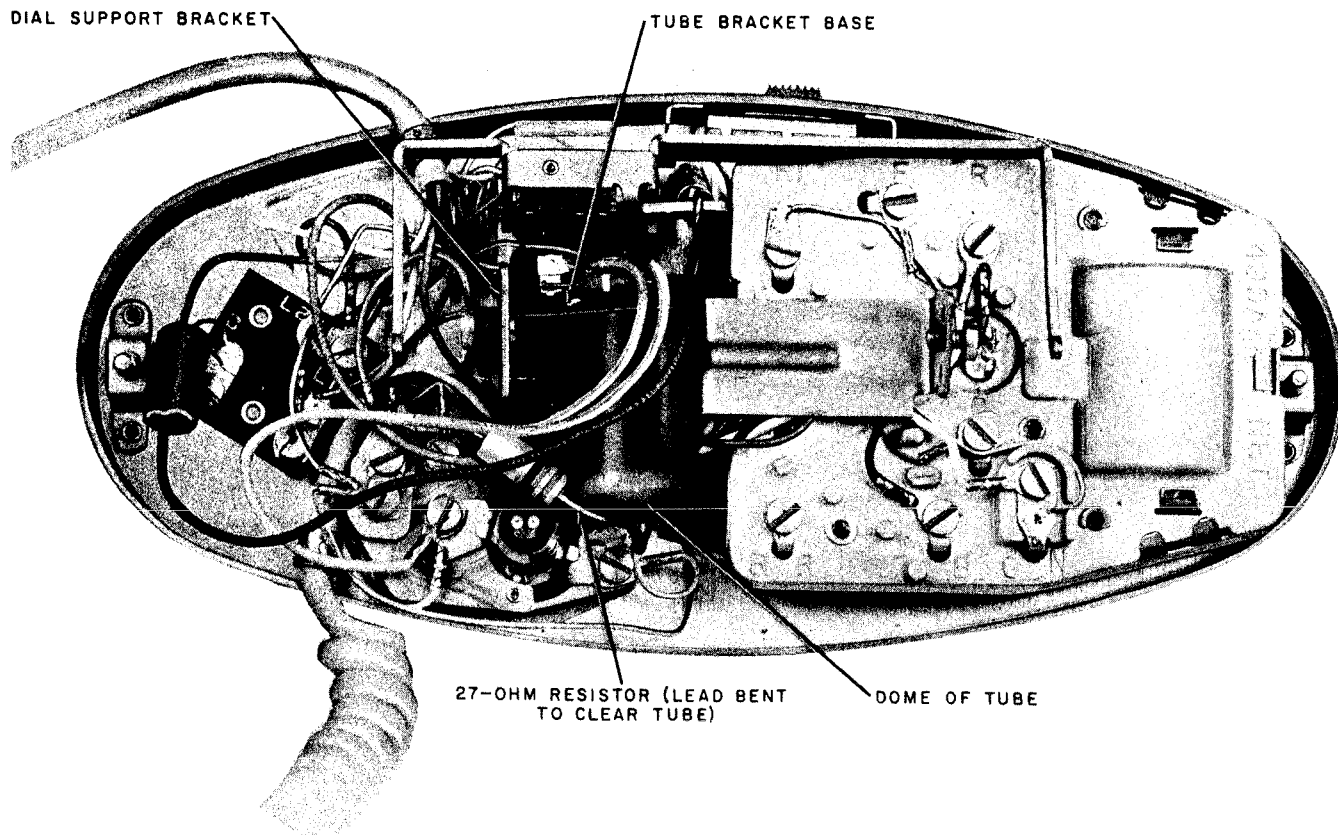


Fig. 13 — Location of Cold-Cathode Tube in 701B Telephone Set

**PORTABLE INSTALLATION**

3.14 Jacks and plugs are available for portable installation of these telephone sets. Refer to Sections 461-630-100 and 461-630-101, respectively, for selection of appropriate types.

**4. MAINTENANCE**

4.01 Maintenance of the 700-series PRINCESS telephone sets is limited to replacing defec-

tive components (Table A) and burnishing or adjusting switch hook contacts.

4.02 Refer to sections covering dials, handsets, cords, ringers, networks, line keys, etc., for maintenance of these components.

4.03 Housings, dial plates, and handsets may be cleaned with a damp KS-2423 cloth. *Do not use scouring cleaners or colored components as this may damage finish.*

## TELEPHONE SETS

### 2702, 2712, AND 2713 TYPES

#### IDENTIFICATION, INSTALLATION AND MAINTENANCE

#### 1. GENERAL

1.01 This section covers PRINCESS® telephone sets equipped with 12-button TOUCH-TONE® dials (Fig. 1, 2, and 3).

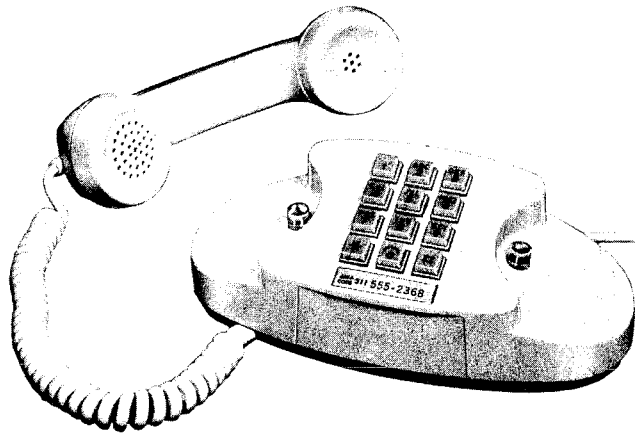


Fig. 1 — 2702B Telephone Set

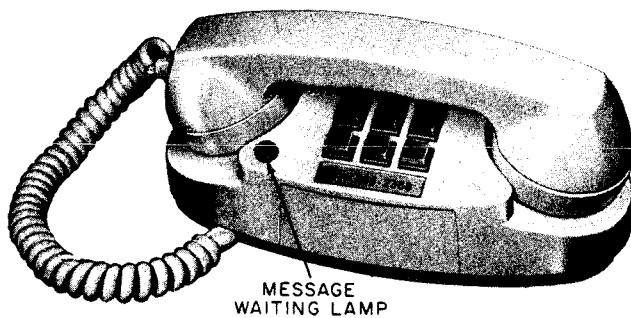


Fig. 2 — 2702D Telephone Set

#### 2. IDENTIFICATION

##### PURPOSE AND APPLICATION

- 2702B — individual or 2-party flat rate service (CO or key telephone system lines)
- 2702D — message waiting indication (PBX)
- 2712B — 2-line pickup (CO or key telephone systems), hold on one CO line
- 2713B — 2-line pickup, hold on both lines (CO-nonkey system)

##### FEATURES

- Set design features are shown in Table A.
- Optional set features are shown in Table B.

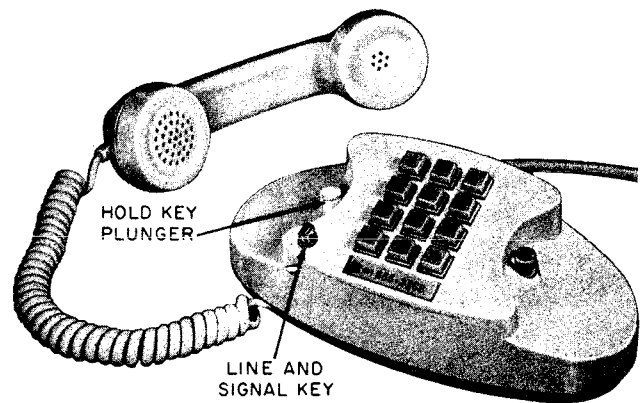


Fig. 3 — 2712B or 2713B Telephone Set

**TABLE A**  
**DESIGN FEATURES**

SET	DIAL/ NIGHT LAMP	MESSAGE WAITING LAMP	RINGER VOLUME/OFF- CONTROL	CO AND 1A KEY TELEPHONE SYSTEM LINES		
				INDIVIDUAL OR 2-PARTY FLAT RATE SERVICE	2-LINE PICKUP	2-LINE PICKUP WITH HOLD (CO LINES ONLY)
2702B	•		•	•		
2702D	•	•	•	•		
2712B	•		*	•	•†	
2713B	•		*	•	•	•

\* Not equipped with internal ringer.

† Shop wired to provide hold on one CO line (for use with 1A home interphone).

**TABLE B**  
**OPTIONAL FEATURES**

SET	1A1 OR 1A2 KEY TELEPHONE SYSTEM (WITHOUT HOLD)		1A HOME INTERPHONE	2A FARM INTERPHONE	3-TYPE SPEAKERPHONE	EXCLUSION OR RINGER/ EXTENSION CUTOFF	SIGNALING
	1-LINE PICKUP	2-LINE PICKUP					
2702B	•				•		
2712B		•	•	•	•	•	•
2713B							*

\* Change mounting cord to provide signal leads.

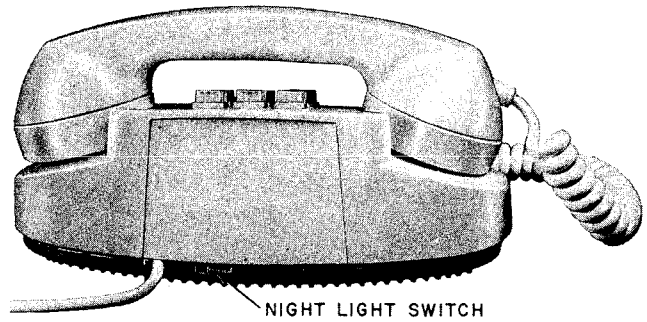
**COLOR**

These sets are available in all standard colors. Refer to Section 500-120-100 for promoted colors.

- **Night light switch:** allows dial lamp to be operated at reduced intensity (dial lamp illuminates dial at full intensity with handset off-hook) (Fig. 4).

**OPERATING FEATURES**

- **Message waiting lamp:** 2702D set — visual signal, under control of a PBX attendant, indicates an uncompleted incoming call (Fig. 2).
- **Line and signal key:** 2712B and 2713B sets — permits line selection by turning, signaling by depressing (Fig. 3 and 6).
- **Hold key plunger:** 2712B set — provides for mechanical hold on one CO line; 2713B set — provides for mechanical hold on either nonselected CO line (Fig. 3).



**Fig. 4 — 2700 Series Telephone Set, Rear — Night Light Switch Location**

**ORDERING GUIDE**

Set, Telephone, 2702B-\*  
Set, Telephone, 2702D-\*

Set, Telephone, 2712B-\*

Set, Telephone, 2713B-\*

\* Add appropriate color suffix.

**TABLE C**  
**COMPONENT ORDERING GUIDE**

COMPONENT	TELEPHONE SET			
	2702B	2702D	2712B	2713B
<b>REPLACEABLE:</b>				
Cord, Handset	H4CJ-*			
Cord, Mounting	D5AK-*	D5AK-*	D14L-*	D6AF-*
Dial	35E4A			
Housing and Plunger Assembly	P-84D8-*	P-85H0-*	P-84D9-*	
Key, Line			638B	638D
Lamp, Dial	KS-19387, L1†			
Lamp, Message Waiting		KS-16893, L1		
Retainer, Number Card	P-25E803			
Ringer	M1A			
Set, Hand	G3AR-*			
Socket, Dial Lamp	KS-19240, L2†			
<b>OPTIONAL:</b>				
Kit of Parts (Polarity Guard)	D-180229‡			
Transmitter			664C§	
<b>ASSOCIATED:</b>				
Transformer (Dial Lamp)	2012A (or equivalent)			
Transformer (Interphone Power)			2012A§	
Unit, Control			51A§	

\* Add appropriate color suffix.

† Available as D-179919 kit of parts (containing dial lamp, socket and installation instructions).

‡ Consists of P-90D054 guard assembly, P-21F675 terminal board assembly, P-26E164 retainer, and P-43A392 screw. The P-90D054 guard assembly may be ordered separately for 2702D sets and 2712B sets equipped with 664C transmitter.

§ For use with 1A home interphone.

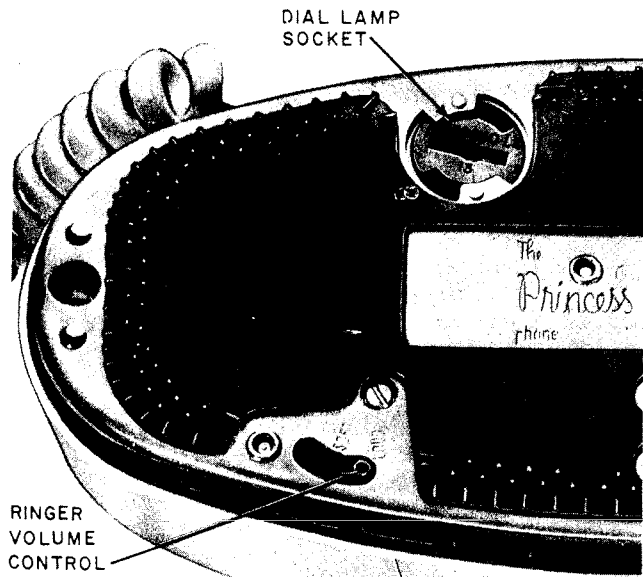


Fig. 5—PRINCESS Telephone Set, Partial Bottom View

- **Ringer volume control:** provides manual control of ringer volume (Fig. 5).

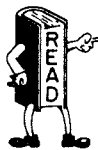
### 3. INSTALLATION

#### 3.01 Planning

(a) Insofar as possible be guided by the customer's wishes in placing apparatus. Consider the following:

- Safety for yourself, customer, and maintenance personnel.
- Availability of power outlet for dial lamp transformer.
- Location of telephone to provide adequate ringer coverage of area.
- General appearance of installation.

(b) Select a 105-120 volt ac receptacle on a circuit not controlled by a switch for dial lamp transformer. A 2A clamp is available to secure the 2012A transformer to the service outlet. For multiplied dial lamp sets, see section covering station transformers for selection information.



*For proper illumination of the dial, the wire run between transformer and telephone set should not exceed 250 feet of standard inside wire. Do not use a 25-foot mounting cord because the added resistance may result in decreased illumination.*

#### 3.02 Installing

(a) **Normal installation** — in accordance with standard practices for desk-type telephone sets.

(b) **Portable installation** — refer to appropriate section in Division 461 for selection of appropriate jacks and plugs for these sets.

(c) **External ringer** — install an E1-type ringer, when required, for 2712- or 2713-type telephone sets.

(d) **664C transmitter** (2712B set — optional) — refer to appropriate connection and maintenance section in Division 512 (1A home interphone).

(e) **Polarity guard (optional)** — install the D-180229 Kit of Parts as follows:

- (1) Remove housing; loosen dial mounting screws and move the dial to one side without disconnecting the dial leads.
- (2) Insert the P-26E164 retainer in left-hand dial mounting bracket (Fig. 7).
- (3) Insert tabs of P-21F675 terminal board into notches in right-hand dial mounting bracket and secure to retainer using P-43A392 screw.
- (4) Connect polarity guard in accordance with connections shown in appropriate connection section.
- (5) Reinstall dial on mounting bracket, securing the P-90D054 guard assembly mounting bracket under the right-hand dial mounting screw (Fig. 8).
- (6) Reinstall housing.

**Note:** The P-21F675 terminal board and P-26E164 retainer, furnished with D-180229 Kit of Parts, are not used in sets equipped with message waiting lamp or home interphone transmitter (2702D and 2712B sets). The 2702D set has spare terminals 3 and 4



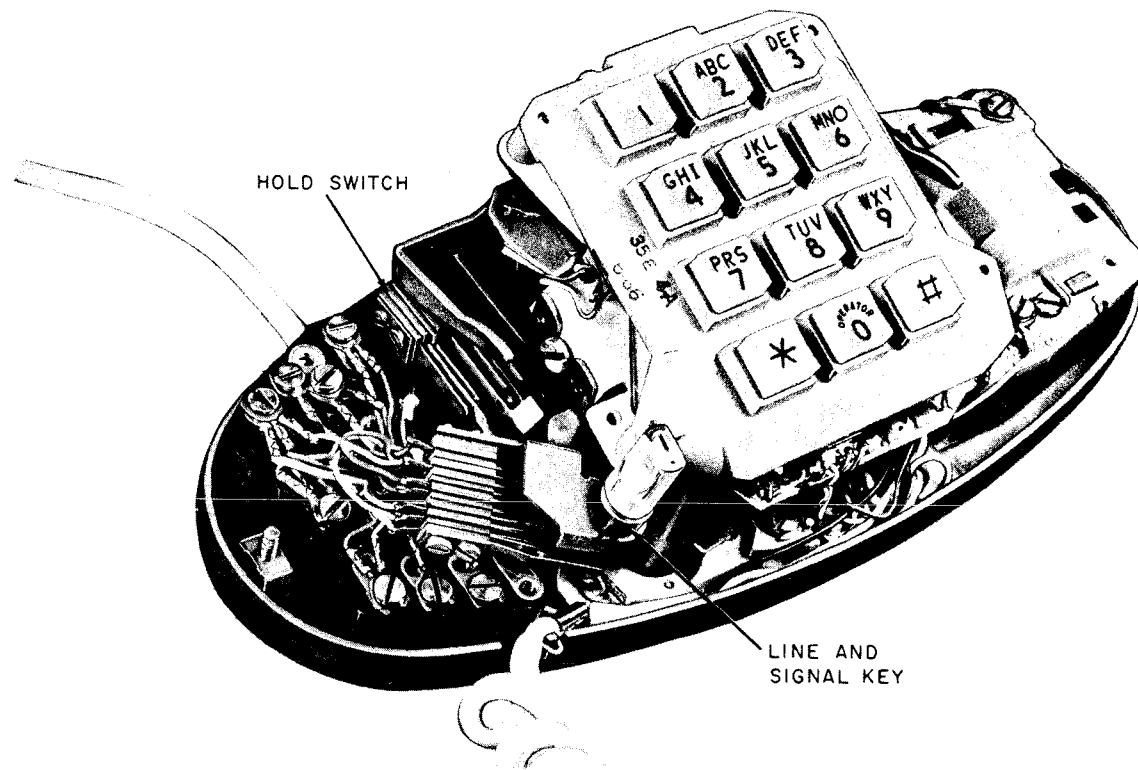


Fig. 6 — 2713B Telephone Set, Housing Removed (2712B set is similar in appearance)

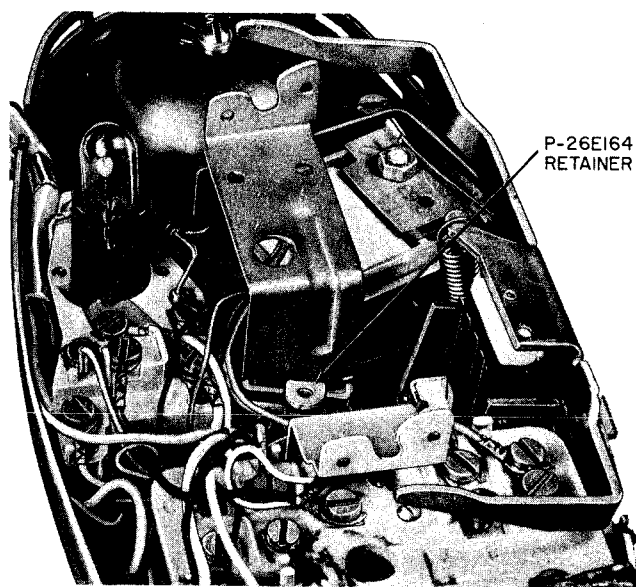


Fig. 7 — Installing Terminal Board Retainer in PRINCESS Telephone Set

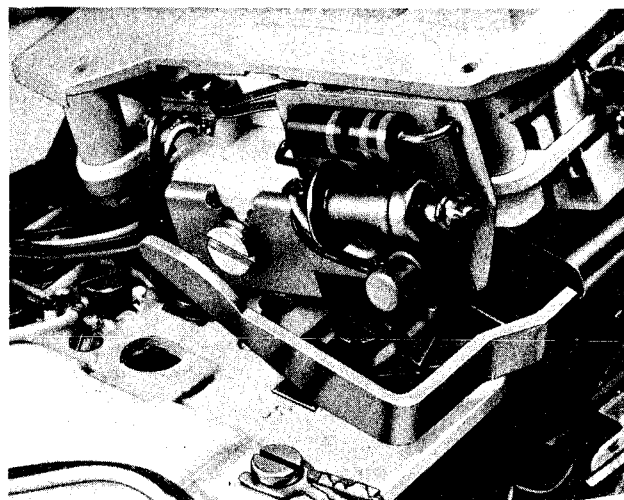


Fig. 8 — Polarity Guard Mounted in PRINCESS Telephone Set

on the message waiting lamp terminal board to facilitate connecting the polarity guard (Fig. 9). Use D-161488 connectors (2) to connect polarity guard in 2712B sets equipped with home interphone transmitter.

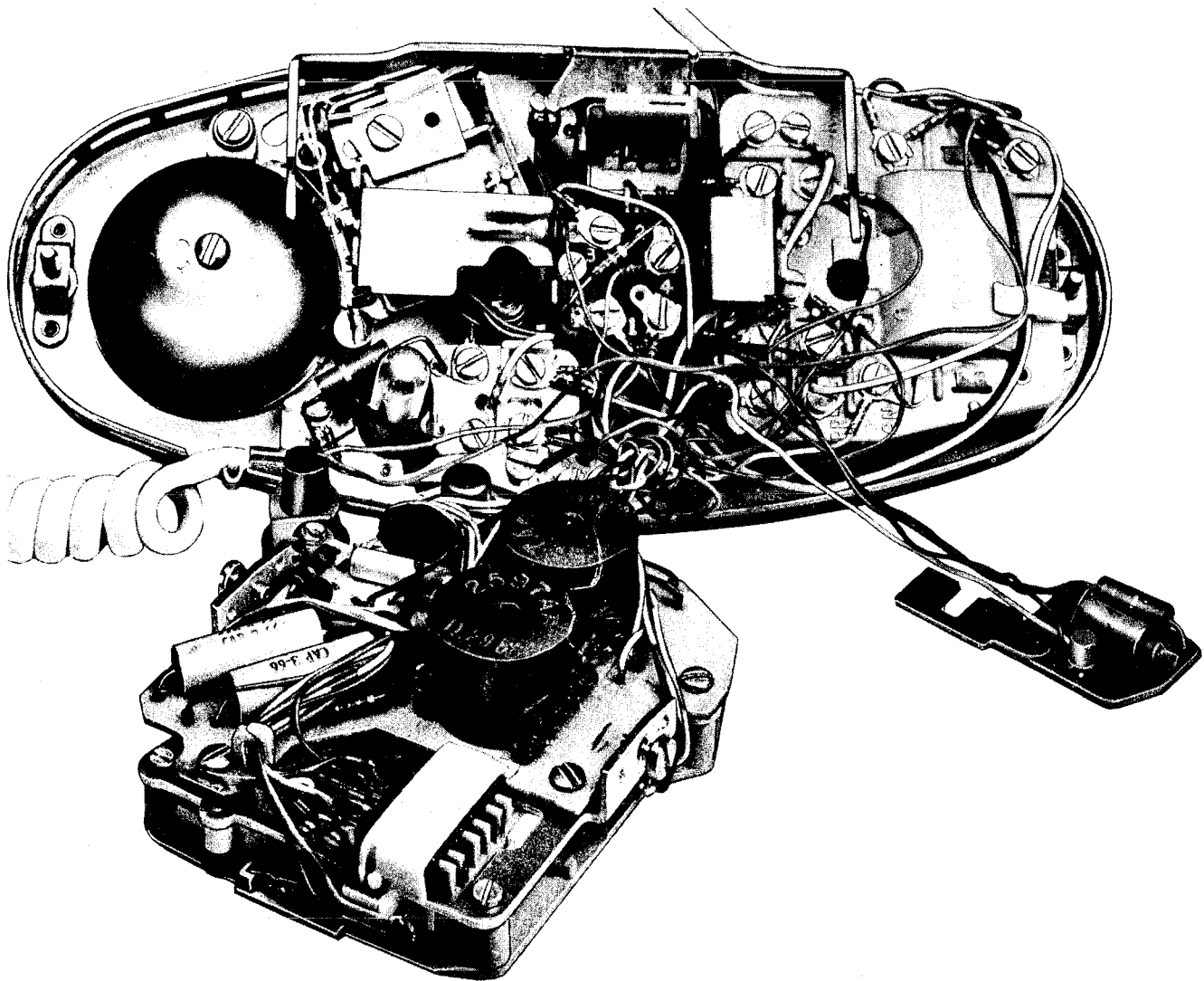
**4. MAINTENANCE**

**4.01** Maintenance of the 2700-type telephone sets is limited to replacing defective com-

ponents and burnishing or adjusting switch contacts.

**4.02** Housings, handsets, and cords may be cleaned with a damp KS-2423 (or equivalent) cloth. *Do not use scouring cleaners or volatile solvents as these may damage finish.*

**4.03** Refer to sections covering dials, handsets, cords, ringers, etc., for maintenance of these components.



**Fig. 9 — Polarity Guard Installation in 2702D Telephone Set**

## TELEPHONE SETS—701B

### CONNECTIONS

#### 1. GENERAL

1.01 This section is reissued to:

- Show 701B telephone set MD.
- Include connection modifications which will prevent false billing due to incomplete hangup.
- Delete connections for the 425A cold-cathode tube. This information is covered in the section on inductive noise.
- Delete connections for 3-type speakerphone option. Refer to Division 512 for speakerphone connections.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.02 For tip party identification when no ringer is used, install a 1610A or 1635A inductor in telephone set. For information on installation of inductor, see identification and installation section for 701-type telephone sets.

1.03 To convert the 701B (MD) telephone set from dial to manual, move the (S-W) lead from terminal F of network to terminal RR. The dial remains on the set.



*The dial light transformer can be damaged by lightening if a sufficient difference in ground potential occurs between telephone plant and power system. Be sure that telephone and power grounds are bonded in accordance with section on protector and signaling grounds.*

1.04 To prevent false billing due to incomplete hangup when tip party identification ground

is used, the set connections are modified by placing the identifying ground under control of the d and e switch hook contacts (see Table D and Fig. 4).

#### 2. CONNECTION INDEX

Table A—Connections For Bridged or Ring Party Service When Using Telephone Set Without Ringer

Table B—Connections For Tip Party Service When Using Telephone Set Without Ringer

Table C—Line and Ringer Connections With E1C or E1A (MD) Ringer

Table D—Connections of Telephone Set and E1C or E1A (MD) Ringer for Tip Party Identification Ground

Table E—Connections With F1A Ringer

Table F—4-Party Selective and 8-Party Semiselective Service

Fig. 1—701B (MD) Telephone Set Without Ringer or As A Portable Installation

Fig. 2—Schematic For 1610A or 1635A Inductor

Fig. 3—Connections For Bridged, Ring, or Tip Party Service

Fig. 4—701B Telephone Set With E1C or E1A (MD) Ringer Connections For Tip Party Identification Ground

Fig. 5—701B (MD) Telephone Set With 426A Cold-Cathode Tube

Fig. 6—701B (MD) Telephone Set Wired For 1A1 and 1A2 Key Telephone Systems

SECTION 502-710-400

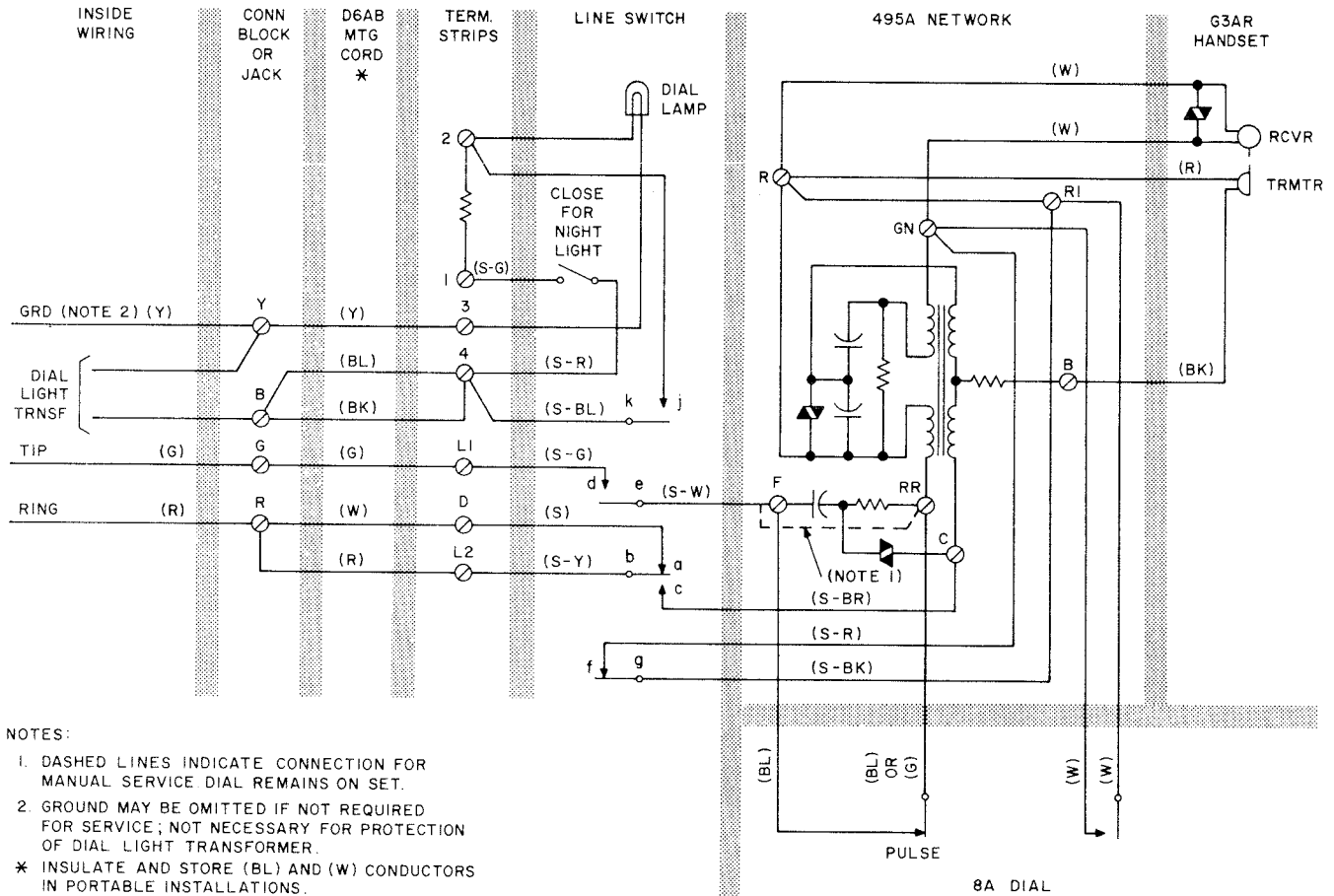
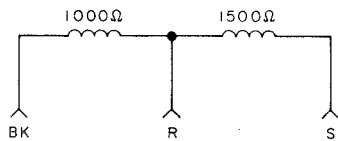


Fig. 1—701B (MD) Telephone Set Without Ringer or As A Portable Installation

**TABLE A**  
**CONNECTIONS FOR BRIDGED OR RING PARTY**  
**SERVICE WHEN USING TELEPHONE SET**  
**WITHOUT RINGER**

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY
Line Wire at Conn Block	Ring	R	R	R
	Tip	G	G	G
	Grd	Y	Y	Y
Trnsf Leads at Conn Block		Y	Y	Y
		BK	B	B
Mtg Cord at Conn Block		R	R	R
		G	G	G
		Y	Y	Y
		BL	B	B
		W	R	R
Mtg Cord at Set		BK	B	B
		R	L2	L2
		G	L1	L1
		Y	3	3
		BL	4	4
		W	D	D
		BK	4	4



**Fig. 2—Schematic For 1610A or 1635A Inductor**

**TABLE B**  
**CONNECTIONS FOR TIP PARTY SERVICE WHEN**  
**USING TELEPHONE SET WITHOUT RINGER**

WIRE OR LEAD		COLOR	TIP PARTY	TIP PARTY WITH IDENT GRD	
				1000Ω	2500Ω
Line Wire at Conn Block	Ring	R	R	R	R
	Tip	G	G	G	G
	Grd	Y	Y	Y	Y
Trnsf Leads at Conn Block		Y	Y	Y	Y
		BK	B	B	B
Mtg Cord at Conn Block		R	R	G	G
		G	G	R	R
		Y	Y	Y	Y
		BL	B	B	B
		W	R	G	G
Mtg Cord at Set		BK	B	B	B
		R	L2	L2	L2
		G	L1	C†	C†
		Y	3	3	3
		BL	4	4	4
		W	D	D	D
		BK	4	4	4
Inductor Leads at Set		BK		3	3
		R		L1	*
		S		L1	L1
Switch Hook Assembly		S-W	F†	B†	B†
		S-BR	C†	F†	F†
		S-G	L1	L1	L1

\* Insulate and store.

† Terminal on network.

- Notes:**
1. Connections include modifications to prevent false billing due to incomplete hangup.
  2. When connecting the D6AB mounting cord leads for tip party identifying ground use D-161488 connectors and M1W straps as required to extend conductor leads.



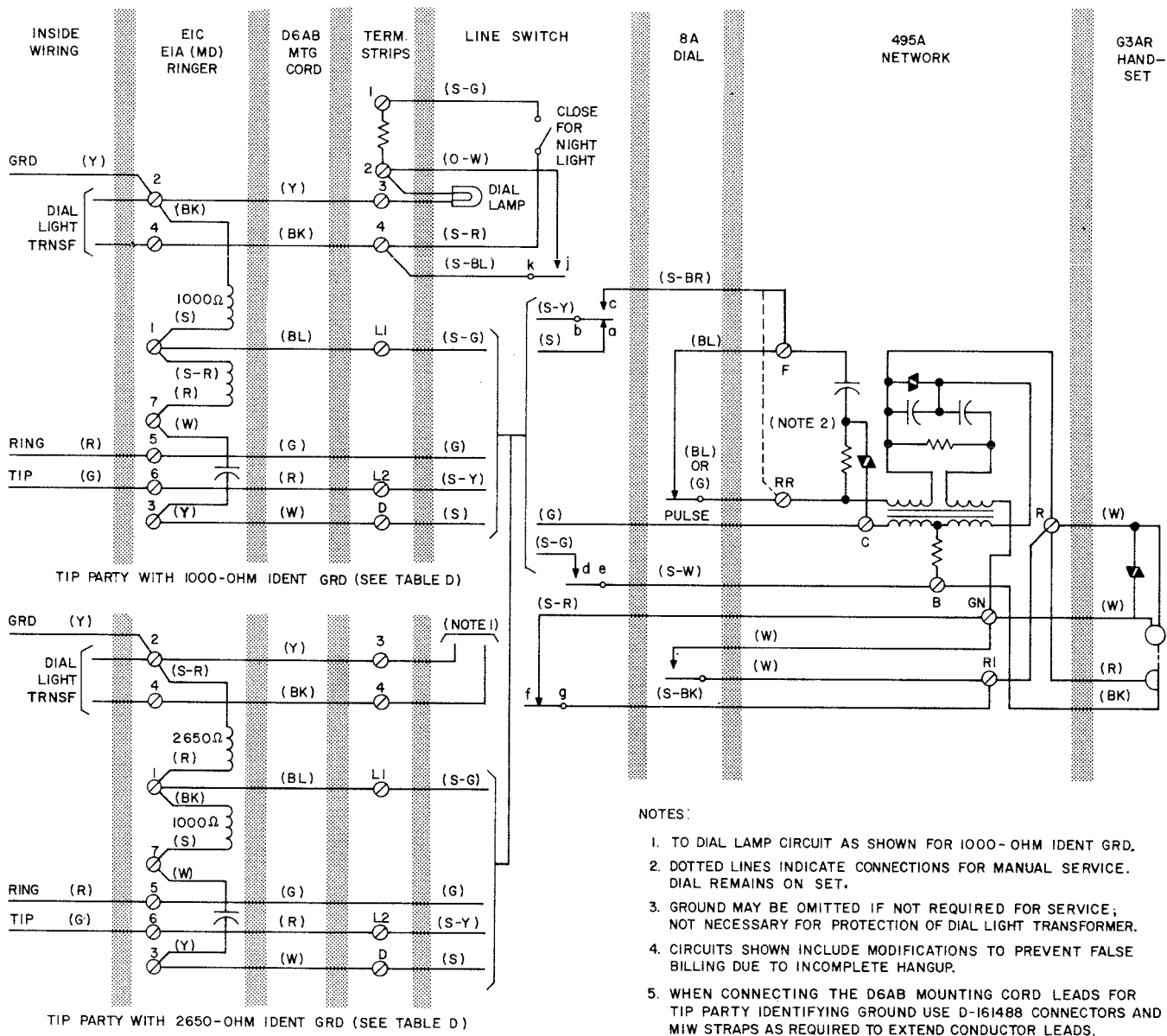


Fig. 4—701B (MD) Telephone Set With E1C or E1A (MD) Ringer Connections For Tip Party Identification Ground

**TABLE C**  
**LINE AND RINGER CONNECTIONS WITH**  
**E1C OR E1A(MD) RINGER**

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY	TIP PARTY
Line or Ringer	Ring	R	5	5	5
	Tip	G	6	6	6
	Grd	Y	2	2	2
Ringer	R	R	7	7	7
	S-R	S-R	1	1	1
	BK	BK	6	2	2
	S	S	1	1	1
Capacitor in Ringer	W	W	7	7	7
	Y	Y	5	3	3
Trnsf Leads	Y	Y	2	2	2
	BK	BK	4	4	4
Mtg Cord at Ringer	R	R	5	5	6
	G	G	6	6	5
	Y	Y	2	2	2
	BL	BL	4	4	4
	W	W	3	3	3
	BK	BK	4	4	4
Mtg Cord at Set	R	R	L2	L2	L2
	G	G	L1	L1	L1
	Y	Y	3	3	3
	BL	BL	4	4	4
	W	W	D	D	D
BK	BK	4	4	4	

**TABLE D**  
**CONNECTIONS OF TELEPHONE SET AND**  
**E1C AND E1A(MD) RINGER FOR TIP PARTY**  
**IDENTIFICATION GROUND**

WIRE OR LEAD		COLOR	TIP PARTY WITH IDENT GRD	
			1000Ω	2650Ω
Line at Ringer	Ring	R	5	5
	Tip	G	6	6
	Grd	Y	2	2
Ringer	R	R	7	1
	S-R	S-R	1	2
	BK	BK	2	1
	S	S	1	7
Capacitor in Ringer	W	W	7	7
	Y	Y	3	3
Trnsf Leads	Y	Y	2	2
	BK	BK	4	4
Mtg Cord at Ringer	R	R	6	6
	G	G	5	5
	Y	Y	2	2
	BL	BL	1	1
	W	W	3	3
	BK	BK	4	4
Mtg Cord at Set	R	R	L2	L2
	G	G	C*	C*
	Y	Y	3	3
	BL	BL	L1	L1
	W	W	D	D
	BK	BK	4	4
Switch Hook Assembly	S-BR	S-BR	F*	F*
	S-G	S-G	L1	L1
	S-W	S-W	B*	B*

\* Terminal on network.



**TABLE E**  
**CONNECTIONS WITH F1A RINGER**

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY	TIP PARTY	TIP PARTY WITH IDENTIFYING GROUND (NOTE 2)		
						1000Ω	2650Ω	
F1A Ringer Term.	Line	Ring	R	6	6	1	1	
		Tip	G	4	1	6	5	
		Grd	Y	1	4	4	4	
	Ringer Coil		R	7	7	7	7	2
			S-R	2	2	2	2	4
			BK	4	4	4	4	2
			S	2	2	2	2	7
	Network Straps	G	BL	4	4	4	4	4
		A	R	7	7	7	7	7
		B	G	6	6	6	6	6
	Dial Light Trans		1	1	4	4	4	4
			2	3	3	3	3	3
	Mtg Cord		R	6	6	6	5	5
			G	4	1	1	1	1
			Y	1	4	4	4	4
			BL	3	3	3	2	2
			W	5	5	5	6	6
		BK	3	3	3	3	3	
Set Term.	Mtg Cord	R	L2	L2	L2	L2	L2	
		G	L1	L1	L1	C*	C*	
		Y	3	3	3	3	3	
		BL	4	4	4	L1	L1	
		W	D	D	D	D	D	
		BK	4	4	4	4	4	
	Switch Hook Assembly	S-BR	C*	C*	C*	F*	F*	
		S-G	L1	L1	L1	L1	L1	
	S-W	F*	F*	F*	B*	B*		

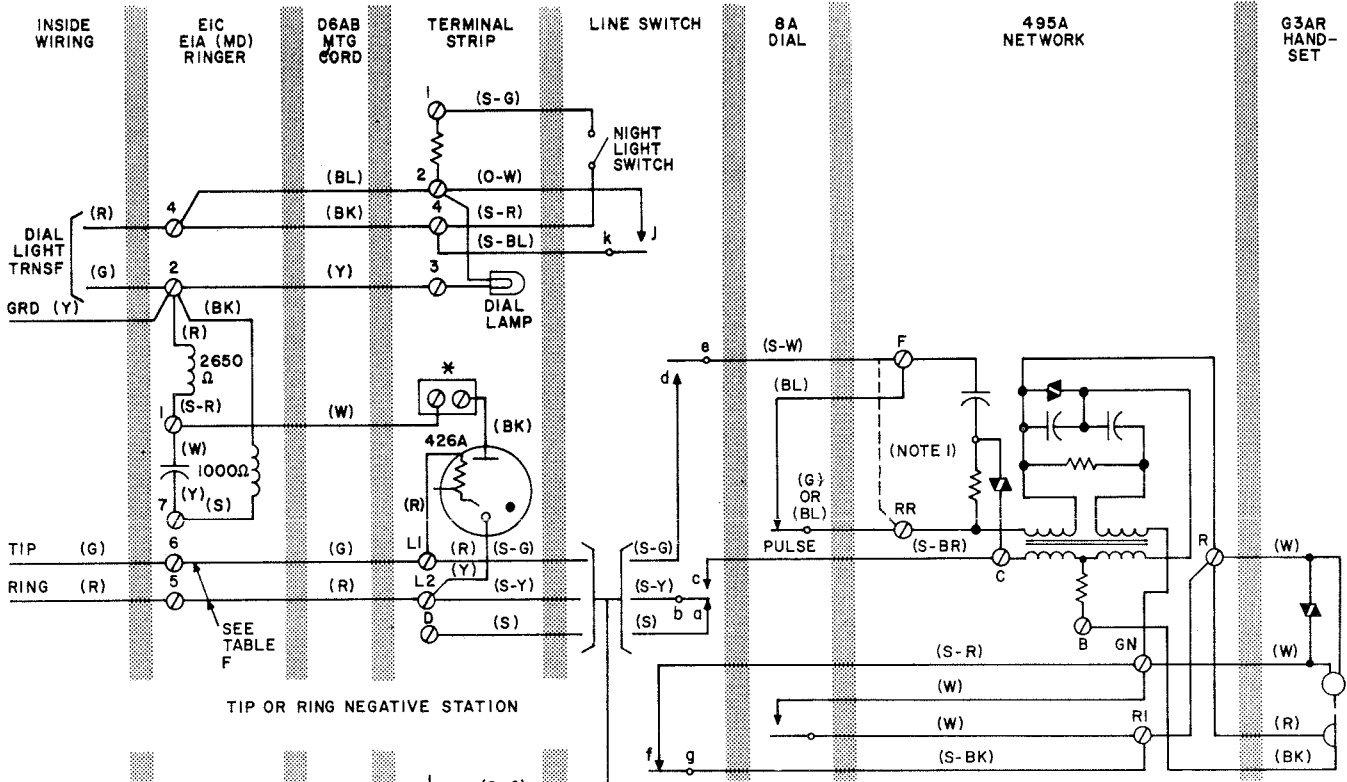


*The F1A ringer is not intended to be used with 4-party selective or 8-party semiselective service, or any other service where code ringing would not be distinguishable in CHIME position. For schematic drawing and maintenance information on F1A ringer, see section on the F1A ringer.*

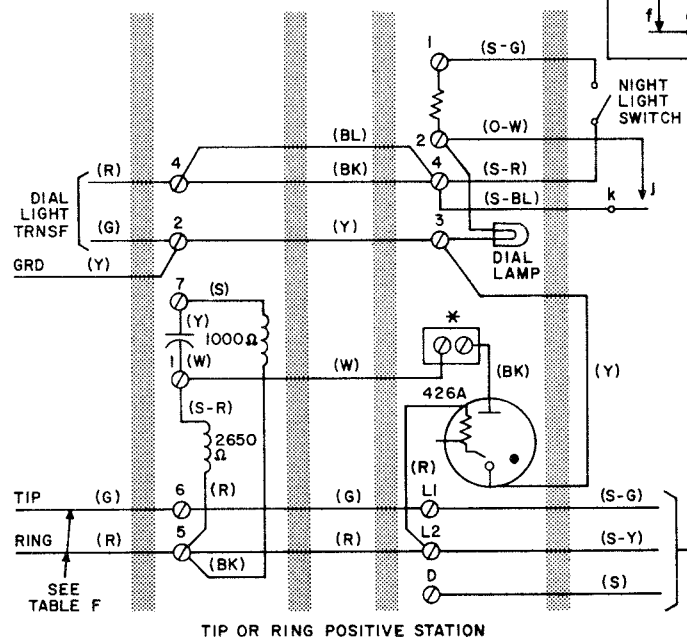
- Notes:**
1. Ringer wired at factory for individual or bridged, ring, and tip party service.
  2. Connections include modification to prevent false billing due to incomplete hangup.
  3. When connecting the D6AB mounting cord leads for tip party identifying ground use D-161488 connectors and M1W straps as required to extend conductor leads.

\* Terminals on network of telephone set.

SECTION 502-710-400



TIP OR RING NEGATIVE STATION



TIP OR RING POSITIVE STATION

NOTES:

1. DOTTED LINES INDICATE CONNECTIONS FOR MANUAL SERVICE. DIAL REMAINS ON SET.
2. FOR NEGATIVE STATIONS IN OFFICES WITHOUT ANI, (R) LEAD FROM 426A TUBE MAY BE CONNECTED TO (G) IF RINGER OPERATION IS MARGINAL.
- \* REMOVE W LEAD FROM D PUNCHING IN SET AND CONNECT TO BK TUBE LEAD USING D-161488 CONNECTOR.

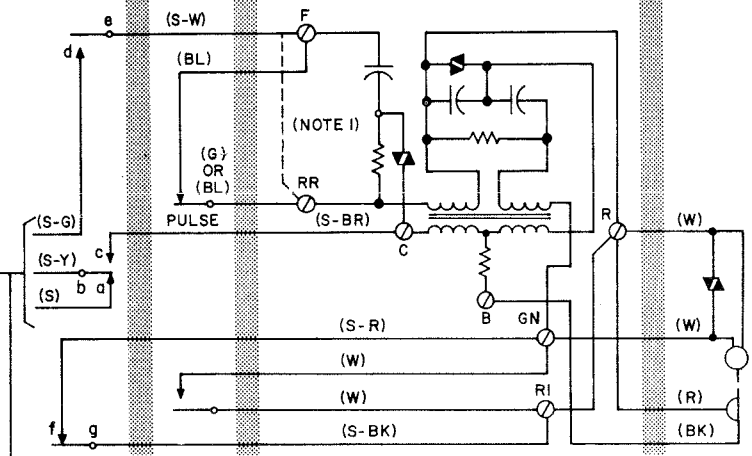
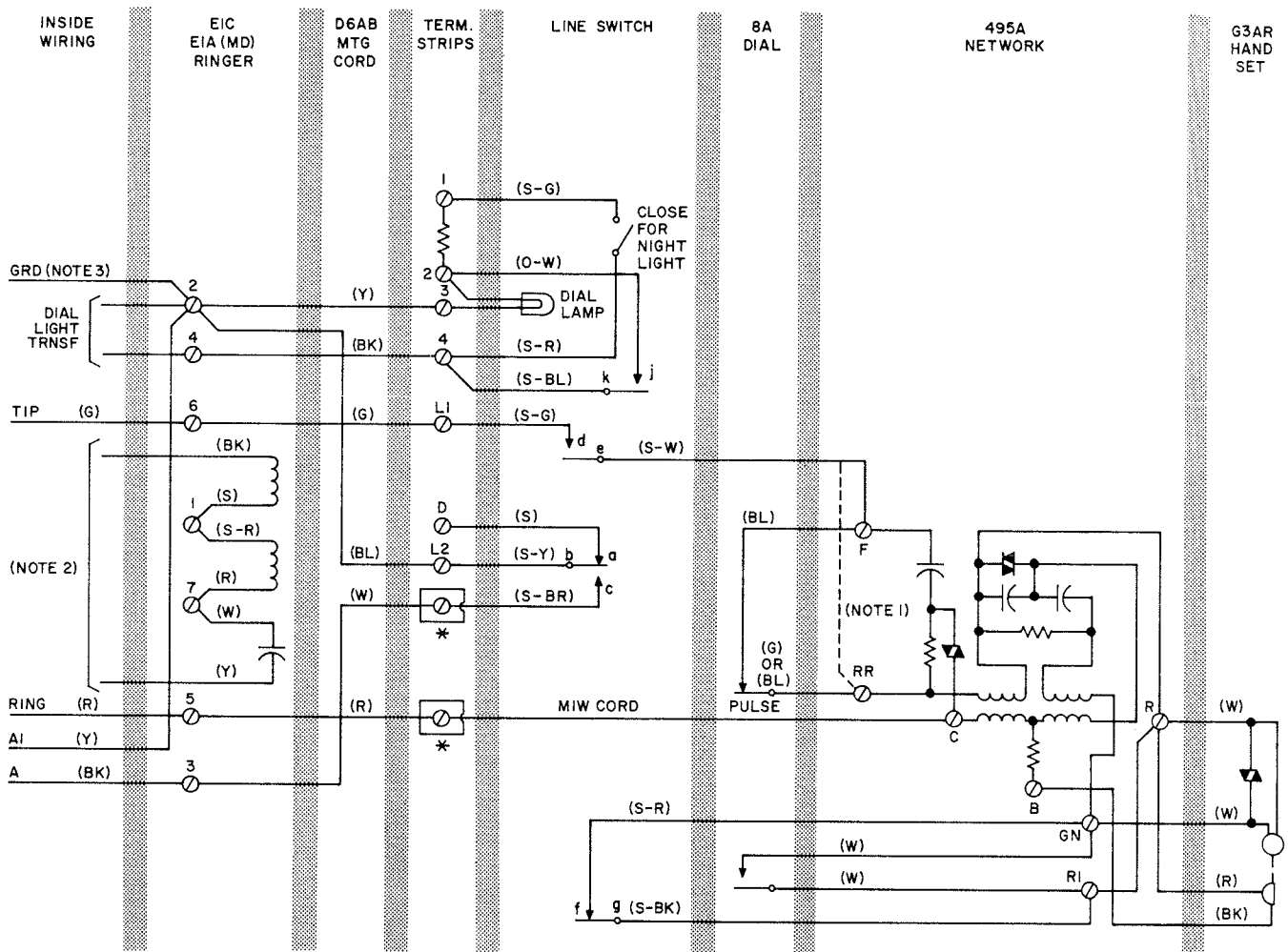


TABLE F  
4-PARTY SELECTIVE AND 8-PARTY SEMISELECTIVE SERVICE

LOCATION	WIRE OR LEAD	COLOR	NEGATIVE STATIONS		POSITIVE STATIONS		
			1 & 5	2 & 6	3 & 7	4 & 8	
Terminals on EIC or EIA (MD) Ringer	Line	Ring	R	5	6	5	6
		Tip	G	6	5	6	5
		Grd	Y	2	2	2	2
	Ringer Coil Leads	R	2	2	5	5	
		S-R	1	1	1	1	
		S	7	7	7	7	
	Capacitor Leads	BK	2	2	5	5	
		Y	7	7	7	7	
	Mtg Cord	W	1	1	1	1	
		R	5	5	5	5	
		G	6	6	6	6	
		W	1	1	1	1	
		Y	2	2	2	2	
		BL	4	4	4	4	
BK		4	4	4	4		
2012A or KS-16184 Trans	G	2	2	2	2		
	R	4	4	4	4		
Terminals in 701B Telephone Set	Mtg Cord	R	L2	L2	L2	L2	
		G	L1	L1	L1	L1	
		W	*	*	*	*	
		Y	3	3	3	3	
		BL	4	4	4	4	
		BK	4	4	4	4	
		426A Tube Leads	BK	*	*	*	*
R	L1	L1	L2	L2			
Y	L2	L2	3	3			

Fig. 5—701B (MD) Telephone Set With 426A Cold-Cathode Tube



NOTES:

1. DOTTED LINES INDICATE CONNECTIONS FOR MANUAL SERVICE. THE DIAL REMAINS ON SET.
  2. FOR INDIVIDUAL LINE RINGER, CONNECT BK TO TIP (6) AND Y CAPACITOR LEAD TO RING (5). FOR COMMON AUDIBLE RINGER, CONNECT TO SIGNAL LEADS FROM EQUIPMENT CABINET. USING D-161488 CONNECTORS.
  3. GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE; NOT NECESSARY FOR PROTECTION OF DIAL LIGHT TRANSFORMER.
- \* CONNECT WITH D-161488 CONNECTOR.

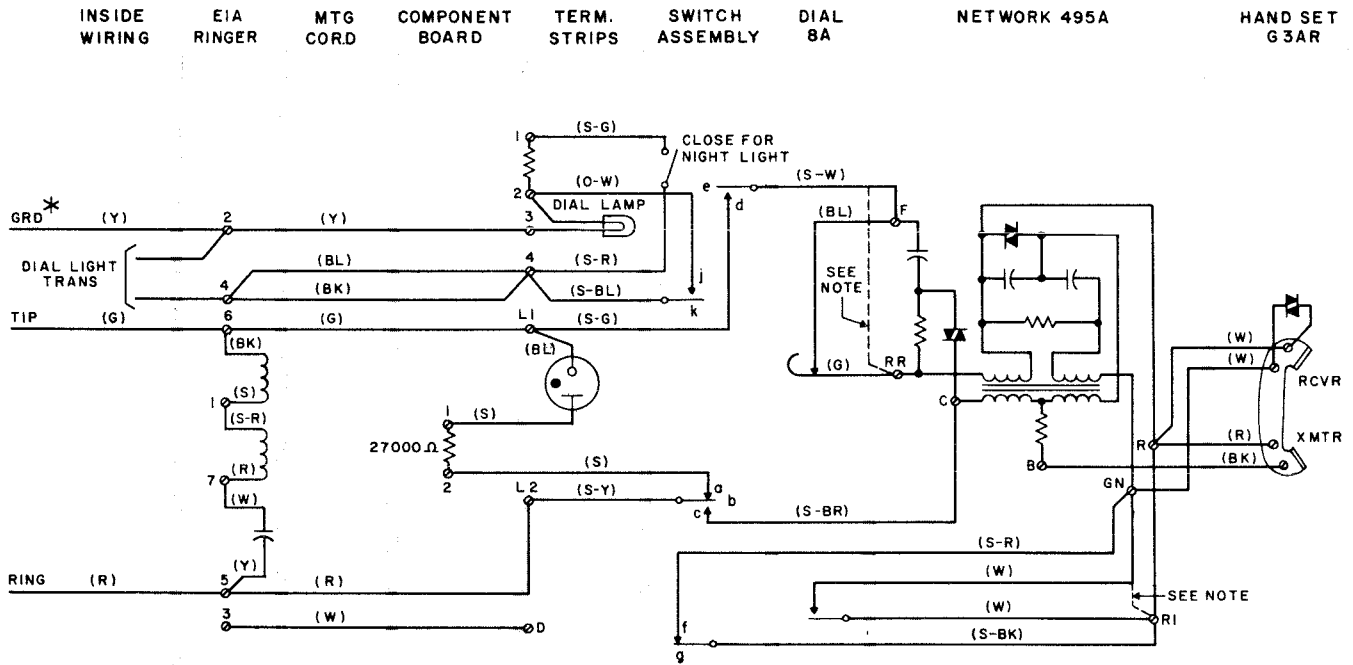


*To prevent false holding condition when handset is restored, switch contacts de must break before cb breaks.*

Fig. 6—701B (MD) Telephone Set Wired For 1A1 and 1A2 Key Telephone System



TELEPHONE SETS  
701D  
CONNECTIONS



**Note:** Dotted line indicates connection for manual service. Dial remains on the set.

\* Ground may be omitted; not required for protection of dial-light transformer.

Fig. 1 – Connections for 701D Telephone Set

TABLE A  
LINE AND RINGER CONNECTIONS

Wire or Lead	Individual or Bridged	Ring Party	Tip Party†
Line at Ringer	Ring R	5	5
	Tip G	6	6
	Grd Y	2	2
Ringer	R	7	7
	S-R	1	1
	BK	6	2
	S	1	1
Capacitor in Ringer	W	7	7
	Y	5	6
Transformer Leads at Ringer	1	2	2
	2	4	4
Mounting Cord at Ringer	R	5	5
	G	6	5
	Y	2	2
	BL	4	4
	W	3	3
	BK	4	4
Mounting Cord at Set	R	L2	L2
	G	L1	L1
	Y	3	3
	BL	4	4
	W	D	D
Message-Waiting Lamp Leads	S	11	11
	BL	L1	L1

† Except tip parties requiring identifying ground.

‡ Terminal on component board.



## TELEPHONE SETS — 702B

### CONNECTIONS

#### 1. GENERAL

1.01 This section is reissued to:

- Show wiring connection changes on 4010B network.
- Delete connections for 425A tube. When a 425A tube is required, refer to Section 500-112-100.
- Delete 3A speakerphone system connections. For 3A speakerphone connections, refer to Section 512-620-472.

#### 2. CONNECTIONS

##### (a) 702B Telephone Set

- Factory wired for bridged or ring party
- Modifications for tip party identification have been arranged to remove possibility of false billing

##### (b) Ringer

- M1A ringer may be silenced by removing (R) ringer lead from network terminal **K**
- Insulate and store lead

##### (c) Selective Ringing (4- or 8-party)

- Obtained by using a 426A tube. A 425A tube is used when inductive noise is excessive.
- Tube requirements are covered in Section 500-114-100.
- When connecting either tube, remove the (S) switch hook lead; insulate and store.

(d) External auxiliary ringer must be provided if common audible ringing is desired when using this set as a line station of 1A1 or 1A2 key telephone systems.

##### (e) Connection Index

Table A — Line and Ringer Connections

Table B — Wiring Changes for 1A1 and 1A2

Table C — Mounting Cord Connections For Selective Ringing

Fig. 1 — 702B Telephone Set, Connections

Fig. 2 — 702B Telephone Set Used With 1A1 and 1A2 Key Telephone Systems

Fig. 3 — Connections For Selective Ringing

**TABLE A**  
**LINE AND RINGER CONNECTIONS**

WIRE OR LEAD		INDIVIDUAL OR BRIDGED*	RING PARTY*	TIP PARTY		
				NO IDENT GRD	IDENTIFYING GROUND	
					1000 OHMS	2650 OHMS
Inside Wire at Conn Block	Ring	R	R	R	R	R
	Tip	G	G	G	G	G
	Grd	Y	Y	Y	Y	Y
Dial Light Transformer	1	Y	Y	Y	Y	Y
	2	B	B	B	B	B
Mtg Cord at Conn Block	R	R	R	G	G	G
	G	G	G	R	R	R
	Y	G	Y	Y	Y	Y
	BK	B	B	B	B	B
	W	Y	Y	Y	Y	Y
Mtg Cord at Set Terminals	R	L2	L2	L2	L2	L2
	G	L1	L1	F	F	F
	Y	G	G	G	G	G
	BK	4†	4†	4†	4†	4†
	W	3†	3†	3†	3†	3†
Ringer Lea's	R	K	K	K	K	K
	BK	G	G	G	G	G
	S	‡	‡	‡	L1	‡
	S-R	‡	‡	‡	‡	L1
Switch Hook	W [S-W]	F	F	B	B	B

\* Factory-wired for bridged or ring party.

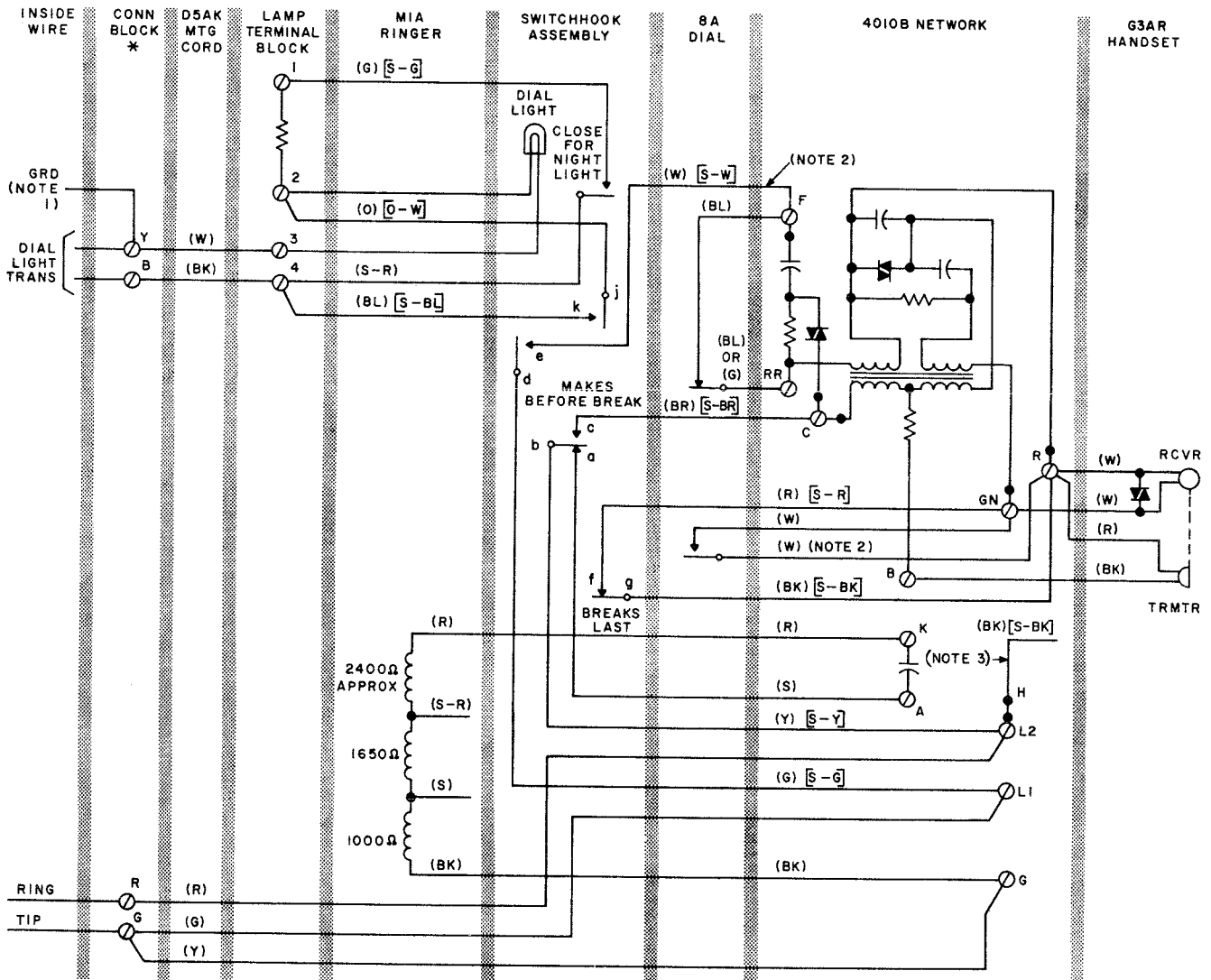
† Terminals on lamp terminal block.

‡ Insulated and stored.

[ ] Indicates MD color code.

**Note:** If [S-BK] or (BK) from **H** on network to terminal **A** is connected remove, insulate, and store for all classes of service in Table A.





NOTES:

1. IF GROUND IS NOT REQUIRED FOR SERVICE, IT CAN BE OMITTED; NOT REQUIRED FOR PROTECTION OF DIAL LIGHT TRANSFORMER.
2. FOR MANUAL SERVICE, MOVE (W) [S-W] SWITCH HOOK LEAD FROM F TO RR TERMINAL AND MOVE (W) DIAL LEAD FROM R TO GN TERMINAL. THE DIAL REMAINS ON THE SET.
3. (BK) [S-BK] FROM H OF NETWORK IS INSULATED AND STORED.

\* FOR PORTABLE INSTALLATIONS WITH BRIDGED RINGING, PLACE YELLOW AND GREEN MOUNTING CORD ON GN TERMINAL OF 283B PLUG. (THIS TERMINAL IS DESIGNATED G ON 505 PLUG.) FOR RING PARTY, PLACE YELLOW AND WHITE MOUNTING CORD LEAD ON Y TERMINAL OF 283B OR 505A PLUG. OTHER MOUNTING CORD LEADS SHOULD BE WIRED ACCORDING TO TABLE A.

( ) INDICATES CURRENT COLOR CODE.

[ ] INDICATES MD COLOR CODE.

Fig. 1 — 702B Telephone Set, Connections

SECTION 502-710-403

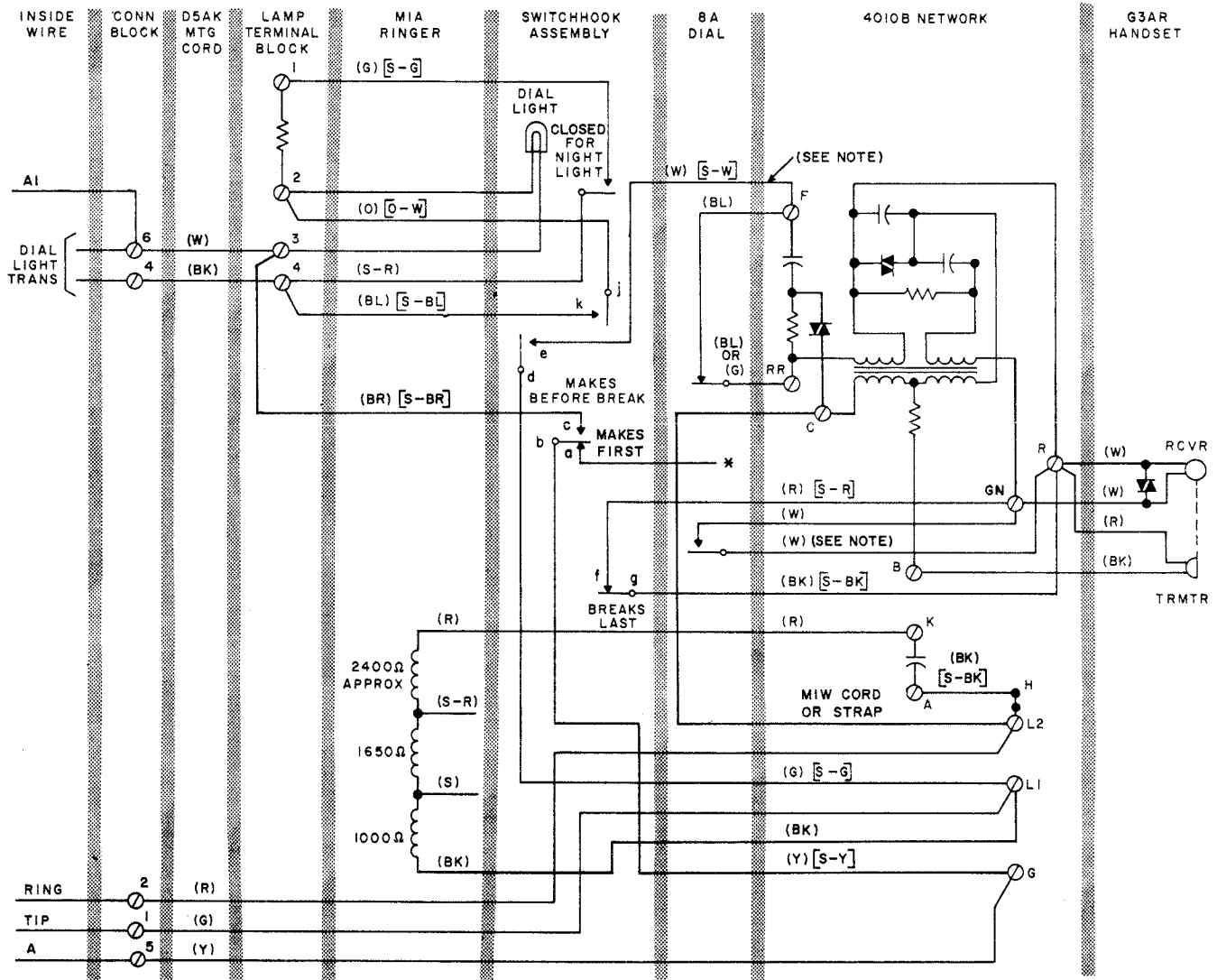


TABLE B  
WIRING CHANGES FOR 1A1 AND 1A2

LEAD OR CONDUCTOR	BK	FROM	TO
RINGER	BK	G	L1
SWITCH HOOK	S	A	INSULATE AND STORE
	[S-Y] (Y)	L2	G
	[S-BR] BR	C	3
STRAP		L2	C
NETWORK	[S-BK] (BK)	*	A

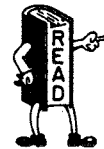
NOTE:

FOR MANUAL SERVICE, MOVE (W) [S-W] SWITCH HOOK LEAD FROM F TO RR TERMINAL, AND MOVE (W) DIAL LEAD FROM R TO GN TERMINAL. THE DIAL REMAINS ON THE SET.

\* INSULATE AND STORE.

() INDICATES CURRENT COLOR CODE.

[] INDICATES MD COLOR CODE.



*To prevent false holding condition when handset is restored, switch contacts de must break before cb break.*

Fig. 2 — 702B Telephone Set Used With 1A1 and 1A2 Key Telephone Systems

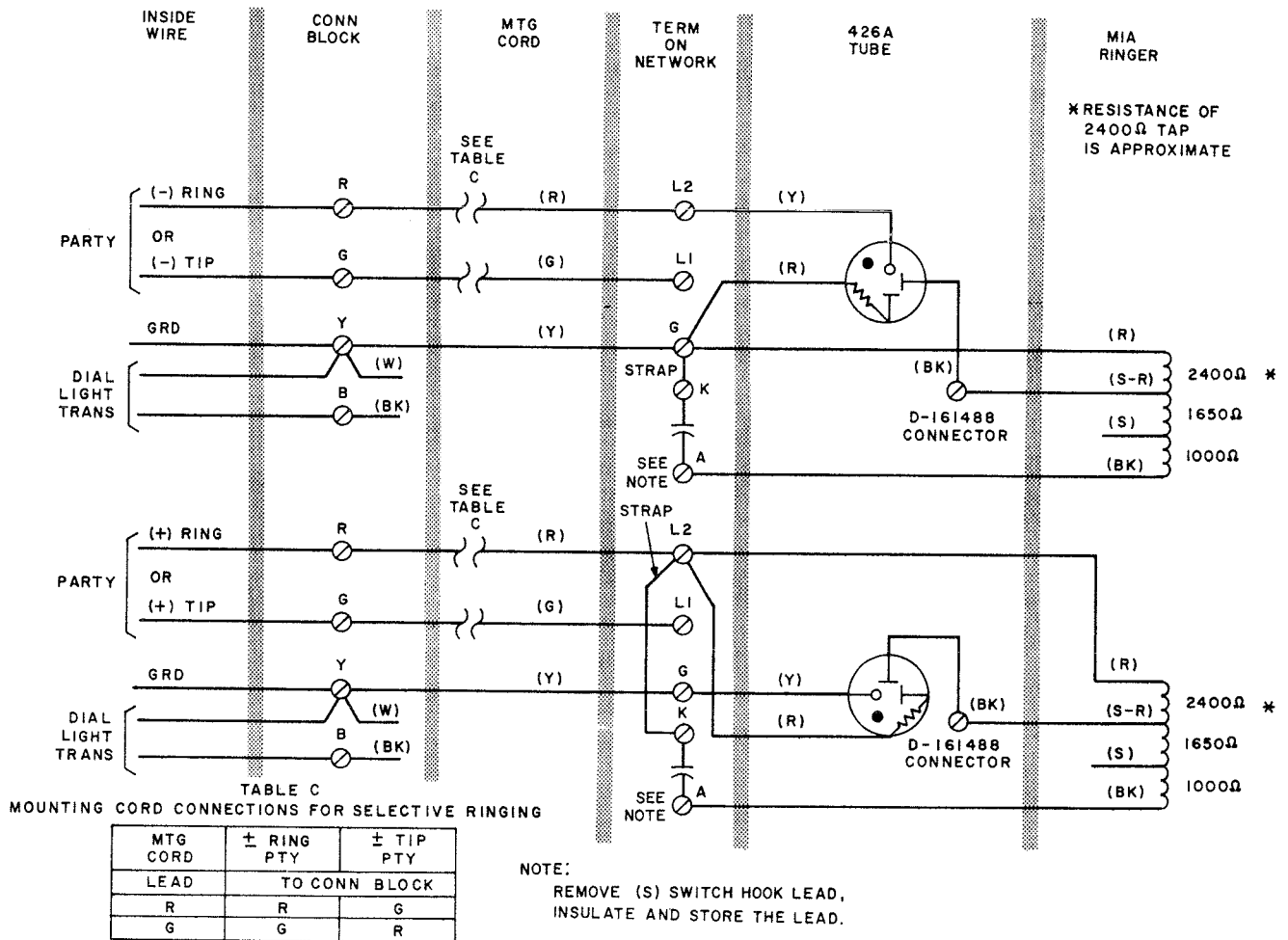


Fig. 3 — Connections For Selective Ringing



## TELEPHONE SETS—702D

### CONNECTIONS

#### 1. GENERAL

(a) This section is reissued to:

- Show current color codes for the telephone set

- Designate location of all solder points in the 4010B network

- Label network terminals *A* and *K*

#### 2. CONNECTION INDEX

Fig. 1—702D Telephone Set, Connections

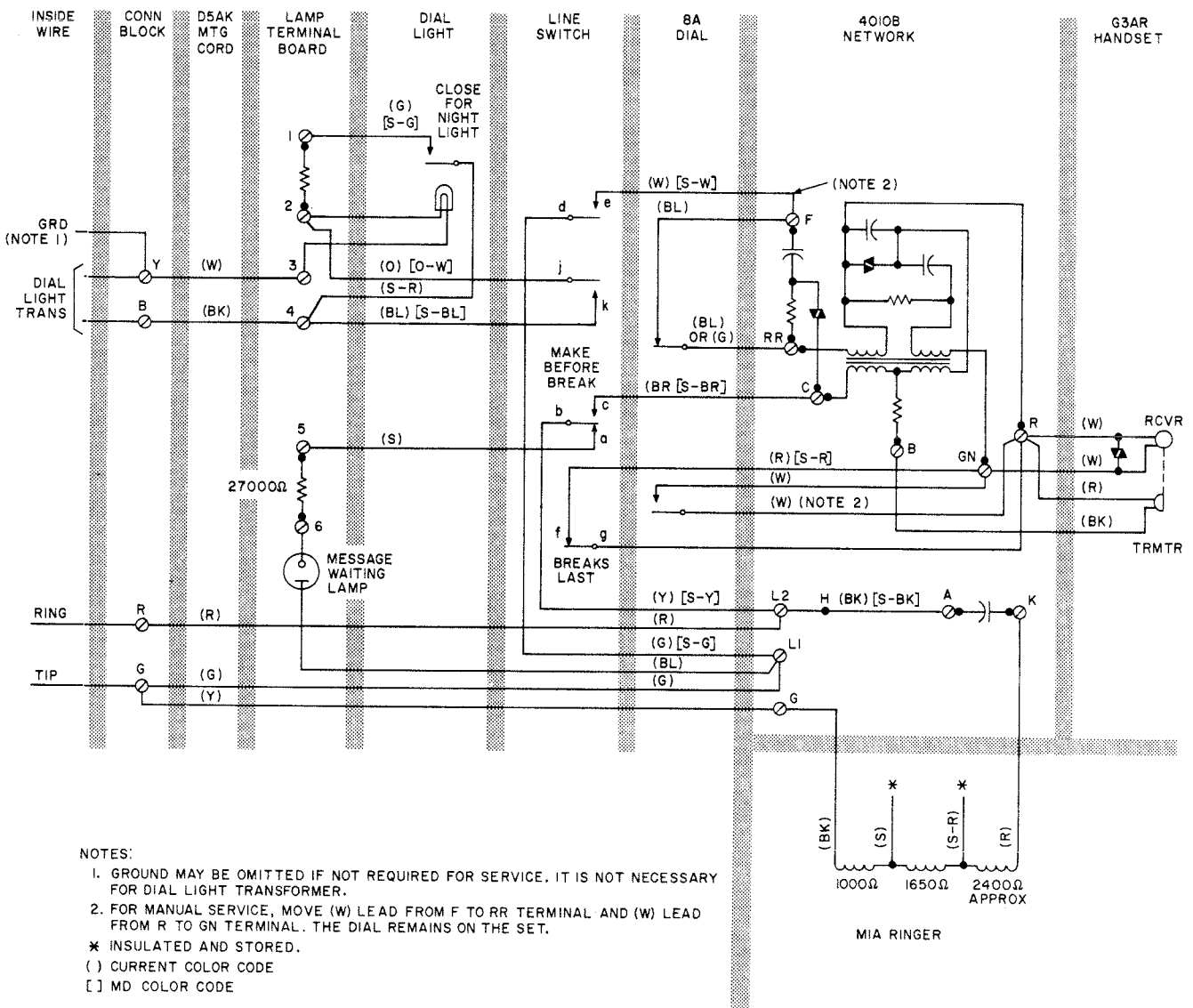


Fig. 1—702D Telephone Set, Connections



TELEPHONE SETS – 711B  
CONNECTIONS

TABLE A

MODIFICATION FOR 1-LINE PICKUP, CUTOFF FEATURE  
FOR EXTENSION STATION OR EXTERNAL LINE RINGER

WIRE OR LEAD	COLOR	REMOVE FROM	CONNECT TO		INSULATE AND STORE
		TERM. STRIP	TERM. STRIP	NET.	
Line Key	(G)	2			•
	(R)	1			•
Exclusion Switch	(G-Y)	2			•
	(R-Y)	1			•
M1W Cord or Strap Wire			2 ←→ F		
			1 ←→ L2		

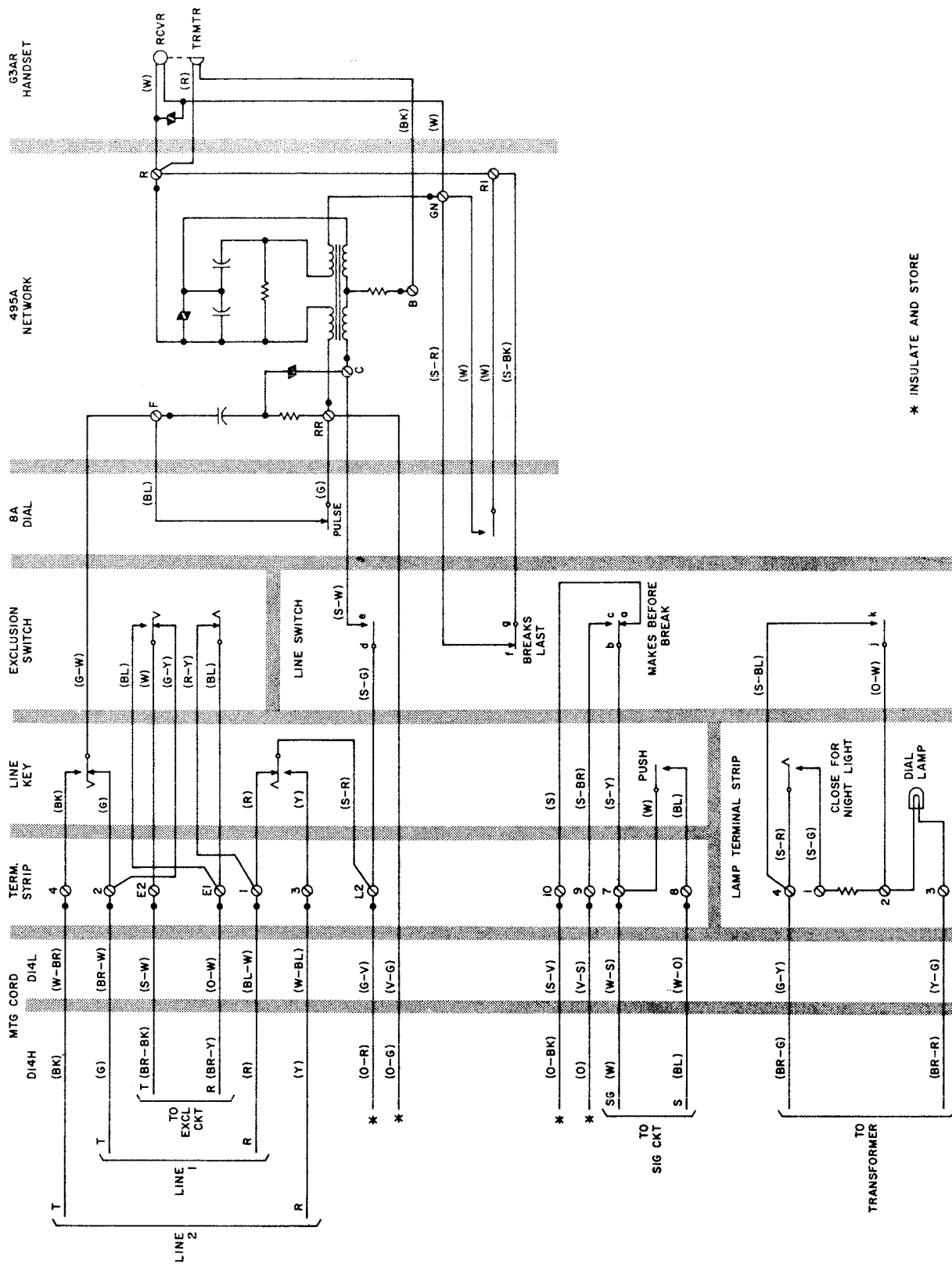
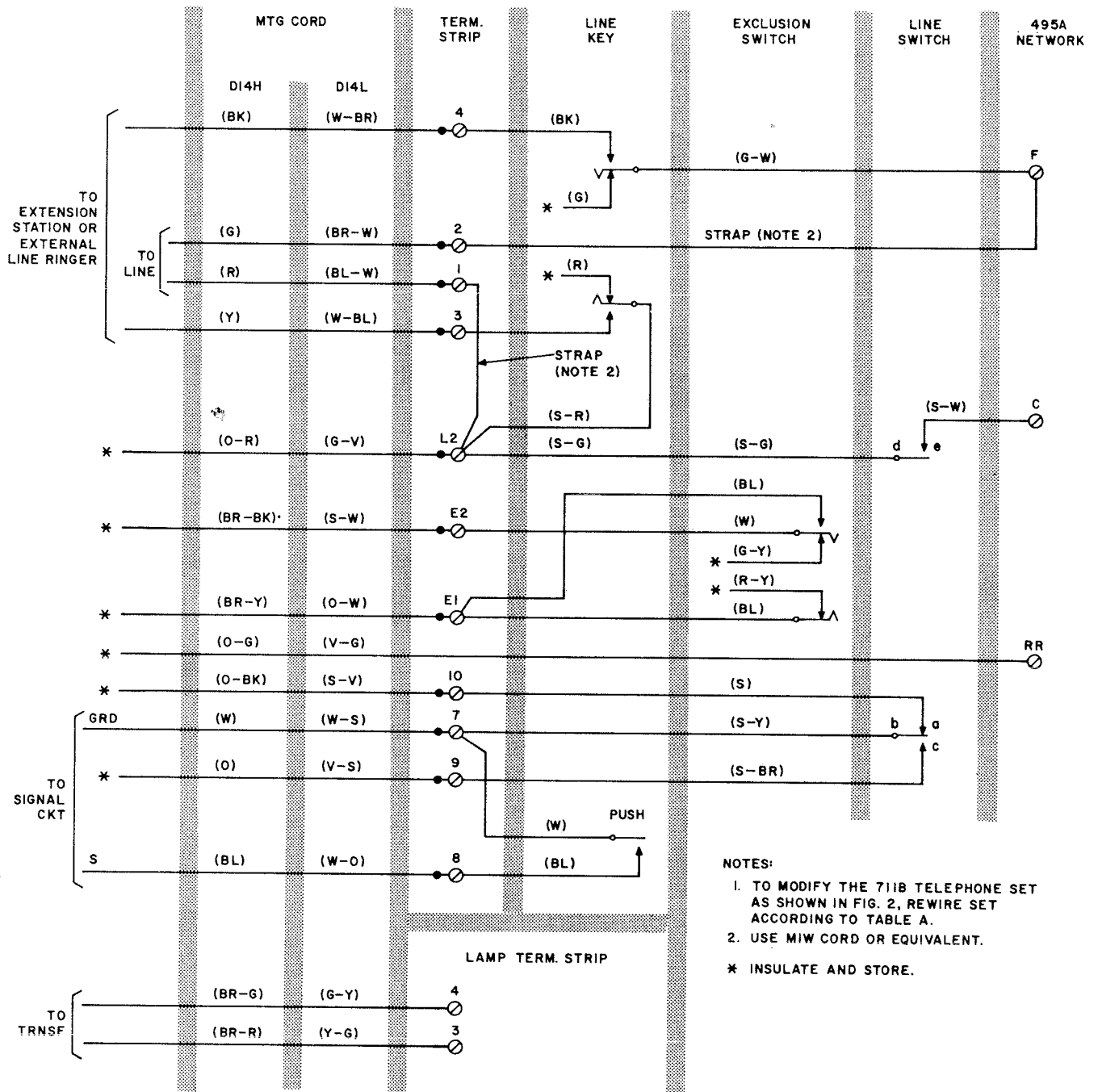


Fig. 1 — 711B Telephone Set — Wired for 2-Line Pickup, Exclusion on Line 1, and Signaling





- NOTES:
1. TO MODIFY THE 711B TELEPHONE SET AS SHOWN IN FIG. 2, REWIRE SET ACCORDING TO TABLE A.
  2. USE MIW CORD OR EQUIVALENT.
- \* INSULATE AND STORE.

Fig. 2 — 711B Telephone Set — Wired for 1-Line Pickup, Cutoff Feature for Extension Station or External Line Ringer



## TELEPHONE SETS — 712B

### CONNECTIONS

#### 1. GENERAL

1.01 A ringer is not provided with these sets.

If a ringer is required, an external (E1-type) ringer must be ordered and installed separately. See section covering E1-type ringers for connections.

1.02 This section is reissued to remove connections for 1A home interphone, 2A farm interphone, and 3-type speakerphone systems which can be found in appropriate sections in Division 512.

#### 2. CONNECTION INDEX

Table A — Modification for 2-Line Pickup, Exclusion on Line 1, and Signaling (Used Without 1A1 or 1A2 KTS)

Table B — Modification for 1-Line Pickup, Cutoff Feature for Extension Station or External Line Ringer

Fig. 1 — 712B Telephone Set, Wired for 2-Line Pickup, Hold on Line 1, and Signaling (Used Without 1A1 or 1A2 KTS)

Fig. 2 — 712B Telephone Set, Wired for 1-Line Pickup, Hold, and Secretarial Service (Used Without 1A1 or 1A2 KTS)

Fig. 3 — 712B Telephone Set, Wired for 2-Line Pickup, Exclusion on Line 1, and Signaling (Used With 1A1 or 1A2 KTS)

Fig. 4 — 712B Telephone Set, Wired for 1-Line Pickup, Cutoff Feature for Extension Station or External Line Ringer

TABLE A

MODIFICATION FOR 2-LINE PICKUP, EXCLUSION ON LINE 1,  
AND SIGNALING (USED WITHOUT 1A1 OR 1A2 KTS)

WIRE OR LEAD	COLOR	REMOVE FROM		CONNECT TO		INSULATE AND STORE
		TERM. STRIP	NET.	TERM. STRIP	NET.	
Line Switch	Y	E1			A	
	BR	E1			G	
638A Line Key	S	8				.
	W	7			A	
Exclusion Switch	BR	1		E1		
	W	3		8		
	Y			1		
	BL			E1		
	S			10		
	O			7		
D14L Mtg Cord	V-G		RR		A	

TABLE B

MODIFICATION FOR 1-LINE PICKUP, CUTOFF FEATURE FOR  
EXTENSION STATION OR EXTERNAL LINE RINGER

WIRE OR LEAD	COLOR	REMOVE FROM		CONNECT TO		INSULATE AND STORE
		TERM. STRIP	NET.	TERM. STRIP	NET.	
Line Switch	BR	E1		8		
Exclusion Switch	BR	1				.
638A Line Key	R	1				.
	W-O		G	E1		
Strap (MIW Cord or equivalent)				3 ←	→ F	

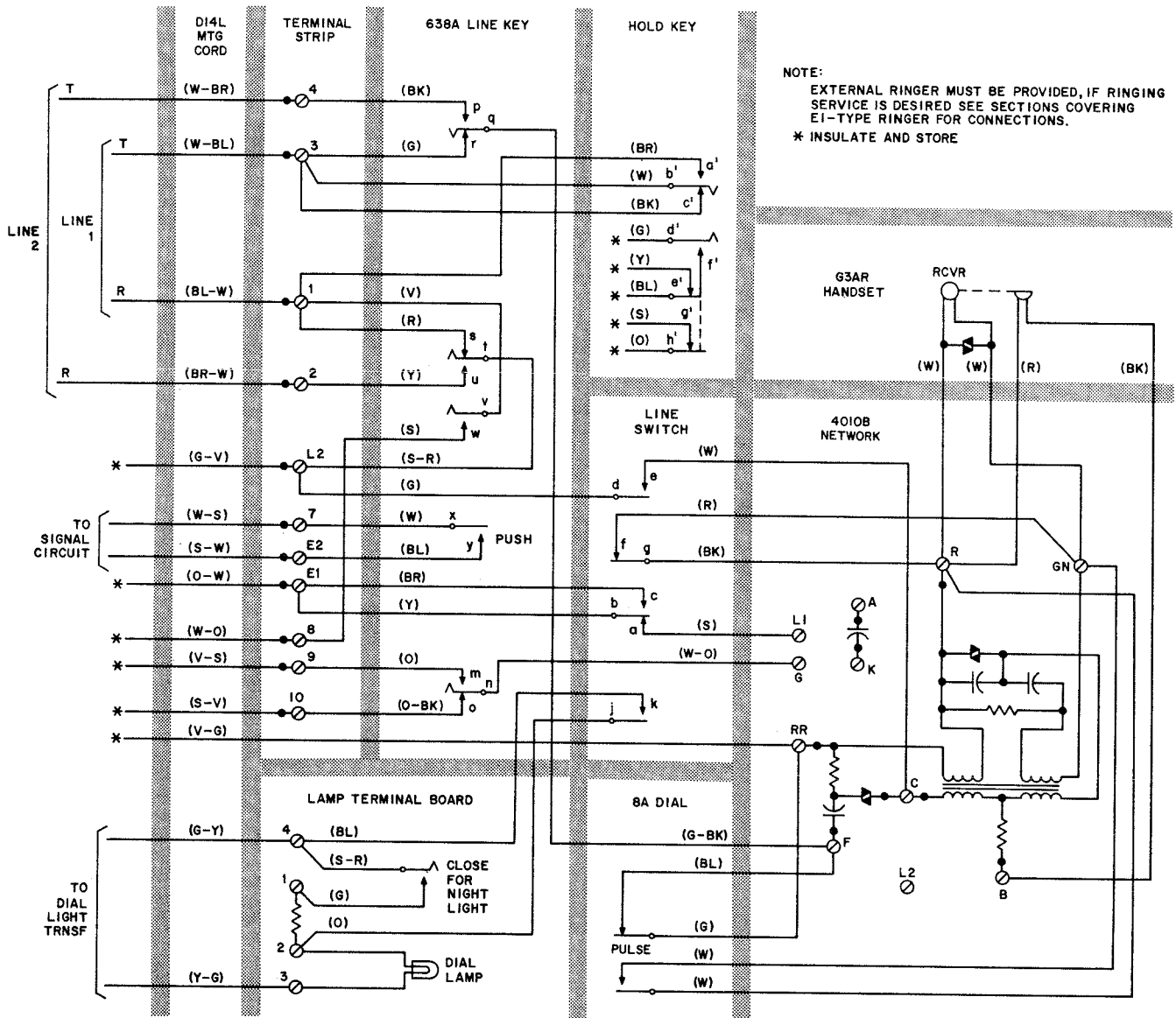


Fig. 1—712B Telephone Set, Wired for 2-Line Pickup, Hold on Line 1, and Signaling (Used Without 1A1 or 1A2 KTS)

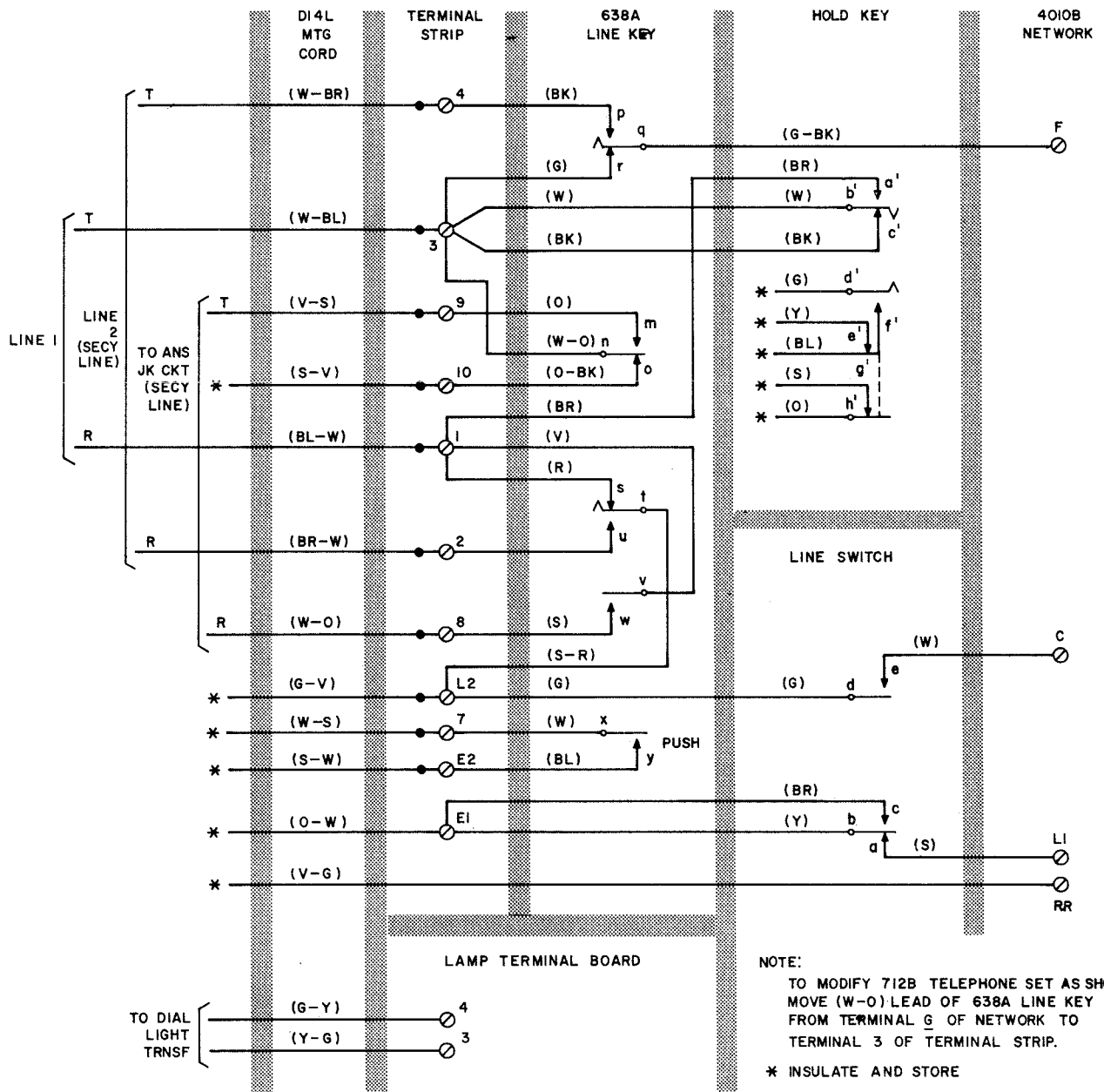
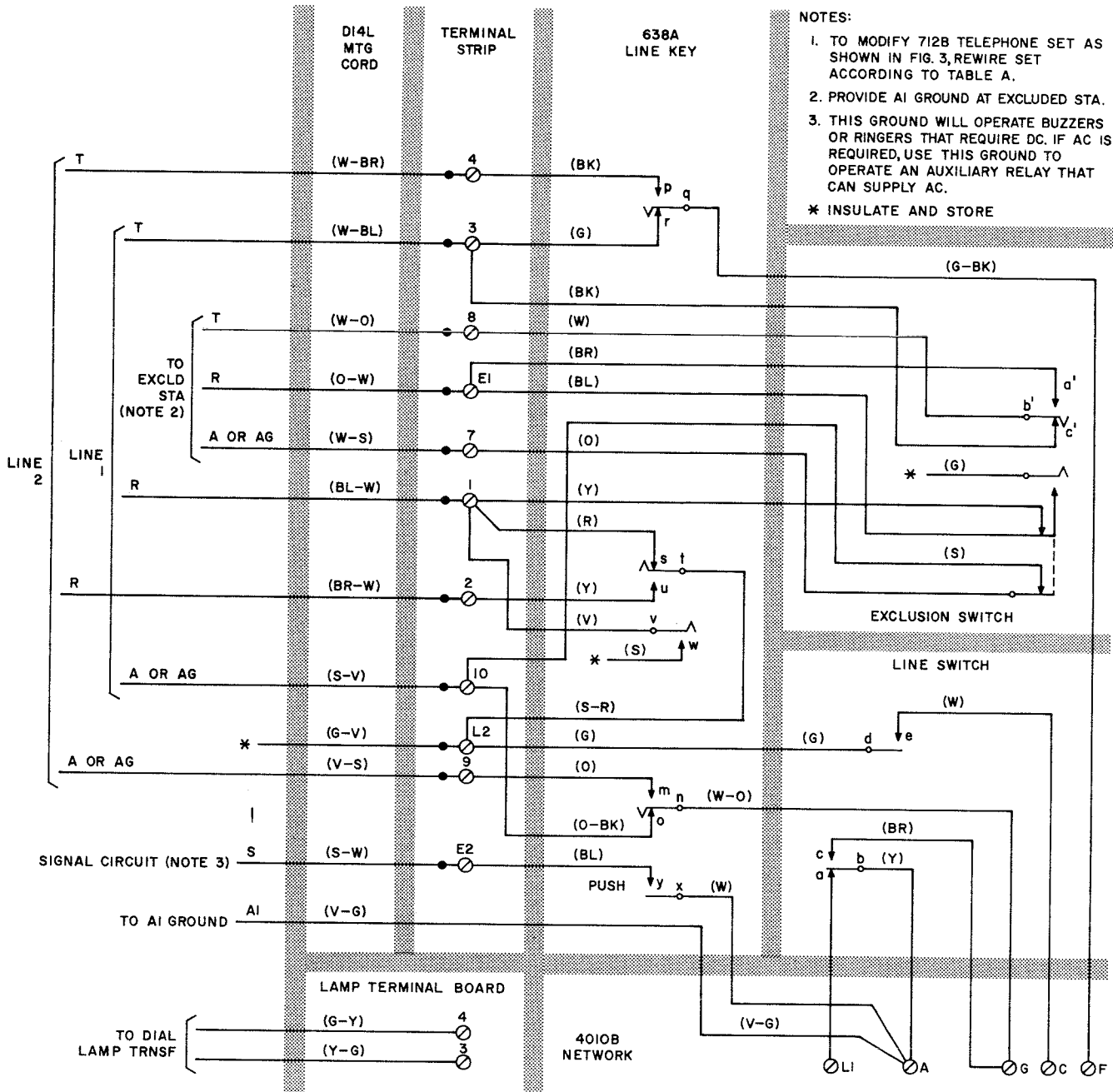


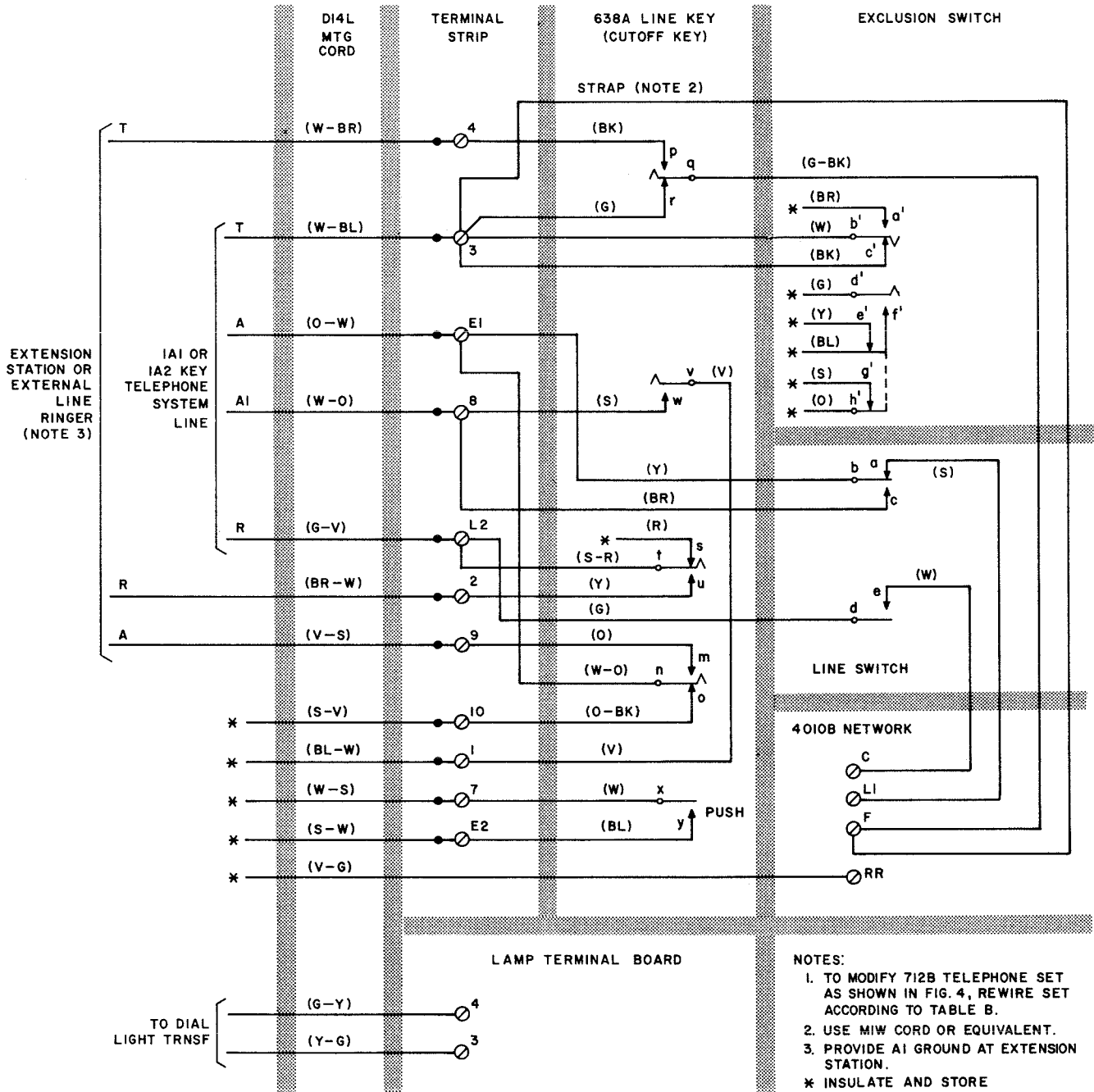
Fig. 2 — 712B Telephone Set, Wired for 1-Line Pickup, Hold, and Secretarial Service (Used Without 1A1 or 1A2 KTS)



NOTES:

1. TO MODIFY 712B TELEPHONE SET AS SHOWN IN FIG. 3, REWIRE SET ACCORDING TO TABLE A.
  2. PROVIDE AI GROUND AT EXCLUDED STA.
  3. THIS GROUND WILL OPERATE BUZZERS OR RINGERS THAT REQUIRE DC. IF AC IS REQUIRED, USE THIS GROUND TO OPERATE AN AUXILIARY RELAY THAT CAN SUPPLY AC.
- \* INSULATE AND STORE

Fig. 3 — 712B Telephone Set, Wired for 2-Line Pickup, Exclusion on Line 1, and Signaling (Used With 1A1 or 1A2 KTS)



- NOTES:
1. TO MODIFY 712B TELEPHONE SET AS SHOWN IN FIG. 4, REWIRE SET ACCORDING TO TABLE B.
  2. USE MIW CORD OR EQUIVALENT.
  3. PROVIDE A1 GROUND AT EXTENSION STATION.
- \* INSULATE AND STORE

Fig. 4 — 712B Telephone Set, Wired for 1-Line Pickup, Cutoff Feature for Extension Station or External Line Ringer



TELEPHONE SETS  
1702B-TYPE  
CONNECTIONS

1. GENERAL

(a) Note 3--added

1.001 This addendum supplements Section 502-710-433, Issue 5.

1.002 This addendum is issued to add note 3 to Table B.

*Note 3:* When connecting the D5AK mounting cord leads for tip party identifying ground, use D-161488 connectors and M1W straps as required to extend conductor leads.

2. CONNECTION INDEX

The following change applies to Part 2 of this section.



TELEPHONE SETS  
1702B-TYPE  
CONNECTIONS

1. GENERAL

1.01 This section is reissued to:

- Revise connection information for tip party identification
- Include connection modifications which will prevent false billing due to incomplete hangup
- Provide polarity guard connections

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

2. CONNECTION INDEX

Table A — Line Connections For Bridged and Ring Party Service

Table B — Line and Ringer Connections For Tip Party Service

Table C — Polarity Guard Connections For Nonkey Telephone Systems (D-180229 Kit of Parts)

Table D — Modification For 1A1 or 1A2 Key Telephone System

Fig. 1 — 1702B Telephone Set (Current Production) Using 25P4 Dial and 4010D Network

Fig. 2 — 1702B Telephone Set (Early Production) Using 25H4 Dial and 4010B Network

Fig. 3 — 1702B Telephone Set Modified For 2650-Ohm Tip Party Identification — Prevention of False Billing Due to Incomplete Hangup

Fig. 4 — 1702B Telephone Set, Wired For 1A1 or 1A2 Key Telephone System

**Note:** To silence ringer for all classes of service remove (R) ringer lead from **K** of network; insulate and store.

TABLE A

LINE CONNECTIONS FOR BRIDGED AND RING PARTY SERVICE

WIRE OR LEAD		COLOR	INDIVIDUAL OR BRIDGED	RING PARTY
D5AK Mtg. Cord at Conn. Block		(R)	R	R
		(G)	G	G
		(Y)	G	Y
		(BK)	B	B
		(W)	Y	Y
Inside Wire at Conn. Block	Ring	(R)	R	R
	Tip	(G)	G	G
	Grd.	(Y)	Y	Y
Conn. For Dial Light Trnsf at Conn. Block			Y	Y
			B	B

Note: Sets are shop wired for ring party or bridged service. See Table B for modification of set for tip party service.

TABLE B

LINE AND RINGER CONNECTIONS FOR TIP PARTY SERVICE

WIRE OR LEAD	COLOR	NO. IDENT GROUND	IDENT GROUND	
			1000 OHM	2650 OHM
Ringer at Net.	(S-R)	*	*	L1
	(S)	*	L1	*
Line Switch at Net.	(BR) [S-BR]	F	F	F
	(W) [S-W]	C	B	B
D5AK Cord at Net.	(G)	L1	C	C
D5AK Cord at Conn. Block	(R)	G	G	G
	(G)	R	R	R
	(Y)	Y	Y	Y
	(BK)	B	B	B
	(W)	Y	Y	Y

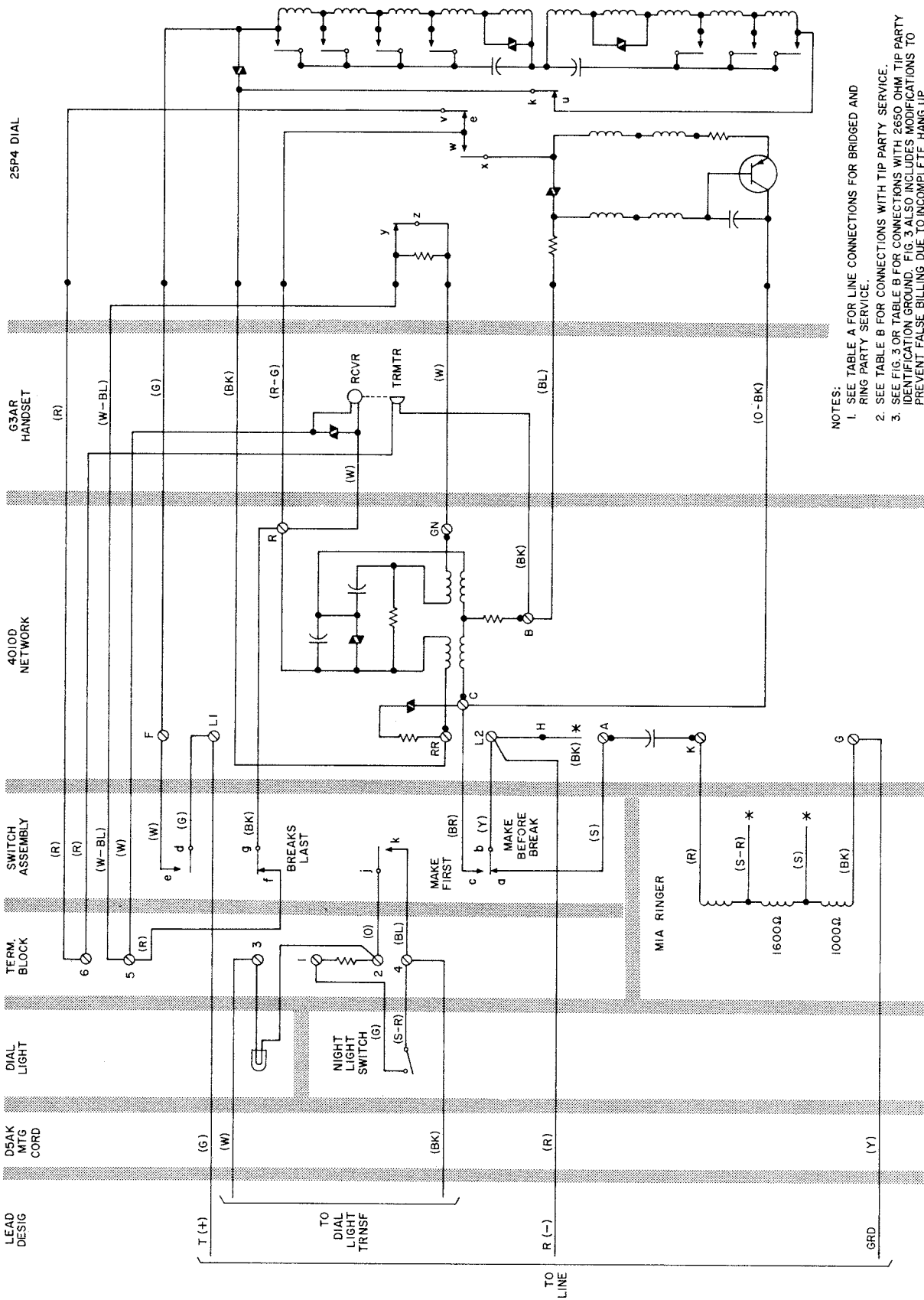
\* Insulated and stored

( ) Current color code

[ ] JMD color code

Notes: 1. See Table A for inside wiring and dial light transformer lead connections at connecting block.

2. If (BK) strap is present between network terms. H and A remove from A; insulate and store.



- NOTES:
1. SEE TABLE A FOR LINE CONNECTIONS FOR BRIDGED AND RING PARTY SERVICE.
  2. SEE TABLE B FOR CONNECTIONS WITH TIP PARTY SERVICE.
  3. SEE FIG. 3 OR TABLE B FOR CONNECTIONS WITH 2650 OHM TIP PARTY IDENTIFICATION GROUND. FIG. 3 ALSO INCLUDES MODIFICATIONS TO PREVENT FALSE BILLING DUE TO INCOMPLETE HANG UP.
- \* INSULATED AND STORED.

Fig. 1 — 1702B Telephone Set (Current Production) Using 25P4 Dial and 4010D Network



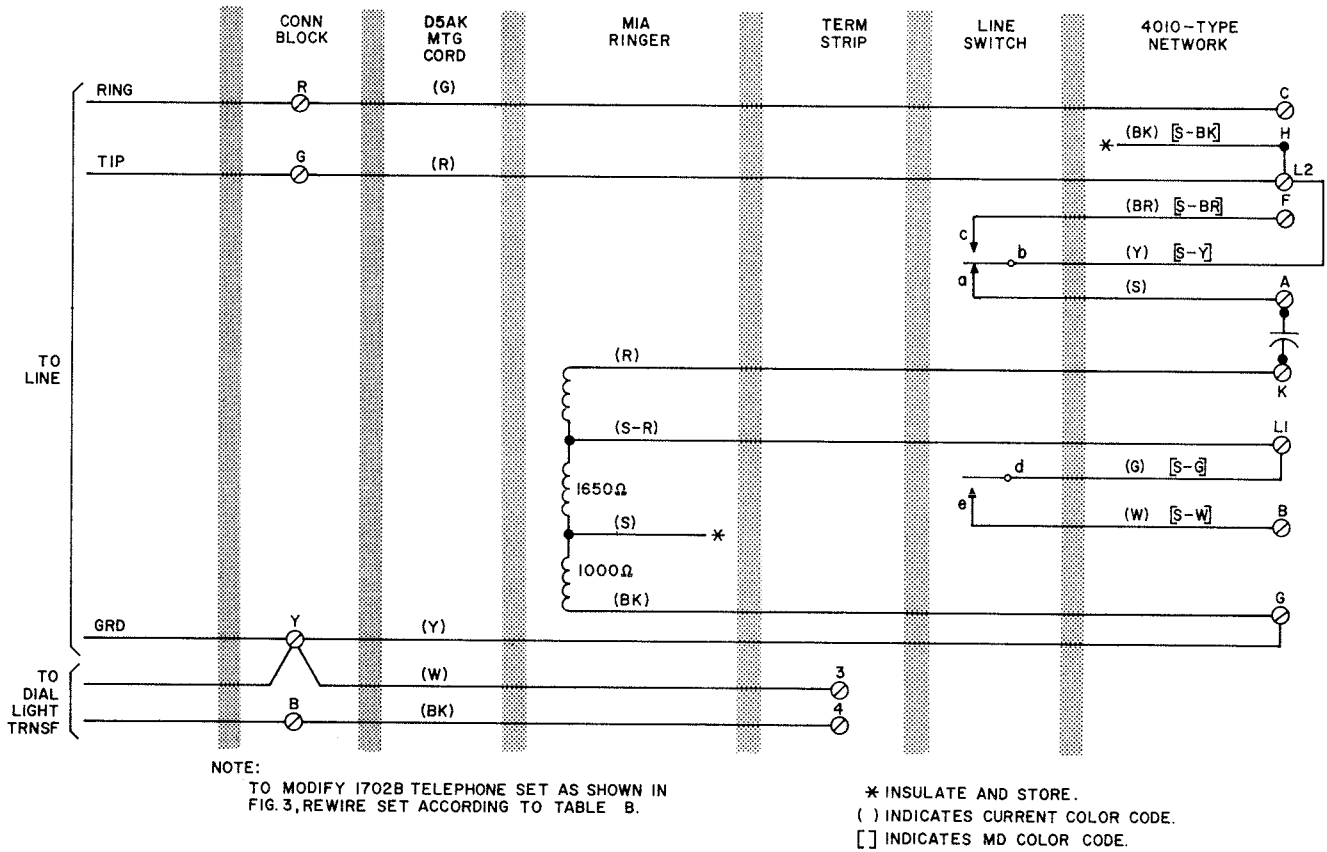


Fig. 3 — 1702B Telephone Set, Wired Line For 2650 ohm Tip Party Identification Ground

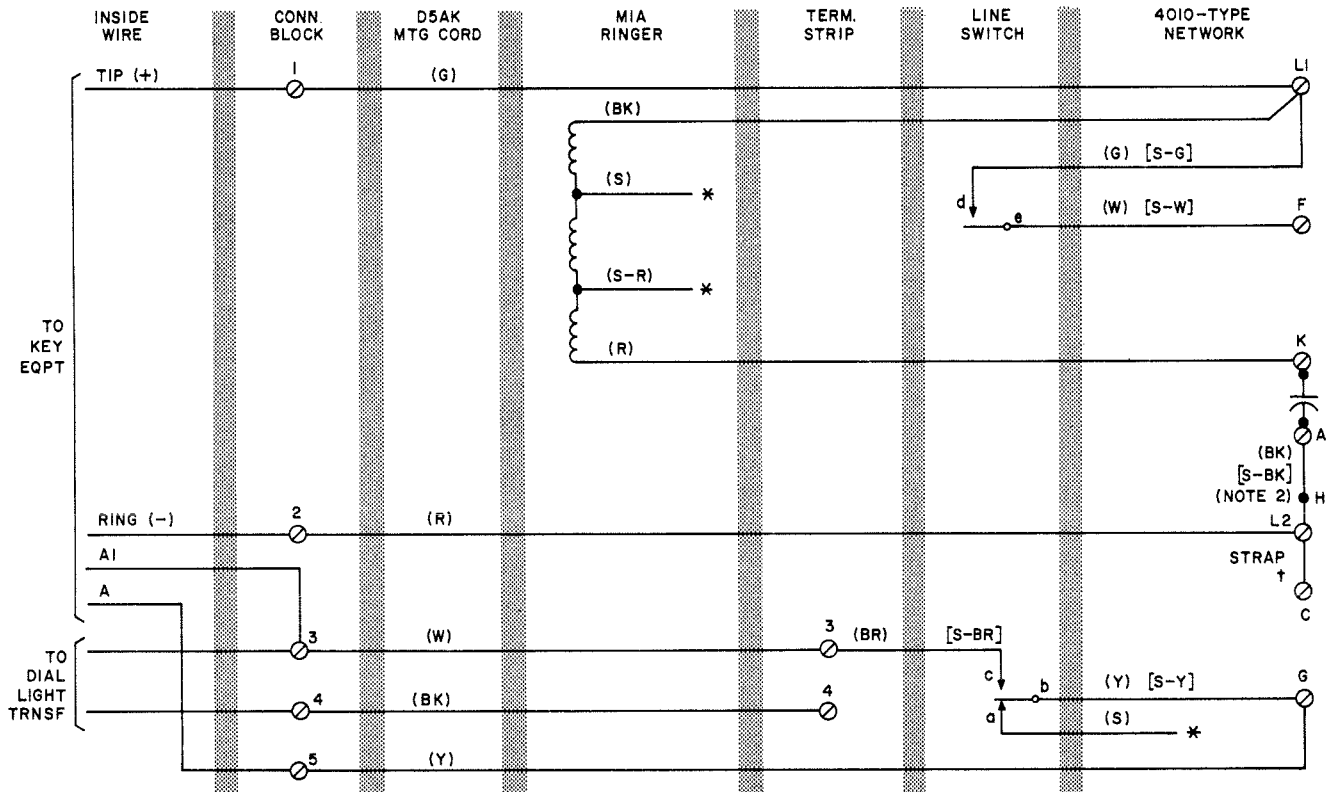
TABLE C  
POLARITY GUARD CONNECTIONS FOR NONKEY TELEPHONE SYSTEMS  
(D-180229 KIT OF PARTS)

WIRE OR LEAD	COLOR	REMOVE FROM NETWORK	CONNECT TO	
			NETWORK	TERM BOARD*
Dial	BK	RR		3
Line Switch	(BR) [S-BR] ①	C		4
	(W) [S-W] ②			
D5AK Cord	(G) ③			
D-180229 Polarity Guard	(R)			3
	(BK)			4
	(G)		RR	
	(W)		C	

\* Component of polarity guard assembly  
 ① If wired for ring or bridged service  
 ② If wired for tip party (no identification ground)  
 ③ If wired for tip party (with identification ground)

( ) Current color code  
 [ ] MD color code  
 Note: Install polarity guard assembly only when specified by local instructions for end-to-end signaling.

SECTION 502-710-433



NOTE:

1. TO MODIFY 1702B TELEPHONE SET AS SHOWN IN FIG. 4, REWIRE SET ACCORDING TO TABLE D.
2. CHECK THAT (BK) [S-BK] STRAP IS TERMINATED ON (A) OF NETWORK, SETS OF LATER MANUFACTURE HAVE THIS LEAD INSULATED AND STORED.

- \* INSULATED AND STORED
- † USE MIW CORD OR EQUIVALENT
- () INDICATES CURRENT COLOR CODE
- [] INDICATES MD COLOR CODE

Fig. 4 — 1702B Telephone Set, Wired for 1A1 or 1A2 Key Telephone System

TABLE D  
MODIFICATION FOR 1A1 OR 1A2 KEY TELEPHONE SYSTEM

WIRE OR LEAD	COLOR	REMOVE FROM NET.	CONNECT TO	
			NET.	TERM STRIP
Line Switch	(Y) [S-Y]	L2	G	
	(BR) [S-BR]	C		3
	(S)	A	Insulate and store	
Ringer	(BK)	G	L1	
Strap	*		C ←→ L2	
Network Strap	(BK)	Stored Location	A	

\* MIW cord or equivalent. Do not use strap if polarity guard is to be installed.

() Current color code

[] MD color code



*To prevent false holding condition when handset is restored; switch contacts de must break before cb break.*

**Note:** Install polarity guard (D-180229 Kit of Parts) only if specified by local instructions for end-to-end signaling.

**Polarity Guard Lead Connections**

- (BK) to L2 on network      (G) to RR on network
- (W) to C on network      (R) to 3 of polarity guard term. strip

Remove (BK) dial lead from RR on network and connect to 3 of polarity guard term. strip.



## TELEPHONE SETS

### 2702-TYPE

### CONNECTIONS

#### 1. GENERAL

- (a) This section is reissued to:
- Include connection modifications which will prevent false billing due to incomplete hangup.
  - Show wiring connection changes in the 4010D network (affects only 2702B sets).
  - Provide polarity guard connections for key and nonkey telephone systems.
  - Delete installation instructions for polarity guard. For polarity guard installation, refer to Section 502-710-103.
- (b) Connections for 3-type speakerphone system are covered in Section 512-622-472.

Table C — Polarity Guard Connections For Nonkey Telephone Systems (D-180229 Kit Of Parts)

Table D — 2702B Telephone Set Modifications For Use With 1A1 or 1A2 Key Telephone System

Table E — Polarity Guard Connections For 1A1 or 1A2 Key Telephone System (D-180229 Kit Of Parts)

Fig. 1 — 2702B Telephone Set, Connections

Fig. 2 — 2702B Telephone Set, Wired For Use With 1A1 or 1A2 Key Telephone System

Fig. 3 — 2702D Telephone Set, Connections

#### 2. CONNECTIONS



*Without a polarity guard the TOUCH-TONE® dial will operate only with the orange-black dial lead connected to the negative (ring) side of the line and the green dial lead connected to the positive (tip) side.*

- (a) **Ringer**
- M1A ringer may be silenced by removing (R) ringer lead from network terminal **K**.
  - Insulate and store lead.

(b) **Connection Index**

Table A — 2702-Type Telephone Sets, Line Connections For Bridged and Ring Party Service

Table B — 2702B Telephone Set Line and Ringer Connections For Tip Party Service

**TABLE A**

**2702-TYPE TELEPHONE SETS, LINE CONNECTIONS FOR BRIDGED AND RING PARTY SERVICE\***

WIRE OR LEAD		COLOR	INDIV OR BRIDGED	RING PARTY
D5AK Cord at Conn. Block		R	R	R
		G	G	G
		Y	G	Y
		BK	B	B
Inside Wire at Conn. Block		W	Y	Y
		Ring Tip	R	R
		GRD	G	G
Dial Light Trnsf Leads at Conn. Block		Y	Y	Y
		Y	B	B

\* Sets are wired for either service. See Fig. 1 and 3. 2702D (Message Waiting) set should be connected for bridged service only.

TABLE B

## 2702B TELEPHONE SET LINE AND RINGER CONNECTIONS FOR TIP PARTY SERVICE\*

WIRE OR LEAD	COLOR	NO IDENT GRD	1000Ω	2650Ω
Ringer at Net.	S-R	†	†	L1
	S	†	L1	†
Line Switch at Net.	BR	F	F	F
	W	C	B	B
D5AK Cord at Net.	G	L1	C	C
D5AK Cord at Conn. Block	R	G	G	G
	G	R	R	R
	Y	Y	Y	Y
	BK	B	B	B
	W	Y	Y	Y

\* Inside wiring and dial light transformer leads at connecting block are wired as in Table A. If BK strap is present between network terminals *H* and *A*, remove from *A*, insulate and store.

† Insulated and stored.

TABLE C

## POLARITY GUARD CONNECTIONS FOR NONKEY TELEPHONE SYSTEMS (D-180229 KIT OF PARTS)

WIRE OR LEAD	COLOR	REMOVE FROM NETWORK	CONNECT TO	
			NETWORK	TERM. BOARD*
Dial	BK	RR		3
Line Switch	BR ①	C		4
	W ②			
D5AK Cord	G ③			
Polarity Guard	R			3
	BK			4
	G		RR	
	W		C	

\* Component of polarity guard assembly (2702B) or message waiting lamp assembly (2702D).

- ① If wired for ring or bridged service.
- ② If wired for tip party (no identification ground).
- ③ If wired for tip party (with identification ground).

**Note:** Install polarity guard assembly only when specified by local instructions for end-to-end signaling.

TABLE D

## 2702B TELEPHONE SET MODIFICATION FOR USE WITH 1A1 OR 1A2 KEY TELEPHONE SYSTEM

WIRE OR LEAD	COLOR	REMOVE FROM	CONNECT TO		INSULATE AND STORE
		NETWORK	NETWORK	TERM BLOCK	
Line Switch	BR	C		3	
	Y	L2	G		
	S	A			•
Ringer	BK	G	L1		
Strap*			C ↔ L2		
Network	BK	Stored Location	A		

\* M1W cord or equivalent. Do not use strap if polarity guard is to be installed.

TABLE E

POLARITY GUARD CONNECTIONS FOR 1A1 OR 1A2 KEY TELEPHONE SYSTEM  
(D-180229 KIT OF PARTS)

WIRE OR LEAD	COLOR	REMOVE FROM NETWORK	CONNECT TO	
			NETWORK	TERM BOARD*
Dial	BK	RR		3
Polarity Guard	W		C	
	R			3
	BK		L2	
	G		RR	

\* Component of polarity guard assembly (2702B set).

**Note:** Install polarity guard assembly only when specified by local instructions for end-to-end signaling.

- NOTES:
1. SETS ARE FACTORY WIRED FOR BRIDGED OR RING SERVICE. FOR TIP PARTY WITH OR WITHOUT IDENTIFYING GROUND, SEE TABLE B.
  2. GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE FORMER.
  3. NOT NECESSARY FOR PROTECTION OF DIAL LIGHT TRANSFORMER.
3. POLARITY GUARD ASSEMBLY CAN BE ORDERED AND INSTALLED SEPARATELY AS D-180229 KIT OF PARTS. CONNECT AS SHOWN IN TABLE C.
- \* INSULATED AND STORED.

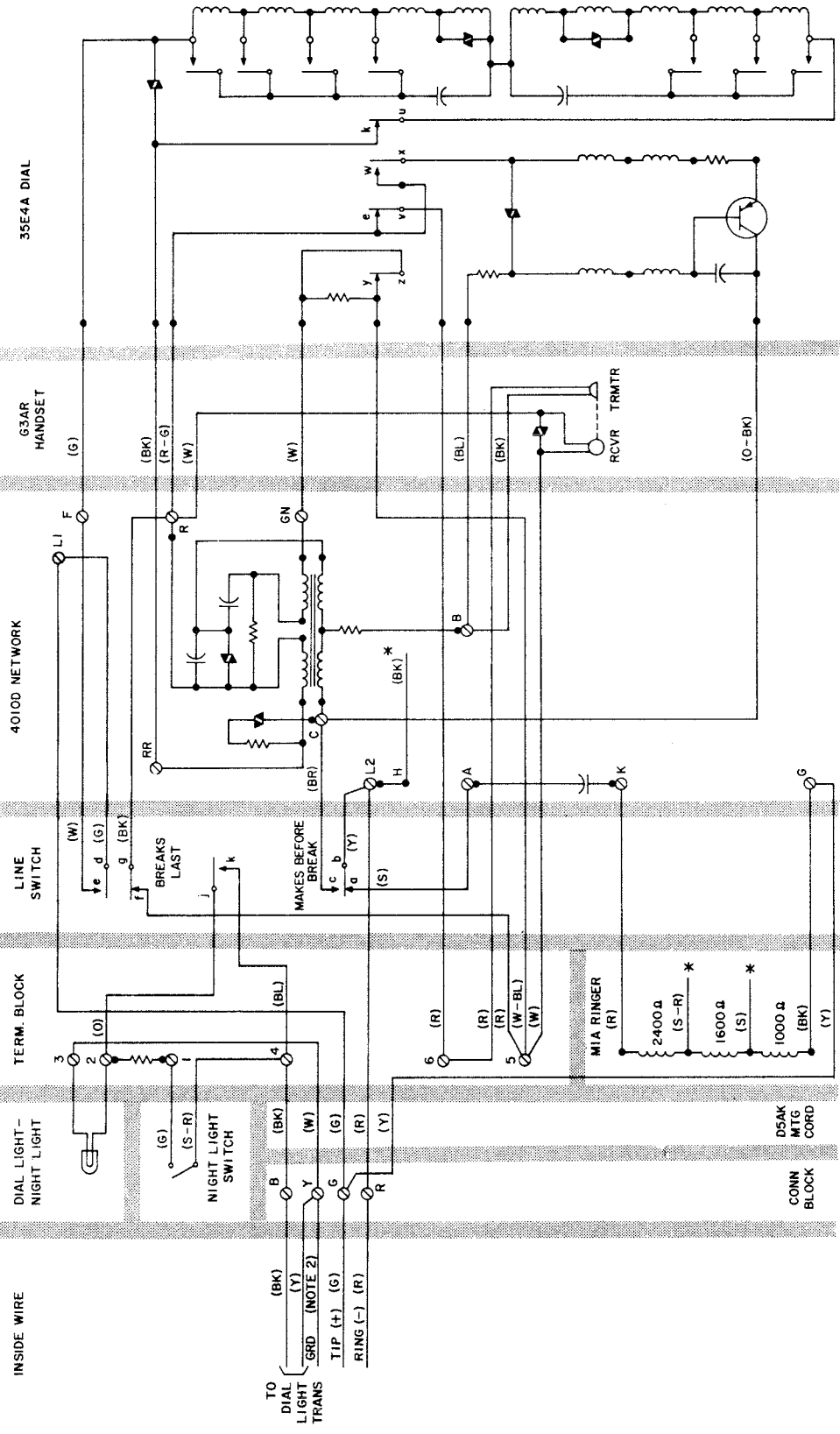


Fig. 1 — 2702B Telephone Set, Connections

- NOTES:
1. TO MODIFY 2702B TELEPHONE SET AS SHOWN IN FIG. 2, REWIRE THE SET ACCORDING TO TABLE D.
  2. POLARITY GUARD ASSEMBLY CAN BE ORDERED AND INSTALLED SEPARATELY AS D-180229 KIT OF PARTS. CONNECT AS SHOWN IN TABLE E.
  3. DO NOT STRAP NETWORK TERMINALS L2 AND C WHEN A POLARITY GUARD IS USED.
- \* INSULATE AND STORED.

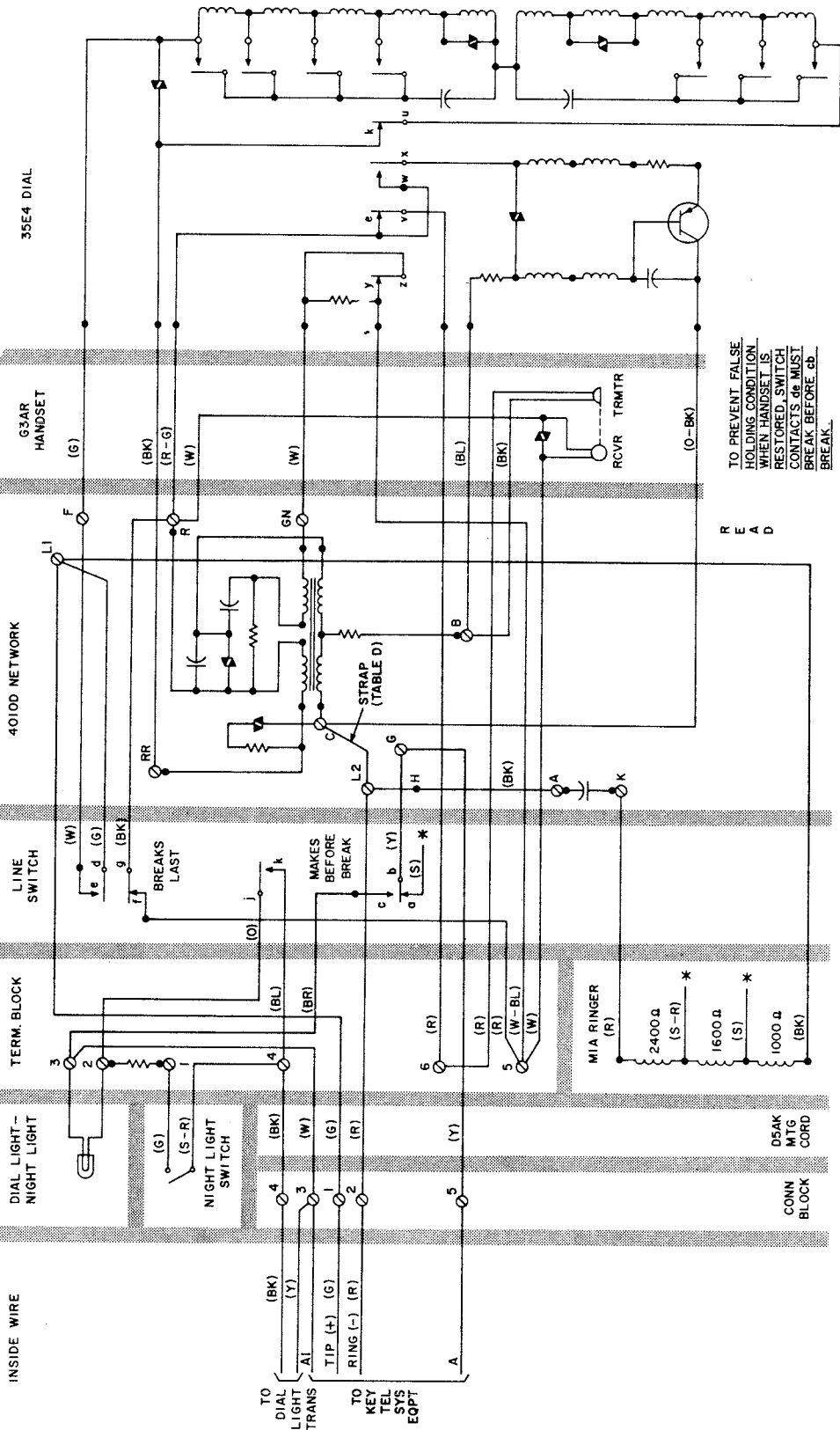


Fig. 2 — 2702B Telephone Set, Wired For Use With 1A1 or 1A2 Key Telephone System

- NOTES:
1. TO PERMANENTLY SILENCE RINGER, REMOVE (R) RINGER LEAD AT k OF NETWORK. INSULATE AND STORE THIS LEAD.
  2. GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE FORMER.
  3. POLARITY GUARD ASSEMBLY CAN BE ORDERED AND INSTALLED SEPARATELY AS D-180229 KIT OF PARTS. CONNECT AS SHOWN IN TABLE C, CONDITION ①.
- \* INSULATED AND STORED.

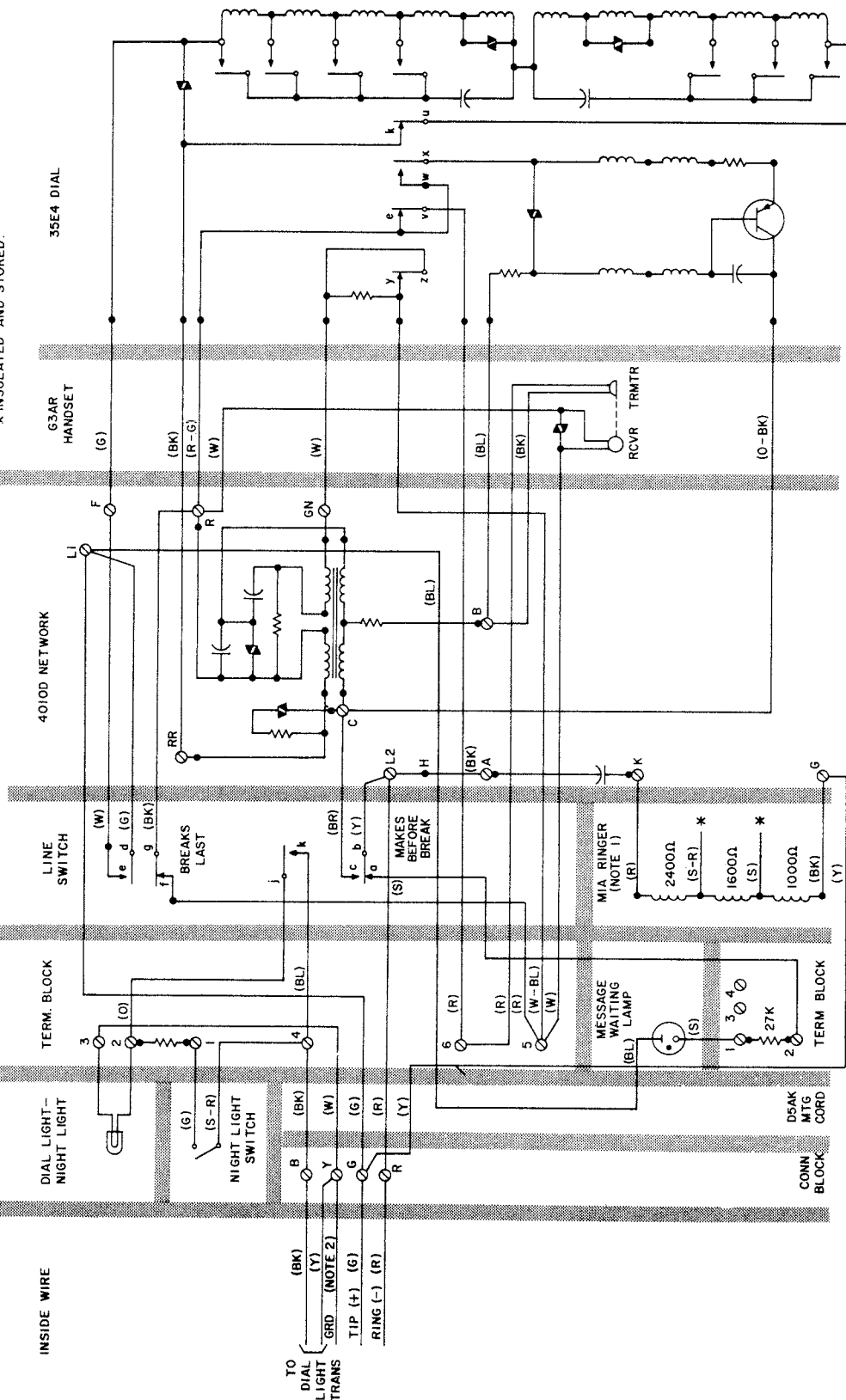


Fig. 3 — 2702D Telephone Set, Connections

TELEPHONE SETS  
750, 751, 1750, 1751, 2750, AND 2751 TYPES  
IDENTIFICATION, INSTALLATION, AND MAINTENANCE

1. GENERAL

1.001 This addendum supplements Section 502-750-100, Issue 5.

1.002 This addendum is issued to add information on the use of the 3A and 3B cord reels.

4. MAINTENANCE

The following change applies to Part 4 of the section.

(a) 4.05 Read — added



*The 3A cord reel shall be used in all locations where the telephone set is subject to temperatures below 40 degrees F. When the telephone set is not subjected to temperatures below 40 degrees F, the 3B cord reel shall be used.*





## TELEPHONE SETS

### 750, 751, 1750, 1751, 2750, AND 2751 TYPES

### IDENTIFICATION, INSTALLATION, AND MAINTENANCE

#### 1. GENERAL

1.01 This section is reissued to add information on:

- 114A apparatus box
- 2750- and 2751-type telephone sets
- 3B cord reel
- 25W3 dial (replaces 25A3 (MD) dial)
- P-90D060 guard assembly
- D-180071, D-180072, and D-180115 Kit of Parts
- 751A and B (MD) telephone sets

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. IDENTIFICATION

2.01 The 750-, 1750-, and 2750-type single line general purpose sets and 751-, 1751-, and 2751-type two line sets may be recess mounted or adapted for surface mounting using D-180071 or D-180072 Kit of Parts (Fig. 1, 2, and 3).

2.02 Component parts (Tables A, B and Fig. 4) of these sets are mounted on a steel panel. An aluminum mat retained by a plastic frame covers the panel and gives the installation a finished appearance.

#### ORDERING GUIDE

Set, Telephone, 750A-58, 750B-60, 751A-58 (MD), 751B-60 (MD), 751C-58, 751D-60

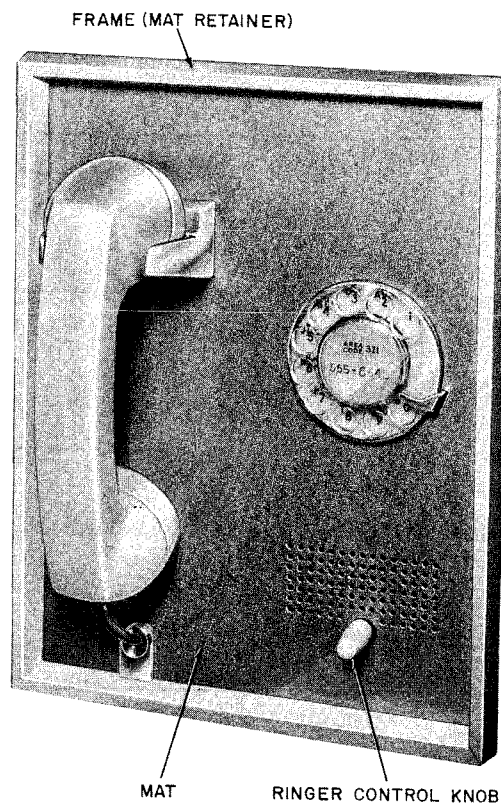


Fig. 1—750-Type Telephone Set

Set, Telephone, 1750A-58, 1750B-60, 1751C-58, 1751D-60

Set, Telephone, 2750A-58, 2750B-60, 2751C-58, 2751D-60

**Note:** -58 includes white handset, aluminum mat, and light gray plastic frame. -60 includes light beige handset, copper mat, and light beige plastic frame.

(a) **Replaceable Components:** Refer to Tables A and B.

**TABLE A**  
**COMPONENT ORDERING GUIDE (COLOR SIGNIFICANT)**

TELEPHONE SET	MAT	FRAME (MAT)	LINE SWITCH ASSEMBLY	HANDSET
750A-58	P-26E934	P-84A261* P-89C261†	P-85A161	G3K-58
1750A-58	P-26E932			
2750A-58	P-21F788			
750B-60	P-26E935	P-84A260* P-89C260†	P-85A160	G3K-60
1750B-60	P-26E933			
2750B-60	P-21F789			
751A-58 751C-58	P-26E928	P-84A261* P-89C261†	P-89A461	G3K-58
1751C-58	P-26E926			
2751C-58	P-21F790			
751B-60 751D-60	P-26E929	P-84A260* P-89C260†	P-89A460	G3K-60
1751D-60	P-26E927			
2751D-60	P-21F791			

\* Furnished with telephone set.

† Furnished with kit of parts used for surface mounting.

**TABLE B**  
**COMPONENT ORDERING GUIDE**

TYPE TELEPHONE SET	DIAL	RINGER	CORD REEL	MOUNTING CORD	EXCLUSION SWITCH	LINE PICKUP KEY	GROMMET (HANDSET CORD)
750	8A	D1B or D1E	3A or 3B	D4BN-3			P-44E501† (Upper Half) P-44E502† (Lower Half)
1750	25W3* 25A3 (MD)	D1E					
2750	35A3A						
751A and B	8A			D12E	P-24E121	584D	
751C and D							
1751	25W3* 25A3 (MD)			P-26E909	584G		
2751	35A3A						

\* May be converted to provide 12-button capability by installing a D-180115 Kit of Parts and replacing mat with appropriate 12-button mat. Refer to Table A for mat piece part ordering information.

† These components replace the P-14E894 (MD) grommet assembly used in early production 750-, 751-, 1750-, and 1751-type sets.

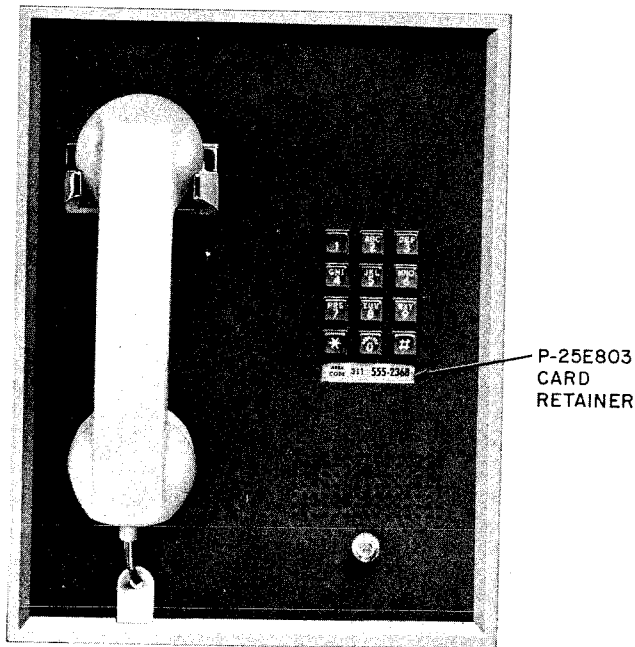


Fig. 2—2750-Type Telephone Set

(b) *Replaceable Optional Components:*

- Loudspeaker, 761A (1A home interphone)
- Transmitter, 664B (1A home interphone)
- P-90D060 Guard Assembly

(c) *Associated Apparatus or Equipment (ordered separately):*

- Apparatus box, 113-type or 114A (recessed mounting)
- D-180071 or D-180072 Kit of Parts (surface mounting)
- Connecting Block, 71B

(d) *Associated Optional Apparatus or Equipment (1A home interphone):*

- Unit, Control, 51A
- Receiver, 730A
- Transformer, 2012A or KS-16184

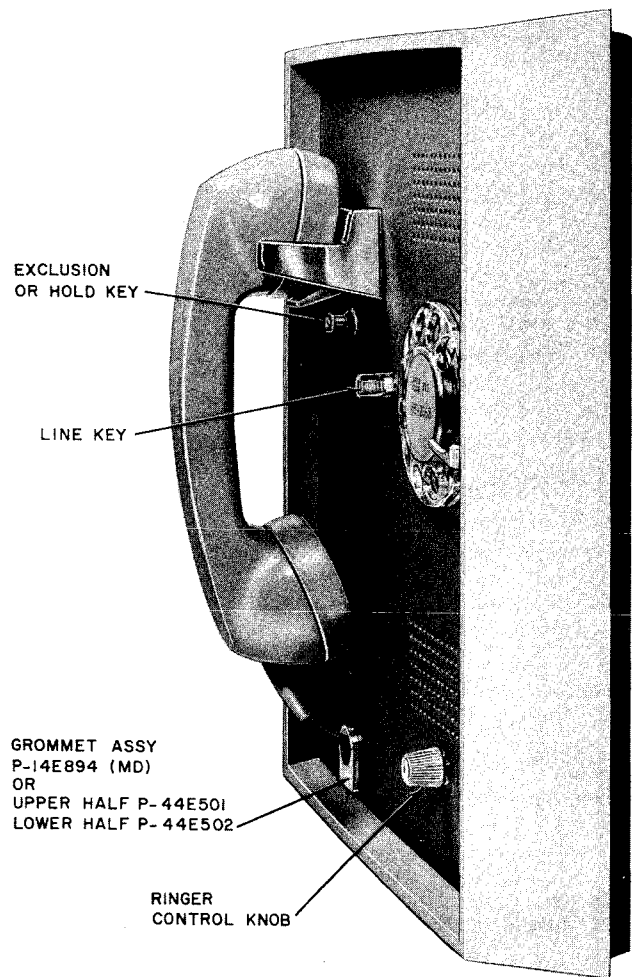


Fig. 3—751-Type Telephone Set Installed in D-180071 or D-180072 Kit of Parts

(e) *Loose Parts Furnished With Set:*

- Cord, Mounting, D4BN-3 equipped with 423A plug (750-, 1750-, and 2750-type sets)
- Cord, Mounting, D12E (751-, 1751-, 2751-type sets)
- Instruction Booklet, GN-2408
- P-160828 Mounting Screws (4)
- P-25E803 Retainer, Card

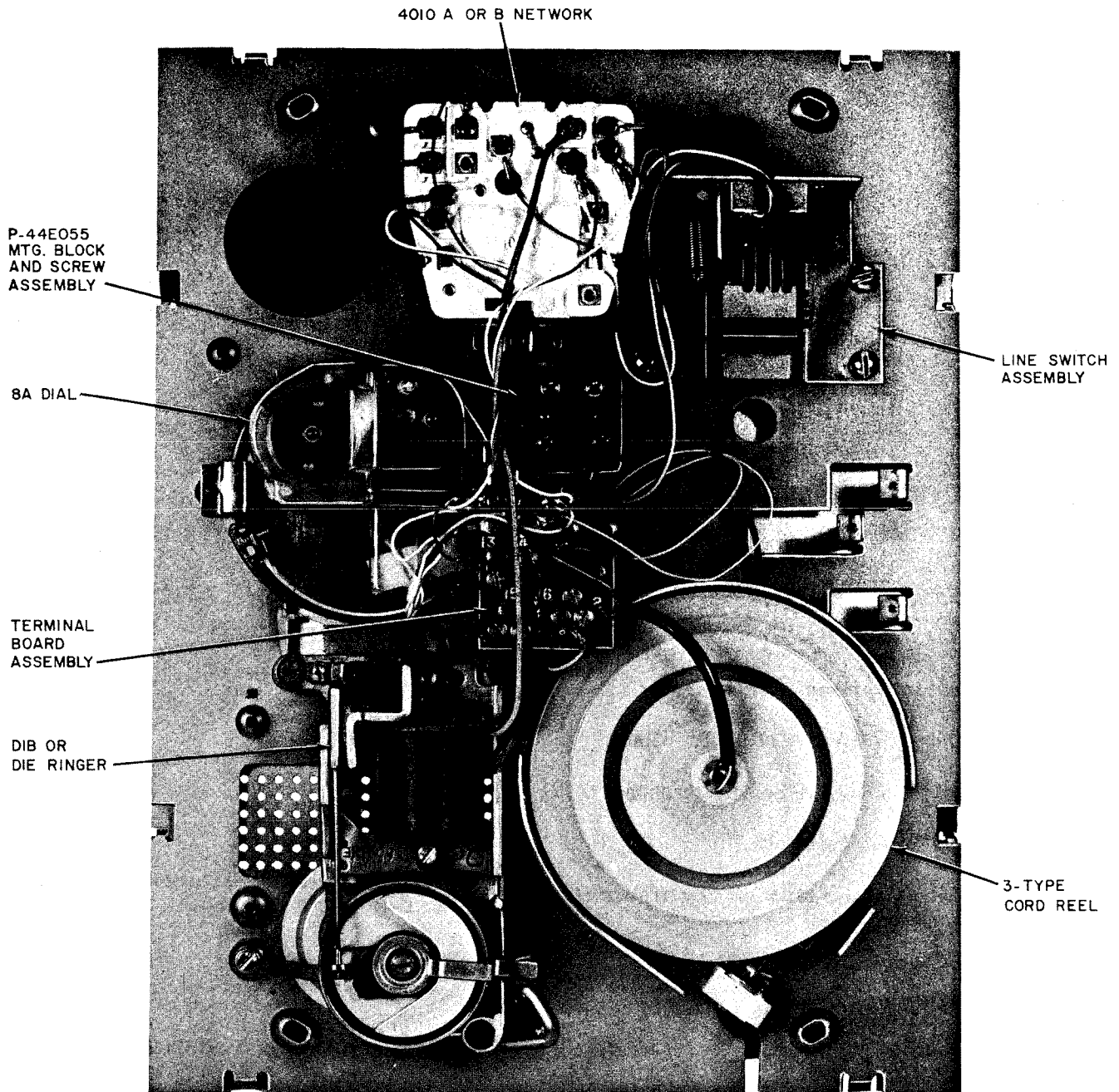


Fig. 4—750-Type Telephone Set, Rear View

**DESIGN FEATURES**

- Single line general purpose (750-, 1750-, and 2750-type sets)
- 2-line pickup, signaling, and exclusion on one line (751-, 1751-, and 2751-type sets)

- 1A home interphone and hold on one line—optional (751-, 1751-, and 2751-type sets)

**APPLICATION**

- CO or PBX lines, 750-, 751A-, 751B-, 1750-, and 2750-type sets

- CO or PBX lines, and 1A1 or 1A2 KTS, 751C-, 751D-, 1751-, and 2751-type sets

### 3. INSTALLATION

#### (a) *Planning:*

- Safety for yourself, customer, and maintenance personnel
- Convenience to the customer
- Space requirements
- Distance between associated equipment or apparatus
- General appearance of installation

(b) *Apparatus Boxes 113-Type or 114A:* Refer to appropriate installation section in Division 463.

#### (c) *Installation Using 113-Type or 114A Apparatus Boxes (Fig. 5):*

- (1) Remove cover of apparatus box, if so equipped (see section covering apparatus boxes).
- (2) Install 71B connecting block (ordered separately) to mounting bracket located in upper right corner of apparatus box. (Consult Division 461 for further information on this type of connecting block.)
- (3) Secure mounting cord stayhook and terminate inside wire or cable and mounting cord in accordance with appropriate connection section.
- (4) Remove plastic mat retainer frame and mat from telephone set.
- (5) Position panel on lower edge of apparatus box with top tilted outward. Connect mounting cord plug to connector on set panel. Dress mounting cord to avoid interference with telephone set components. Align panel of set with mounting brackets on box and secure with four mounting screws furnished with set.

- (6) Position mat on panel and secure using the mat retainer frame. If necessary, the projecting tabs may be adjusted to insure a snug fit.

#### (d) *Installation Using D-180071 or D-180072 Kit of Parts (Fig. 6):*

- (1) The D-180071 (light gray frame) or D-180072 (light beige frame) Kit of Parts, ordered separately, permits mounting these sets on the surface of a wall.
  - (2) The base pan assembly is arranged for mounting on a 63A or KS-19407L1 bracket or a standard electrical outlet box.
- Note:** Additional mounting holes in the base pan assembly provide for securing to wall surface using nails or screws as required.
- (3) After securing the base pan to the wall fasten the 71B connecting block (ordered separately) to the bracket provided. Terminate inside wire or cable and telephone set mounting cord as shown in appropriate connection section.

- (4) Connect mounting cord plug to connector on set panel. Dress mounting cord to avoid interference with telephone set components.

- (5) Align panel of set with mounting screws furnished with the set.

- (6) Position mat on panel and secure using plastic frame (P-89C260 or P-89C261) from kit of parts.

**Note:** The frame furnished with the telephone set is not required for this installation.

(e) *Installation of Optional 1A Home Interphone Components (751-, 1751-, and 2751-type sets):* Refer to appropriate connection and maintenance section in Division 512.

#### (f) *Installation of P-90D060 Guard Assembly:*

The P-90D060 polarity guard-surge protector assembly may be installed in sets equipped with either a 10- or 12-button TOUCH-TONE® dial (Fig. 7). Refer to appropriate connection section for connection information.

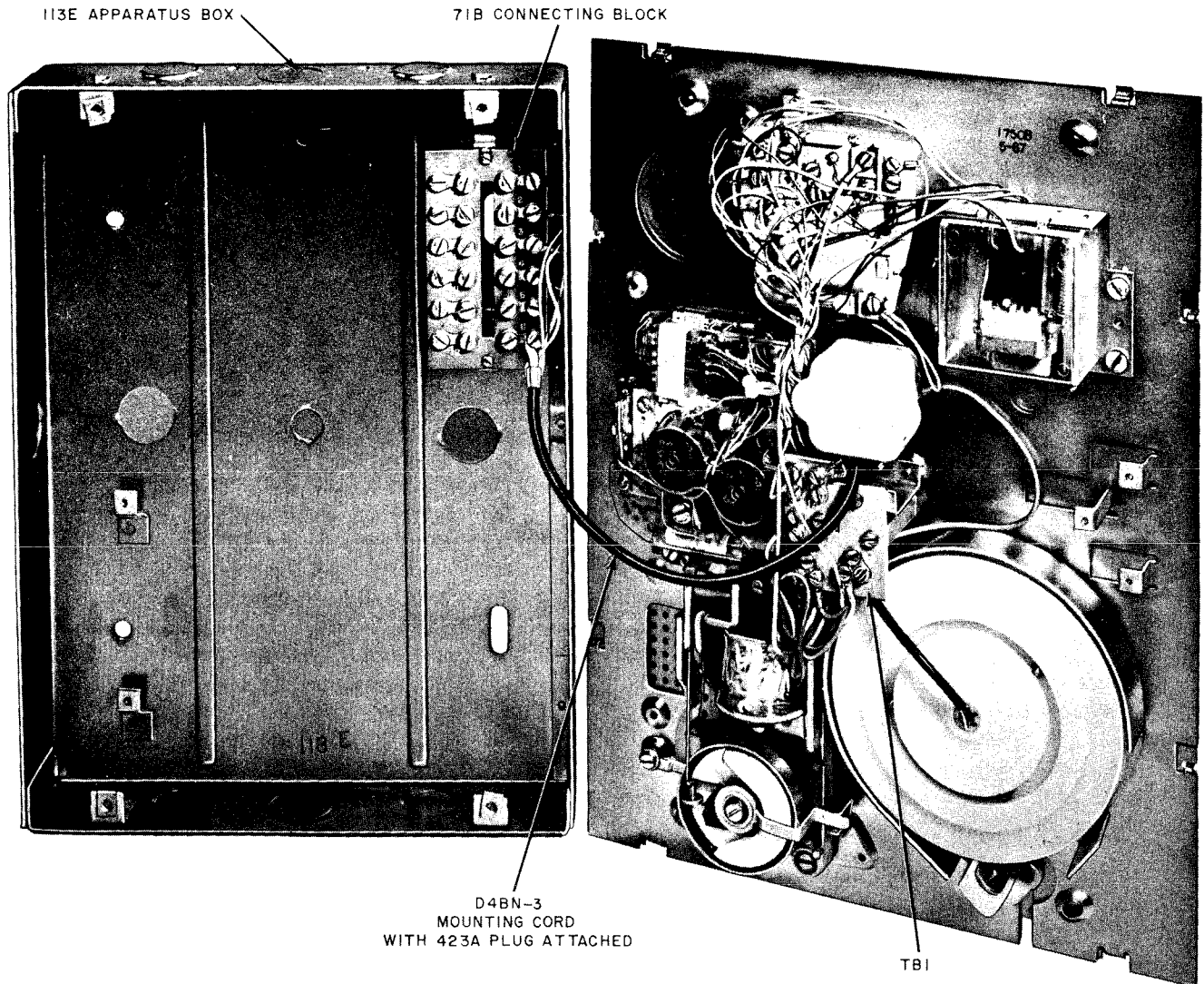


Fig. 5—1750-Type Telephone Set With 113E Apparatus Box

**Note:** Make connections to terminals of polarity guard before mounting assembly.

(g) **Installation of Cold-Cathode Tubes:**

- A 425A or 426A cold-cathode electron tube may be required to provide selective or semiselective ringing service when a 750- or 751-type telephone set is installed for 4- or 8-party service. The tubes are not furnished with the set and must be ordered and installed separately.
- To install in an apparatus box, obtain a 1/4-inch Tinnerman clamp and a No. 10 X 3/4-inch long self-tapping screw. Secure the clamp to the tube base using the mounting screw furnished with the tube. Insert the self-tapping screw through the cable clamp loop and fasten tube to the apparatus box using an existing nailing hole or a hole drilled at required location (Fig. 8).
- To install on the base pan assembly, secure the tube to an existing nailing hole using the mounting screw furnished with the tube (Fig. 9).

- Use M1W cords or equivalent and D-161488 connectors to extend tube leads sufficiently to reach terminal block. Make connections as shown in appropriate connection section.

**Note:** Select a location for the tube which will not interfere with telephone set components when the panel set is installed. For 750- or 751-type sets not equipped with 1A home interphone components, tube can be located on upper-right side of apparatus box near connecting block. For 751-type sets with home interphone components mounted, locate the tube on the lower wall of the apparatus box so that it will be between the ringer and cord reel when the telephone set is installed.

#### 4. MAINTENANCE

**4.01** Work done on customer's premises should be limited to replacement of accessible parts which are available through supply channels; refer to ordering guide tables.

**Note:** Early production 750-, 751-, 1750-, and 1751-type sets were equipped with a three piece metal grommet assembly (Fig. 10). It is recommended that the metal grommet assembly be replaced when any maintenance is performed on these sets. (See Table B, Fig. 10 and 11.)

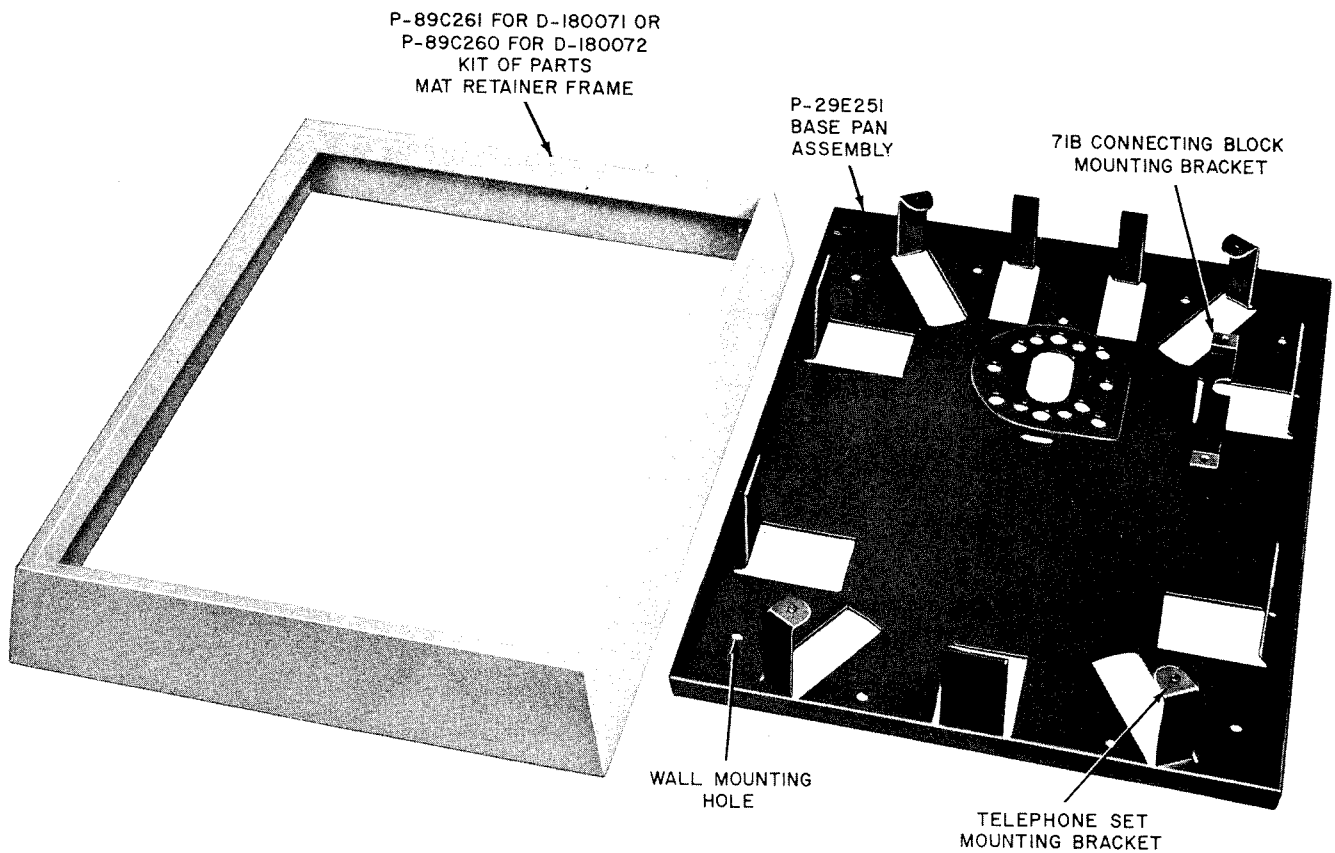


Fig. 6—D-180071 or D-180072 Kit of Parts For Surface Mounting

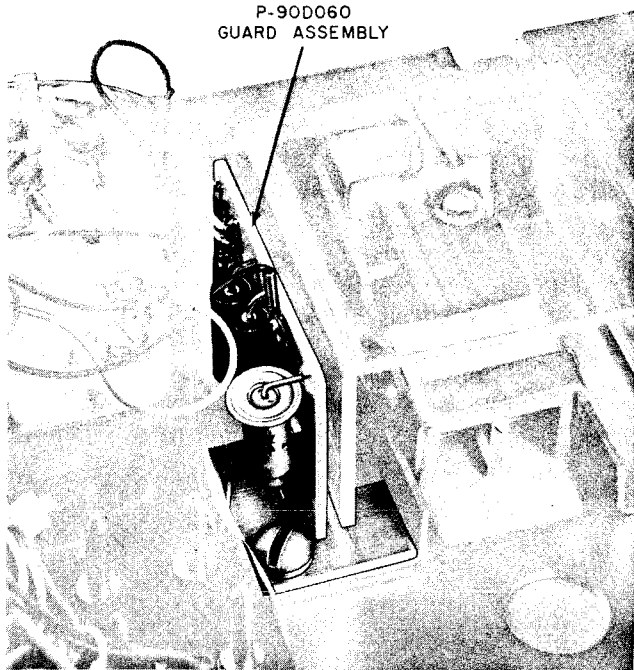


Fig. 7—Installed P-90D060 Guard Assembly

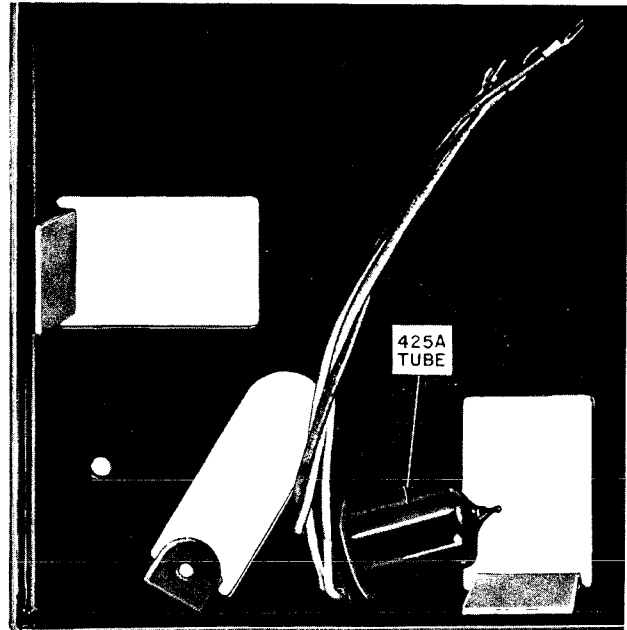


Fig. 9—Installation of Cold-Cathode Tube on Base Pan Assembly

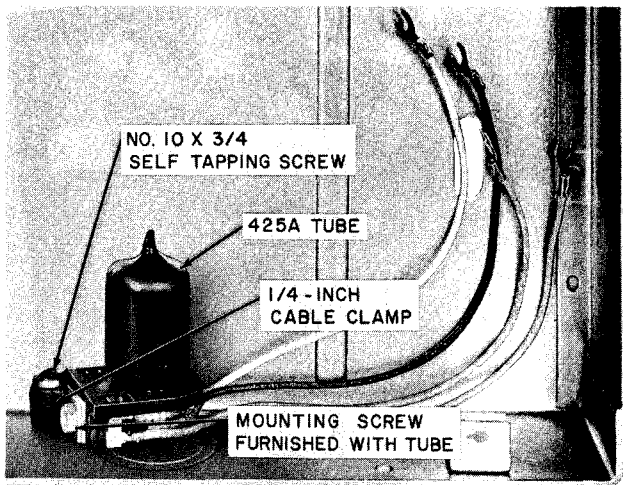


Fig. 8—Installation of Cold-Cathode Tube in Apparatus Box

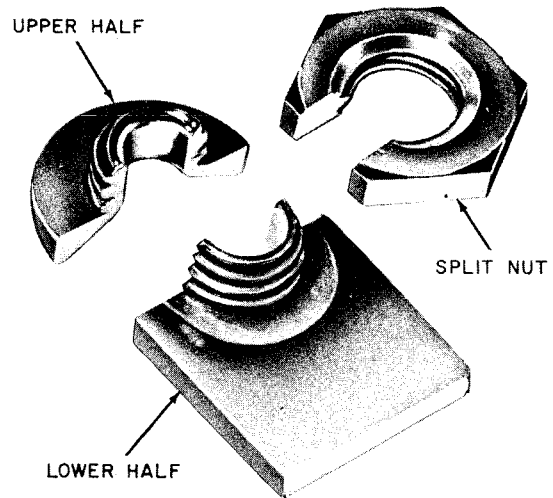


Fig. 10—P-14E894 (MD) Grommet Assembly

4.02 Ringers, handsets, dials, etc. used in these sets should be maintained in accordance with section covering the particular item.

**MAT**

4.03 The exterior of these sets should be clean and not marred or chipped. The vinyl-faced



mat may be cleaned with a water-dampened KS-2423 or equivalent cloth. Replace defective mat as follows:

- Grasp mat retainer frame at top, lift upward and out to release frame from panel of set.
- Remove handset from hook of set.
- Pull out handset cord to allow working slack.
- Remove mat from face of panel.
- Remove grommet from mat as shown in Fig. 11.
- Install grommet in new mat by reversing procedure used in removal.
- Position mat on panel and secure using the mat retainer frame.

### 3-TYPE CORD REEL

**4.04** To test the cord reel, pull the handset cord out to its maximum length. With the cord maintained perpendicular to the panel, the cord should retract fully. Any twists in the cord should be removed before making test.

**4.05** Replace the cord reel if the cord will not retract or if the cord is frayed, kinked, or noisy. Field maintenance of the cord reel or replacement of the cord is not recommended.

### RINGER VOLUME CONTROL

**4.06** The ringer volume control should operate without restriction when the knob is turned. Replace set if the control mechanism is worn or defective.

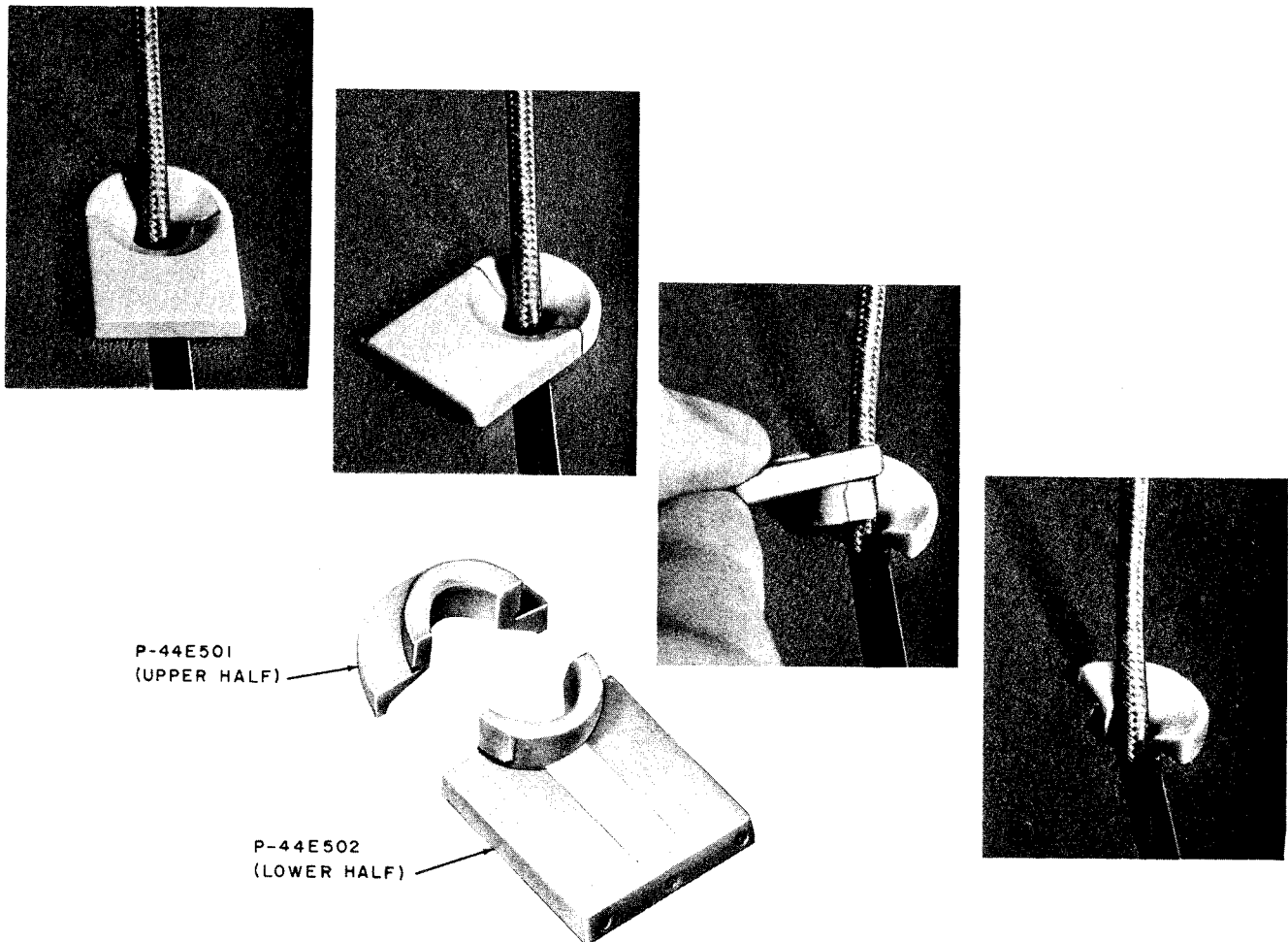


Fig. 11—Removal of Handset Cord Grommet



## TELEPHONE SETS—750A AND 750B CONNECTIONS

### 1. GENERAL

**1.01** This section is reissued to include information on the 3B cord reel used as a component of current production panel style telephone sets, to include operating temperature limitations for the 3-type cord reel, and to show current connections for electron tubes used for selective ringing service. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.



*Current production models are equipped with the 3B cord reel. Either the 3A or 3B cord reel may be used when the telephone set is not subjected to temperatures below 40 degrees F. Below 40 degrees F only the 3A cord reel should be used.*

**1.02** The 3B cord reel is similar to the 3A cord reel except that the conductor insulation and outer covering is poly-vinyl chloride (PVC) material. The conductor insulation of 3A cord reels is braided nylon.

### 2. PERMANENTLY SILENCED RINGER

**2.01** To silence ringer permanently, proceed as follows:

- (1) For all classes of service except tip party identification, remove, insulate, and store the (BK) ringer lead from **BK** (early model) or **I** (later model) terminal of TB1.
- (2) For tip party service with 1000 ohm identification ground, remove, insulate, and

store the (S-R) ringer lead from **BK** (early model) or **I** (later model) terminal of TB1.

- (3) For tip party service with 2650 ohm identification ground, remove, insulate, and store the (BK) strap lead of terminal board (TB1) from **K** of network.

### 3. CONNECTION INDEX

Table A—750A and 750B Telephone Sets (Later Models) Line and Ringer Connections

Table B—750A and 750B Telephone Sets (Later Models) Line, Ringer, and 426A Tube Connections for Selective Ringing Service

Table C—750A and 750B Telephone Sets (Later Models) Line, Ringer, and 425A Tube Connections for Selective Ringing Service and Noise Reduction

Table D—750A and 750B Telephone Set (Early Models) Line and Ringer Connections

Table E—750A and 750B Telephone Sets (Early Models) Line, Ringer, and 426A Tube Connections for Selective Ringing Service

Table F—750A and 750B Telephone Sets (Early Models) Line, Ringer, and 425A Tube Connections for Selective Ringing Service and Noise Reduction

Fig. 1—750A and 750B Telephone Sets (Later Models)—Connections

Fig. 2—750A and 750B Telephone Sets (Early Models)—Connections

TABLE A  
750A AND 750B TELEPHONE SETS (LATER MODELS) LINE AND RINGER CONNECTIONS

WIRE OR LEAD	COLOR	INDIVIDUAL OR BRIDGED (FACTORY WIRING)	RING PARTY	TIP PARTY			TIP PARTY WITH IDENTIFICATION GROUND										
				NORMAL CONNECTIONS			1000 OHMS			2650 OHMS			RINGER REVERSAL (NOTE 1)				
				TB2	283B PLUG	NET.	TB2	283B PLUG	NET.	TB2	283B PLUG	NET.	TB2	283B PLUG	NET.	TB2	283B PLUG
C. O. LINE AT TERMINAL STRIP	R	2															
	G	1	2														
	Y	3*	1														
RINGER LEADS	R																
	BK	1															
	S																
	S-R	2															
TB1 STRAPS (NOTE 2)	BK																
	S-R																
LINE SWITCH	S																

\* Ground may be omitted if not required for service.

Note 1: Use normal connections for tip party identification ground station. If bell taps on station connected to long-line equipment, reverse ringer leads as shown in this column to retain proper tip party identification.

Note 2: One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.

**TABLE B**  
**750A AND 750B TELEPHONE SETS (LATER MODELS) LINE, RINGER, AND 426A TUBE CONNECTIONS**  
**FOR SELECTIVE RINGING SERVICE**

WIRE OR LEAD	COLOR	NEGATIVE (-) PARTIES						POSITIVE (+) PARTIES										
		RING STATION 1 AND 5			TIP STATION 2 AND 6			RING STATION 3 AND 7			TIP STATION 4 AND 8							
		TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	
C. O. LINE AT TERMINAL STRIP	R	2				1				2								
	G	1				2				1								
	Y	3				3				3								
RINGER LEADS	R		1								1							1
	BK		1								1							1
	S								K									K
	S-R		2								2							2
TB1 STRAPS (NOTE)	BK			Y								Y						R
	S-R								A									A
	BK								A									A
426A TUBE (3-ELEMENT)	R																	1
	Y																	Y

**Note:** One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.

**TABLE C**  
**750A AND 750B TELEPHONE SETS (LATER MODELS) LINE, RINGER, AND 425A TUBE CONNECTIONS**  
**FOR SELECTIVE RINGING SERVICE AND NOISE REDUCTION**

WIRE OR LEAD	COLOR	NEGATIVE (-) PARTIES						POSITIVE (+) PARTIES										
		RING STATION 1 AND 5			TIP STATION 2 AND 6			RING STATION 3 AND 7			TIP STATION 4 AND 8							
		TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	
C. O. LINE AT TERMINAL STRIP	R	2				1				2								
	G	1				2				1								
	Y	3				3				3								
RINGER LEADS	R		1							1								K
	BK		1							1				2				
	S															Y		Y
	S-R		2							2						Y		Y
TB1 STRAPS (NOTE)	BK			R												R		R
	S-R				A												A	A
425A TUBE (4-ELEMENT)	R			GN										1				1
	G		1							1							GN	
	BK			Y														1
	Y				A													K

**Note:** One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.

**TABLE D**  
**750A AND 750B TELEPHONE SETS (EARLY MODELS) LINE AND RINGER CONNECTIONS**

WIRE OR LEAD	COLOR	INDIVIDUAL OR BRIDGED (FACTORY WIRING)	RING PARTY			TIP PARTY			TIP PARTY WITH IDENTIFICATION GROUND									
			RING PARTY		TIP PARTY		NORMAL CONNECTIONS			RINGER REVERSAL (NOTE 1)								
			TB2	283B PLUG	NET	TB2	283B PLUG	NET	1000 OHMS	2650 OHMS	1000 OHMS	2650 OHMS	1000 OHMS	2650 OHMS				
C. O. LINE AT TERMINAL STRIP	R	2					1					1						
	G	1					2					2						
	Y	3*					3					3						
RINGER LEADS		TB1	283B PLUG	NET	TB1	283B PLUG	NET	TB1	283B PLUG	NET	TB1	283B PLUG	NET	TB1	283B PLUG	NET	TB1	283B PLUG
	R	R					R	SR				SR						
	BK	BK					BK	SR				SR	Y				BK	
	S											Y					SR	
	S-R	SR					SR	BK					Y				SR	
TB1 STRAPS (NOTE 2)	R	R					R					R						R
	BK	GN					Y										K	
	S-R																B	
LINE SWITCH	S	R				R										A		

\* Ground may be omitted, if not required for service.

Note 1: Use normal connections for tip party identification ground station. If bell taps on station connected to long-line equipment, reverse ringer leads as shown in this column to retain proper tip party identification.

Note 2: One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.

**TABLE E**  
**750A AND 750B TELEPHONE SETS (EARLY MODELS) LINE, RINGER, AND 426A TUBE CONNECTIONS**  
**FOR SELECTIVE RINGING SERVICE**

WIRE OR LEAD	COLOR	NEGATIVE (-) PARTIES						POSITIVE (+) PARTIES										
		RING STATION 1 AND 5			TIP STATION 2 AND 6			RING STATION 3 AND 7			TIP STATION 4 AND 8							
		TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	
C. O. LINE AT TERMINAL STRIP	RING	R	2			1				2								
	TIP	G	1			2				1								
	GRD	Y	3			3				3								
RINGER LEADS	R	R		BK				BK						R				
	BK	BK		BK				BK						BK				
	S	S											K					K
	S-R	S-R		SR				SR						SR				SR
TB1 STRAPS (NOTE)	R	R					R							R				R
	BK	BK		Y			Y							R				R
	S-R	S-R											A					A
426A TUBE (3-ELEMENT)	BK	BK											A					A
	R	R		GN			GN											BK
	Y	Y												R			Y	Y

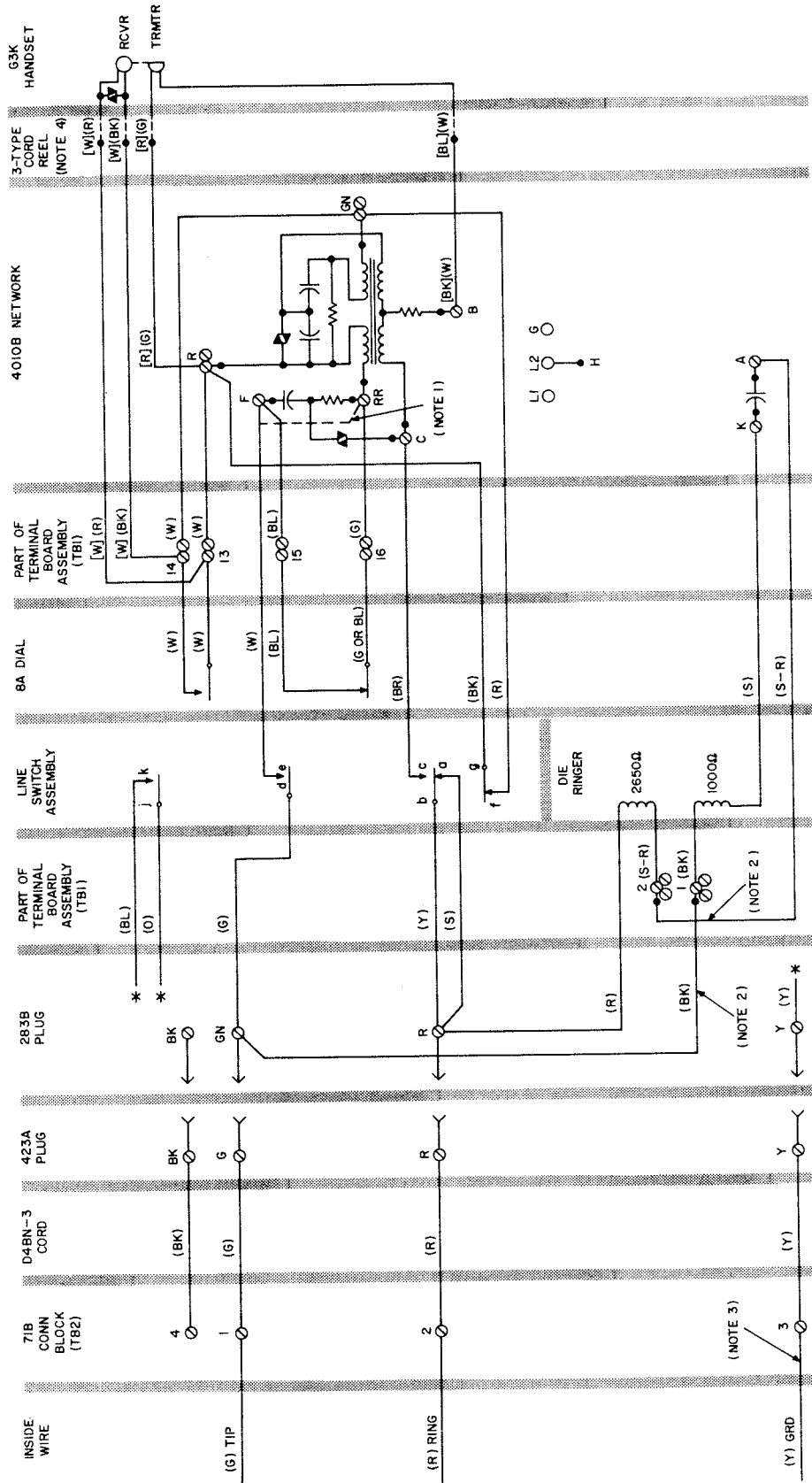
**Note:** One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.



**TABLE F**  
**750A AND 750B TELEPHONE SETS (EARLY MODELS) LINE, RINGER, AND 425A TUBE CONNECTIONS**  
**FOR SELECTIVE RINGING SERVICE AND NOISE REDUCTION**

WIRE OR LEAD	COLOR	NEGATIVE (-) PARTIES												POSITIVE (+) PARTIES							
		RING STATION 1 AND 5				TIP STATION 2 AND 6				RING STATION 3 AND 7				TIP STATION 4 AND 8							
		TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.	TB2	TB1	283B PLUG	NET.				
C. O. LINE AT TERMINAL STRIP	R	2				1				2											
	G	1				2				1											
	Y	3				3				3											
RINGER LEADS	R		R						R						R						
	BK		BK						BK						BK						
	S						K							SR			K				
	S-R		SR						SR						SR						
TB1 STRAPS (NOTE)	R			R							R							K			
	BK		R						R									A			
	S-R						A									Y					
425A TUBE (4-ELEMENT)	R			GN							GN					R					
	G		BK						BK								GN				
	BK			Y							Y						R				
	Y						A							R				R			

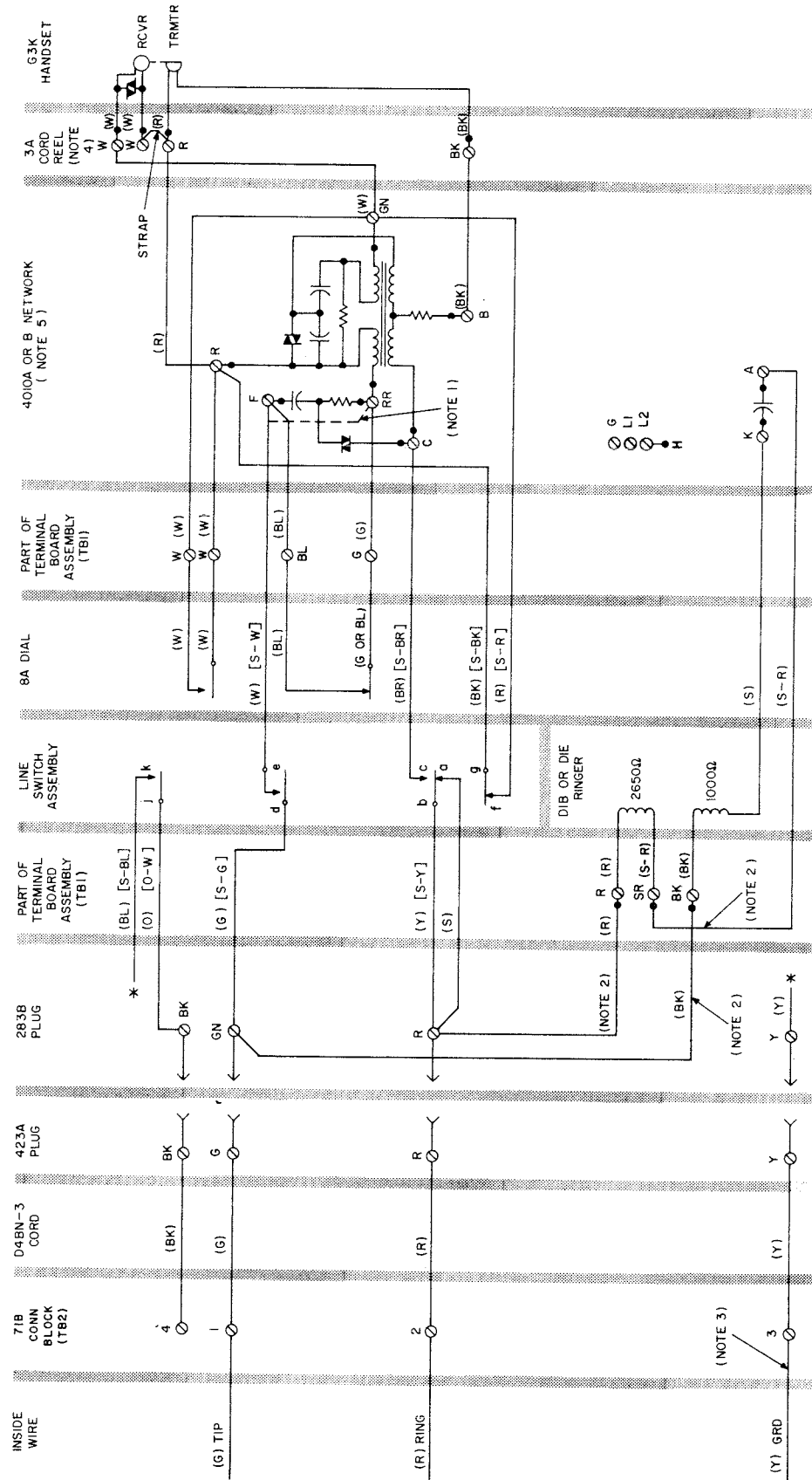
**Note:** One end of straps permanently soldered to TB1, other end equipped with spade tip terminal.



⊙ INDICATES TERMINAL WITH SCREW  
 ○ INDICATES TERMINAL WITHOUT SCREW  
 \* INSULATE AND STORE

NOTES:  
 1. FOR MANUAL SERVICE MOVE (W) LINE SWITCH LEAD FROM NETWORK TERMINAL F TO RR. DIAL REMAINS IN SET.  
 2. SEE TABLE C FOR TERMINATION OF THESE LEADS.  
 3. GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE.  
 4. (.) DENOTES 3A CORD REEL LEAD COLORS.  
 ( ) DENOTES 3B CORD REEL LEAD COLORS.

Fig. 1—750A and 750B Telephone Sets, (Later Models)—Connections



- NOTES:
1. FOR MANUAL SERVICE MOVE (W) [S-W] LINE SWITCH LEAD FROM NETWORK TERMINAL F TO RR. DIAL REMAINS IN SET.
  2. SEE TABLE A FOR TERMINATION OF THESE LEADS.
  3. GROUND MAY BE OMITTED IF NOT REQUIRED FOR SERVICE.
  4. LATE PRODUCTION CORD REELS ARE NOT EQUIPPED WITH TERMINAL STRIP.
5. 4010B NETWORK IS EQUIPPED WITH TERMINALS G, LI, L2, AND H.  
 \* INSULATE AND STORE.  
 ( ) INDICATES CURRENT COLOR CODE.  
 [ ] INDICATES MD COLOR CODE.

Fig. 2—750A and 750B Telephone Sets (Early Models)—Connections



TELEPHONE SETS — 1750-TYPE  
CONNECTIONS

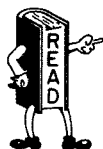
1. GENERAL

1.001 This addendum supplements Section 502-750-420, Issue 4.

1.002 This addendum is issued to add information on the use of the 3A and 3B cord reels.

The following change applies to Part 1 of the section.

(a) Read — added



*The 3A cord reels shall be used when the telephone set is subjected to temperatures below 40 degrees F. The 3B cord reel shall be used when the telephone set is not subjected to temperatures below 40 degrees F.*



## TELEPHONE SETS — 1750-TYPE CONNECTIONS

### 1. GENERAL

1.01 This section is reissued to:

- Add Fig. 2
- Add connections for 1A1 or 1A2 key telephone system
- Add polarity guard connections
- Change ringer connections for ring and tip parties without identifying ground in Table C

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

### 2. CONNECTION INDEX

Table A — Modifications for Use With 1A1 or 1A2 KTS

Table B — Polarity Guard Connections (P-90D060 Guard Assembly)

Table C — Line and Ringer Connections

Fig. 1 — 1750-Type Telephone Set Connections With 25A3 Dial

Fig. 2 — 1750-Type Telephone Set Connections With 25W3 Dial

**TABLE A**

**MODIFICATIONS FOR USE WITH 1A1 OR 1A2 KTS**

LEAD		FROM	TO
Line Switch	(Y) S-Y	R*	Y*
	(BR) S-BR	C	BK*
	(G) S-G	GN*	R*
	(W) S-S	F	C
M1W Cord or Equiv.			GN* to F
Line Wire	Y		3†
	BK		4†

\* Terminal on P-44E055 mounting block

† Terminal on 71A connecting block

**TABLE B**

**POLARITY GUARD CONNECTIONS  
(P-90D060 GUARD ASSEMBLY)**

LEAD		FROM	TO
Line Switch (Note)	(BR) S-BR	C	S*
Dial	BK	RR	T*
Polarity Guard	G		RR
	W		C

\* Terminal on polarity guard

*Note:* When connected for 1A1 or 1A2 KTS per table A, move (W)|S-S| from C to S.

TABLE C  
LINE AND RINGER CONNECTIONS

WIRE OR LEAD	INDIVIDUAL OR BRIDGED (NOTE 1)	RING PARTY	TIP PARTY	TIP PARTY WITH IDENT GRD				
				NORMAL CONNECTIONS		RINGER REVERSAL (NOTE 2)		
				1000 OHMS	2650 OHMS	1000 OHMS	2650 OHMS	
Incoming Line at 71A Connecting Block	Tip	G	1	1	2	2	2	
	Ring	R	2	2	1	1	1	
	GRD	Y	3	3	3	3	3	
Ringer Leads (Note 3)	R	R	R	GN	L1	B	2	Y
	BK	1	1	1	Y	L1	1	1
	S	K	K	K	B	K	Y	L1
	S-R	2	2	2	2	2	L1	2
Switch Hook Leads	S	R	R	R	A	A	A	A
	(W) [S-S]	F	F	F	C	C	C	C
	(BR) [S-BR]	C	C	C	F	F	F	F
Strap Connections	BK	GN to 1	1 to Y	1 to Y			1 to B	1 to K
	S-R	A to 2	A to 2	A to 2	B to 2	Y to 2	B to 2	2 to B
	W				L1 to K	L1 to B	L1 to K	L1 to B

Note 1: Set is factory wired for individual or bridged service.

Note 2: Use normal connections for tip party identification. If bell taps on station connected to long line equipment, reverse ringer leads as shown in this column to retain tip party identification.

Note 3: To silence ringer permanently when connected for:

- Individual, ring party, and tip party without identifying ground --- remove (S-R) strap from A of network and connect to 2 of TB1.
- 1000 Ω or 2650 Ω GRD --- remove (S) switch hook lead from A of network and insulate and store.

( ) Indicates current color code.

[ ] Indicates MD color code.



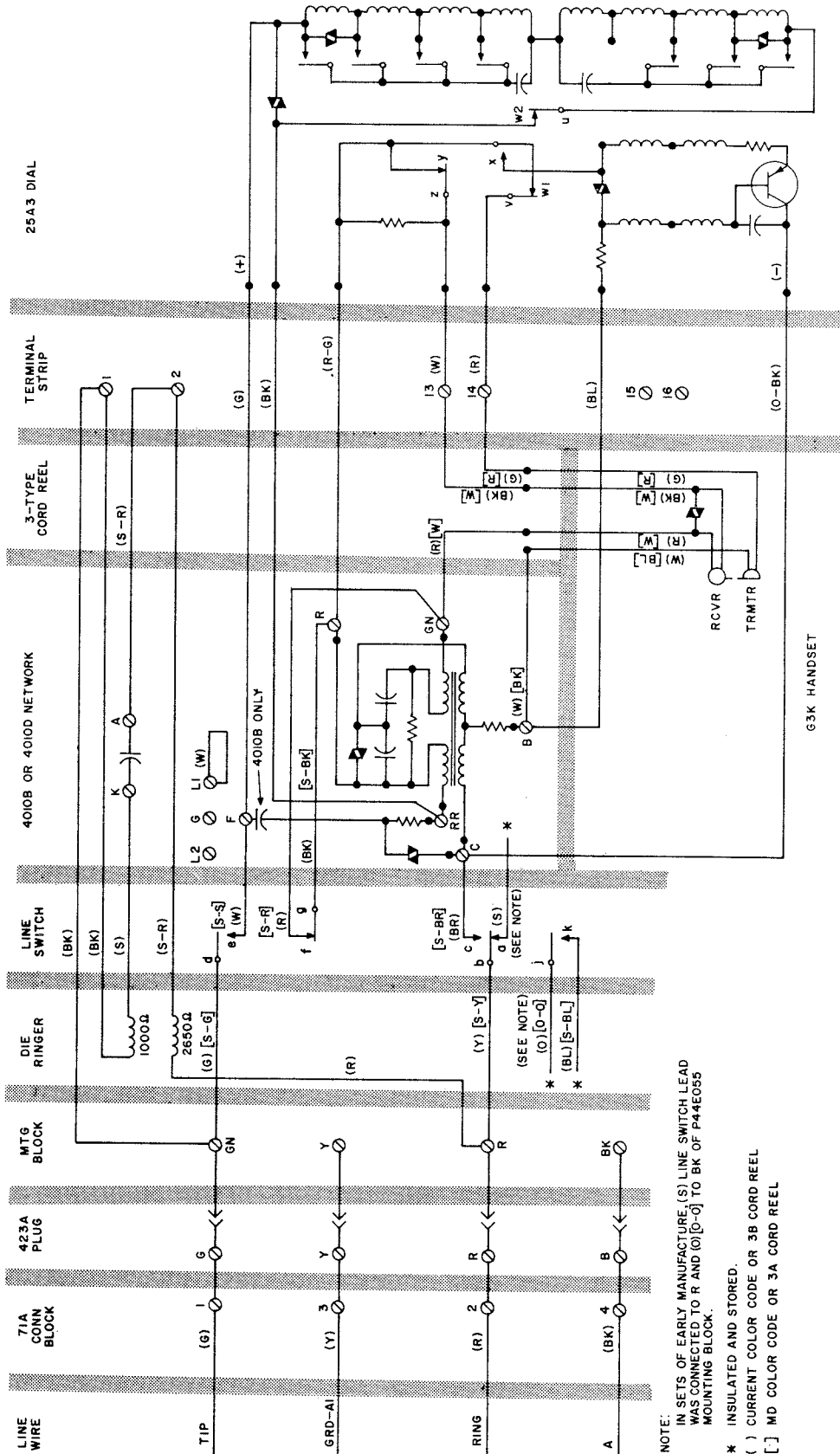


Fig. 1 — 1750-Type Telephone Set Connections With 25A3 Dial

NOTE:  
 IN SETS OF EARLY MANUFACTURE (S) LINE SWITCH LEAD  
 WAS CONNECTED TO R AND (O) [O-G] TO BK OF P44E055  
 MOUNTING BLOCK.

\* INSULATED AND STORED.

( ) CURRENT COLOR CODE OR 3B CORD REEL

[ ] MD COLOR CODE OR 3A CORD REEL

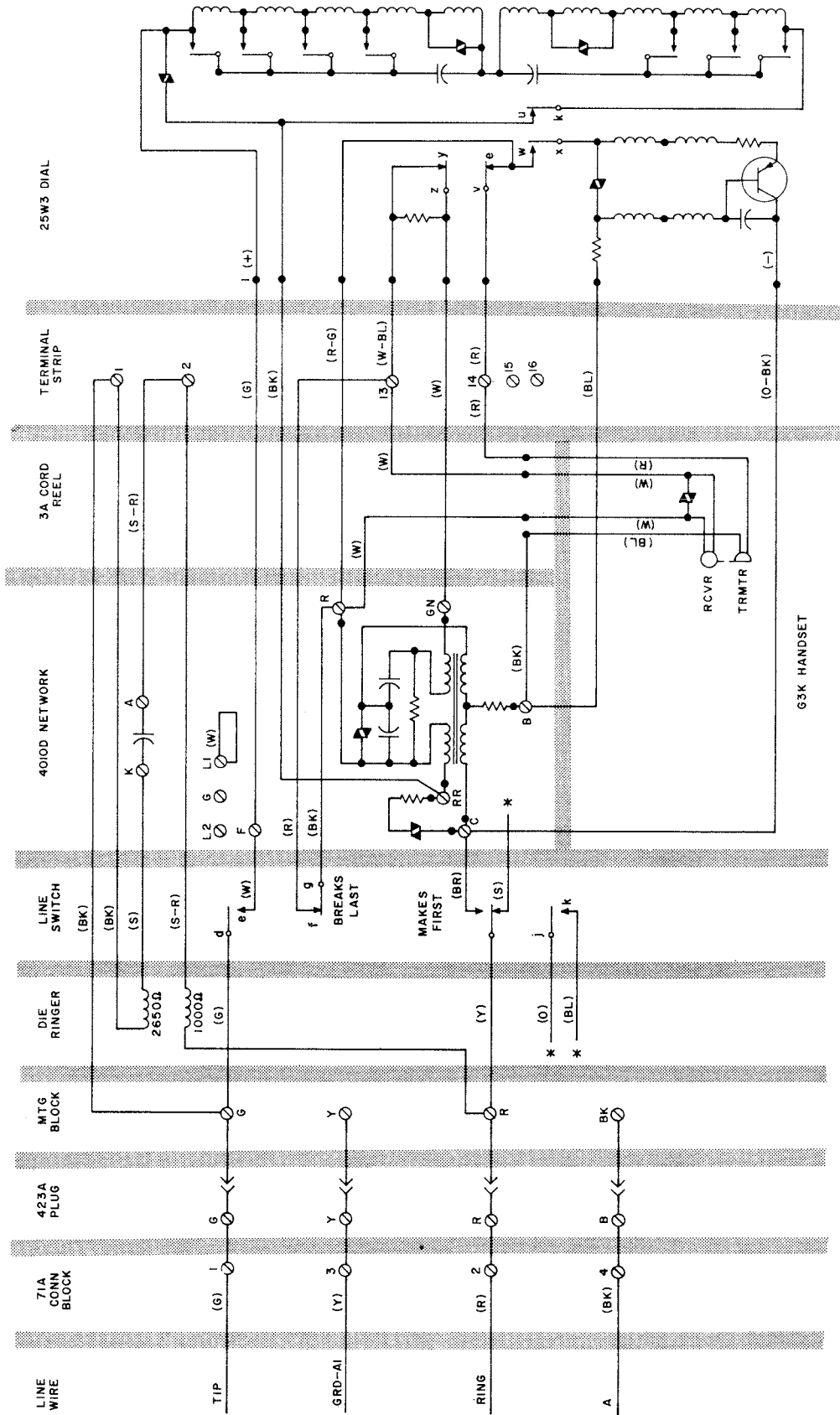


Fig. 2 — 1750-Type Telephone Set Connections With 25W3 Dial

## COIN COLLECTORS

### GENERAL INFORMATION AND METHOD OF OPERATION

#### 1.00 GENERAL

A coin collector, in addition to performing basic functions of a telephone set, must be capable of collecting charges for calls and refunding deposits when required.

#### 2.00 TELEPHONE CIRCUIT

**2.01** The talking circuit is the same as the one used in conventional telephones, except for the addition of two signal transmitters and an electromagnet in series in the primary circuit, as shown in Fig. 1.

**2.02** Coin signal tones are picked up by the two signal transmitters and carried over the

voice path to the local or toll operator, indicating the denomination and number of coins deposited. The two transmitters are in parallel with a 22-ohm resistor. This arrangement controls the volume level and protects the transmitters against excessive current.

**2.03** The electromagnet is a part of the coin chute and is used in conjunction with 10-cent operation, as covered in Part 3. A capacitor is connected in parallel with the electromagnet winding to minimize its effect on transmission. Network-type circuits equipped with dial have a resistor in series with the capacitor to protect the off-normal dial contacts from excessive arcing. In areas of low-frequency inductive interference, it may be necessary to substitute a unit of higher capacity in order to keep the noise pickup within

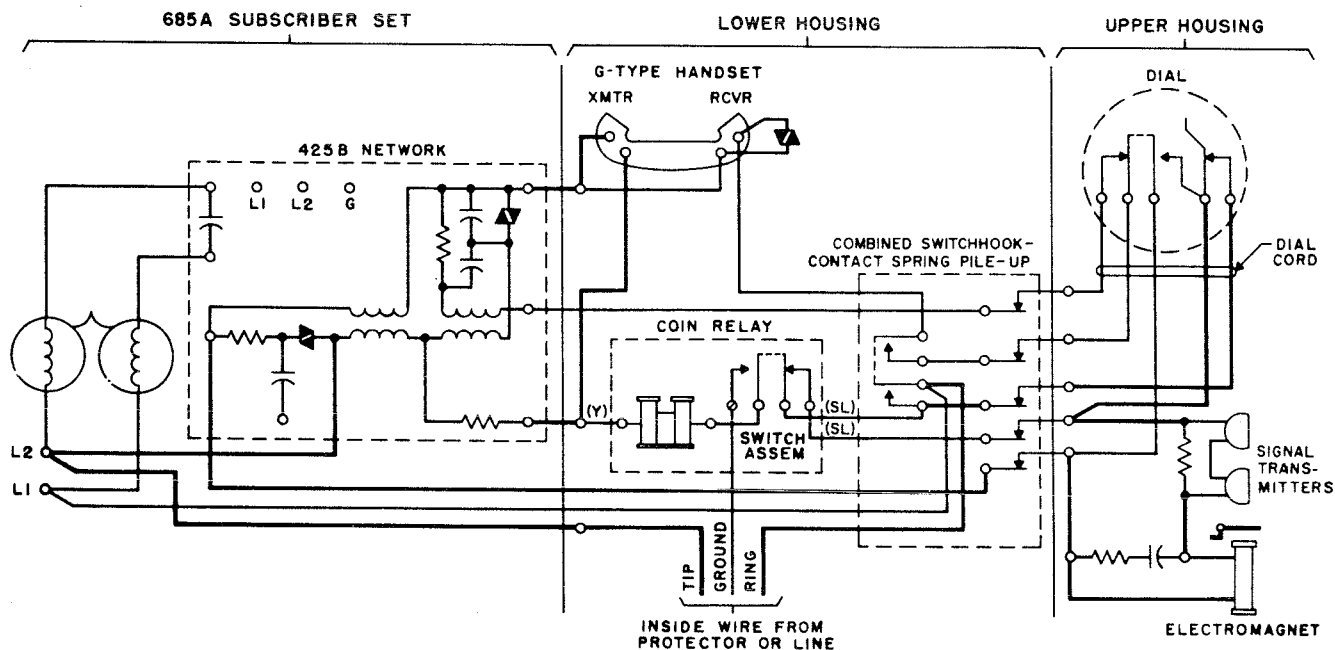


Fig. 1 — Prepay Network-type Coin Collector Circuit

acceptable limits. (See section entitled Inductive Noise.)

**2.04** The G-type handset is equipped with a 44A varistor bridged across the receiver to reduce acoustic disturbances. A set equipped with an F-type handset has a 37A varistor bridged across the receiver terminals on the backplate.

**3.00 COIN-HANDLING FEATURES, UPPER HOUSING**

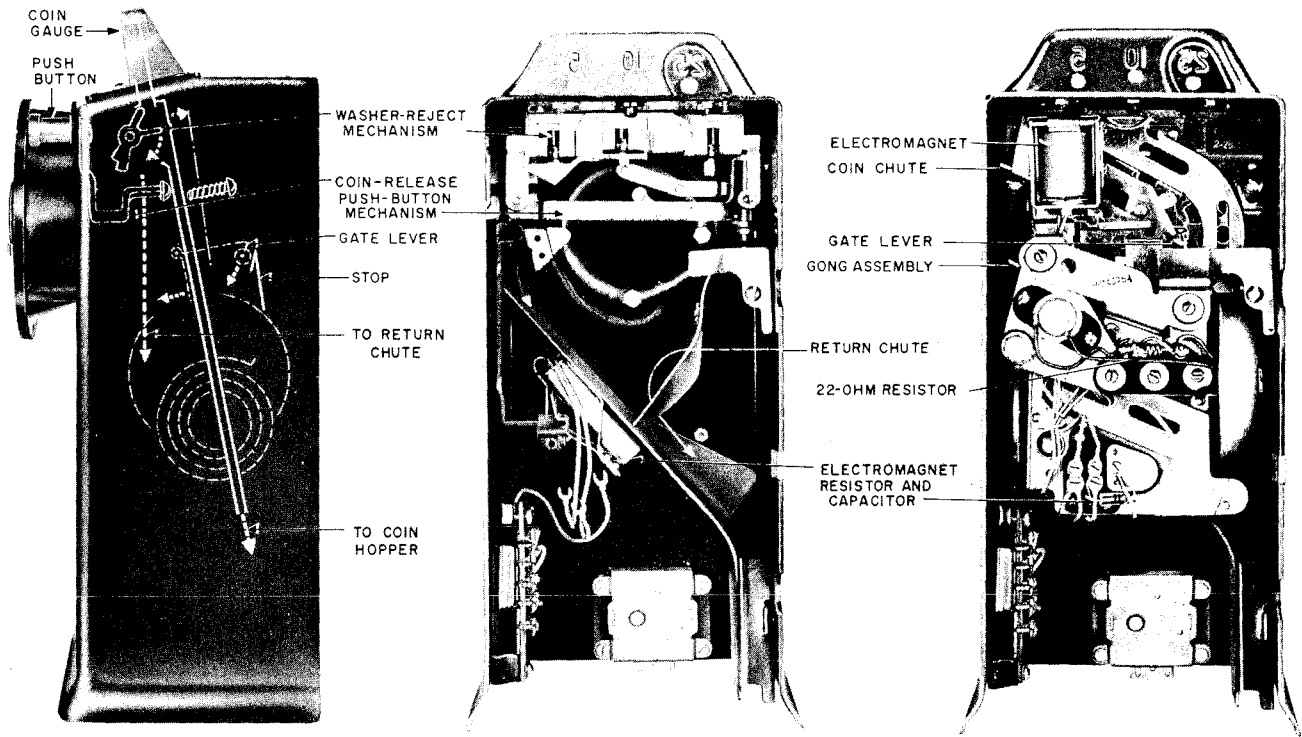
**3.01** Coin-handling features of the upper housing consist of a coin gauge, washer-reject and coin-release push-button mechanism (when provided), and coin-chute assembly (see Fig. 2). These units control the coins and, if accepted, direct them to the coin hopper of the mechanism unit on the lower housing. From the coin hopper, they reach the coin receptacle or return chute. Rejected coins fall directly into the return chute.

**Coin Gauge**

**3.02** The coin gauge is positioned on top of the upper housing and provides nickel, dime, and quarter openings for the deposit of coins. The respective openings are dimensioned to receive United States and Canadian coins and guide them to their proper channel in the coin chute.

**Washer-reject and Coin-release Push-button Mechanism**

**3.03** The washer-reject mechanism functions to prevent washers from entering the coin chute. Washers are detected and ejected by star wheels associated with each channel. The bottom spoke of the star wheel is moved downward by the deposited coin. The second spoke moves against the side of the coin near its center, deflecting it into the coin chute. Washers having open centers will not be deflected and will drop into the return chute.



**Fig. 2 — Coin-handling Features, Upper Housing**

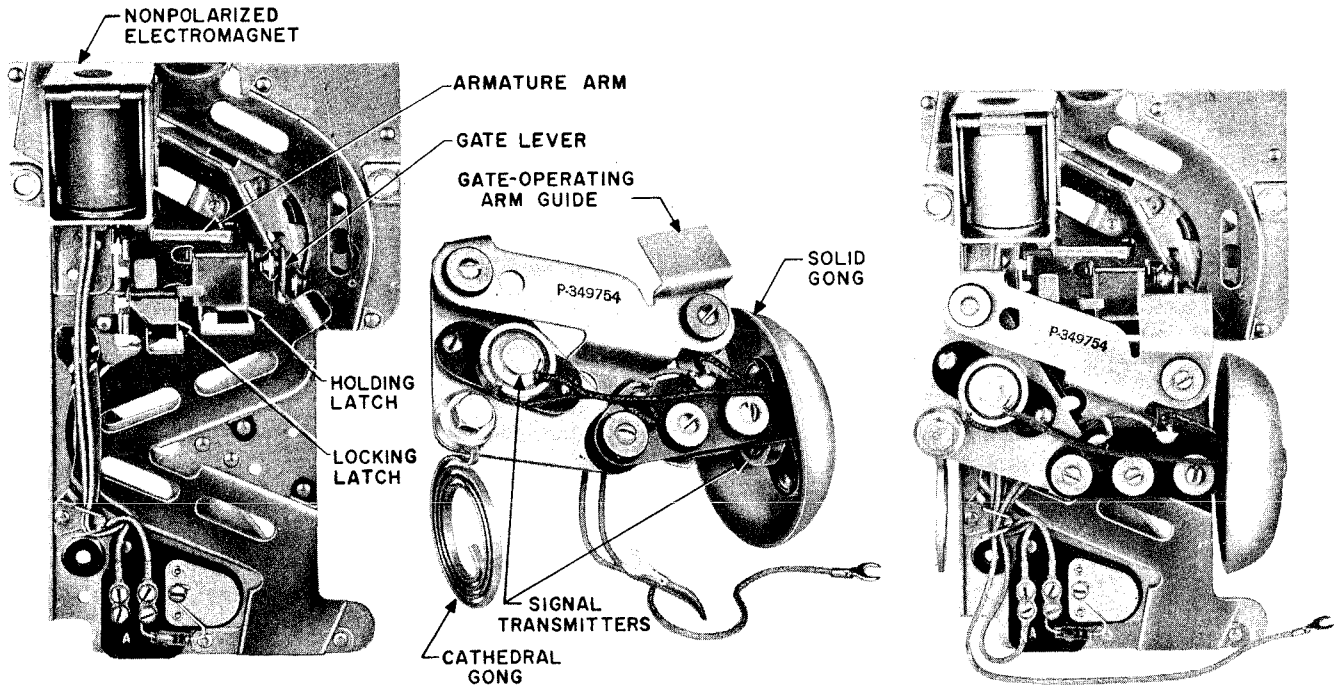


Fig. 3 — Coin Chute and Assembly

**3.04** The operation of the coin-release push button moves the upper part of the coin chute away from the washer-reject mechanism. This will release washers or coins wedged at this location and allow them to drop into the return chute. This movement of the coin chute also opens the gate associated with the nickel channel, releasing coins held at that location (see 3.10).

#### Coin-chute Assembly

**3.05** Several different types of coin chutes and coin-chute assemblies are provided. They differ according to service and associated equipment. Three services are provided: manual postpay, 10-cent prepay, and 10-cent dial postpay (CDO). Each service may be arranged for the use of United States coins only or for United States and Canadian coins. The difference here is in the size of the reject openings in the quarter channel. Coin chutes used with washer-reject and push-button mechanisms are not interchangeable with those used without such equipment. Piece-part

numbers for coin chutes and coin-chute assemblies are covered in the section entitled Coin Collectors, Identification and Assembly of Parts.

**3.06** Generally, the coin-chute assembly consists of a coin chute, including electromagnet, and a gong assembly with signal transmitters, as shown in Fig. 3.

#### Coin Chute

**3.07** The coin chute is made of stainless steel and provides nickel, dime, and quarter channels leading to the coin hopper of the mechanism unit. Nickels are routed to strike a solid gong once. Dimes are routed to strike the same solid gong twice. Quarters are routed to strike a cathedral gong once.

**3.08** Control and reject features are provided in the channels. Each channel rejects coins or discs which are below the minimum dimensions allowed for worn coinage. Such coins or discs leave

the coin chute before reaching the gongs and fall into the return chute.

**3.09** Ten-cent operation requires a minimum deposit of two nickels or one dime to initiate a prepay call, or to complete a dial postpay non-free call. To provide for this service, the nickel channel is equipped with a holding latch which is controlled by a locking latch (see Fig. 3). The first nickel deposited is stopped and held by the holding latch. A second nickel deposited is deflected by the first nickel into the locking latch. The locking latch is operated by this coin, releasing the first nickel at the holding latch. The two coins pass on down the channel in succession, each striking the solid gong and dropping into the coin hopper.

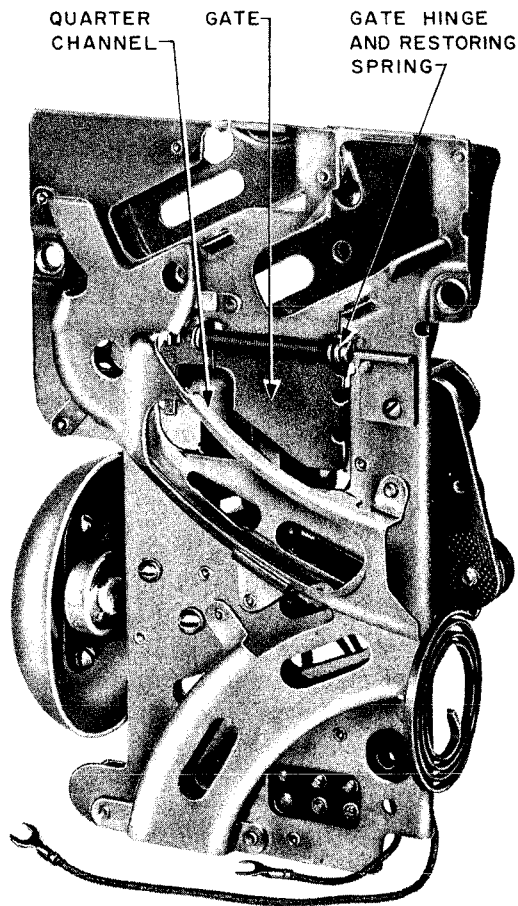


Fig. 4 — P-20A125 Coin-chute Assembly, Rear View

**3.10** A hinged gate is provided in the rear wall of the nickel channel opposite the holding and locking latches (see Fig. 4). Pennies which may reach the holding latch will be ejected through an opening in the gate. A single nickel deposited and held by the holding latch will be released by the gate and fall into the return chute when the handset or receiver is hung up. The gate is controlled by an operating arm on the switchhook. The gate is open when switchhook is down and closed when switchhook is up. Nickels deposited when switchhook is down will pass through the open gate and into return chute. The gate is also opened by the coin-release push-button mechanism.

**3.11** When the gate is open, it protrudes into the quarter channel. A quarter deposited when the switchhook is down will be stopped and held by the open gate until switchhook is raised. When released by the gate's closing, the quarter will continue down its channel, strike the gong, and reach the coin hopper.

**3.12** The position of the switchhook has no effect on the dime channel. Dimes will follow their channel into the coin hopper at all times.

**Electromagnet**

**3.13** The purpose of the electromagnet is to arrange for single nickel deposits to meet requirements of toll and overtime charges. This is accomplished by routing nickels around the holding latch after the central office loop is established.

**3.14** Nonpolarized electromagnets are used for prepay service and polarized for postpay service. Both types are energized by the central office battery in series with the loop and telephone set primary circuit. An arm on the electromagnet armature is moved into the nickel channel by the operation of the armature. With this armature arm in the channel, nickels bypass the holding latch. This allows single nickel deposits to continue on down the channel, strike the gong, and drop into the coin hopper.

**3.15** The nonpolarized electromagnet used in prepay service moves the arm into the nickel channel regardless of which direction current is flowing. The electromagnet operates on **out calls** when dial tone is received or the local operator answers. The electromagnet also operates on **in calls**, as from an operator completing delayed calls.

**3.16** The polarized electromagnet used in dial postpay service moves its arm into the nickel channel only when the current flow is in a certain direction. The electromagnet is connected in the circuit so that the current received for dialing moves the arm into the channel. At the time a nonfree call from the coin telephone is answered by the called party, the current flow is reversed to the coin station. This reversed flow of current moves the arm out of the nickel channel, which then requires that two nickels or a dime be deposited to complete the call. On calls to or from an operator, the current flow is not reversed, and the arm is positioned in the nickel channel. This allows single nickel deposits.

#### **Gong Assembly**

**3.17** The gong assembly is mounted on the coin chute, as shown in Fig. 3. It consists of a supporting bracket on which are mounted the two gongs and their associated signal transmitters. The solid gong for nickel and dime signals and one signal transmitter are mounted on a metal plate. The cathedral gong for quarter signals and the second signal transmitter are mounted on a bracket. The two units are insulated against vibration from each other and from the coin chute by use of rubber grommets at all mounting points. The support bracket also provides a guide to protect the switchhook gate-operating arm from damage when the upper housing is assembled on the backplate.

**3.18** The signal transmitters are associated with handset-type coin collectors. In the construction originally employed, the gong assembly

was supported on hinge lugs in the top of the upper housing to allow the assembly to be swung out for maintenance purposes. The first of this type employed only one signal transmitter. A second signal transmitter was added later to improve the coin signals. Transmitter- and receiver-type coin collectors have the gongs mounted on the sides of the upper housing, and the coin signal is picked up by the talking transmitter. When converted to handset types, these collectors are equipped with a signal transmitter inside the solid gong.

#### **4.00 MECHANISM UNIT**

The mechanism unit consists of a steel base and coin hopper on which are mounted coin-operated and coin-control equipment as required for the particular service involved. The mechanism base is mounted on top of the lower housing, where the base also serves as a cover for the coin-receptacle compartment.

#### **5.00 MANUAL POSTPAY SERVICE**

**5.01** In manual postpay service coins are deposited only after the operator has completed the connection to the called party. Refund of deposits is not required. The coin hopper serves simply as a guide to direct coins from the coin chute into the coin receptacle. The later-type coin hopper has clean-out holes to aid in removing stuck coins (see Fig. 5).

**5.02** The central office line circuit for manual postpay service furnishes battery on the ring side and ground on the tip side of the line, the same as for flat-rate individual lines. This requires only a completion of the loop through the telephone primary circuit to operate the line circuit and signal the local operator (loop start).

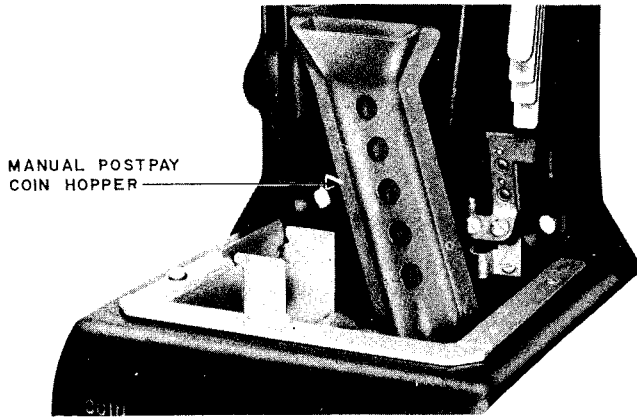


Fig. 5 — Manual Postpay Mechanism Unit

## 6.00 MANUAL OR DIAL PREPAY SERVICE

**6.01** In prepay service a deposit is required before dial tone is received or the local operator answers. Deposits are refunded if the call is not completed. The coin-relay assembly has a coin trigger which extends into the coin hopper above the coin trap (see Fig. 6 and 8). The first coin entering the hopper forces the trigger down to a tripped position. Tripping of the coin trigger operates contacts on the coin-relay switch assembly, preparing the telephone circuit for out calls.

**6.02** The central office line circuit used with dial prepay service supplies battery on the ring side of the line and has the tip side of the line open. A coin or coins must be deposited to place a ground at the station to operate the line-circuit equipment (ground start). The ground is placed on the tip side and is connected to the battery on the ring side through the primary circuit when the switchhook is up. The line circuit operates and prepares the line for dialing over the tip and ring conductors as indicated by dial tone.

**6.03** Manual offices supply battery on the tip side of the line with the ring side open. With the trigger tripped, the ground on the tip side will signal the operator even though the handset or receiver is not off switchhook. The central office cord circuit supplies talking battery over the tip and ring conductors.

## Coin-relay Switch Assembly

**6.04** The coin-relay switch assembly consists of two pairs of spring contacts (see Fig. 1). One pair, which is normally open, closes when the trigger is tripped by a deposited coin and connects ground through the coin-relay winding and to the tip side of the line. The connection to the tip side of the line is made through the center tap connection of the network or induction coil. This balances the talking circuit to ground and prevents excessive inductive noise interference.

**6.05** The second pair of spring contacts is normally closed and is opened when the trigger is tripped. The contacts are wired in parallel with the pulsing contacts of the dial. With the coin-relay contacts closed, the dial-pulsing contacts are shorted. The coin trigger must be tripped and the shorting contacts opened before dialing can be accomplished.

**6.06** Earlier-type coin relays were equipped with ground contact springs only (2-spring relay). Dial shorting was first accomplished by adding one normally made contact to the assembly (3-spring relay).

**6.07** The single-coil, slow-release, coin-relay switch assembly, in addition to ground and dial-shortening contacts, has a 3-spring break-make combination which functions to short-circuit either a resistor or the relay coil as shown in Fig. 10 and as covered in 6.16.



## Coin Hopper

6.08 For prepay service, the hopper is equipped with a coin trap which stops and holds all coins that enter the coin hopper. The coin trap is

held in its horizontal position or released in relation to the position of a coin vane. The coin vane is under the control of the coin relay which is mounted on the mechanism base, Fig. 6 and 7, or on the coin hopper, Fig. 8 and 9.

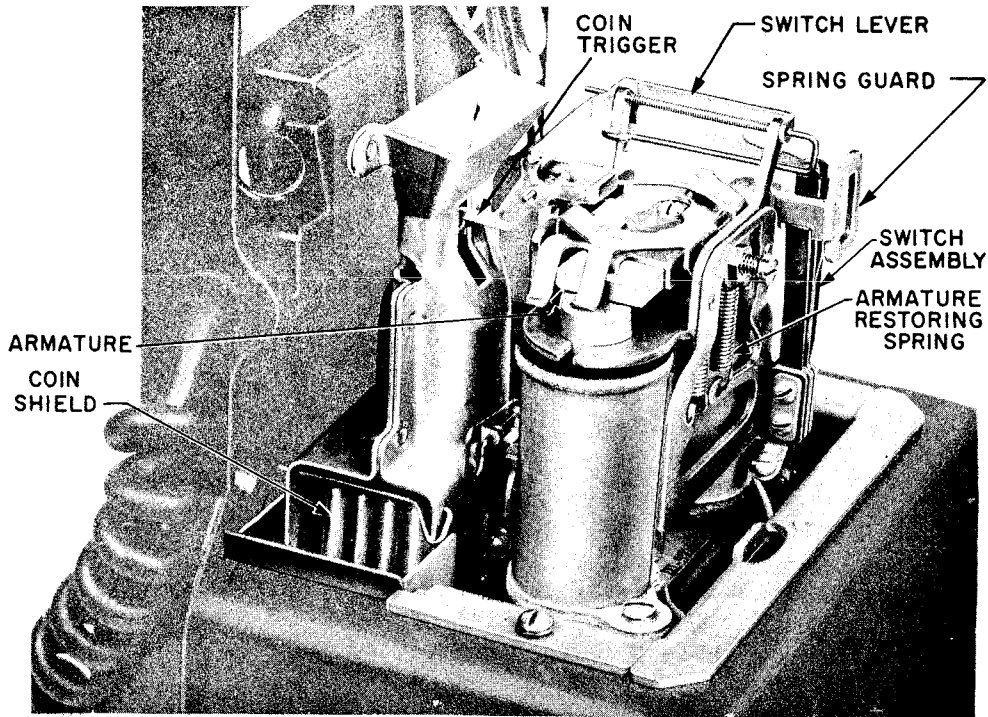


Fig. 6 - Prepay Mechanism Unit, 2-coil Coin Relay

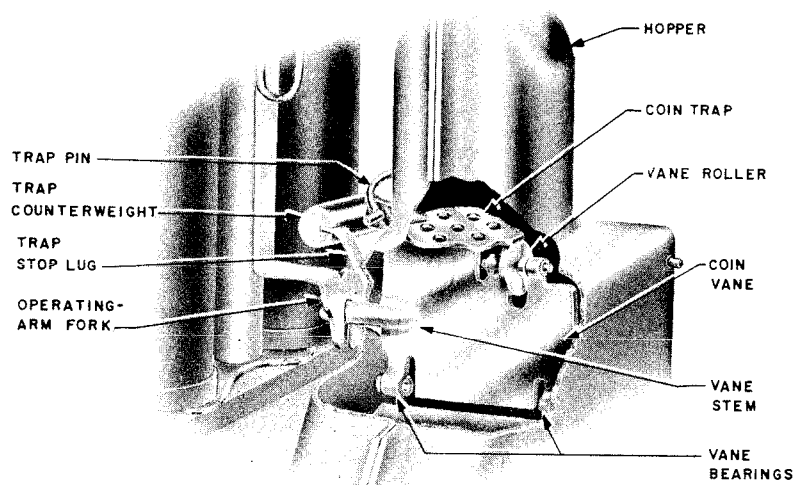


Fig. 7 - Coin Hopper and Rear View of 2-coil Coin Relay

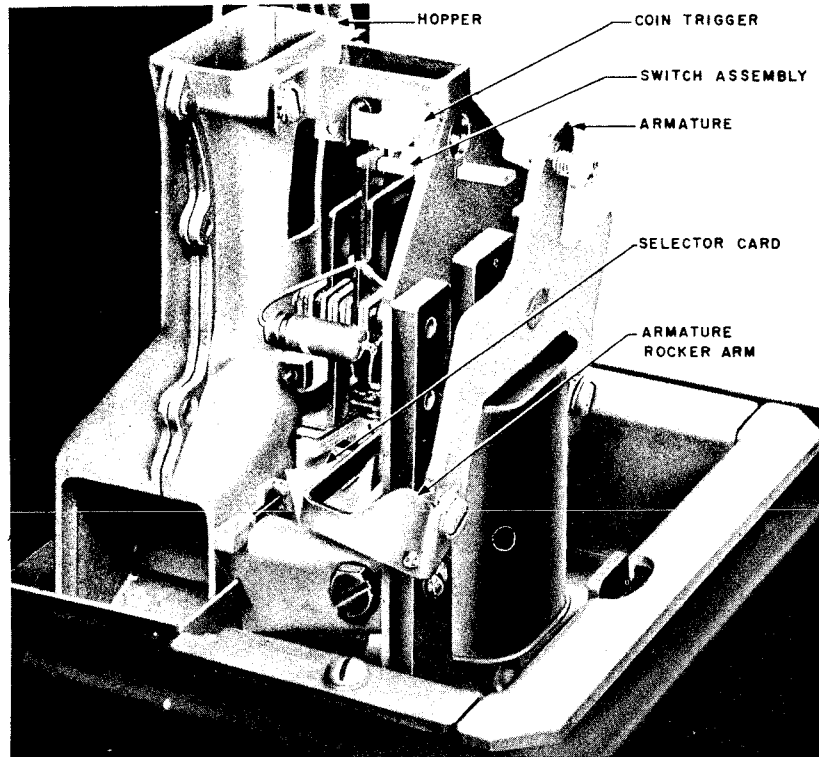


Fig. 8 — Prepay Mechanism Unit, Single-coil, Slow-release Coin Relay

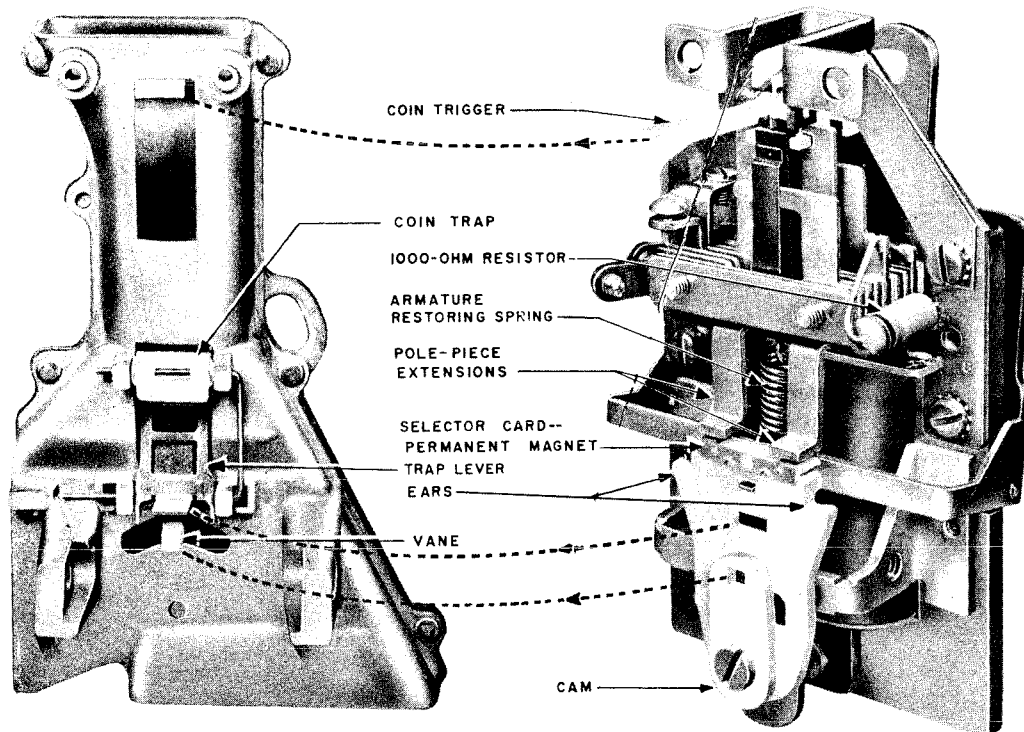


Fig. 9 — Coin Hopper and Rear View of P-10E786 Single-coil, Slow-release Coin Relay

### Coin Relay

**6.09** The coin relay is operated to its collect or refund position through the tip ground. Positive coin-collect battery or negative coin-return battery (nominally 116 or 125 volts) is applied to the line, as required, under the control of central office equipment or the operator. To clear coins from the hopper, the relay must remain operated for approximately 1/2 second, otherwise the coins may become wedged in the hopper. The tip ground also provides a signal to other central office equipment, showing that coins have been deposited. Coins may be disposed of while the customer is on the line.

**6.10** The operation and subsequent release of the coin relay restores the coin trigger and switch-assembly contacts to their normal position.

### Two-coil Coin Relay

**6.11** The 2-coil coin relay is a polarized relay. Its direction of operation depends on the direction of the current flow through its windings. Positive current pulls the armature down on the right side and operates the coin vane to the left or collect position. Negative current pulls the armature down on the left side and operates the coin vane to the right or refund position. Moving the coin vane from under the coin trap allows the weight of the held coin or coins to swing the coin trap downward. The coins drop into the coin receptacle or the return chute according to the position of the coin vane.

### Single-coil, Slow-release Coin Relay

**6.12** The single-coil coin relay shown in Fig. 8 consists of a nonpolarized armature and relay coil designed for fast operation and slow re-

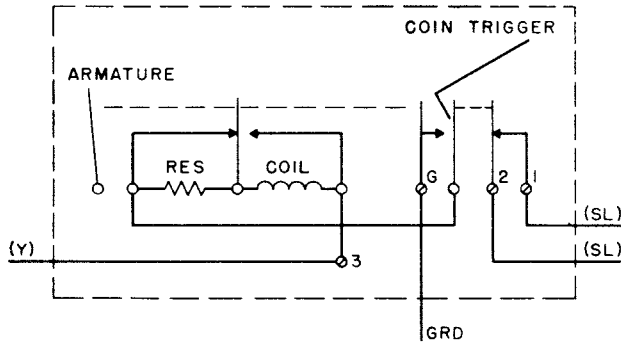
lease. Collect and refund operation of the coin vane is controlled by a polarized selector card located at the back of the relay assembly as shown in Fig. 9. The selector card is made of nylon and has a small permanent magnet embedded along its upper edge.

**6.13** The selector card is tilted slightly to one side or the other according to the polarity of the current applied to the relay. This is accomplished by two pole-piece extensions, one extension being positioned above each end of the permanent magnet. While in the tilted position, the selector card is moved downward by the operation of the relay armature. This movement guides a cam coupled to the coin vane to the right or to the left according to the direction in which the selector card is tilted.

**6.14** With the selector card tilted down on the right side, the coin vane is moved to the right or refund position. With the selector card tilted down the left side, the coin vane is moved to the left or collect position.

**6.15** The coin trap is also mechanically opened by the downward stroke of the selector card and restored on the release stroke. This expedites coin disposal and avoids coins' lodging on the trap. With the coin vane and the coin trap both under the control of the selector card, their movements are synchronized and friction and scoring between these two moving parts are eliminated. The slow-release feature of the relay ensures time for complete disposal of coin deposits even on short coin-battery pulses.

**6.16** The slow-release feature is obtained by short-circuiting the coin-relay winding near the end of the operate stroke (see Fig. 10). During the holding period the 1000-ohm resistor is substituted for the short-circuited relay coil. This



**Fig. 10 — P-10E786 Single-coil, Slow-release Coin Relay**

protects the coin battery resistance lamps in the central office from a current surge and protects the coin-relay ground contacts from excessive arcing when they open while coin battery is still applied to the line. To prevent reoperation of the relay the ground contacts are opened on the release stroke before the short circuit is removed from the relay coil.

**6.17** With either-type relay, the ground circuit remains closed at the station until the release stroke to ensure proper operation of coin pilot lamps at manual or toll switchboards. On the 2-coil relay the station ground circuit remains closed, and the coin pilot lamp is lighted as long as the collect or refund key is held operated. Due to the self-restoring feature of the single-coil relay, however, the station ground remains closed only during the operate and slow-release holding period. This limits the maximum time the coin pilot lamp will remain lighted but ensures at least 1/4-second appearance, which is considered adequate.

**6.18** The selector card and vane cam are designed so that they center mutually at the end of the release stroke. When the relay is operated **manually**, the selector card must first be tilted by pressing downward on one of the ears located on either side of the selector card before the armature is closed. This avoids jamming the engaging surfaces of the selector card and the cam. Force applied downward to the ear on the **right**

side of the selector card will operate the relay mechanism in the return direction. Force applied downward on the **left** side will operated it in the collect direction.

### Coin Shield

**6.19** The coin shield shown in Fig. 6 functions to prevent unauthorized access to the coin hopper. The coin shield is required on all prepay coin collectors which do not have pull-bucket return chutes.

### 7.00 DIAL POSTPAY SERVICE (CDO)

**7.01** In dial postpay service, dial tone is received, the called number is dialed, and the called party answers before a deposit is required. Refund of deposits is not necessary. Dial postpay service has central office equipment which, when the called party answers on nonfree calls, automatically splits the connection and sends a deposit-coin tone to the calling party. Deposit-coin tone is a low tone to inform the calling party that the called party has answered and that the required coins should be deposited. During the time the connection is split, the battery supply to the coin station is reversed in direction. This current reversal prepares the coin collector for the 10-cent initial coin deposit. The first coin, passing through the coin hopper, opens a pair of contacts on the spring assembly, which places a 4450-ohm resistor momentarily in the circuit. The increased loop resistance will cause the central office equipment to remove the split connection and prepare the circuit for conversation.

**7.02** The central office line circuit for dial postpay service furnishes battery on the ring side and ground on the tip side of the line. This requires only a completion of the loop through the primary circuit to operate the line circuit and prepare the line for dialing as indicated by dial tone (loop start).

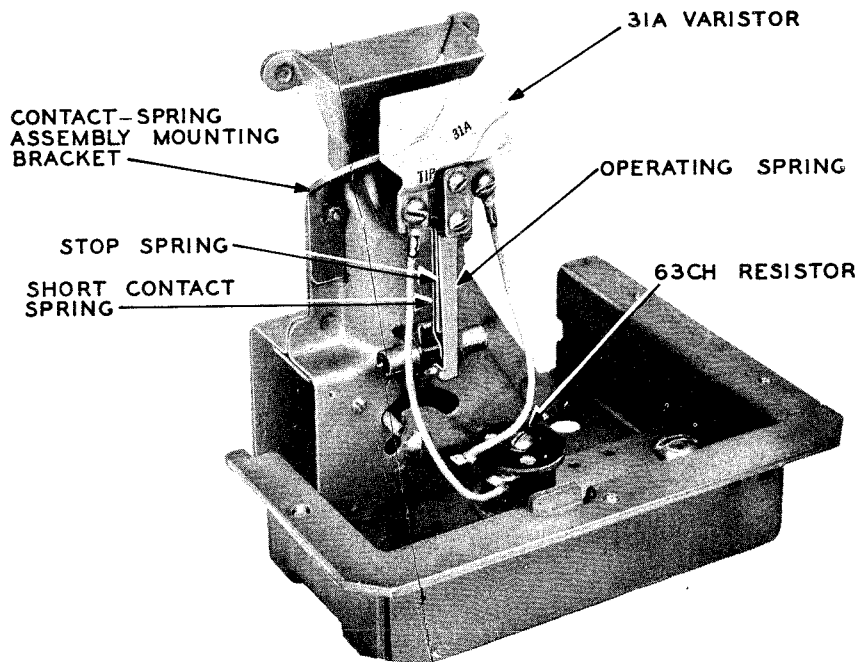
**7.03** For dial postpay service, the coin hopper is equipped with a coin trap and a coin vane. The coin vane is positioned permanently to the

left, allowing all coins to drop into the coin receptacle. With the coin vane locked in the collect position, a coin shield is not required. A coin-trap counterweight holds the coin trap in a horizontal position unless it is forced downward by a passing coin. (See Fig. 11.)

**7.04** A contact-spring assembly is mounted on the coin hopper. The assembly consists of a pair of normally closed contacts which are opened by linkage to the movement of the coin trap. This results in the contacts' being opened momentarily as each coin drops through the coin hopper and forces the coin trap downward. The contacts are wired in series with the telephone's primary circuit.

**7.05** A 63CH (4450-ohm) resistor mounted on the mechanism base is wired in multiple with the contact springs in the primary circuit. The resistor is shunted out of the circuit when the contacts are closed and is effective in the circuit when the contacts are opened.

**7.06** A 31A varistor which is mounted on the contact-spring assembly bracket is also bridged across the resistor and the contacts. The varistor is poled so as to be in opposition (open) to the reverse current flow on the line. Under this reverse current condition, the varistor will not shunt out the resistor when the contacts are opened. Normal direction current will flow through the varistor, shunting the resistor, as when coins are deposited with an operator on the line. This reduces objectionable clicks.



**Fig. 11 – Dial Postpay**



**ALARM SWITCHES AND SECURITY DEVICES  
FOR COIN COLLECTORS/TELEPHONES  
IDENTIFICATION AND INSTALLATION**

**1. GENERAL**

**1.001** This addendum supplements Section 506-110-103, Issue 1.

**1.002** This addendum is issued to revise the method of securing an armored cord in the backplate of a coin collector.

The following change applies to Part 3 of the section.

(a) 3.38 (10)—revised

(10) A P-26E084 1/4-20 by 5/16-inch self-locking setscrew is used to secure the cord to the coin collector backplate (Fig. 29). A flat surface is located approximately 1/4-inch from the set end of the stainless steel flexible hose. Using a 1/8-inch Allen wrench, screw the socket setscrew into the hole drilled in step 5 until it just makes contact with the flat surface of the metal hose. Give the setscrew a minimum of 1/4 turn and a maximum of 1/2 turn. This should hold the cord firmly in the coin collector.





**ALARM SWITCHES AND SECURITY DEVICES  
FOR COIN COLLECTORS/TELEPHONES  
IDENTIFICATION AND INSTALLATION**

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**1. GENERAL**

1.01 Alarm switches are devices which are mechanically connected to a lock, door, or

upper housing and electrically connected to a local alarm panel or central office.

1.02 The purpose of an alarm switch is to alert proper authorities when a coin collector/telephone is being tampered with by unauthorized personnel.

1.03 Security devices are those items which are added to the standard equipment to prevent or discourage thievery and vandalism.

**2. ALARM SWITCHES**

2.01 There are four current models of alarm switches available; P-372083, 227A, 257A, and 1A switch kit.

**P-372083 ALARM SWITCH ASSEMBLY**

2.02 The P-372083 alarm switch assembly (Fig. 1) consists of a single-pole double-throw contact spring pile-up mounted on a bracket and wired to three terminals on a terminal block.

2.03 The P-372083 alarm switch assembly is designed for use on all 190 and 200 series coin collectors/telephones and is mounted in the cash compartment above the door. The stop spring of the switch assembly rests on the bolt of the cash compartment lock. When the bolt is released, the switch contacts make and energize the alarm.

2.04 Connections are made to the terminal block as determined by the local operating company. After the connections are made, slide the insulation sleeving, shown in Fig. 1, over the terminal block to prevent shorting.

**227A ALARM SWITCH ASSEMBLY**

2.05 The 227A alarm switch assembly (Fig. 2) consists of a single-pole double-throw contact spring pile-up mounted on a bracket and wired to three terminals on a terminal block.

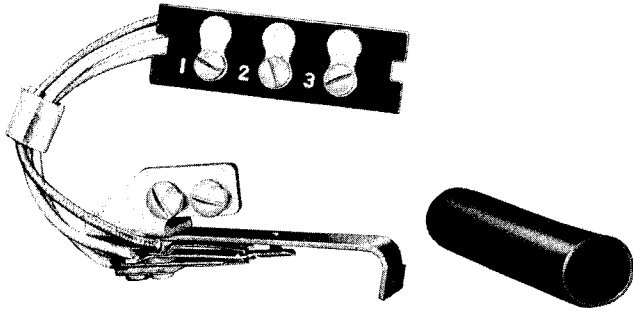


Fig. 1—P-372083 Alarm Switch Assembly

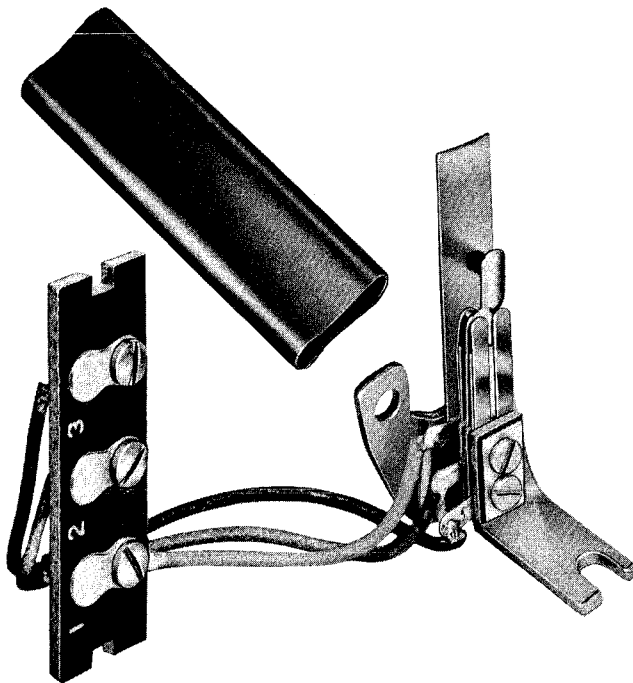


Fig. 2—227A Alarm Switch Assembly

- 2.06 The 227A alarm switch assembly is arranged for use on all coin collectors having upper housings with terminal plate type transfer contacts.
- 2.07 It is intended for use to indicate removal of the upper housing.
- 2.08 Install the 227A alarm switch assembly as shown in Fig. 3.
- 2.09 Connections are made to the terminal block as determined by the local operating company. After the connections are made, slide the insulation

sleeving, shown in Fig. 2, over the terminal block to prevent shorting.

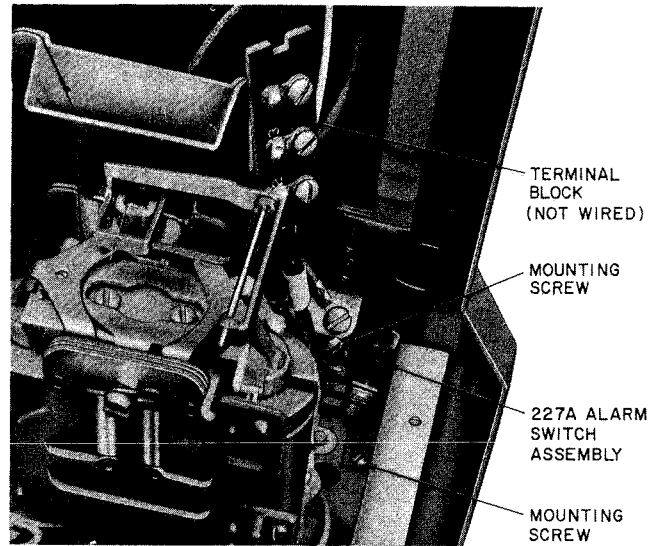


Fig. 3—227A Alarm Switch Assembly Installed

**257A ALARM SWITCH ASSEMBLY**

2.10 The 257A alarm switch assembly (Fig. 4) consists of a single-pole double-throw sensitive subminiature switch, mounted on a bracket and wired to three terminals on a terminal block.

2.11 The 257A alarm switch assembly is arranged for use on all coin collectors/telephones equipped with a 30-type cash compartment lock and is mounted by using two of the existing lock mounting screws. Fig. 5 shows the switch mounted on a lock.

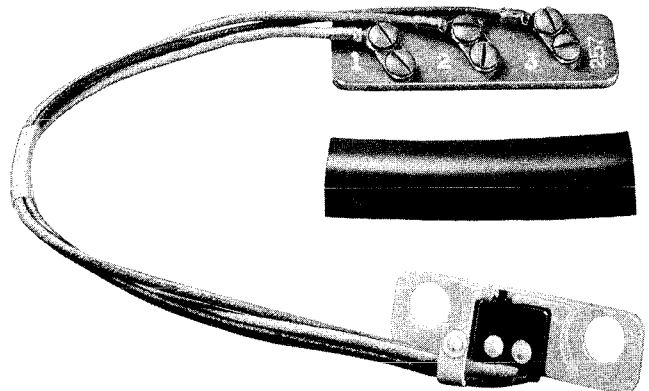
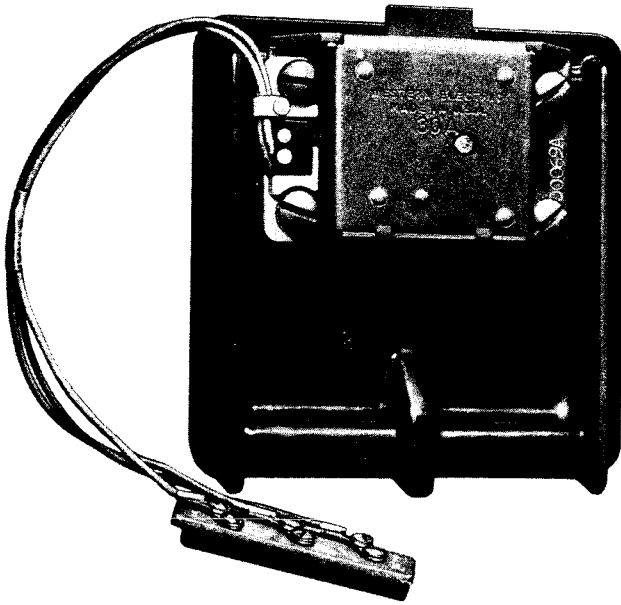
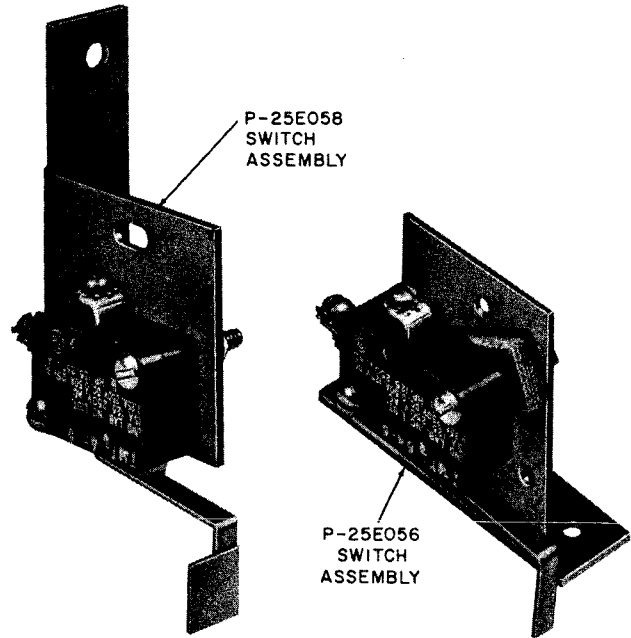


Fig. 4—257A Alarm Switch Assembly



**Fig. 5—257A Alarm Switch Assembly Mounted on 30-Type Lock**



**Fig. 6—1A Switch Kit**

**2.12** A plunger is provided on the 30-type lock which protrudes when the key is turned to trigger the switch.

**2.13** Connections are made to the terminal block as determined by the local operating company. After the connections are made, slide the insulation sleeving, shown in Fig. 4, over the terminal strip to prevent shorting.

#### **1A SWITCH KIT**

**2.14** The 1A switch kit (Fig. 6) consists of two microswitches, assembled with associated brackets, actuators, and screws.

**2.15** It is designed for use in the 1A1 and 1A2 coin telephone sets.

**2.16** The P-25E056 switch assembly mounts above the cash compartment with its actuator detecting the retraction of the cash compartment door locking bolt.

**2.17** The P-25E058 switch assembly mounts in the upper left portion of the backplate to detect removal of the cover unit assembly.

**2.18** Install the switch kit in accordance with Fig. 7 using four No. 6-32 by 1/4 RHM screws.

**2.19** Connections are made to the switches as determined by the local operating company.

### **3. SECURITY DEVICES**

**3.01** Security devices include locks, studs, special tools, special backplate, covers, ring seals, armored cords, and a switch hook kit.

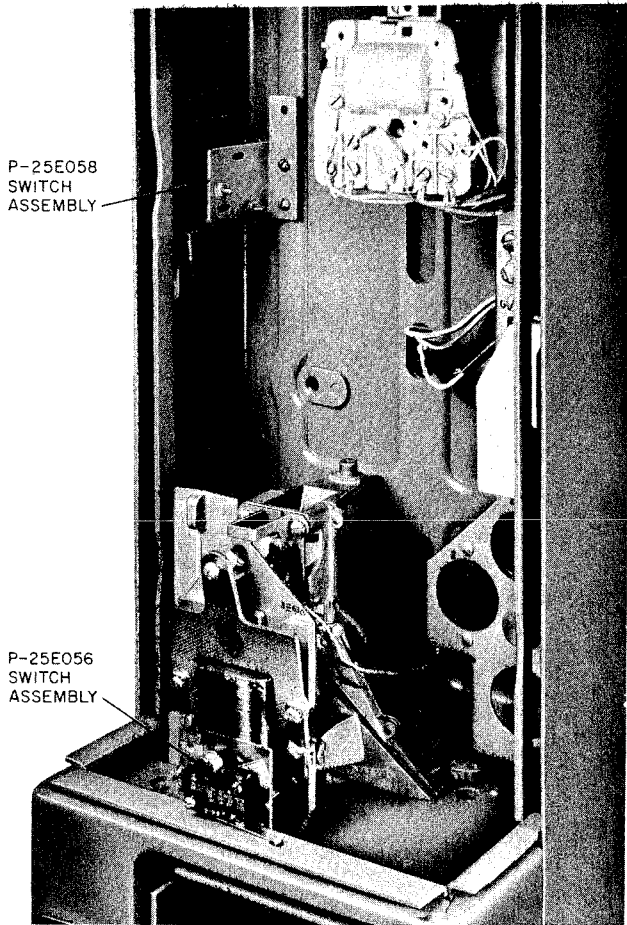
#### **A. Locks**



*Locks and keys will be shipped only on orders that specify the responsible persons to whom they are to be directed.*

#### **Upper Housing and Cover Assembly Locks**

**3.02** There are three current models of locks available for upper housings and cover assemblies; 10-type, 27-type, and 29-type (Fig. 8). Each of these locks is a lever tumbler type using a corrugated key.



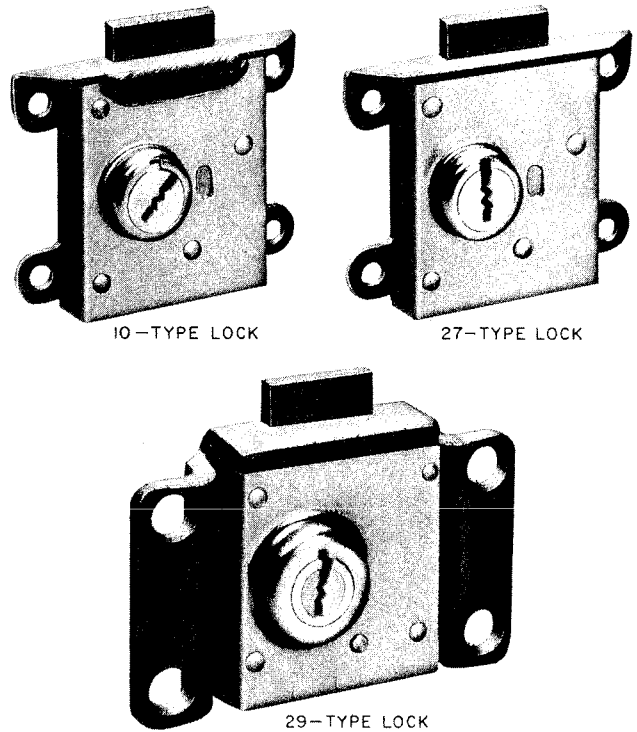
**Fig. 7—1A Switch Kit Installed on 1A1 Coin Telephone Set**

**3.03** The 10-type and 27-type locks are intended for use in upper housing assemblies of 190 and 200 series coin collectors/telephones.

**3.04** The 27-type is similar to the 10-type except it is equipped with a key trapping feature (called a key snatcher). When a key is turned in this lock, the key snatcher grabs it and a P-248585 release tool is required to remove the key (Fig. 9). The release tool is ordered in the same manner as a key.



*Use of release tool requires removal of cash compartment door, coin receptacle, and left front mounting screw of coin receptacle rail.*



**Fig. 8—Upper Housing And Cover Assembly Locks**

**3.05** The 29-type lock is intended for use in the cover assemblies of 1A-, 2A-, 235-, and 1235-type coin telephones.

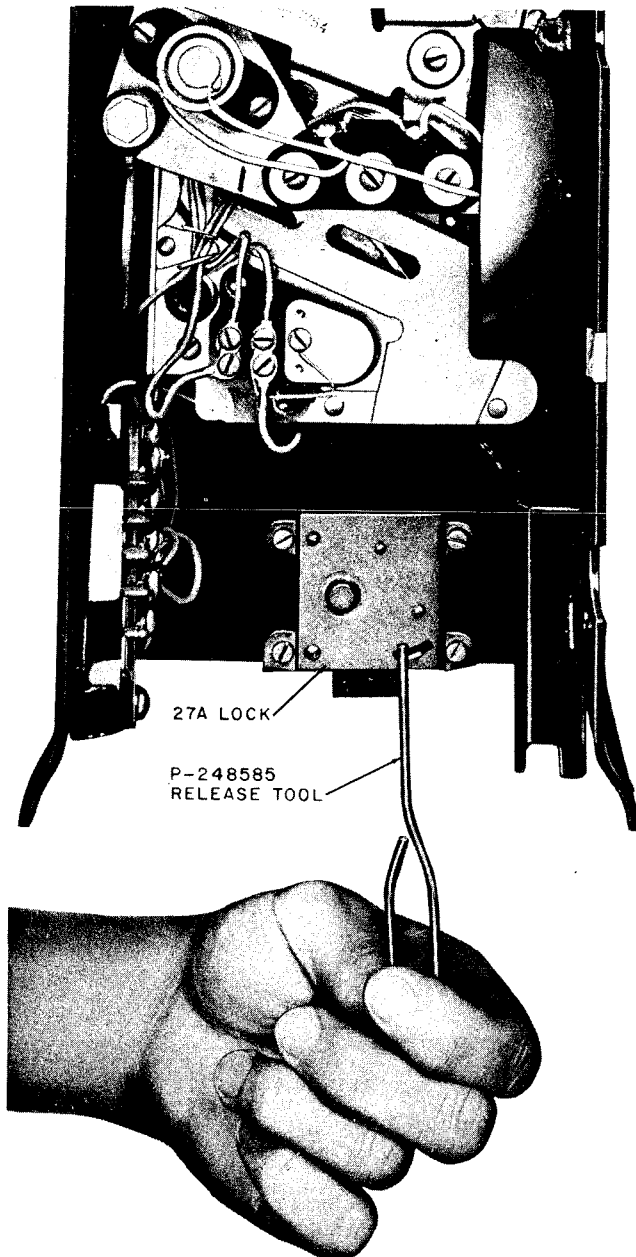
**Cash Compartment Locks**

**3.06** There are two current models of locks available for cash compartments; 14-type and 30-type (Fig. 10). Each of these locks is a lever tumbler type using a corrugated key.

**3.07** The 14- and 30-type locks are intended for use with 1A-type coin collector door and 4A- and 5A-type cash compartment doors plus cash compartment of 1A-type coin telephones.

**3.08** The 30-type lock is arranged for but not equipped with a 257A alarm switch assembly (Fig. 5).

**3.09** When a 14-type lock is used on a 1A-type coin collector door, a P-20F653 plug washer (Fig. 11 and 12) must be used to fill a portion of the lock hole to discourage the use of a door puller.



**Fig. 9—27A Lock Mounted in Upper Housing Showing Use of P-248585 Release Tool**

#### **KS-19277 Lock and Associated Parts**

**3.10** The KS-19277 lock and associated parts (Fig. 13) are designed to give additional security to the upper housing. The arrangement consists of a screw type lock and appropriate

fasteners which secure upper housing to either backplate or mounting surface.

**3.11** The lock (Fig. 14) mounts in a specially provided hole in the lower right side of the upper housing. Drilling this hole is a difficult operation and it is not recommended that it be done in the field.

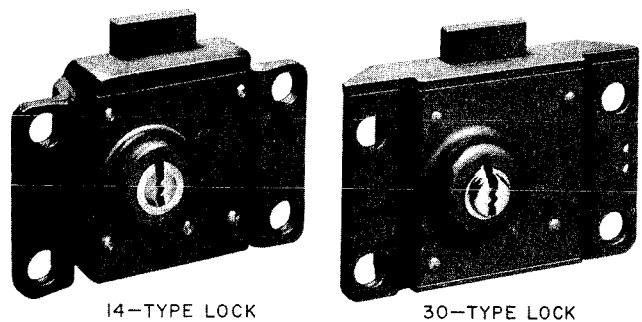
**3.12** The lock is held in place by a spring steel washer and heavy steel nut (Fig. 15). Use of a tubular key permits the back of the lock to rotate and screw on to the end of a security fastener.

**3.13** The lock cannot be used on coin collectors equipped with 2-coil relays, or those without a lower right security stud hole.

**3.14** The P-13A091 BKX terminal assembly (Fig. 16) must be replaced with a P-25E300 terminal assembly to provide clearance for fasteners (Fig. 17 and 18).

**3.15** There are three fasteners available for use with the KS-19277 lock (Fig. 13).

- (a) P-25E301 bolt fastener—short shoulder; intended for use in installations with 3/16-inch thick backboards.
- (b) P-25E302 bolt fastener—long shoulder; intended for use in installations with 5/16-inch thick backboards.
- (c) P-25E303 stud fastener—intended for use in installations where security studs are not required.



**Fig. 10—Cash Compartment Locks**

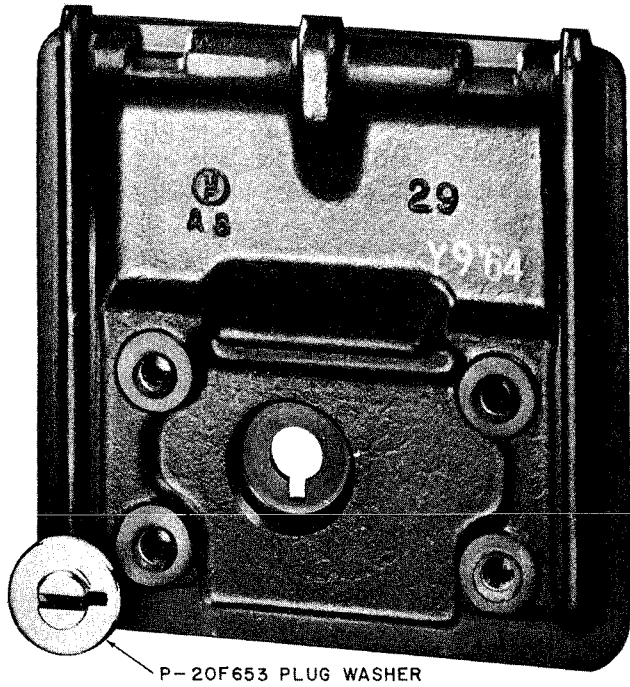


Fig. 11—1A-Type Coin Collector Door and P-20F653 Plug Washer

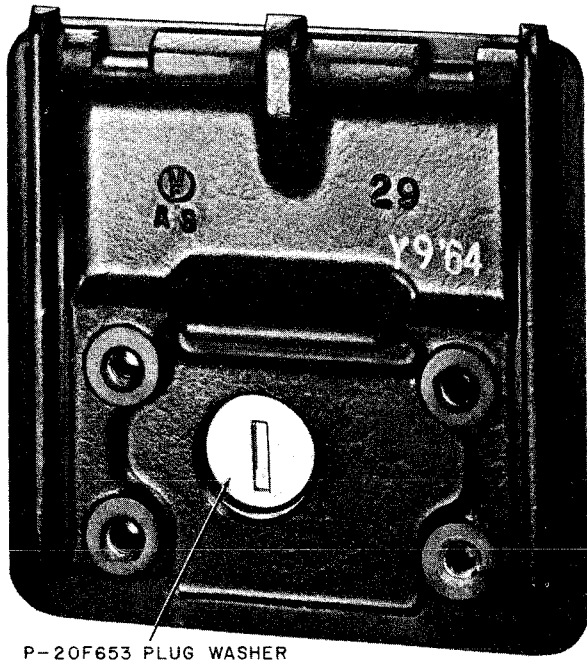


Fig. 12—P-20F653 Plug Washer Installed in 1A-Type Coin Collector Door

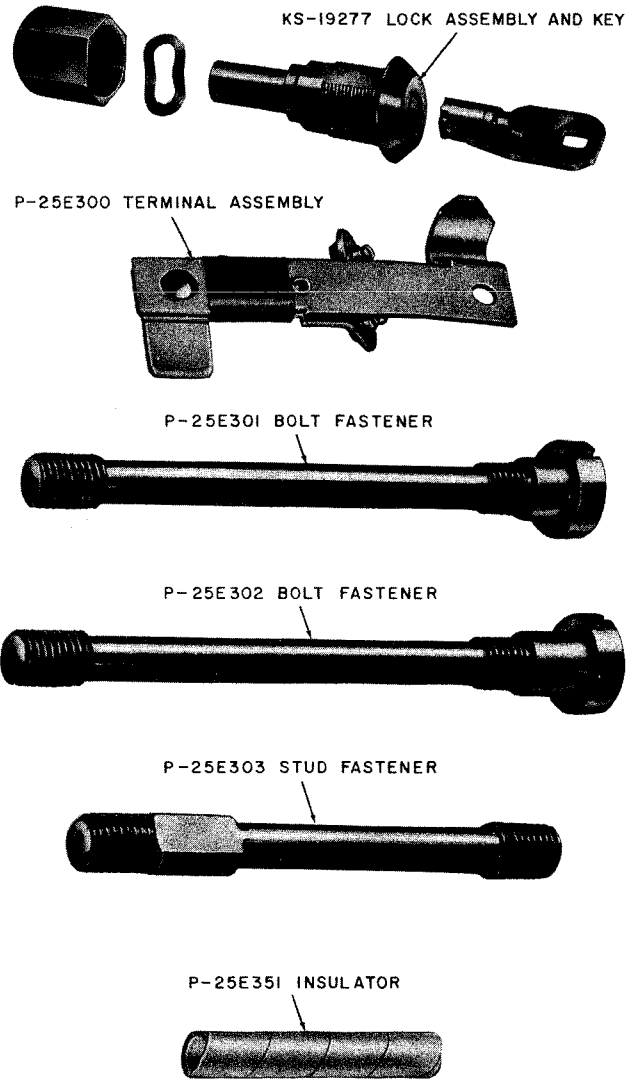


Fig. 13—KS-19277 Lock And Associated Parts

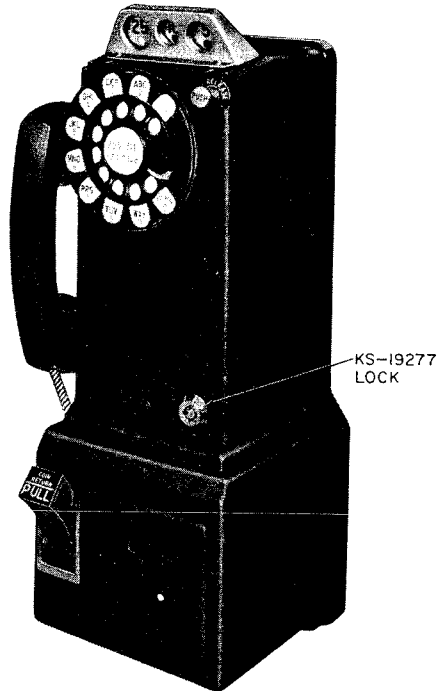


Fig. 14—Coin Collector Equipped with KS-19277 Lock

3.16 Two methods may be used to determine if mounting surfaces on existing installations are equipped with keyhole slots. This can be done without removing the coin collector from its mounting fixture. Check the following:

- If a security stud is present in the lower right security stud hole (Fig. 16), the appropriate bolt fastener (3.15) may be used after removing the security stud.
- If a security stud is absent in the lower right security stud hole, place a small-bladed screwdriver in this hole (Fig. 19). If blade enters to a depth of at least 3/4-inch, a keyhole slot is present (Fig. 20) and the appropriate bolt fastener can be used. If the keyhole slot is missing, replace mounting surface to permit use of a bolt fastener or use stud fastener.

3.17 Use of bolt fasteners is limited by the surface (backboards, shelf, or booth) upon which the coin collector is mounted.



*In vulnerable locations where prying of upper housing is more likely, always use bolt fastener.*

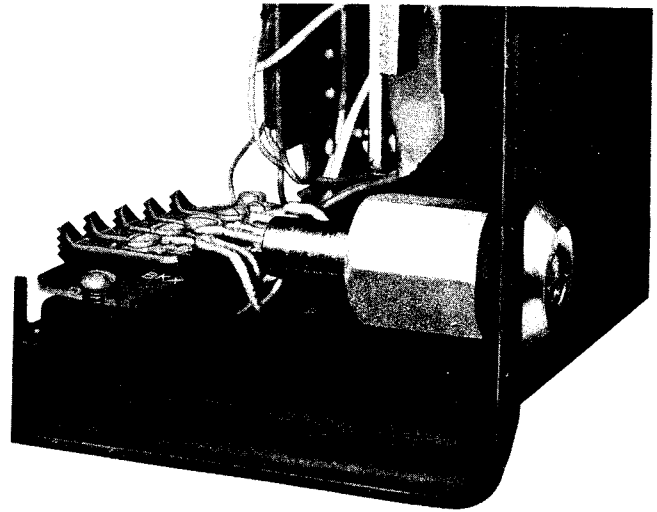


Fig. 15—KS-19277 Lock Installed in Upper Housing

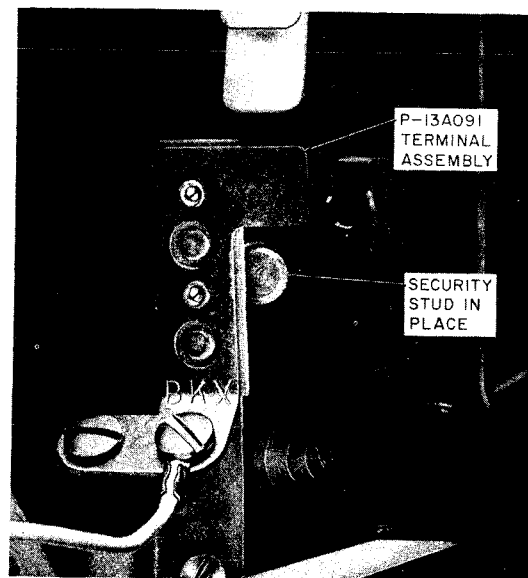


Fig. 16—P-13A091 Terminal Assembly with Security Stud Installed

3.18 The P-25E301 and P-25E302 bolt fasteners screw from the rear into the lower right security stud hole (viewed from front), of the coin collector backplate (Fig. 18). The coin collector is installed on the mounting surface in the same manner as any other coin collector equipped with security studs.

3.19 To install a bolt fastener on existing installations, it is necessary to disconnect

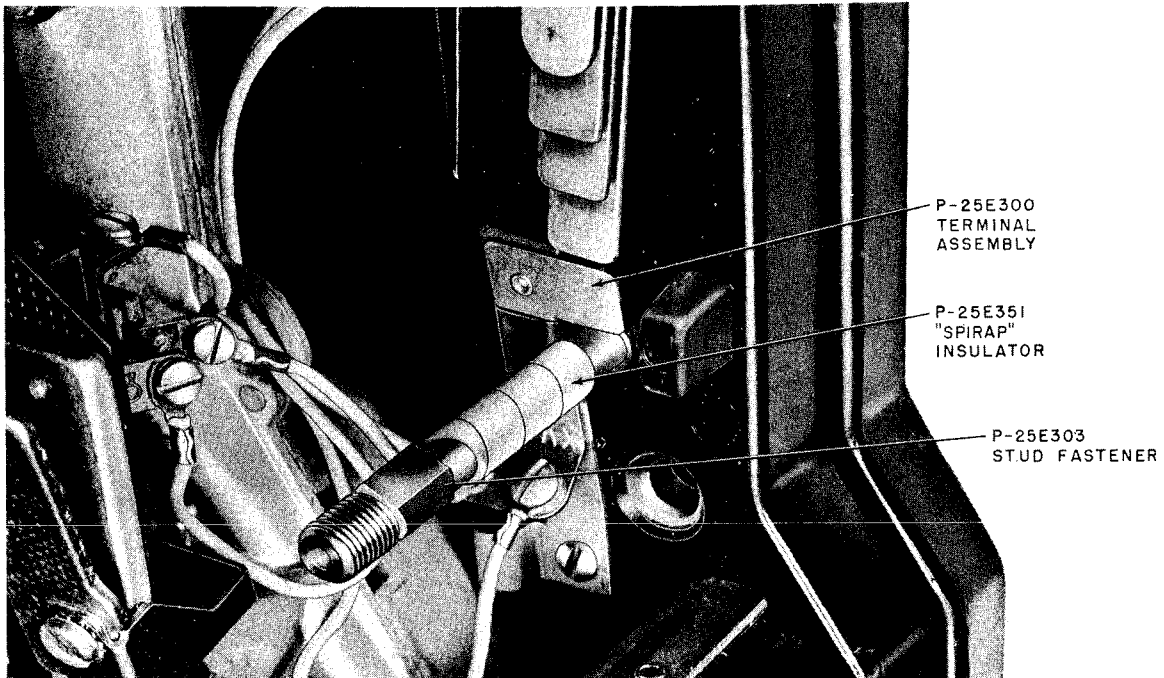


Fig. 17—New Terminal Assembly, Insulator, and Stud Fastener

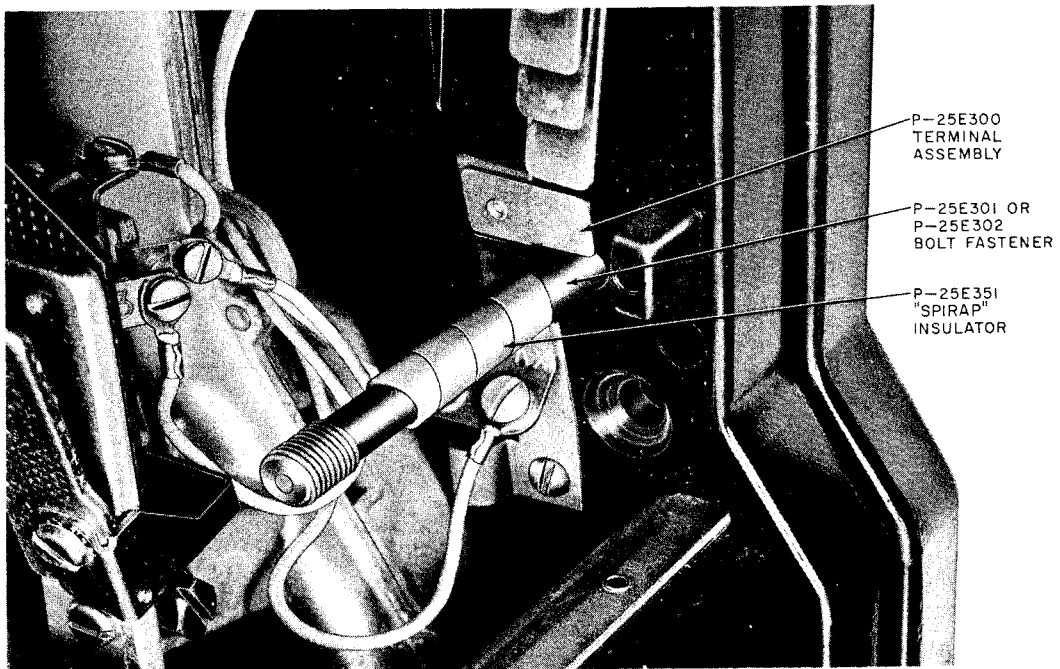
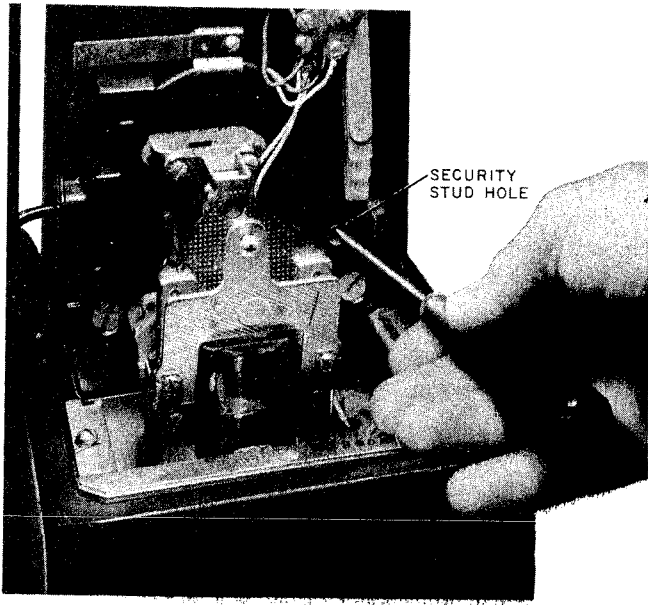


Fig. 18— New Terminal Assembly, Insulator, and Bolt Fastener





**Fig. 19—Method of Determining if Mounting Surface is Equipped with Keyhole Slots**

and remove the coin collector from its mounting surface.

**3.20** Use the P-25E303 stud fastener (Fig. 17) where maximum security is *not* essential, but where protection is desired against unauthorized use of the 10-type upper housing key.

**3.21** The stud fastener can be installed without removing the backplate assembly from its mounting surface.

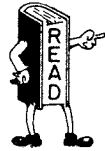
**3.22** Use a P-25E351 "SPIRAP" insulator on either the bolt or stud fastener (Fig. 17 and 18). The purpose of the "SPIRAP" is to eliminate the possibility of the fastener grounding the lower lug of the housing contacts. To install, start at the BKX terminal and wind the "SPIRAP" in "barber pole fashion" around the stud or bolt. Do not allow the "SPIRAP" to cover any of the threads on the exposed end of the stud or bolt. Redress the wiring to the upper housing contacts (Fig. 21).

**3.23** Apply a coating of KS-19094 antiseize compound to the threaded area of the bolt or stud fastener which engages the security lock.

**3.24** After the bolt or stud fastener is properly installed, fasten upper housing as follows:

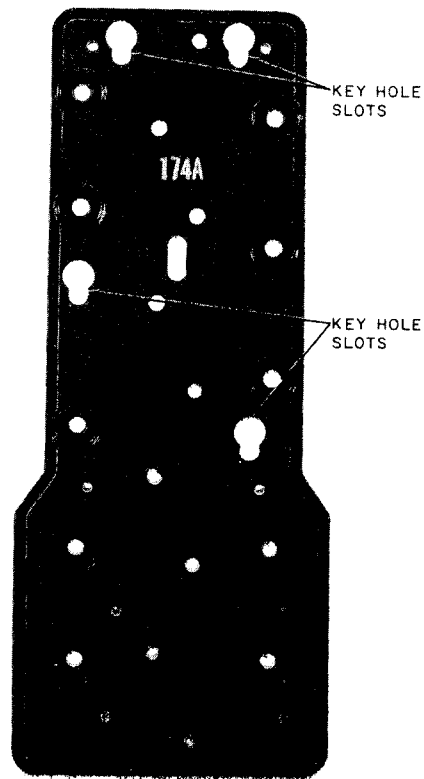
(a) Insert the tubular key into the KS-19277 lock.

(b) Apply and maintain a slight forward pressure on the key while rotating it in a clockwise direction until the key is hand tight. Do not force the key beyond this point. To remove the key, turn counterclockwise to the first release position and pull the key away from the lock.



*Do not use pliers or other tools or instruments on the handle of the key. Do not file tab off end of key. Once the upper cover assembly has been drawn to the backplate assembly so that the upper cover assembly lock can be engaged, there is no need to further tighten the KS-19277 lock.*

**3.25** When an upper housing equipped with a KS-19277 lock is removed for maintenance, apply a coating of KS-19094 antiseize compound to the threaded area of the bolt or stud fastener



**Fig. 20—174A Backboard with Four Keyhole Slots for Security Studs and Bolt Fastener**

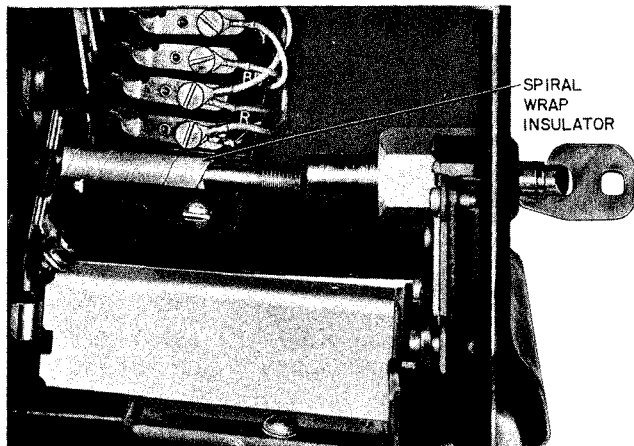


Fig. 21— Cutaway Section of Upper Housing Showing Mating of Bolt Fastener and KS-19277 Lock

which engages the security lock. The compound will facilitate subsequent installations and removals of the upper housing.

**B. Security Studs**

3.26 Security studs are used to give added strength to the mounting of a coin collector/telephone on a backboard. Four versions are available as shown in Fig. 22.



*Security studs can be used only if the backboard is designed with key-hole slots that align with the security stud mounting holes in the coin collector.*

3.27 The P-10E070 and P-12E798 studs are used with the 190 and 200 series coin collectors plus the 235 and 1235 panel telephones. The P-40Y060 and P-40Y061 studs are used with the 1A-type coin telephones.

3.28 Security studs with long shoulders are intended for use in installations with 5/16-inch thick backboards. Those with short shoulders are intended for use in installations with 3/16-inch thick backboards.

**C. 719A Tool**

3.29 A 719A tool (Fig. 23) is used in conjunction with the locks on the 1A-, 2A-, 235-, and

1235-type coin telephones. It is required to release or engage the locking mechanism on both the cover assemblies and cash compartment doors.

NOTE:  
ALL DIMENSIONS SHOWN ARE IN INCHES.

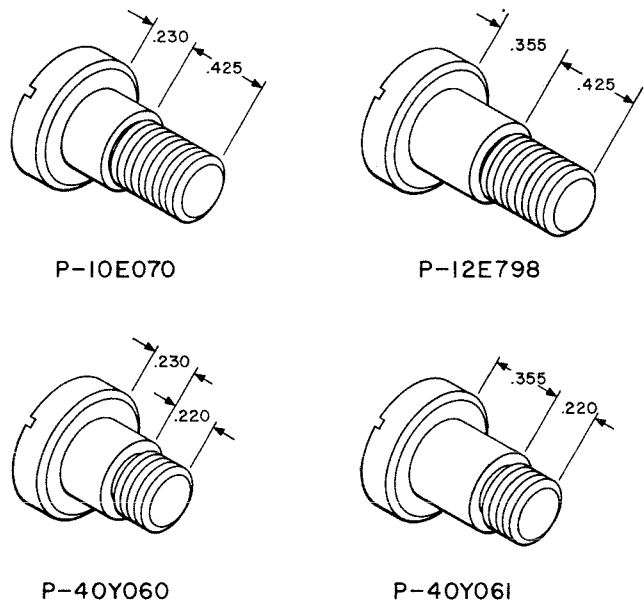


Fig. 22—Security Studs

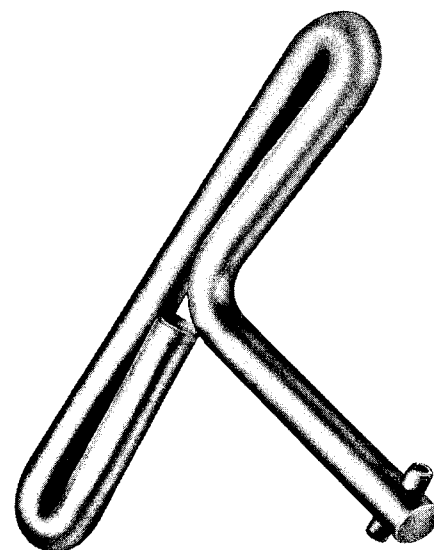


Fig. 23—719A Tool

#### D. 1A Backplate

3.30 The 1A backplate made of sheet steel (Fig. 24), is intended for use on coin collectors equipped with aluminum backplates to reduce the possibility of breaking away the lower housing by means of a pry bar.

3.31 The 1A backplate is provided with clearance holes for security studs and mounting screws. It is fastened to the coin collector backplate by replacing the four lower housing assembly screws with one P-12E799 and three P-13E656 high-strength flathead steel screws (Fig. 25). The replacement screws must be ordered separately.

3.32 The 1A backplate cannot be used with 139A backboards or 19-type shelves.

#### E. Coin Receptacle Covers

3.33 The 1D coin receptacle cover is a zinc chromate finished metal cover intended for use with a 1B or 1C coin receptacle. It is provided with a self-locking mechanism which is set from the inside before being sealed to the coin receptacle and automatically locks itself on the inside when removed from the cash compartment.

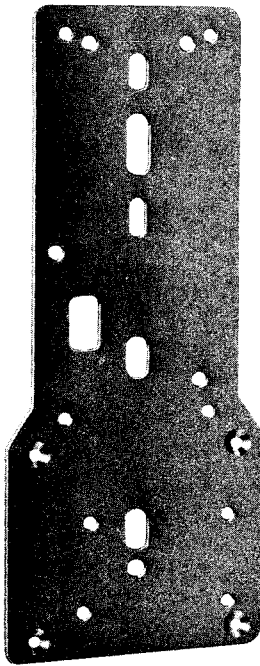


Fig. 24—1A Backplate

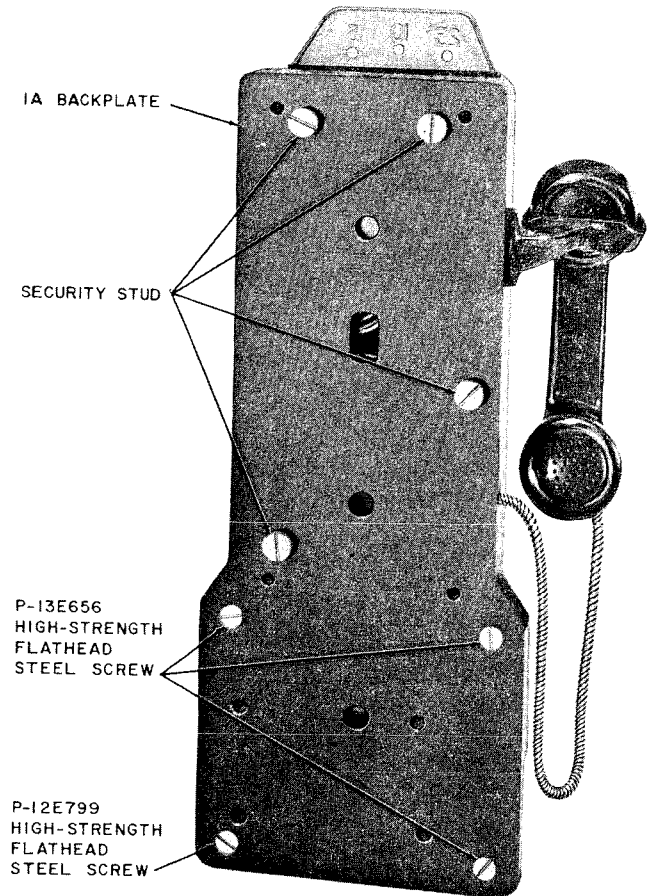


Fig. 25—Rear View of Coin Collector with 1A Backplate Attached

3.34 The 1E coin receptacle cover is similar to the 1D coin receptacle cover except it is provided with an insulated contact to facilitate the use of a coin level detector.

#### F. Ring Seals

3.35 Ring seals, formed from sheet aluminum, (Fig. 26) are used to seal the coin receptacle cover to the cash box.

3.36 The ring seal is placed in the hasp staple in the same manner as a padlock and crimped with a ring seal press.

#### G. Armored Cords and Handsets

3.37 All new coin collectors/telephones and all reissued 200-type coin collectors are furnished with handsets equipped with PVC jacketed cords

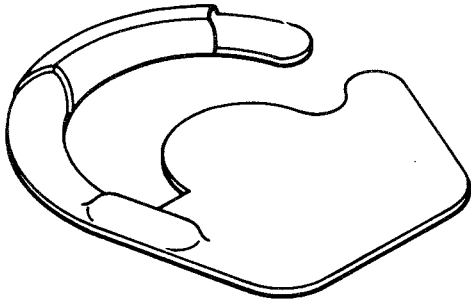


Fig. 26—Typical Ring Seal

having an outer covering of stainless steel flexible hose. The transmitter and receiver caps are cemented to the handset handle (Fig. 27).

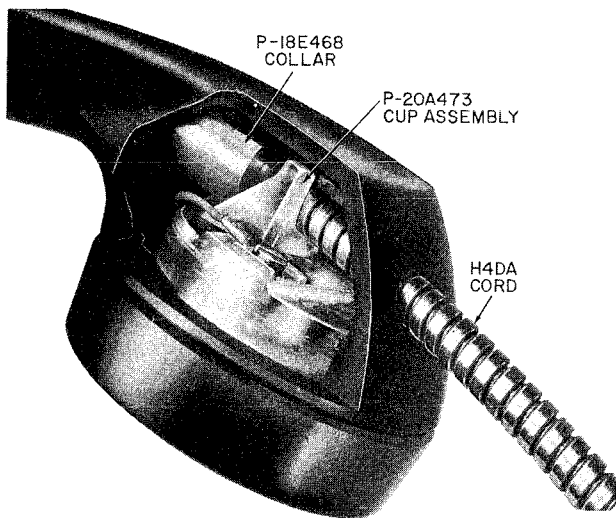
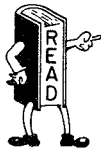


Fig. 27—Handset with Armored Cable

**3.38** Use the following procedures to equip existing coin collectors in the field with G3R or F1L handset.

- (1) Refer to Section 506-110-101 entitled Coin Collectors, Identification and Selection for the proper handset.
- (2) Remove the upper housing from the coin collector.
- (3) Disconnect the handset cord conductors and cord fasteners from the coin collector. Before removing old cord from the cord entrance hole

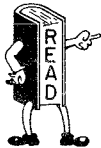
it is recommended a pull wire or equivalent be attached to the old cord as it is being removed. This will aid in pulling in new cord.



*Cover the coin relay, hopper, and return chute with a piece of plastic, cloth, or other suitable material to prevent metal drill shavings from falling into these mechanisms.*

- (4) Using a small center punch and hammer, mark hole to be drilled and tapped in the coin collector backplate. This hole is to be located in the cord entrance tube halfway between the outer beveled edge of the coin collector and the left edge of the cord chamber (Fig. 28).

- (5) Drill hole located in step 4 with a No. 7 drill.



*When drilling aluminum backplates do not exert too much pressure to drill. This may cause drill to cut too fast, thus making hole oversized.*

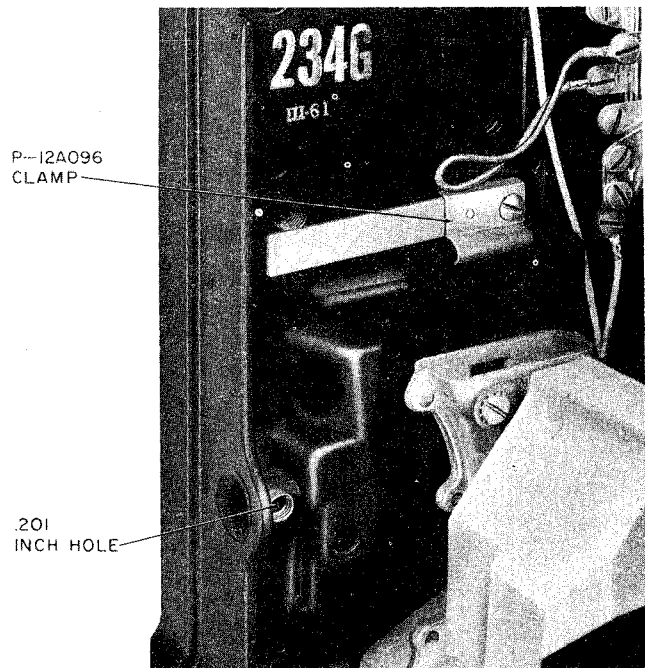


Fig. 28—Location of .201 Inch Hole

- (6) Tap the hole drilled in step 5 using a 1/4-20 tap with a Greenfield T-Handle tap wrench or an approved equivalent.

**Caution:** *The tap wrench should be long enough to permit the wrench handle to protrude out and beyond the coin relay. This is to prevent injury to the installer or possible damage to the coin relay.*

- (7) Clean metal shavings from the cord entrance hole.
- (8) Using the pull-in wire placed in step 3, pull in new cord.
- (9) Remove the pull-in wire from the new cord and fasten the P-12A096 clamp over the cord (Fig. 29).

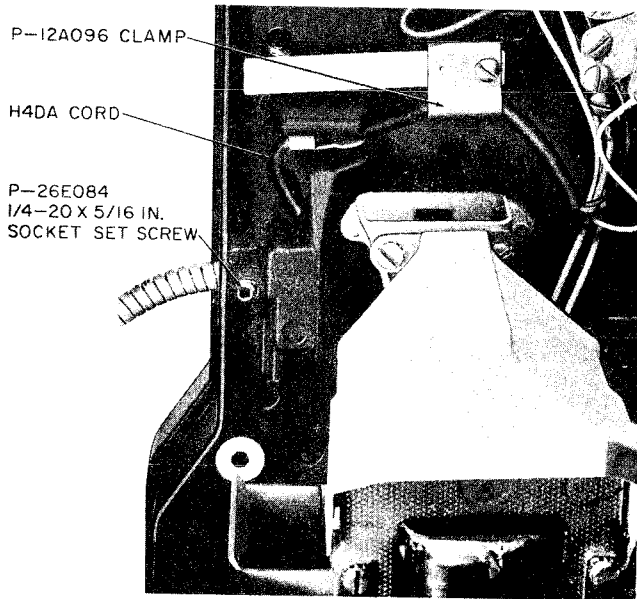


Fig. 29— Installation of Armored Cord

- (10) A P-26E084 1/4-20 by 5/16-inch self-locking setscrew is used to secure the cord to the coin collector backplate (Fig. 29). A flat surface is located approximately 1/4-inch from the set end of the stainless steel flexible hose. Using a 1/8-inch Allen wrench, screw the socket setscrew into the hole drilled in step 5 until it just makes contact with the flat surface of the metal hose. Give the setscrew one full turn. This should hold the cord firmly in the coin collector.

**Caution:** *Screwing the socket setscrew down more than one turn against the steel flexible hose may damage the cord conductors.*

- (11) Remove the protective covering placed in step 3 and replace the upper housing.

**Caution:** *Brush out all metal shavings from the coin collector, booth shelf, and booth. Dispose of these metal shavings where they will not cause injury to the public or damage to equipment.*

- 3.39 Refer to Fig. 30 for routing and securing handset cord in 1A-type coin telephone.

- 3.40 Refer to Fig. 31 for routing and securing handset cord in 2A-, 235-, and 1235-type coin telephones.

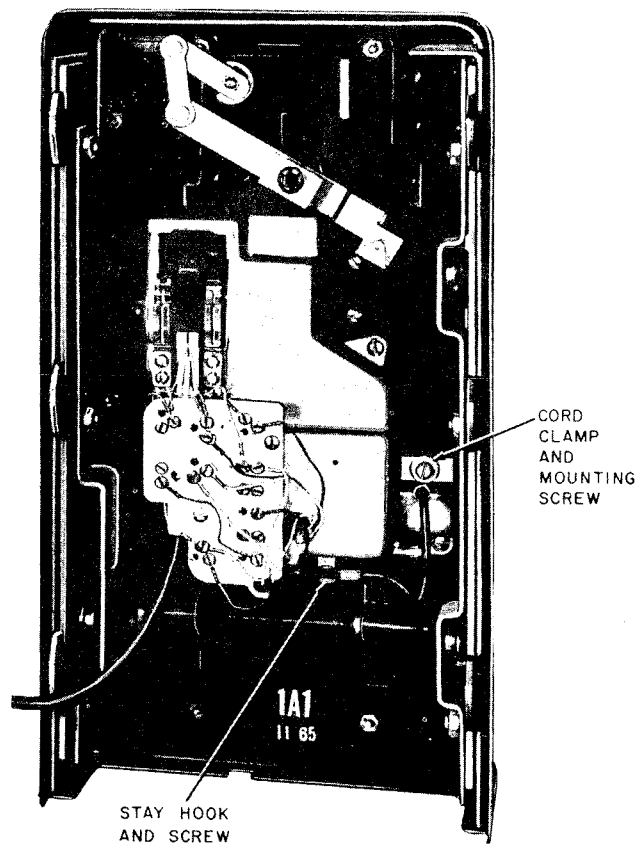


Fig. 30— Location of Armored Cord Mounting Hardware in 1A-Type Coin Telephones

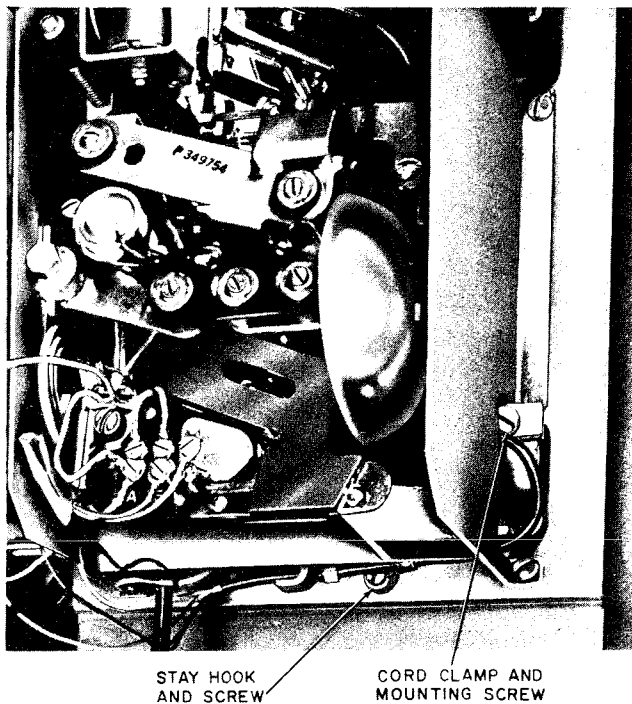


Fig. 31—Location of Armored Cord Mounting Hardware in 2A, 235, and 1235-Type Coin Telephones

**H. D-180009 Switch Hook Conversion Kit**

3.41 The D-180009 switch hook conversion kit (Fig. 32) is designed to place the rotation stops inside the housing to reduce switch hook blocking. It also permits a simple adjustment of switch hook travel.

3.42 The conversion kit is designed for field conversion of the 200-type and 1234-type coin collectors.

3.43 Two types of switch hooks exist in the field. The one-piece switch hook has a long shaft while the 2-piece has a short shaft plus an adapter.

3.44 To remove a one-piece switch hook:

- (1) Remove and retain hex head machine screw, lockwasher, tension spring, switch hook arm assembly, and any spacing washer that may be present, from right end of shaft (Fig. 33).
- (2) Slide switch hook to the left and out of bearings.

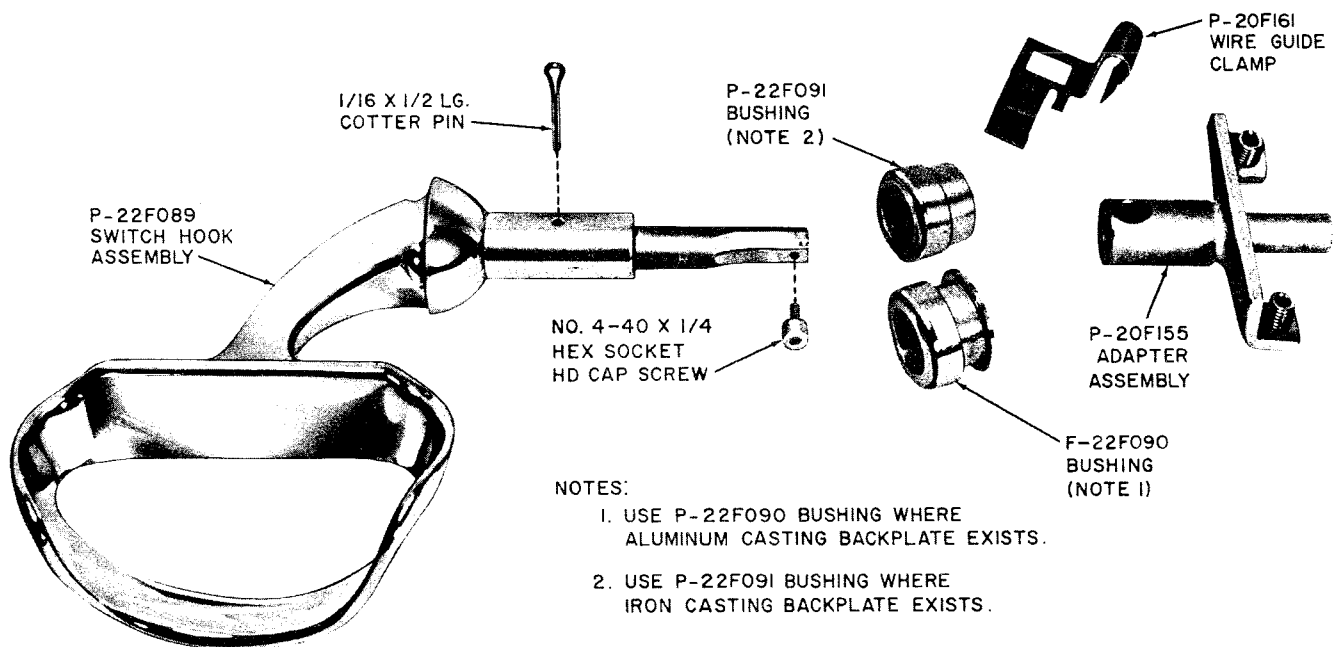
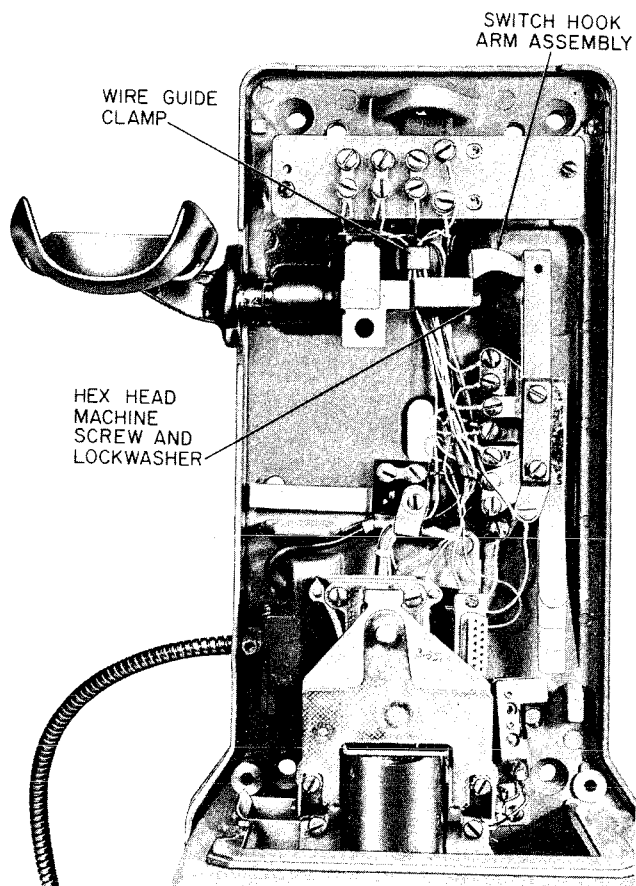


Fig. 32— D-180009 Switch Hook Kit



**Fig. 33—Old 2-Piece Switch Hook Installed**

**3.45** If coin collector is located in a corner, a one-piece switch hook may be removed without removing the coin collector from backboard. Do this as follows:

- (1) Perform operations outlined in 3.44 (1).
- (2) Place the larger notch of a 710A bending tool on the switch hook hub as shown in Fig. 34, View A. Apply force on the tool as shown and move the switch hook out, bending it slightly.
- (3) Having partially bent the shaft, move the switch hook to the left. Place the smaller notch of the bending tool over the shaft as shown in Fig. 34, View B. Apply force on the tool as shown.

- (4) Continue moving the switch hook to the left and applying additional bends as needed to remove the switch hook.

**3.46** To remove a 2-piece switch hook:

- (1) Perform operations outlined in 3.44 (1).
- (2) Loosen the flathead screw which secures P-12E828 adapter (Fig. 35) to the switch hook shaft.
- (3) Slide switch hook to left and out of bearing.
- (4) Slide adapter to left and out of bearing.

**3.47** Remove wire guide clamp (Fig. 33).

**3.48** To install new switch hook kit:

- (1) Install P-20F161 wire guide clamp (Fig. 36) on backplate. Ensure that wiring is routed as shown.
- (2) Select correct bushing (Fig. 32) and slide over shaft of switch hook.
- (3) Secure bushing on shaft with a cotter pin (Fig. 37).
- (4) Slide the P-20F155 adapter assembly into right bearing (Fig. 37).
- (5) Slide switch hook assembly with bushing installed, in left bearing to mate with adapter assembly.
- (6) Secure adapter to shaft with hex socket head cap screw (Fig. 38). Screw is furnished with kit.
- (7) Install P-297872 spacing washers as required to reduce excessive end play. End play of switch hook shaft shall not exceed 1/32-inch.
- (8) Place switch hook arm assembly (Fig. 39) retained in 3.44 over switch hook shaft and secure to end of adapter shaft with lockwasher and hex head machine screw retained in 3.44(1). Install tension spring.

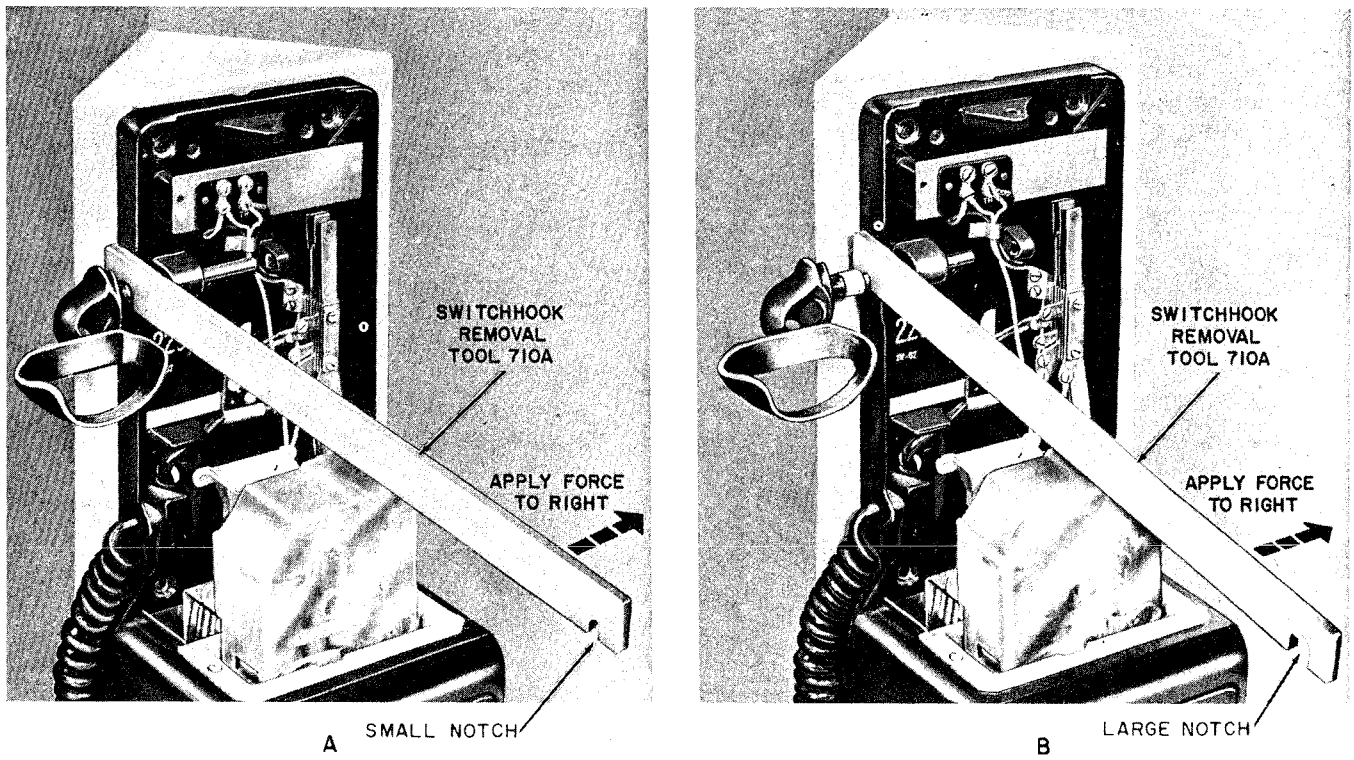


Fig. 34—Removal of 1-Piece Switch Hook Located in Corner

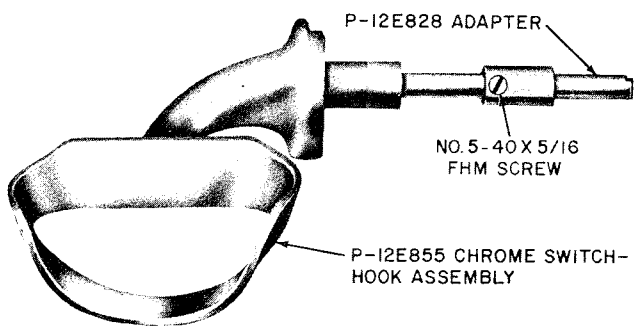


Fig. 35—2-Piece Switch Hook

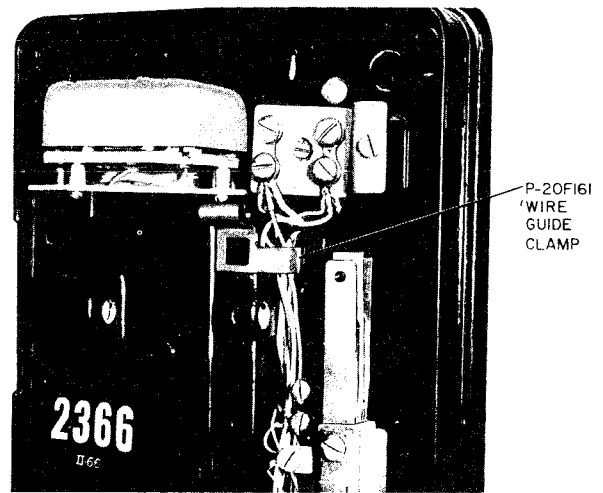


Fig. 36—Installation of Wire Guide Clamp



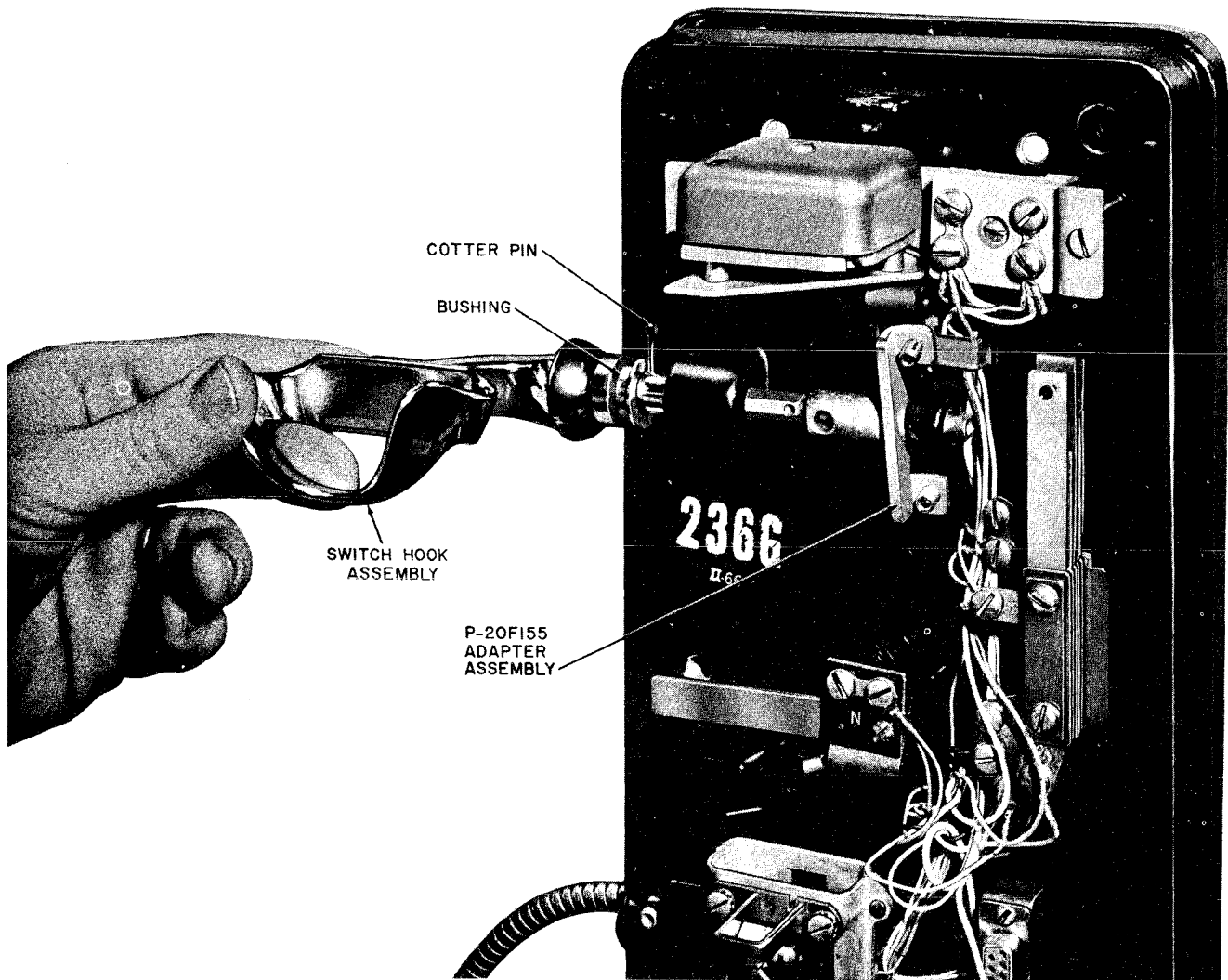


Fig. 37—Installation of Adapter Assembly and Switch Hook Assembly

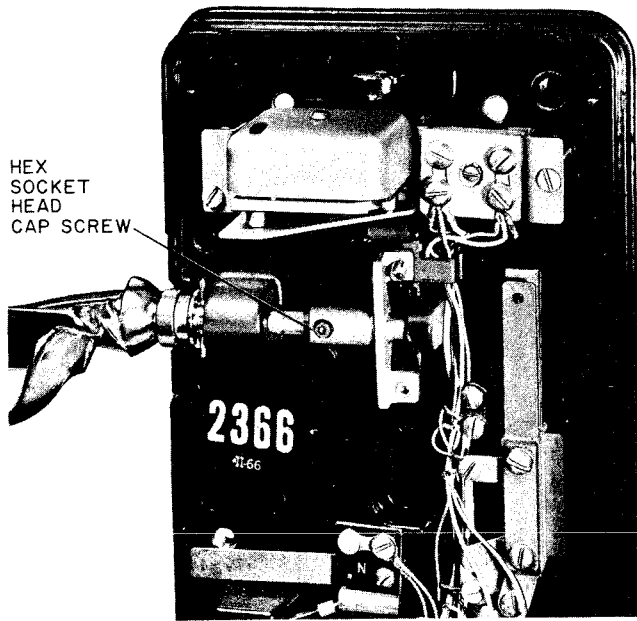


Fig. 38—Method of Securing Adapter to Switch Hook Assembly

3.49 Adjust switch hook travel with the two adjusting screws (Fig. 39) to meet contact spring pile up requirements as described in Section 506-110-301.

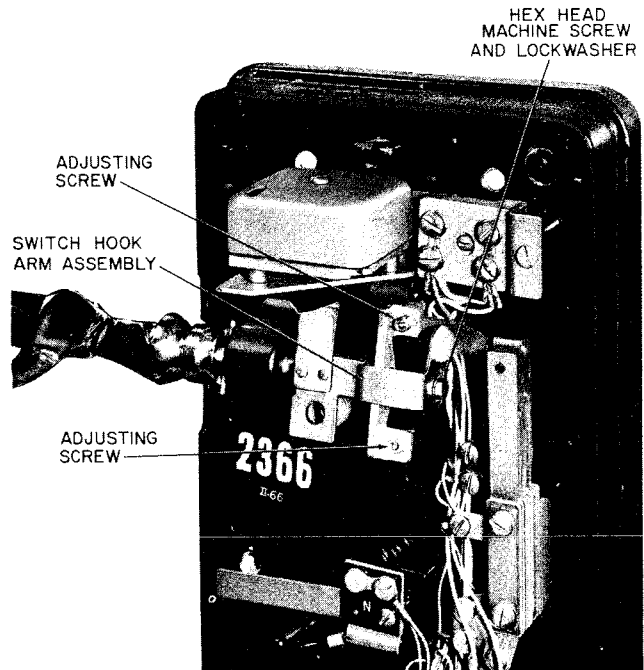


Fig. 39—Installation of Switch Hook Arm Assembly

3.50 Ensure that all wires are clear of adapter travel and adjusting screws.

3.51 Check switch hook operation as outlined in Section 506-110-301.

## COIN COLLECTORS/COIN TELEPHONES INSTALLATION

### 1. GENERAL

1.01 This section is reissued to:

- Delete information on 2-coil relay.
- Delete information on fasteners.
- Revise illustrations.
- Revise text.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.02 Connections for each type coin station are given in the appropriate connection section.

### LOCATION

*Note:* The location of a coin collector should be specified by the service order or an accompanying work sheet. If a location is not specified, obtain instructions from the customer before proceeding.

1.03 Consider the following:

- Visibility, accessibility, and convenience to customers
- Sufficient light
- Privacy
- Absence of noise and vibration
- Clearance from oily or dirty surfaces
- Clearance from stoves and heaters
- Clearance from moving machinery, piled merchandise, or narrow aisles

1.04 Locations over or adjacent to glass counters, showcases, or other property which may be damaged by falling handsets should be avoided.

### *Mounting Surfaces*

1.05 Consult a supervisor before locating coin stations on finishes that would be expensive to repair if the set is removed.

1.06 Have customer or building owner drill mounting and wire entrance holes through glazed tile, marble, or similar surfaces.

### *Inductive Effects*

1.07 Locate set and associated wiring at least 6 inches from neon fixtures, transformers, or other interference-causing equipment.

### *Security of Coin Station*

1.08 Avoid locations where:

- Coin station can be dislodged by hard use.
- Fasteners cannot be placed in solid backing.
- Coin station can be pried loose (on round columns, door or window facings, uneven surfaces, etc.).

### *Booths, Shelves, and Mountings*

1.09 Location requirements for booths, shelves and mountings are shown in the appropriate installation section.

### WIRING

1.10 Select and place wire in accordance with section covering wiring.

1.11 Wire coin station with triple station wire to provide an individual ground conductor for each station.

## SECTION 506-110-200

- The ground connection must be the same as for signaling grounds. (Refer to Section 638-210-100.)

**1.12** Conceal wiring near coin station. If this is not practical, use approved molding or woven conduit to cover wiring.

**1.13** Locate connecting block, protector or other terminating apparatus where it is not accessible to person using coin station. If necessary, locate protector outside building.

### BACKBOARDS

**1.14** See Section 506-110-105 for installation of backboards.

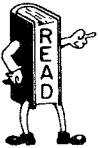


**Mount all coin stations on an approved backboard.**

**1.15** Backboard and coin station must be securely mounted with the required fasteners, mounting screws, security studs, and associated fasteners.

**Note:** If the coin station is wall mounted (not in a booth) the mounting surface must be plane. An uneven mounting surface will warp the backplate and cause misalignment between upper and lower housing.

## 2. INSTALLATION



**Remove handset from switch hook before removing or replacing upper housing to avoid damage to the gate operating arm. Do not reassemble upper housing on prepay coin collectors without placing a P-10E783 cover over the coin relay.**

### Alarm Switches and Security Devices

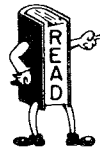
**2.01** Alarm switches and security devices are available as described in Section 506-110-103. The local telephone company shall regulate the installation of these devices.

**2.02** The 233-, 234-, 1234-type coin collectors and 236-type coin telephones are equipped with the KS-19277 lock and P-25E301 bolt fastener (Fig. 1).

(a) If the P-25E302 bolt fastener is required, order separately and substitute for the P-25E301 fastener prior to mounting coin collector.

(b) If it is necessary to replace P-25E301 bolt fastener with P-25E302 bolt fastener, proceed as follows:

(1) Unlock upper housing locks.

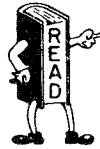


**To prevent damage to the tubular key when locking or unlocking KS-19277 lock, apply a slight forward pressure on the key while rotating it in either direction.**

(2) Remove upper housing.

(3) Unscrew P-25E301 bolt fastener from the security stud hole and replace with P-25E302 bolt fastener.

**Note:** If molded plastic insulating material is on existing bolt fastener, remove all of this material before attempting to unscrew the bolt fastener from the security stud hole.



**The fasteners must be screwed down tightly against the backplate when mounting coin collectors equipped with a bolt or stud fastener or when changing from one type to another.**

(4) Replace upper housing.

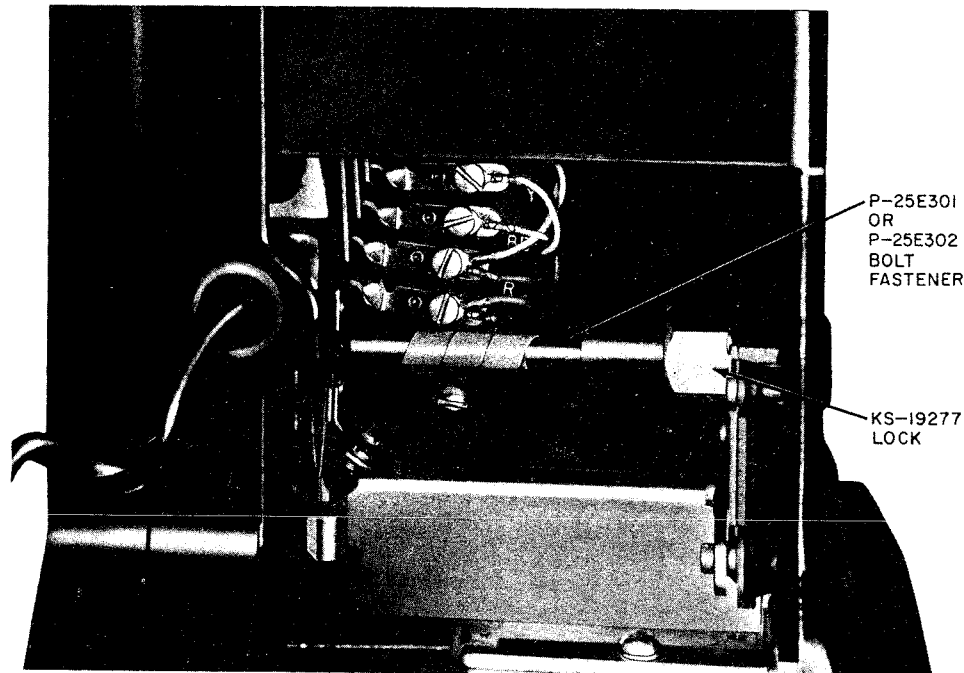
(c) For installation of bolt and stud fasteners on a coin collector in use, see Section 506-110-103.

**2.03** Fig. 2 shows the suggested mounting height and clearance for all coin stations. Stations may be mounted at other heights to meet local conditions providing this does not create service or maintenance problems.

**2.04** To mount coin station:

(1) Place required number of screw fasteners in upper and lower mounting holes.

**Note:** If coin compartment is not open, the lower fasteners will be added later by the public telephone representative.



**Fig. 1—Cutaway Section of Upper Housing, KS-19277 Lock and Associated Parts, Completely Installed**

- (2) Bring wires through opening in backplate.
- (3) Avoid bowing backplate by partially tightening each screw fastener alternately.
- 2.05** Location requirements for associated subscriber sets are specified in sections covering installation of station sets, booths, shelves, and mountings.
- 2.06** Ground housing assembly, as follows:
- (a) Prepay open type installation
- Connect JKT lead or GS insulated wire as shown in Fig. 3.
  - Dress wire so that it will not interfere with moving parts of coin mechanism or coin relay shield.
- (b) Indoor wooden booths
- A 14-gauge insulated ground wire (P-12C414 ground wire assembly) is provided. (Fig. 4)
- Connect ground wire from outside grounded BX armored power cable to ventilator or blower and to housing ground screw on coin station.
- (c) Metal booths
- Grounding is provided through mounting screws.
- (d) 19-and 20-type shelves
- See (a)
- 2.07** To ground upper housing to backplate:
- Place U-shaped spring clip on left edge of upper housing so as to contact housing contact spring (Fig. 5).
- 2.08** To mount 8-type cardholder.
- (1) Remove and retain the four slotless screws located at the rear of the coin gauge.

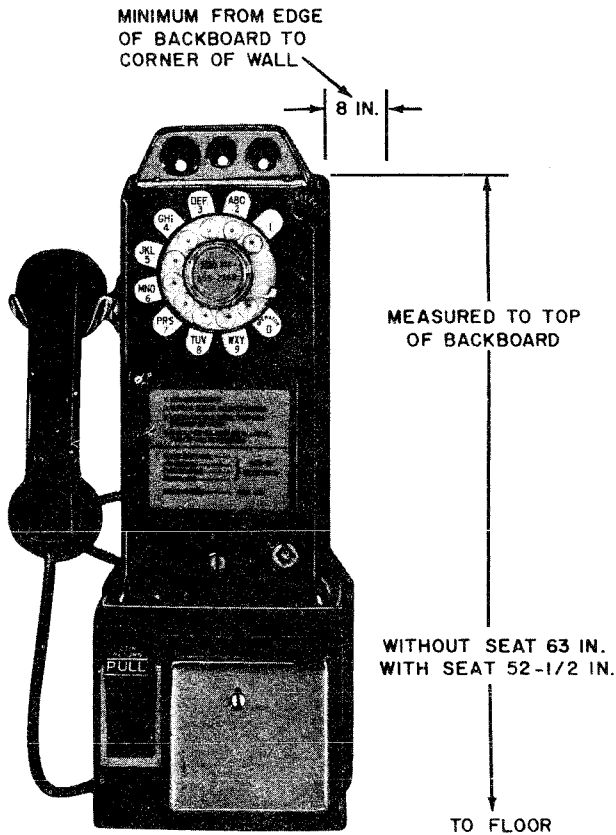


Fig. 2—Suggested Mounting Height and Clearance

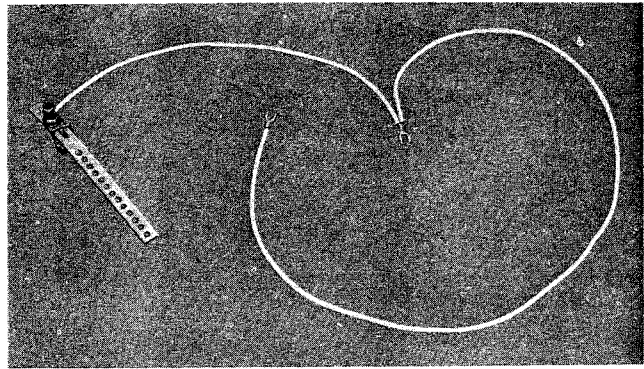


Fig. 4—P-12C414 Ground Wire Assembly

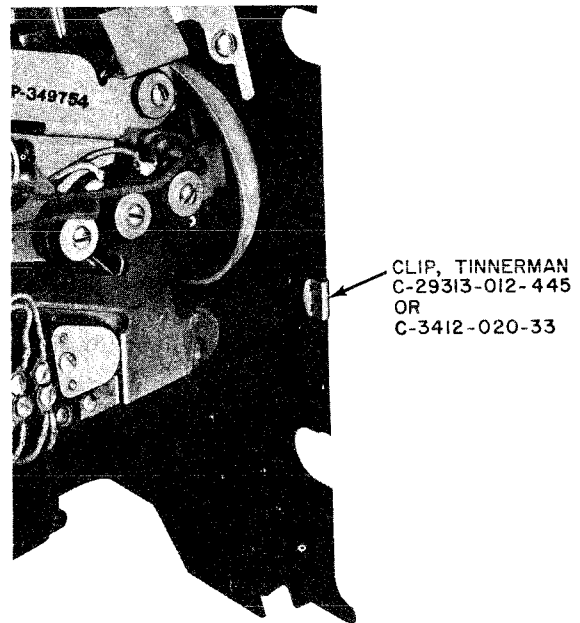


Fig. 5—Method of Grounding Upper Housing to Backplate

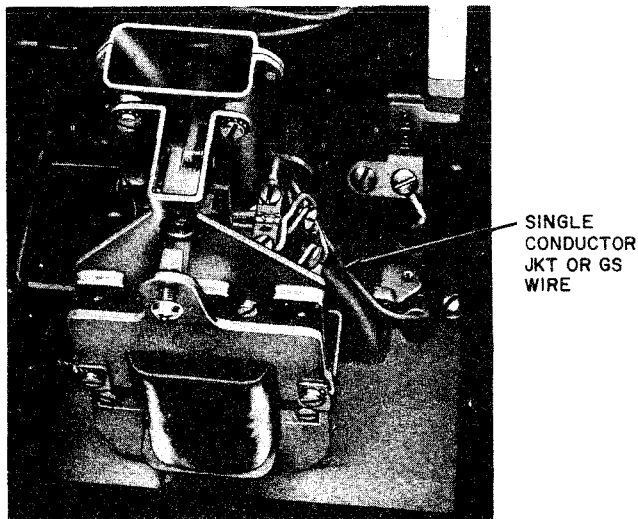


Fig. 3—Method of Grounding Coin Collector Housing Assembly, Open Type Installation

(2) Attach cardholder to upper housing with screws and nuts removed previously or use the following new hardware;

- P-81J700 RH slotless machine screws (last two digits signify color)
- P-423631 external-tooth lockwashers
- P-92383 hexagon nuts

**2.09** The 50-type apparatus blank may be used as an instruction cardholder.

- (a) Two plugged mounting holes are located below the dial in the upper housing.
- (b) use two P-222882, No. 4-36 by 1/4 inch RH machine screws to mount blank.

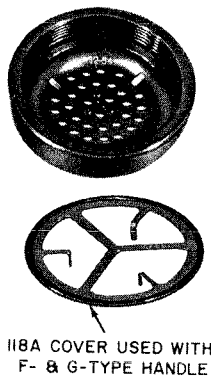
**AUXILIARY HANDSET DEVICES**

**2.10** Transmitter and Receiver Cap Locks

- Install cap locks per Section 501-210-101.
- Refer to Section 501-210-102 for cemented receiver caps.

**2.11** Antifrost Transmitter Cover

- (a) The 118A cover is intended for use on F- and G-type handsets where subfreezing temperatures occur (Fig. 6).



**Fig. 6—118A Transmitter Cover**

- Mounts on transmitter cap exterior to prevent condensed grid moisture from freezing in grid holes of cap.

- Use as designated locally.

**2.12** Antifraud Transmitter Unit

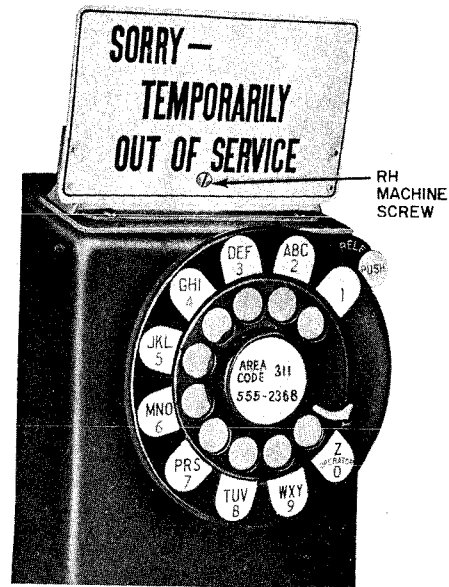
- Install per Section 501-230-100.

**2.13** Handsets With Armored Cords

- Install per Section 506-110-103.

**OUT-OF-SERVICE NOTICES**

- (a) If coin station is not ready for service when installation work is completed, place KS-7991 sign (Fig. 7) or E-4914 Form (Fig. 8) on coin gauge so customers will not deposit coins.

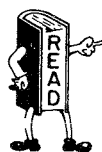


**Fig. 7—KS-7991 Sign in Place Over Coin Gauge**



**Fig. 8—Form E-4914**

- (b) A book of E-4914 Forms is included in the packing container of each new coin collector/telephone.



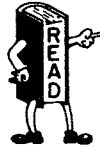
*When coin station is placed in service, leave book of E-4914 Forms with agent and give instructions for use when coin station is out of service.*

- (c) The KS-7991 sign is not included and must be ordered separately.
- Mounts by means of a No 8-32 by 3/4 inch RH machine screw and a self retained speed nut, Tinnerman C-6724-832-373 (Fig. 7 and 9).



Fig. 9—Rear View of KS-7991 Sign

#### RELAY COVER



*On 230-, 233-, 234-, 235-, 236-, 1234-, and 1235-type coin collectors/telephones, place P-10E783 plastic coin relay cover over relay before assembling upper housing on backplate.*

#### 3. FINAL TESTS, CHECKS, AND INSPECTION

- 3.01 Refer to Section 506-110-301 for tests.
- 3.02 Check that numberplate, instruction card, and directory are in place.
- 3.03 Inspect area around the installation and ensure that all debris is removed.



- I. This section is reissued to add information on the D5AM cord.
- 1.01 The D5AM cord replaces the D5AF cord which is rated Manufacture Discontinued.

CIRCUIT DIAGRAM NOTES

- ( ) Indicates current color code.
- [ ] Indicates MD color code.

Note 1: Dotted lines in diagram show manual set connections.

Note 2: New manufactured sets are wired as drawn. On converted 190 series sets, if the BR lead does not reach the BKX terminal, it is terminated on a BK terminal and a black strap connects BK and BKX.

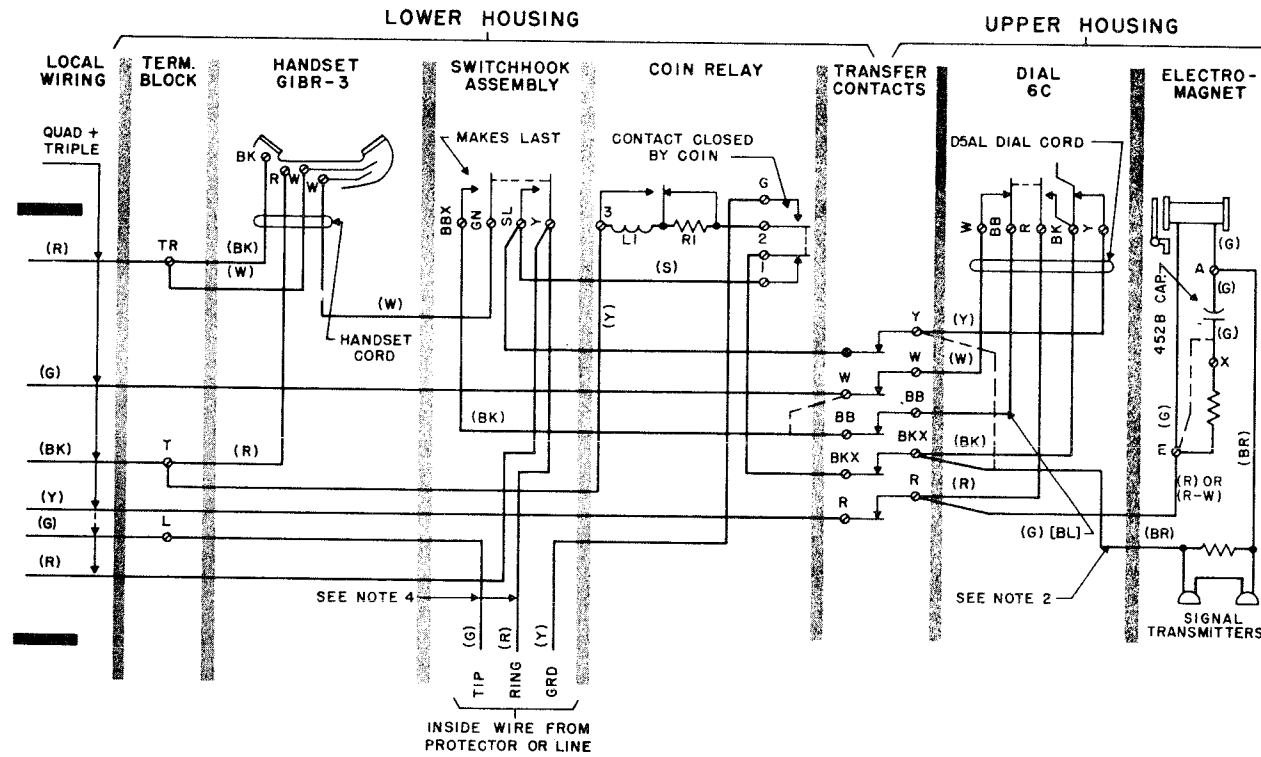
Note 3: When a 61R filter is required for radio frequency suppression, move yellow dial lead from Y upper housing contact spring to filter bracket terminal and connect filter leads as follows:

- Yellow lead to filter bracket terminal.
- Black lead to BK or BKX upper housing contact.
- Red lead to Y upper housing contact.

Note 4: When coin collector is installed in a KS-14611, List 2 booth or a KS-16705 mounting, the tip and ring line terminations are connected directly to the subscriber set.

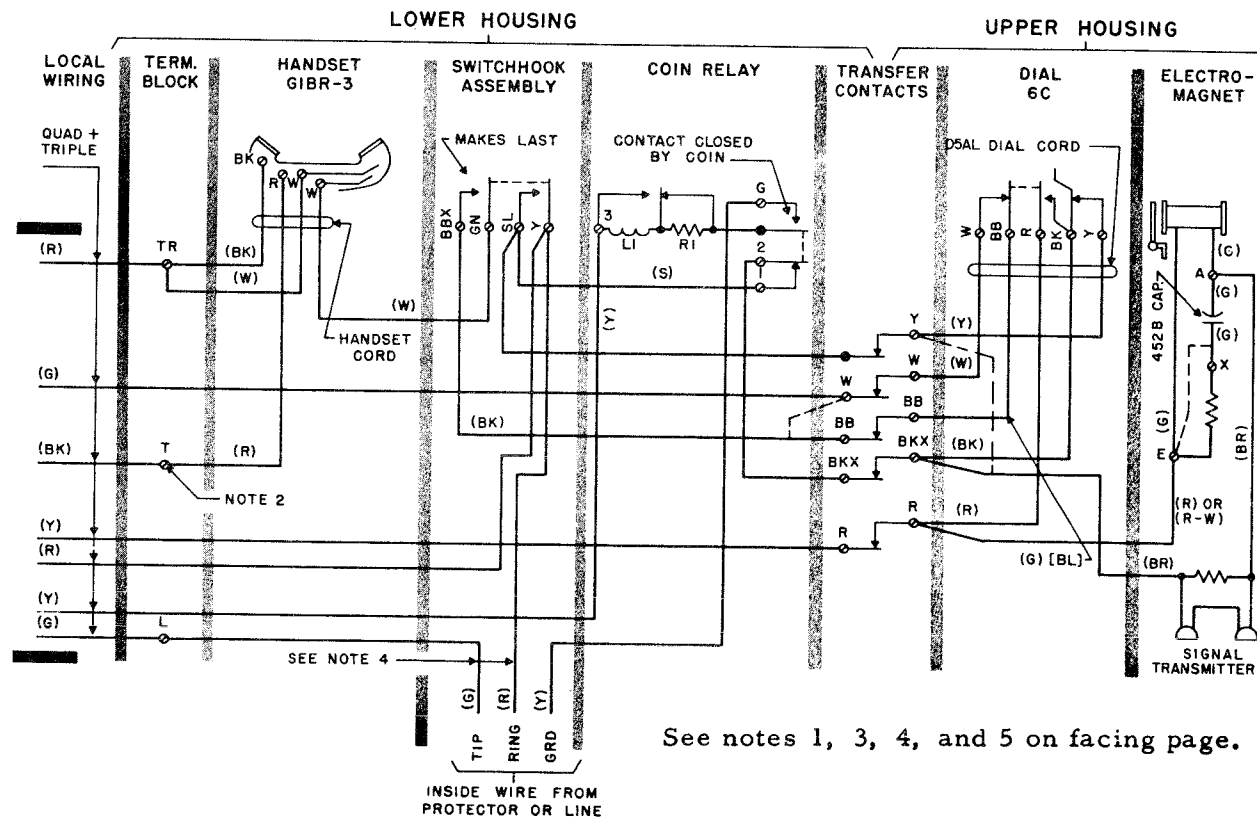
Note 5: New manufactured sets are wired as shown in 2. To rearrange for use with 685B subscriber set, disconnect yellow strap between T terminal and coin relay and wire as shown in 3. Insulate and store yellow strap for future use.

2. Circuit diagram for connection with 685A network-type subscriber set.



See notes 1, 2, 3, and 4 on facing page.

3. Circuit diagram for connection with 685B network-type subscriber set.



See notes 1, 3, 4, and 5 on facing page.

COIN COLLECTORS - PREPAY

234 (G)

230, 233 (C, D, G, H)

220, 223 (CT, DT, GT, HT)

191, 195, 196, 197 (CNT, DNT, GNT, HNT)

CONNECTIONS

**COIN TELEPHONE  
236G  
CONNECTIONS**

**1. GENERAL**

- 1.01** This section is reissued to add connections for 687A subscriber set which is optional.

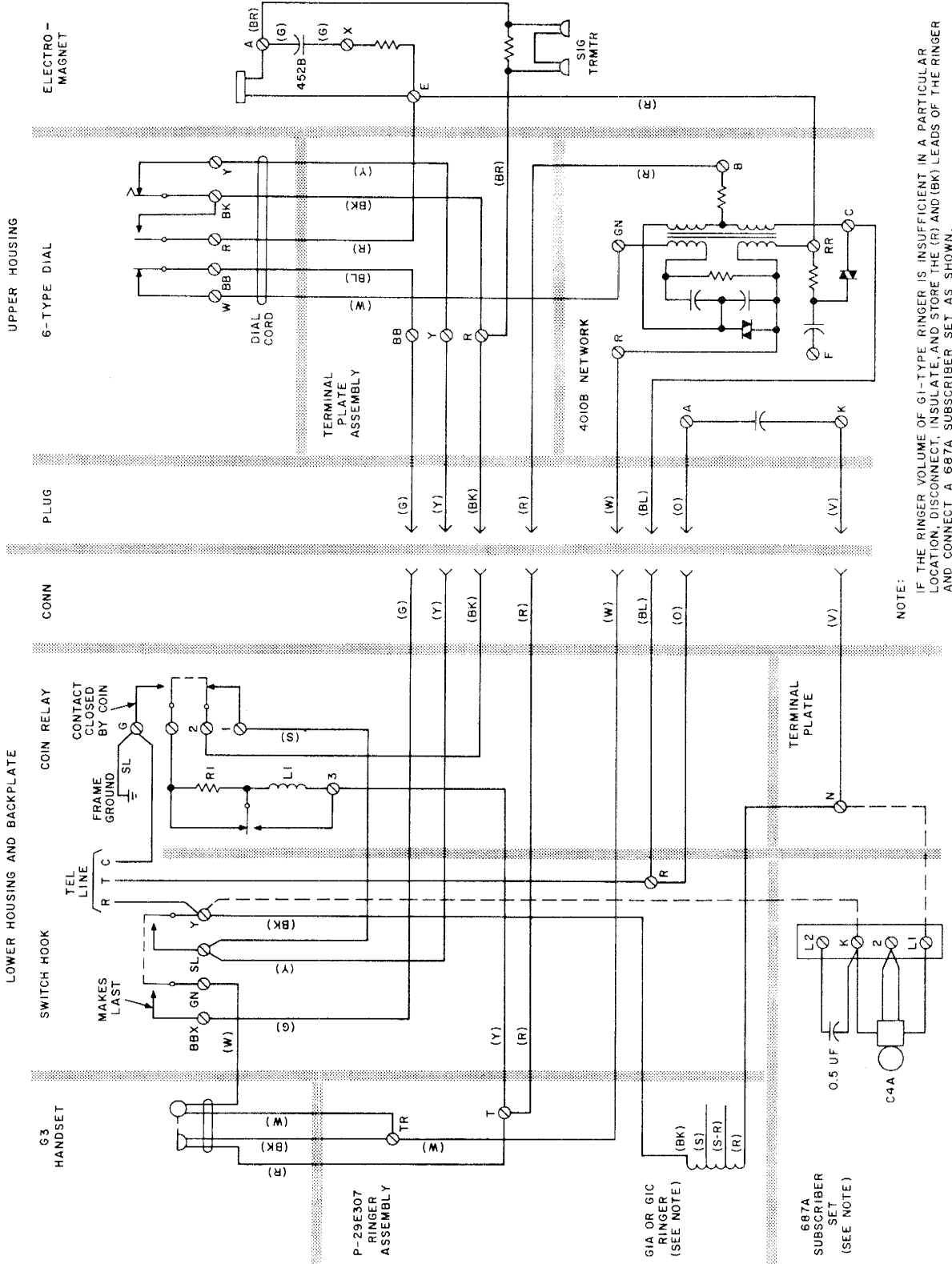


Fig. 1—236G Coin Telephone Set Connections

### COIN TELEPHONE — 1A-TYPE IDENTIFICATION

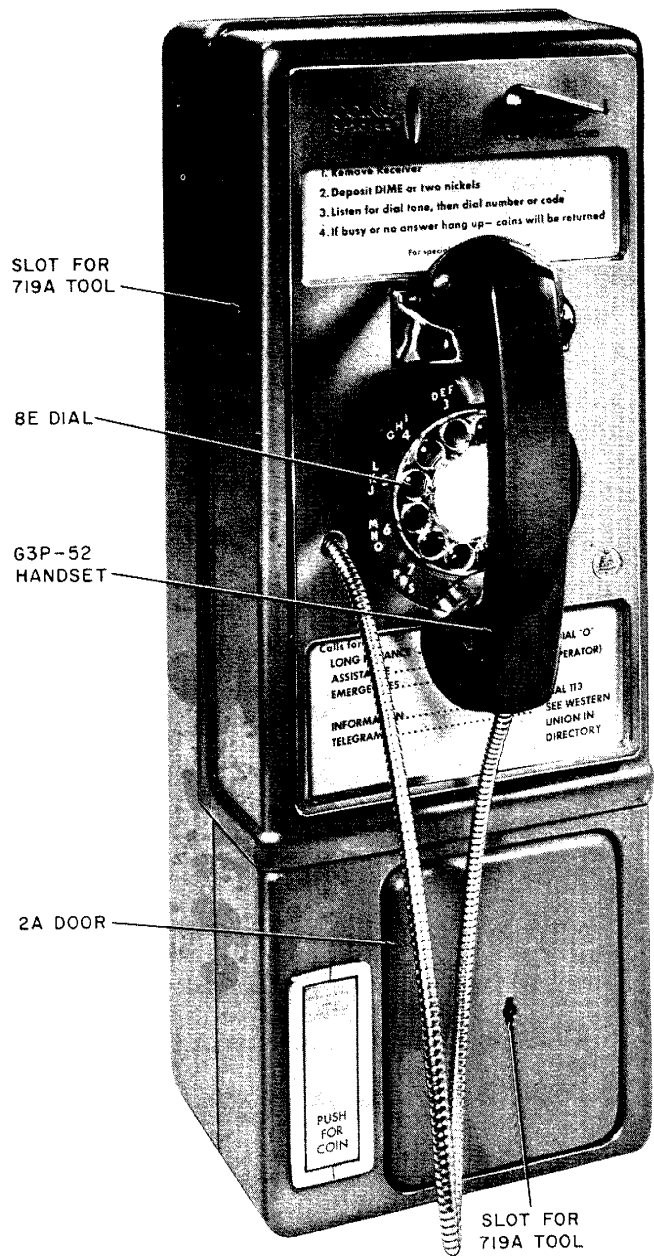


Fig. 1 — 1A1 Coin Telephone

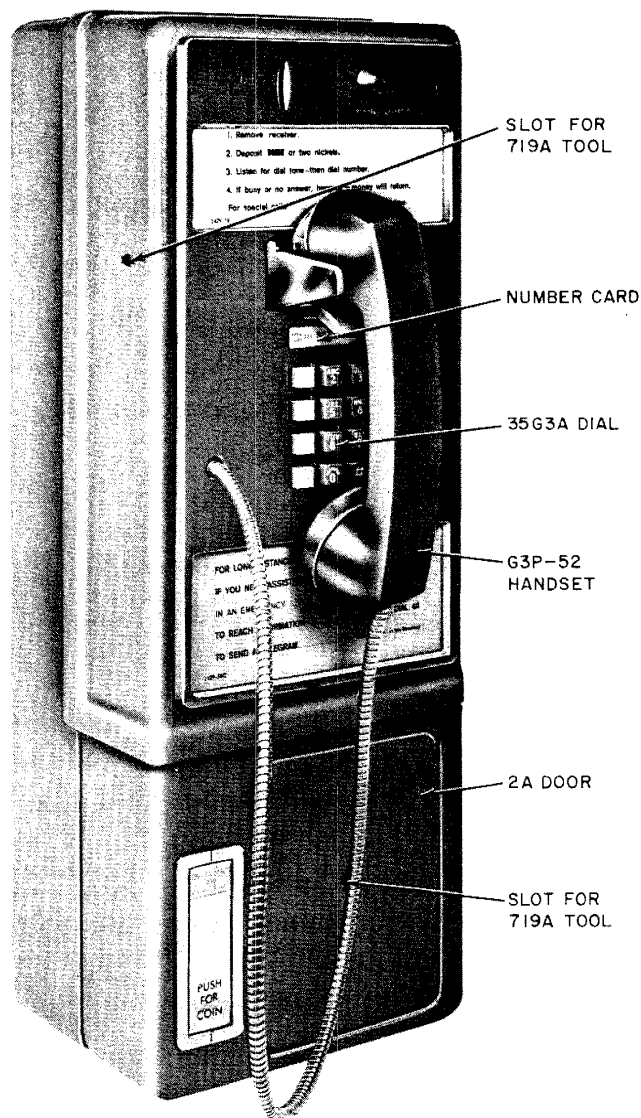


Fig. 2 — 1A2 Coin Telephone

## SECTION 506-326-100

### 1. GENERAL

**1.01** This section is reissued to incorporate information on 1A2 coin telephone.

**1.02** The 1A2 coin telephone set is similar to the 1A1 except the rotary dial is replaced with a 12-button TOUCH-TONE dial.

**1.03** The 1A1 coin telephone can be converted to a 1A2 coin telephone by replacing the P-90C800 cover unit assembly with a P-91C600 cover unit assembly. No wiring changes are necessary.

### 2. ORDERING GUIDE

Set, Telephone, 1A1 or Set, Telephone, 1A2

#### (a) *Replaceable Components For 1A1 (Fig. 3)*

- P-90C800\* cover unit assembly consisting of:
  - P-83B752 dial and housing assembly
  - 8E dial
  - G3P-52 handset
  - P-84A852 number plate assembly
- P-15E428 coin chute-totalizer assembly consisting of:
  - P-24E342 coin chute assembly
  - P-15E579 totalizer assembly
- P-85A200\* housing and mounting plate assembly
- P-15E437 chassis assembly
- P-15E718 coin relay and hopper assembly consisting of:
  - P-15E687 coin relay assembly
  - P-15E717 coin hopper assembly
- P-15E730 return chute assembly
- P-21F546 coin return assembly
- 303K mercury (A) relay

\* See Table A for color selection.

#### Γ (b) *Replaceable Components For 1A2 (Fig. 3)*

- P-91C600\* cover unit assembly consisting of:
  - P-26E153 dial and housing assembly
  - 35G3A 12-button TOUCH-TONE dial
  - G3P-52 handset
- P-15E428 coin chute-totalizer assembly consisting of:
  - P-24E342 coin chute assembly
  - P-15E579 totalizer assembly
- P-85A200\* housing and mounting plate assembly
- P-15E437 chassis unit assembly
- P-15E718 coin relay and hopper assembly consisting of:
  - P-15E687 coin relay assembly
  - P-15E717 coin hopper assembly
- P15E730 return chute assembly
- P-21F546 coin return assembly
- 303K mercury (A) relay

↳\* See Table A for color selection.

#### (c) *Associated Apparatus (Fig. 4, 5, and 6)*

- 2A door
- 1B or 1C coin receptacle
- 1D or 1E coin receptacle cover
- 1A switch kit (alarm)
- 14D lock (cash compartment)
- 30A lock (cash compartment)
- 29A lock (cover assembly)
- 719A tool
- P11C test cord\*

\* Used for testing with cover unit assembly removed.

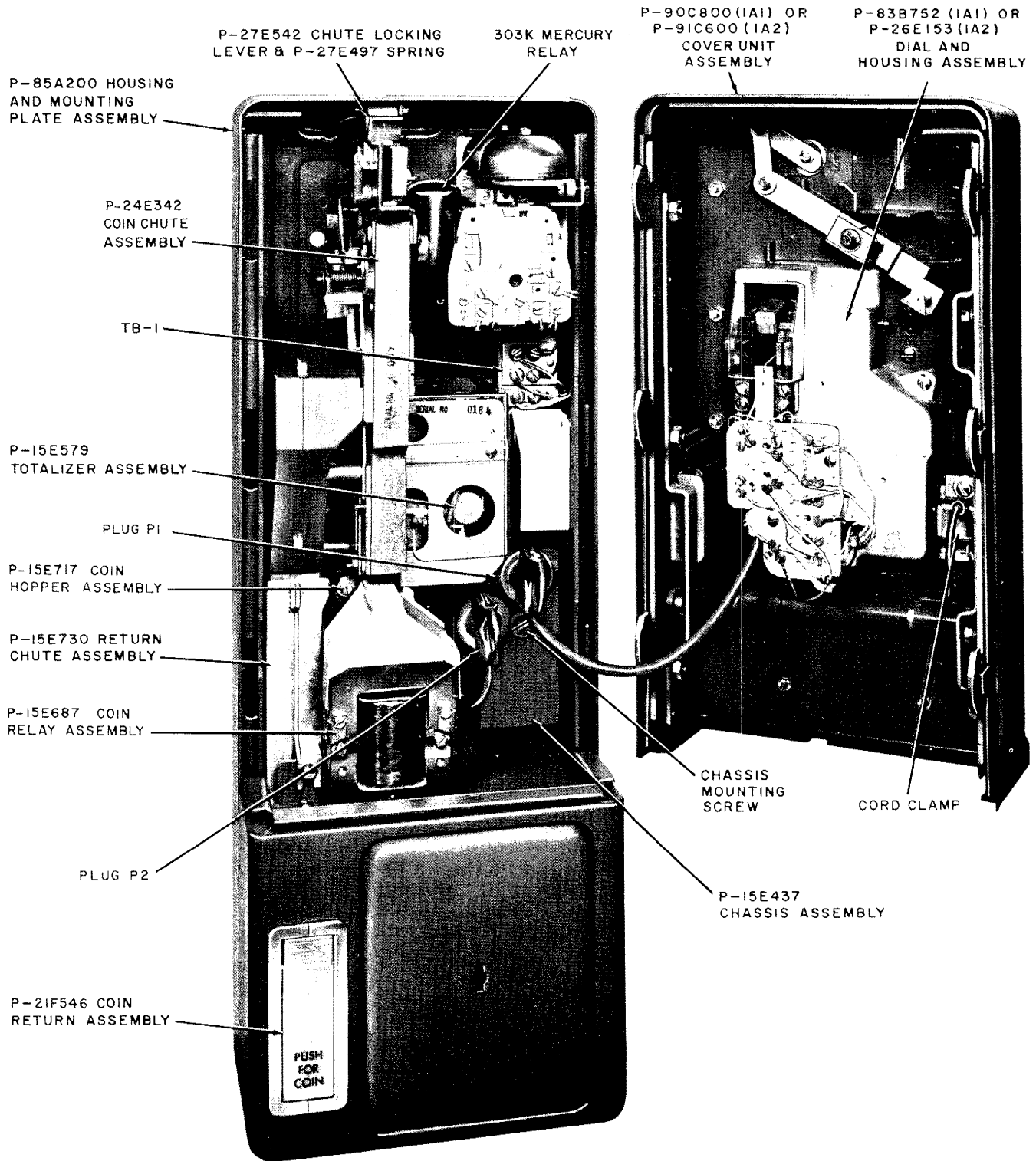


Fig. 3 — Assembly of Parts (Typical)

3. COLOR

Table A  
COLOR ORDERING GUIDE

COLOR	HOUSING AND MTG PLATE ASSEM	COVER UNIT ASSEM	NUMBER PLATE ASSEM (1A1 ONLY)	DIAL AND HOUSING ASSEM	HANDSET
Black - 03	•	•			
Moss Green - 51	•	•			
Gray - 52			•	•	•
→ Chrome - 44	•	•			

4. DESIGN FEATURES

- (a) Used only with dial prepay coin trunks.
- (b) All parts are contained in a high-security steel housing.
  - Cover unit assembly has six locking points actuated by a 719A tool.
  - Cover unit assembly is secured by 29A lock plus 719A tool.
  - Cash compartment door has four locking points actuated by a 719A tool.
  - Cash compartment door is secured by 14D or 30A lock plus 719A tool.
- (c) Provision is made for use of four security studs.
- (d) A single slot is provided to accept U. S. nickels, dimes, and quarters.
- (e) All sorting of coins is done internally by coin chute-totalizer assembly.
- (f) Coin return is designed to deter stuffing.
- (g) Has transmission characteristics equivalent to a 500/1500-type coin telephone.
- (h) Arranged to accept 1B or 1C coin receptacle.

- (i) ID or 1E coin receptacle cover may be used.
- (j) All electrical connections of field replaceable internal assemblies, except coin relay and ringer, are made by plug and jack arrangement.
- (k) Equipped for using 1A alarm switch kit.

5. OPERATING FEATURES

**5.01** Each 1A-type coin telephone is equipped with a totalizer mounted on the side of the coin chute. The totalizer cam shaft is rotated 10 degrees for each nickel deposited, 20 degrees for each dime, and 50 degrees for each quarter. Each cog (10 degrees) on the gear wheel represents a 5-cent deposit. The totalizer can be set for an initial rate of any amount from 5 cents to 45 cents in increments of 5 cents. A call can not be made until the preset initial rate has been deposited. All totalizers received from the factory will be preset at 10-cent initial rate.

**5.02** Coin identification is made by beep tones generated by an oscillator in the set. A nickel is identified by one beep, a dime by two beeps, and a quarter by a series of five rapid beeps. These tones are not audible in the handset. A transmitter mounted on the side of the chute transmits the sound of coins, passing through the chute, to the operator. This sound



*The 1C coin receptacle has a 50-percent greater money capacity than the 1B. When 1C is used, removal of false floor in cash compartment is required.*

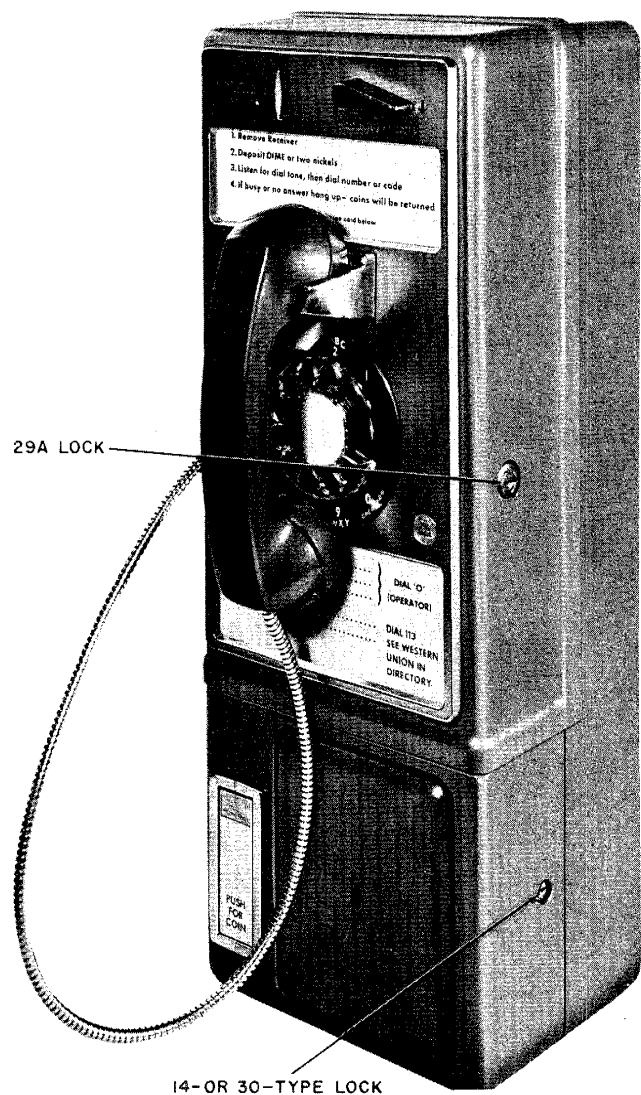


indicates that coins are being deposited and false tones are not being generated.

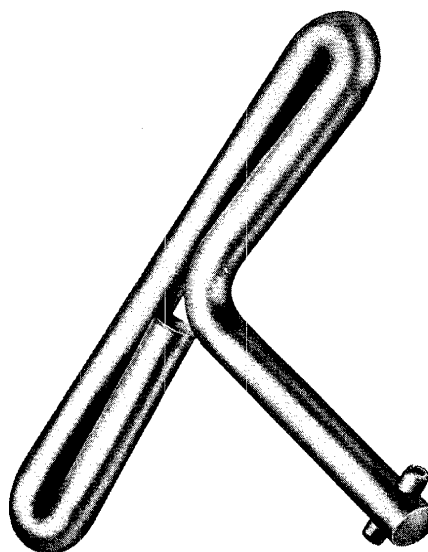
**5.03** Coins are sorted as they are deposited and, if accepted, rotate the totalizer cam shaft 10 degrees for each 5 cents deposited. Dial tone will not be heard until the preset initial rate

on totalizer is reached. The call proceeds in the normal manner after the preset amount has been deposited.

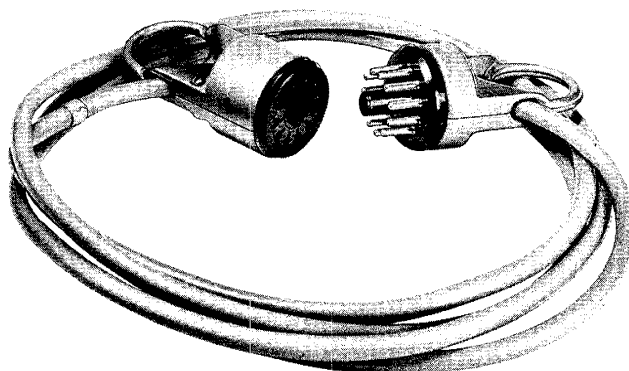
**5.04** Coins deposited on long distance calls are identified by beep tones (5.02) which are audible only to the operator.



**Fig. 4 — Location of Locks**



**Fig. 5 — 719A Tool**



**Fig. 6 — P11C Test Cord**



## COIN TELEPHONES—1A-TYPE INSTALLATION AND MAINTENANCE

### 1. GENERAL

1.01 The 1A1 coin telephone can be converted to a 1A2 coin telephone by replacing the P-90C800 cover unit assembly with a P-91C600 cover unit assembly. No wiring changes are necessary.

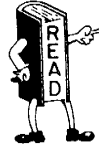
1.02 This section is reissued to add information on 1A2 coin telephone.

### 2. LOCATION

2.01 Consider the following:

- Accessibility to customers
- Sufficient light
- Privacy
- Absence of noise and vibration
- Absence of grease, smoke, or dust
- Clearance from oily or dirty surfaces
- Clearance from stoves or heaters
- Clearance from moving machinery, piled merchandise, or narrow aisles
- Mounting surfaces—Consult a supervisor before locating coin telephone on finishes that would be expensive to repair if the set is removed.
- Inductive effects—Locate telephone and associated wiring at least six inches from neon fixtures, transformers, or other interference-causing equipment.

### 3. BACKBOARDS



*When mounting the 1A-type coin telephone, a vertical surface must be provided. A tilt greater than 1-1/2 degrees in any direction will cause malfunction of the telephone. A vertical surface may be determined by the following steps:*

- (1) Place a spirit level vertically against the mounting surface with the top end of the level at the required height of the coin telephone (3.04).
- (2) Move the top or bottom end of the level away from the mounting surface as required to obtain a vertical reading.
- (3) When a vertical reading is obtained, the end of the level opposite the point of contact shall be no farther from the mounting surface than described in Table A.
- (4) Ensure that a vertical surface is obtained in both directions.

**TABLE A**

**METHOD FOR DETERMINING  
A VERTICAL SURFACE**

SPIRIT LEVEL LENGTH	MAXIMUM DISTANCE ALLOWED FROM SPIRIT LEVEL TO MOUNTING SURFACE ON OPPOSITE END FROM POINT OF CONTACT
18 inches	15/32 inch
24 inches	5/8 inch
30 inches	25/32 inch
36 inches	15/16 inch

## SECTION 506-326-200

- 3.01 Refer to Section 506-110-105 for identification and installation of backboards.
- 3.02 Refer to Section 506-110-103 for use of security studs.

**Note:** Security studs and mounting screws are not furnished and must be ordered separately.

### WALL APPLICATIONS

#### 178A-3 Backboard

- 3.03 The 178A-3 backboard is designed for mounting the 1A-type coin telephone on a wall.
- 3.04 When mounting backboard on wall, observe following:
- If seat is used, install backboard with top edge approximately 52 inches from floor.
  - If seat is not used, install backboard with top edge approximately 63 inches from floor.
- 3.05 Refer to Fig. 1 for mounting screw and security stud locations in the coin telephone.



*Security studs used with 1A-type coin telephone must have a thread length of not more than 1/4-inch to avoid interference with coin chute-totalizer assembly.*

- 3.06 Secure coin telephone to 178A-3 backboard using four P-40Y060 security studs and 1/4-20 by 5/8 RHM screws as required.

### BOOTH APPLICATIONS

#### 10- and 11-Type Booths

- 3.07 Use one of the following kits:

(1) D-179939 Kit of Parts which includes:

- One KS-19340, List 53 backboard (Fig. 2)
- Two P-48F349 rails (Fig. 3)
- Six 1/4-20 by 3/4 hex head cap screws
- Six 1/4-20 by 1-1/8 hex head cap screws

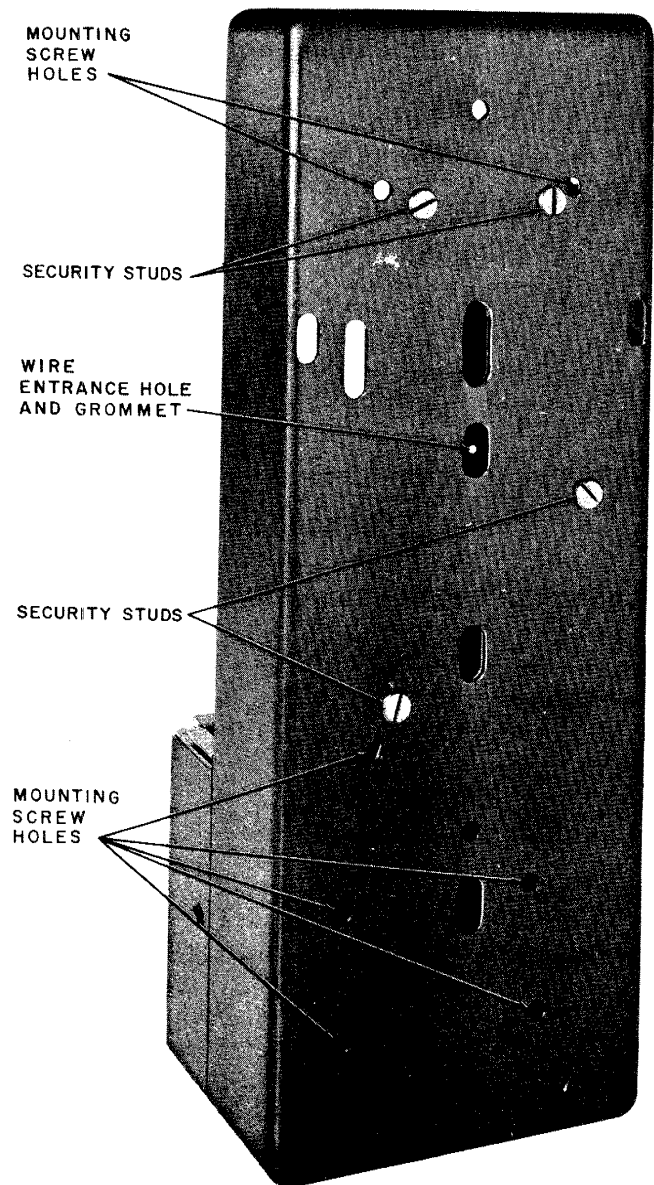


Fig. 1—Location of Mounting Screw Holes and Security Studs

(2) D-179940 Kit of Parts which includes:

- Two P-48F349 rails (Fig. 3)
- One P-48F348 filler block assembly (Fig. 4)
- Six 1/4-20 by 3/4 hex hd cap screws
- Six 1/4-20 by 1-1/8 hex hd cap screws

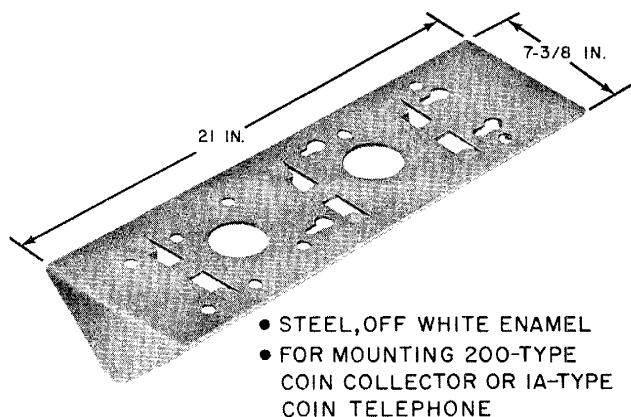


Fig. 2—KS-19340, List 53 Backboard



*Mounting holes in the booth sides may be relocated instead of using rails and screws provided in the kit of parts.*

- (3) Use four P-40Y060 security studs and 1/4-20 by 5/8 RHM screws as required.

**KS-16797 Universal Booth**

**3.08** Inspect backboard

- Early models (Fig. 5) are too short for the 1A-type coin telephone and must be replaced.
- Later models (Fig. 6) will accept 1A-type coin telephone or 200-type coin collectors.

**3.09** If short backboard exists

- (1) Remove and discard.

- (2) Obtain and install B-190387 backboard and two B-650326 filler blocks (Fig. 6).

- Blocks are for securing backboard to cross rails.

- 3.10** Use four P-40Y061 security studs and 1/4-20 by 5/8 RHM screws as required.

**KS-19206 Curved Door Booth**

- 3.11** Use KS-19206, List 6 coin telephone installation kit

- Refer to Section 506-115-200

- 3.12** Use four P-40Y060 security studs and 1/4-20 by 5/8 RHM screws as required.

**KS-19340 Wood Booth**

- 3.13** Use KS-19340, List 53 backboard (Fig. 2) four P-40Y060 security studs; and 1/4-20 by 5/8 RHM screws as required.

**KS-14611 Outdoor Booth**

- 3.14** Use backboard furnished with booth, four P-40Y060 security studs, and 1/4-20 by 5/8 RHM screws as required.

**KS-19425 Indoor—Outdoor Booth**

- 3.15** Use backboard furnished with booth, four P-40Y061 security studs, and 1/4-20 by 5/8 RHM screws as required.

**KS-19580 Outdoor Booth**

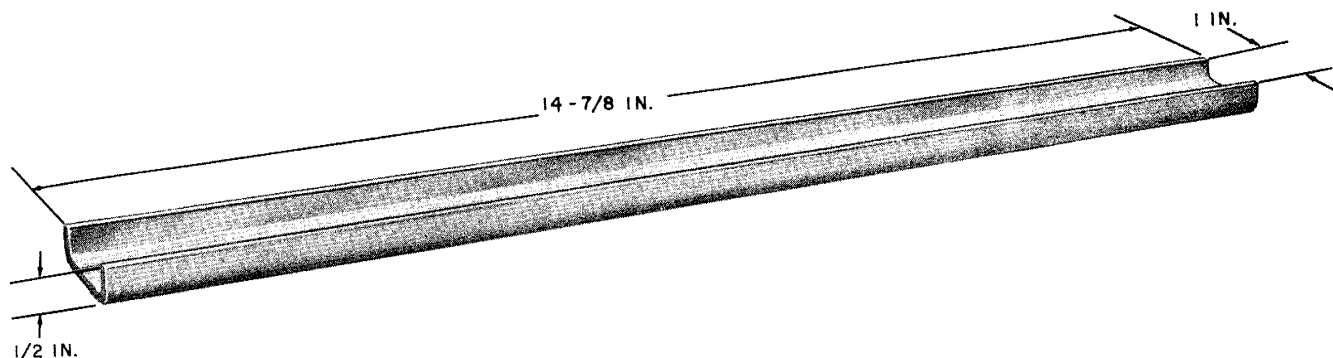


Fig. 3—P-48F349 Rail

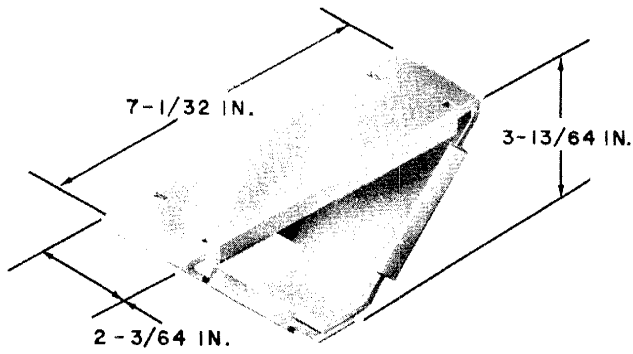


Fig. 4—P-48F348 Filler Block Assembly

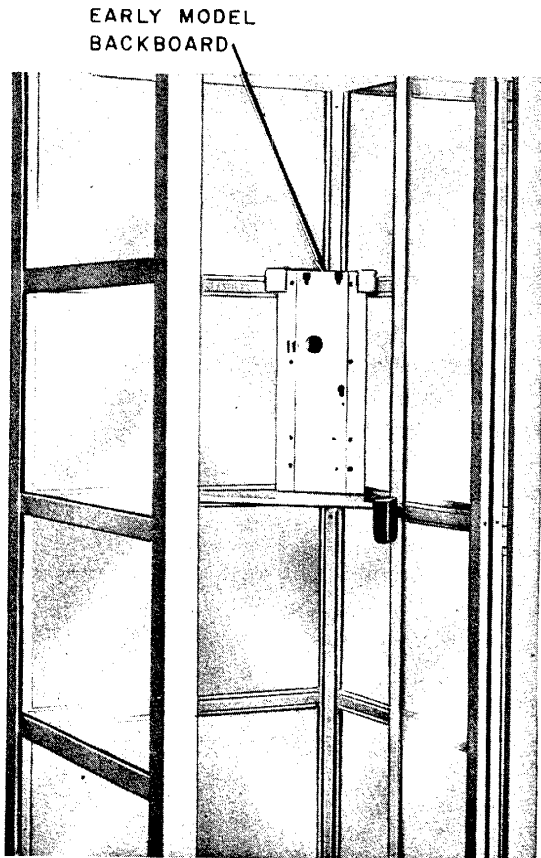


Fig. 5—KS-16797 Universal Booth with Early Version Backboard

3.16 Use backboard furnished with booth, four P-40Y060 security studs; and 1/4-20 by 5/8 RHM screws as required.

◆KS-20255 Telephone Kiosk◆

3.17 Use backboard furnished with booth

- Refer to Section 508-355-100

3.18 Use four P-40Y061 security studs and 1/4-20 by 5/8 RHM screws as required.

**SHELF AND MOUNTING APPLICATIONS**

*KS-19267 Coin Telephone Shelf*

3.19 Use backboard furnished with shelf, four P-40Y060 security studs, and 1/4-20 by 5/8 RHM screws as required.

*KS-19426 Walk-Up, Drive-Up Mounting*

3.20 Use KS-19426, List 7 installation kit

- Refer to Section 508-470-100,

3.21 Use four P-40Y061 security studs and 1/4-20 by 5/8 RHM screws as required.

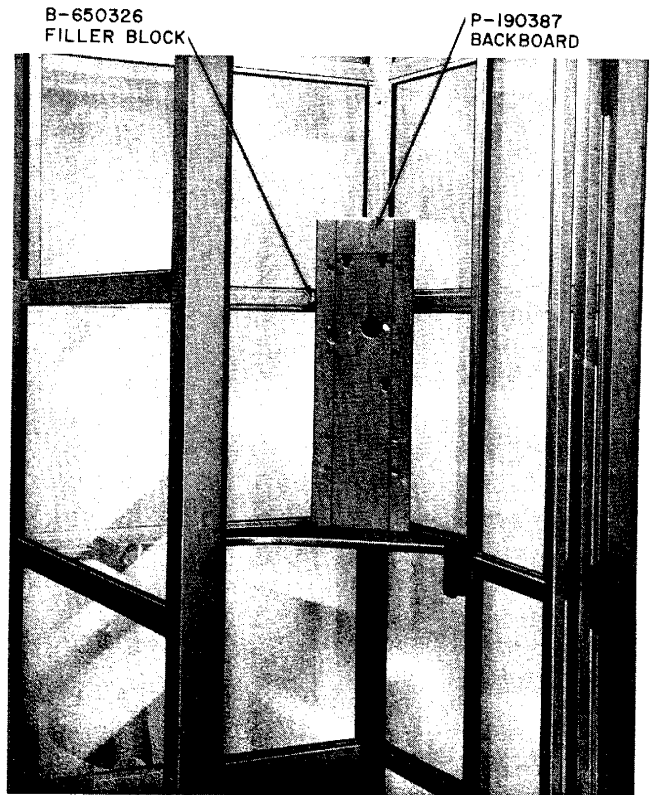


Fig. 6—KS-16797 Universal Booth with B-190387 Backboard

## 4. INSTALLATION

**4.01** To gain access to the coin telephone mounting holes: remove cover unit assembly, coin chute-totalizer assembly, and chassis assembly as follows:

### COVER UNIT ASSEMBLY

**4.02** To remove cover unit assembly:

- (1) Unlock 29A lock.
- (2) Release locking mechanism with 719A tool by turning tool 1/8-turn counterclockwise. See Section 506-326-100 for illustration of 719A tool.
- (3) Slide cover forward about 3 inches to obtain access to plug P1.
- (4) Disconnect plug P1 (Fig. 7) by pulling straight out as cover is carefully lifted off.

### COIN CHUTE-TOTALIZER ASSEMBLY

**4.03** To remove coin chute-totalizer assembly:

- (1) Disconnect plug P2 (Fig. 7).
- (2) Release chute locking lever and spring.
- (3) Lift spring out of groove in coin chute.
- (4) Tilt top of coin chute forward and lift out.

**4.04** To replace coin chute-totalizer assembly:

- (1) Place assembly on pins located on rear of hopper assembly and back of housing (Fig. 8).

**Note:** Be sure reject chute assembly, return chute assembly, and coin return assembly line up.

- (2) Place spring in groove on coin chute.
- (3) Lock spring in place by pushing chute locking lever down.
- (4) Reconnect totalizer plug P2 to J2.

### Totalizer

**4.05** The totalizer, mounted on the side of the coin chute, steps one increment for each 5 cents deposited. A nickel equals one, a dime two, and a quarter equals five increments.

**4.06** To remove totalizer from coin chute:



*Do not separate coin chute-totalizer assembly unless necessary. Take care not to damage totalizer arms when removing or replacing totalizer on coin chute.*

- (1) Disconnect 654B transmitter by separating connector (Fig. 9).
- (2) Remove three totalizer mounting screws from chute. (These are captive screws and will not fall out of totalizer.)
- (3) Carefully remove totalizer from chute.

### Setting Totalizer Rate

**4.07** Totalizers are preset at manufacture at an initial rate of 10 cents. If initial rates other than 10 cents are required, they may be reset.



*Use extreme care when resetting totalizer. Avoid damaging pawl and spring pile-ups. Do not attempt to turn totalizer cam shaft in direction opposite that shown in Fig. 10.*

**4.08** Two KS-16750, List 2 releasers or two paper clips are used to set the totalizer.

**4.09** To set totalizer:

- (1) Remove totalizer cover by loosening captive cover screw (Fig. 9).
- (2) Rotate totalizer shaft in proper direction (from bottom to top) until springs T2 (Fig. 10) rest in depression in shaft as indicated by movement of springs.
- (3) Depress reset latch (Fig. 10) toward bottom of totalizer.
- (4) Rotate shaft in proper direction until contacts T1 operate as indicated by an upward movement of the reset latch.

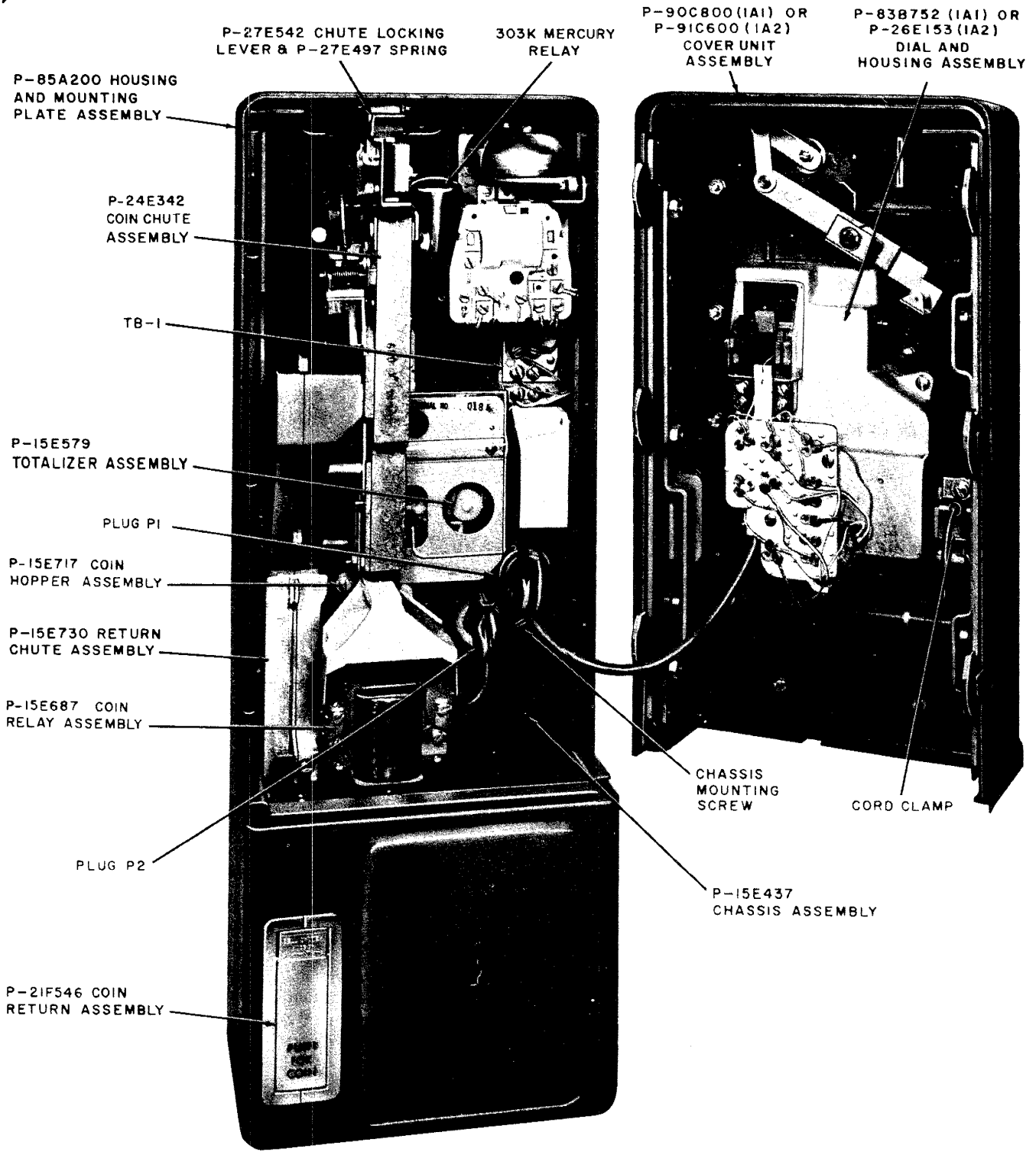


Fig. 7—Assembly of Parts (Typical)



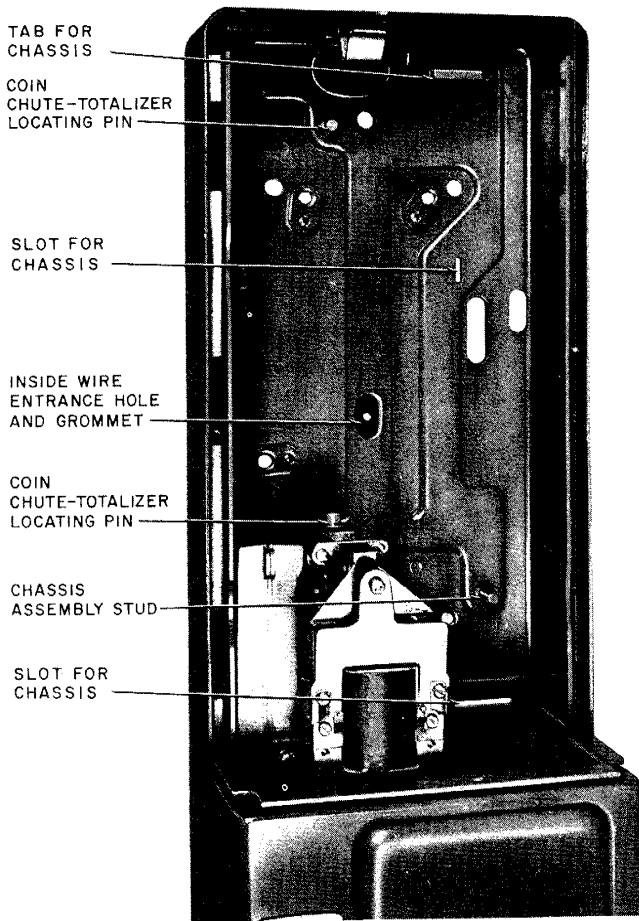


Fig. 8—P-85A200 Housing and Mounting Plate Assembly

- (5) Do not allow shaft to move. Insert one KS-16750, List 2 releaser or paper clip into hole 1 (Fig. 10) located near right-hand end of shaft. Take care not to disturb contact springs.
- (6) Hold the paper clip firmly so that right-hand end of shaft cannot move.
- (7) Insert the second releaser or paper clip into one of four holes indicated as hole 2 in center of shaft (Fig. 10). Do not allow end of releaser or clip to extend too far beyond shaft; this may damage insulation of coil located directly beneath shaft.
- (8) Rotate second releaser or clip in proper direction until springs T2 come to rest in depression in shaft. This is zero rate position. Do not remove releasers or clips from holes in shaft.

- (9) Set desired charge rate by further rotating shaft in proper direction according to Table B.
- (10) Remove releasers or paper clips.

4.10 To check for correct totalizer setting:

- (1) Rotate shaft in proper direction until springs T2 rest in depression in shaft.
- (2) Release reset latch.
- (3) Rotate shaft in proper direction, one step for each 5 cents of the lowest chargeable rate.
- (4) Springs T1 should operate (indicated by reset latch moving forward) when lowest chargeable rate has been reached.

4.11 Example: For a 10-cent rate, shaft should be rotated two steps. On the second step, springs T1 should operate.

TABLE B

SETTING CHARGE RATE OF TOTALIZER

LOWEST CHARGEABLE RATE	ROTATE SHAFT IN PROPER DIRECTION (FROM BOTTOM TO TOP)
5 cents	One step
10 cents	Two steps
15 cents	Three steps
20 cents	Four steps
25 cents	Five steps
30 cents	Six steps

4.12 To replace totalizer:

- (1) Replace totalizer cover.
- (2) Line up the long guide pins on the totalizer with holes in the coin chute.
- (3) Place totalizer on coin chute making sure that totalizer arms enter slots in coin chute. Also be sure short guide pins on coin chute are in holes in totalizer bracket.

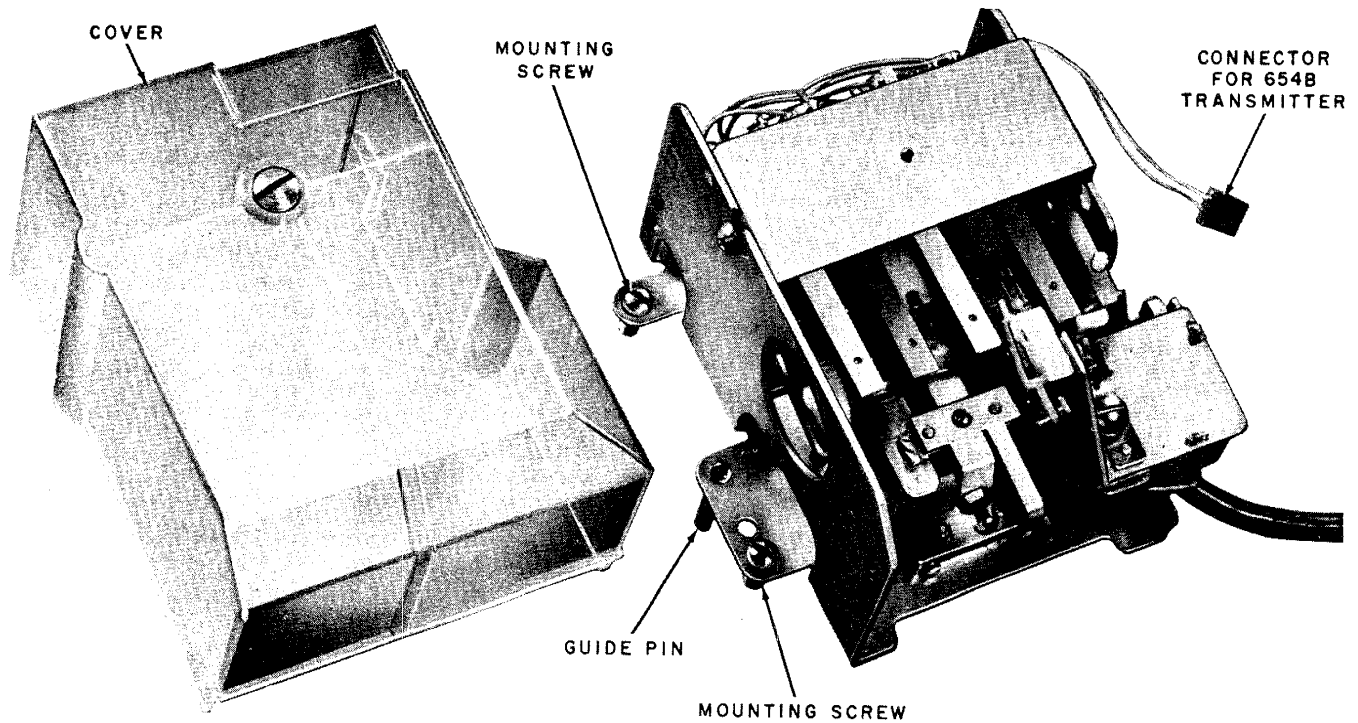


Fig. 9—Totalizer

- (4) Tighten three captive totalizer mounting screws.
- (5) Reconnect 654B transmitter.

**Note:** Two different types of connectors exist for connecting the 654B transmitter to the totalizer assembly. *Early assemblies* have **black wires** with the male connector on the totalizer assembly and the female connector on the transmitter. *Later assemblies* have **white wires** with the male connector on the transmitter and the female connector on the totalizer assembly. If either, the transmitter or totalizer assembly requires replacing, the other must be replaced to ensure matching connectors.

**CHASSIS ASSEMBLY**

**4.13** To remove chassis assembly:

- (1) Remove coin chute-totalizer assembly (4.03).
- (2) Disconnect black and yellow leads from coin relay and carefully pull leads through guide hole on coin hopper.

- (3) Loosen chassis mounting captive screw (Fig. 7).
- (4) Pull chassis assembly out at bottom and slide down to remove.

**4.14** To replace chassis assembly:

**Note:** When installing chassis assembly, dress inside wire behind chassis as shown in Fig. 11. Allow for the wire to be connected to TB-1 from right side.

- (1) Slide chassis under tab (Fig. 8).
- (2) Seat chassis tabs in slots.
- (3) Tighten chassis mounting captive screw (Fig. 7).
- (4) Replace black and yellow leads on coin relay after threading through hole in hopper. Connect yellow lead to terminal G and black lead to terminal 3 of coin relay.

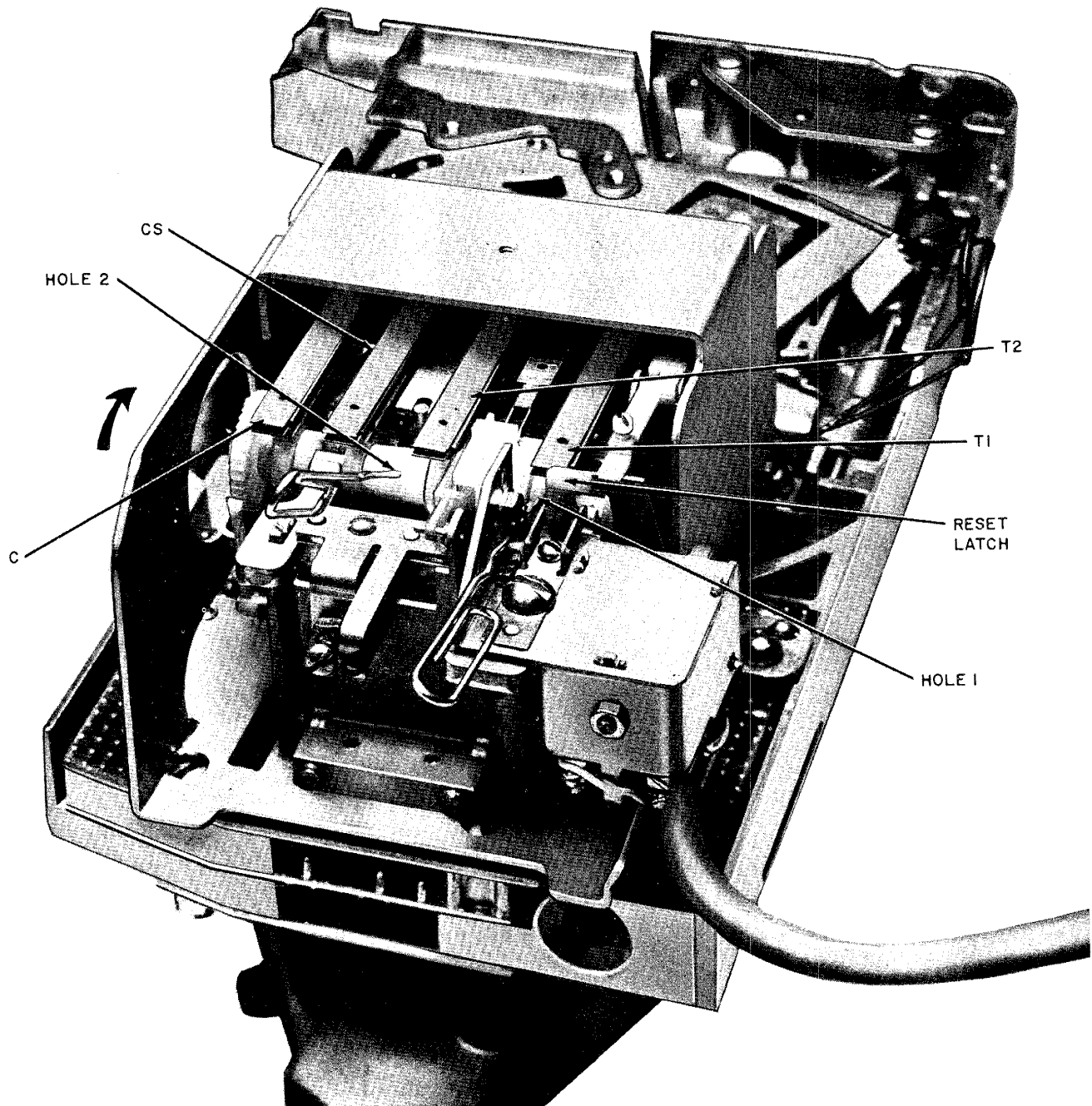


Fig. 10—Setting Totalizer Rate

#### WIRING

4.15 Select and place wire in accordance with sections covering inside wiring. Wire all coin telephones with triple conductor station wire to provide individual ground for each station. The

ground connection for this conductor must be the same one used for signaling ground.

4.16 Feed inside wire through wire entrance hole grommet (Fig. 1 and 11) as the set is mounted on backboard. Do not displace grommet.

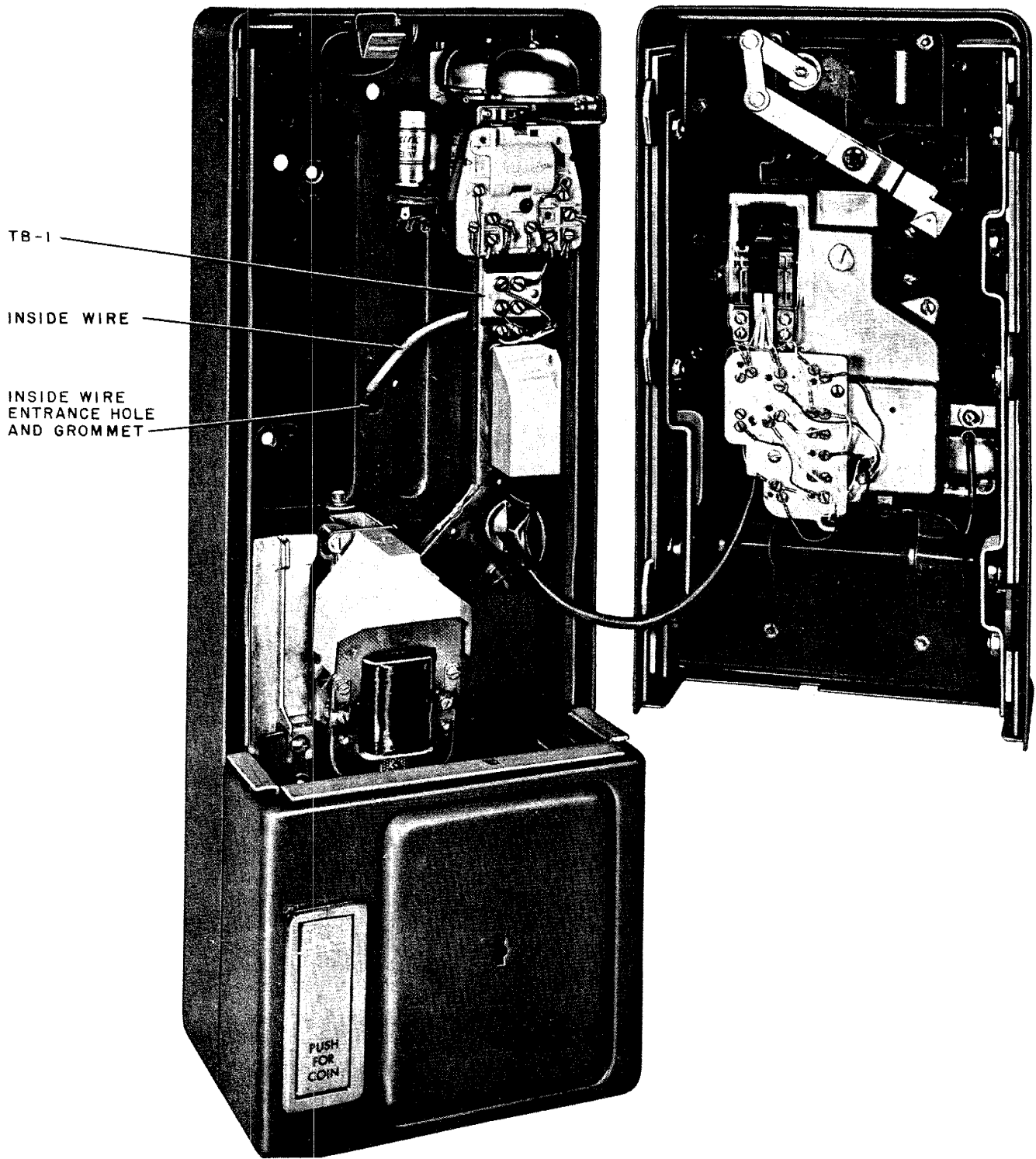


Fig. 11—1A-Type Coin Telephone Showing Wire Entrance and Routing (Typical)

4.17 See Fig. 11 for correct routing of inside wire. Dress wire behind chassis and run to right side of TB-1.

4.18 Conceal wiring near telephone. If this is not possible, use approved moulding or tubing. If moulding or tubing is not used, GS-type wire must be taped with friction tape. JKT wire need not be taped.

4.19 Locate any terminating apparatus, such as protectors, connecting blocks, etc, where they will be inaccessible to person using coin telephone.

#### COIN RECEPTACLE (CASH BOX)

4.20 The 1A-type coin telephone is equipped with a 1B coin receptacle. If a greater capacity is desired, a 1C coin receptacle can be installed as follows:

- (1) Remove 2A (cash compartment) door.
- (2) Remove 1B coin receptacle.
- (3) Remove false floor from bottom of cash compartment.
  - Brake spot weld at left front tab.
  - Pry with large screwdriver or equivalent.
- (4) Install 1C coin receptacle.
- (5) Install 2A (cash compartment) door.

#### INSTRUCTION CARDS

4.21 Instruction cards are not furnished and must be procured locally

4.22 To install card:

- Push up with fingers (Fig. 12)
- Snap card in place
- Ensure that card is seated properly in slot

4.23 To remove card:

- Push up with fingers

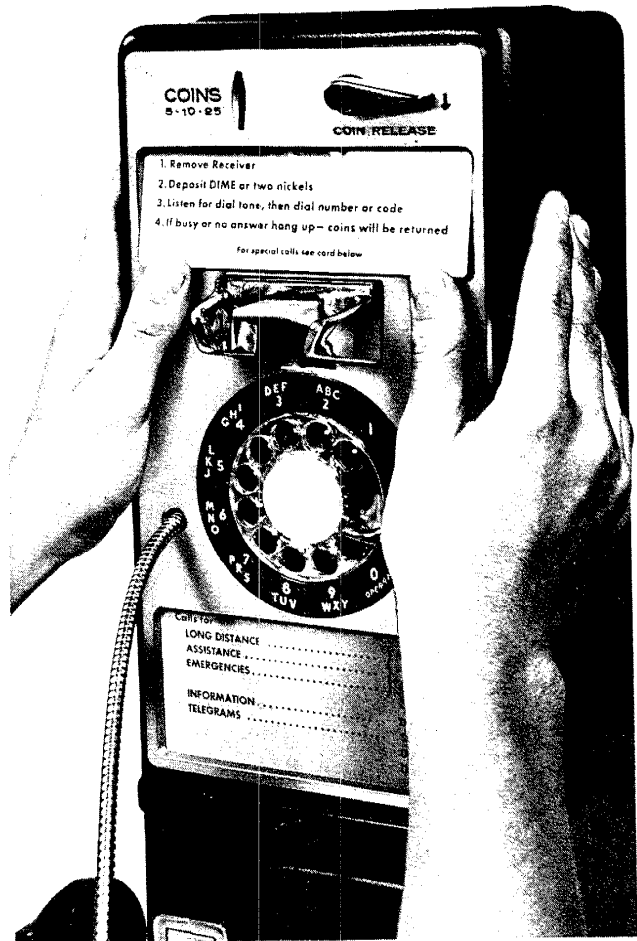


Fig. 12—Installing Instruction Card (Typical)

- Pry bottom out with small screwdriver or equivalent

4.24 A gummed OUT-OF-SERVICE sticker (Form E-4914) is available.

- Place over coin slot
- Available in books of five.

#### NUMBER CARD (1A2 ONLY)

4.25 The number card shall be furnished locally.

4.26 The P-21F947 card holder bracket, P-21F948 window and two hex nuts (Fig. 13) are packaged separately and shipped in the cash compartment.

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4.27 Install number card as follows:

- (a) Remove dial housing (see 5.11).
- (b) Insert P-21F948 window in faceplate from rear (Fig. 14).
- (c) Insert number card in window (Fig. 15).
- (d) Secure window and number card using the P-21F947 card holder bracket and two hex nuts (Fig. 16).
- (e) Install dial housing.



*After installation has been completed, refer to Section 506-326-500 and verify if the coin telephone is operating correctly.*

### 5. MAINTENANCE

5.01 Maintenance of the 1A-type coin telephone is limited to cleaning switch hook, clearing of foreign objects from coin chute, and replacement of the following components:

- G3P-52 handset
- 8E dial (1A1)
- 35G3A dial (1A2)
- 1B Coin receptacle rail
- P-83B752 (1A1) or P-26E153 (1A2) dial and housing assembly
- P-90C800 (1A1) or P-91C600 (1A2) cover unit assembly
- P-15E730 return chute assembly
- P-15E718 coin relay and hopper assembly
- P-15E687 coin relay assembly
- P-15E428 coin chute-totalizer assembly
- P-24E342 coin chute assembly
- P-15E579 totalizer assembly
- P-21F546 coin return assembly

- P-15E437 chassis unit assembly
- C4A ringer
- Instruction cards
- 303K Mercury relay
- 654B Transmitter

5.02 Refer to Part 4 of this section for the removal and replacement of cover unit assembly, coin chute-totalizer assembly, and chassis assembly.

### COIN RELAY

5.03 To remove coin relay:

- (1) Disconnect black and yellow leads.
- (2) Remove two screws on top front of coin relay (Fig. 17).
- (3) Remove two hex head screws on sides of coin relay.
- (4) Check that hopper trigger (Fig. 18) is in horizontal (up) position and pull off coin relay. Take care not to damage hopper trigger.

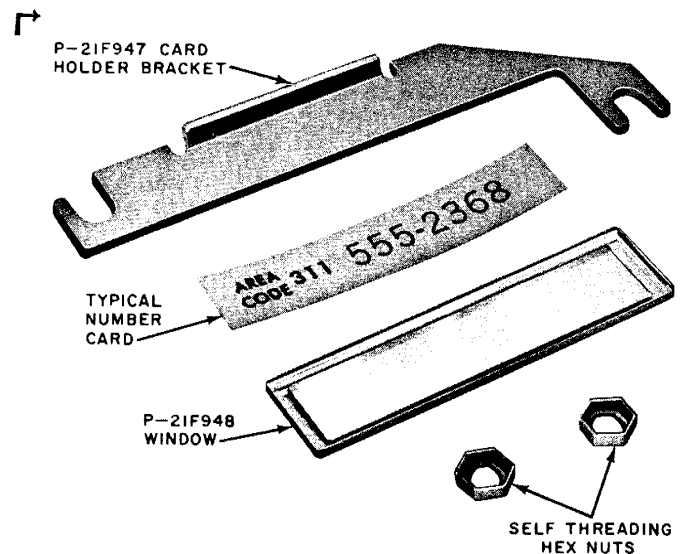


Fig. 13—Number Card and Associated Parts (1A2)

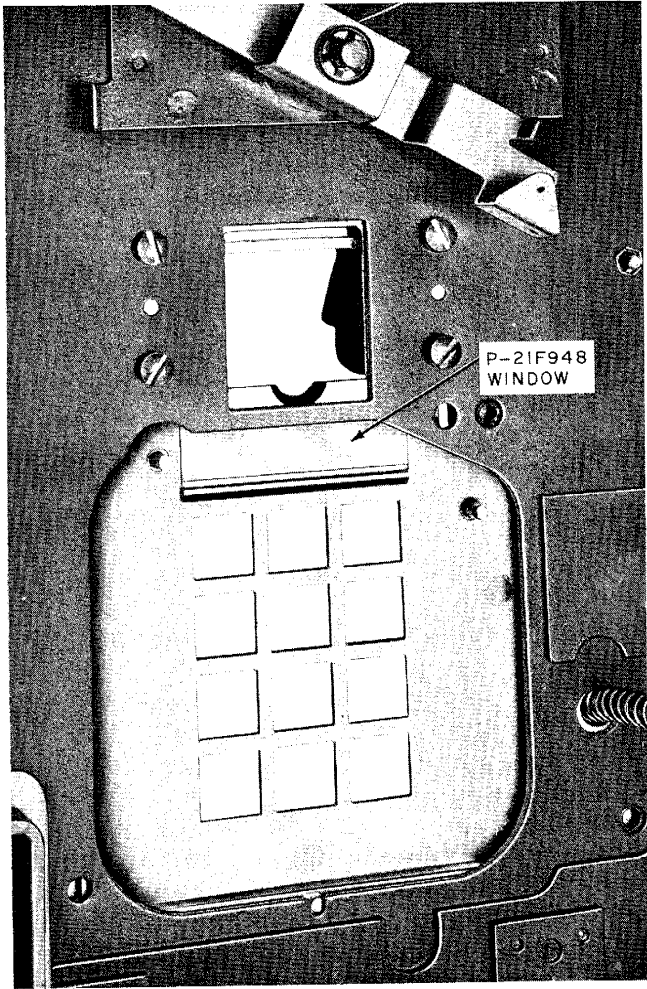


Fig. 14—Window Installed in Faceplate (1A2)

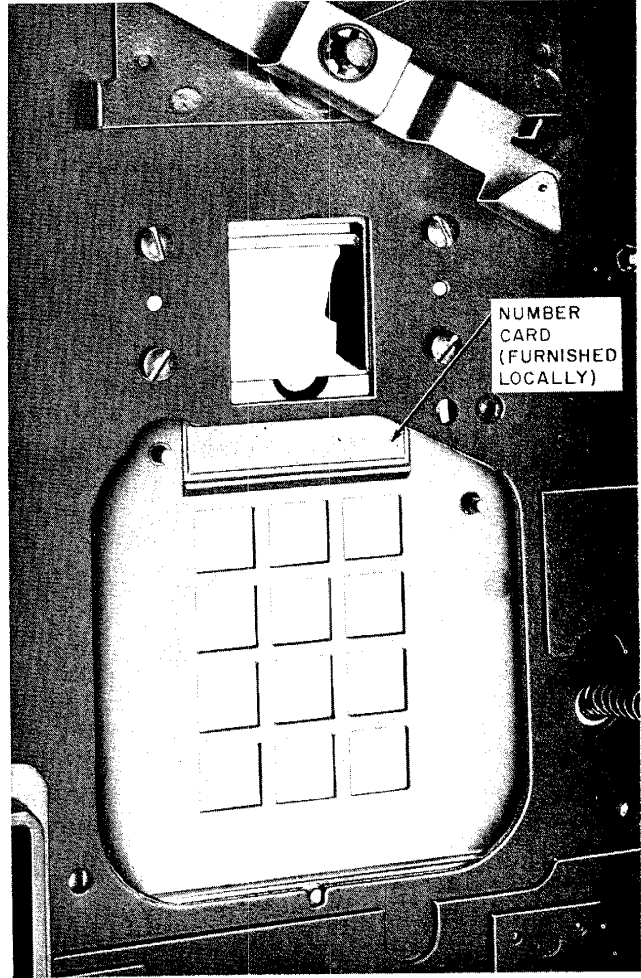


Fig. 15—Number Card Installed in Window (1A2)

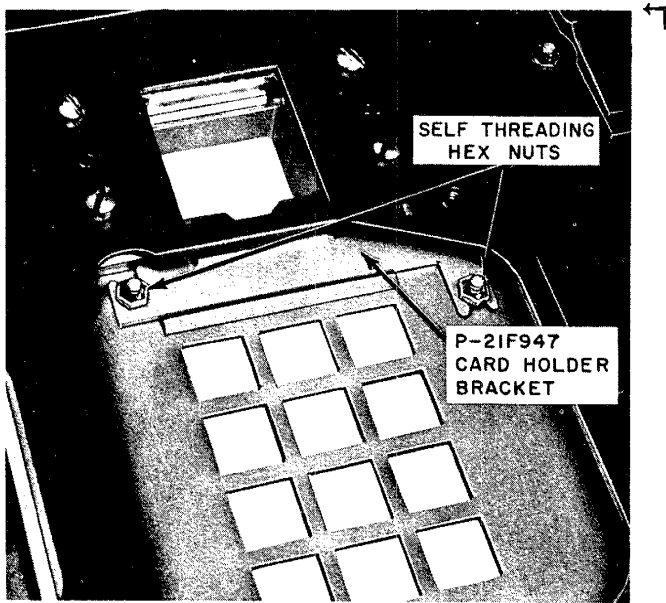


Fig. 16—Card Holder Bracket Installed (1A2)

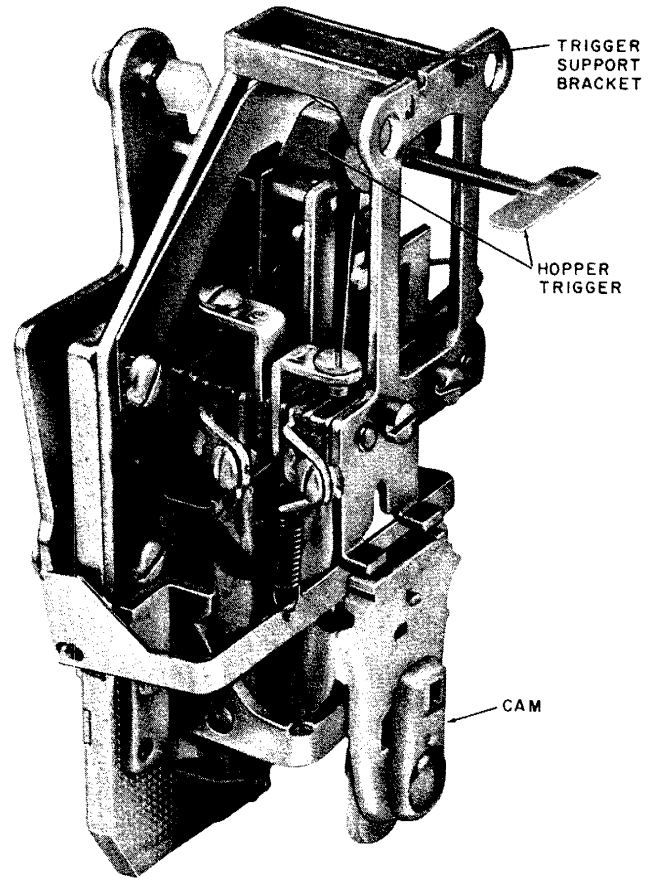


Fig. 18—Coin Relay

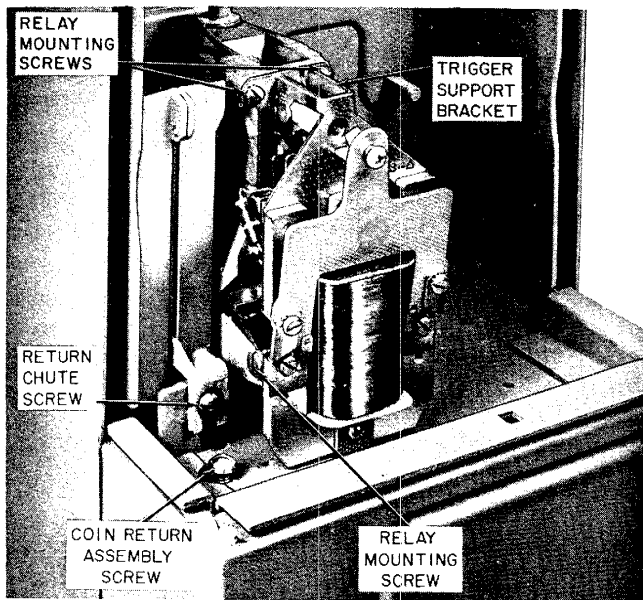


Fig. 17—Coin Relay and Return Chute

5.04 To replace coin relay :

- (1) Move vane on hopper to left or collect position.
- (2) With hopper trigger in nonoperated position (up), move relay into position until trigger enters T-shaped slot in hopper and trap lever tab just enters opening in selector card.
- (3) Press down slightly on ear on left side of selector card and manually move armature forward to its operated position. Hold armature in this position.
- (4) Move coin relay forward until square stem on vane enters hole in cam and mounting screw holes line up.



**Note:** Do not attempt to install relay if trigger support bracket (Fig. 17) is so distorted that mounting holes do not engage bosses on hopper.

- (5) Place and tighten evenly two mounting screws in top of coin relay and two hex head mounting screws in each side of relay.
- (6) Make sure that trigger, armature, trap, and vane operate without binding.
- (7) Reconnect yellow lead to terminal G and black lead to terminal 3.

#### RETURN CHUTE ASSEMBLY

**5.05** To remove return chute assembly:

- (1) Remove coin chute-totalizer assembly (4.03).
- (2) Loosen screw on return chute assembly (Fig. 17).
- (3) Lift assembly up and off.

**5.06** To replace return chute assembly, reverse procedure.

#### COIN RETURN ASSEMBLY

**5.07** To remove coin return assembly:

- (1) Remove coin chute-totalizer assembly (4.03).
- (2) Remove return chute assembly (5.05).
- (3) Remove coin return assembly locking screw (Fig. 17).
- (4) Insert finger in coin return and tilt top forward.
- (5) Lift coin return. Pull coin return assembly out and up.

**5.08** To replace coin return assembly:

- (1) Tilt top of coin return assembly toward set.
- (2) Push coin return assembly into set.
- (3) Push in and down on bottom of coin return assembly until flush with front of housing.

(4) Install coin return assembly locking screw. Tighten screw only enough to hold return assembly in place. Further tightening will bend screw.

(5) Replace return chute assembly (5.06).

(6) Replace coin chute-totalizer assembly (4.04).

#### RINGER

**5.09** To remove C4 ringer:

- (1) Remove coin chute-totalizer assembly (4.03).
- (2) Remove chassis assembly (4.13).
- (3) Disconnect four ringer leads—two from TB1 and two from network.
- (4) Remove two ringer mounting screws and lift ringer off.

**5.10** Replace C4 ringer by reversing procedure, making sure that locating pin on bottom of ringer is in grommet on chassis assembly. Make connections as follows:

WIRE COLOR	CONNECT TO
BK	TB1-T
R	TB1-R
S-R	Term. A (Network)
S	Term. K (Network)

#### DIAL HOUSING AND DIAL

**5.11** To remove dial housing:

- (1) Remove four mounting screws in dial housing (Fig. 19).
- (2) Lift dial housing off.

**Note:** Handset cord will pull through cover to enable access to dial without disconnecting cord.

**5.12** To replace dial housing, reverse procedure.

**5.13** To remove dial:

- (1) Remove dial housing (5.11).

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- (2) Disconnect dial leads from TB2.
- (3) Loosen two mounting screws on sides of dial through access holes in dial housing.
- (4) Lift dial off.

**Note:** When installing a new 8E dial in the 1A1, remove and discard the dust cover before installing it in the dial housing.

**5.14** To replace dial, reverse procedure, making sure that dial is properly seated on four locating pins. Make connections as follows:

1A1		1A2	
WIRE COLOR	CONNECT TO	WIRE COLOR	CONNECT TO
BL	TB2-9	G	TB2-4
G	TB2-10	W	TB2-2
W	TB2-3	R	TB2-5
W	TB2-2	R-G	TB2-6
		BK	TB2-1
		O-BK	TB2-11
		O-R	TB2-12
		BL	TB2-3
		BL-W	TB2-7

**HANDSET**

- 5.15** To remove handset:
- (1) Disconnect handset leads from TB2.
  - (2) Loosen cord stay screw (Fig. 19).
  - (3) Remove screw and cord clamp from armored cord.
  - (4) Pull cord out front of cover.
- 5.16** To replace handset, reverse procedure. Make connections as follows;

WIRE COLOR	CONNECT TO
R	TB2-3
BK	TB2-5
W	TB2-7
W	TB2-8

**COIN HOPPER**

**5.17** The coin hopper cannot be removed without removing 2A door and coin receptacle.

**DEFECTIVE COINS**

**5.18** When tests indicate foreign objects or defective coins in coin chute-totalizer assembly:

- (1) Operate coin release lever in attempt to clear coins into return chute.
- (2) If trouble does not clear
  - Remove upper cover assembly
  - Remove coin chute-totalizer assembly (4.03).
  - Swing upper plate assembly open (Fig. 20).



*Exercise extreme care when closing the upper plate assembly. If the quarter divider (Fig. 20) gets positioned differently from the way shown, it may become damaged when the upper plate assembly is closed.*

- Remove any foreign objects or stuck coins.



*Remove totalizer from coin chute only when necessary to clear objects that cannot be dislodged from lower portion of coin chute.*



*Exercise care when removing or replacing totalizer from coin chute to prevent damage to totalizer coin arms. Do not attempt to make any adjustments to the totalizer other than setting the initial charge rate (see note in 4.12).*

- Check for foreign material on coin chute magnets.
- (3) If no foreign objects are found and coins will not pass through chute, replace coin chute assembly.

**Note:** In early models, the quarter keeper, located in the coin chute, may become loose and not permit the quarter to pass. **Do not** attempt to repair this in the field.

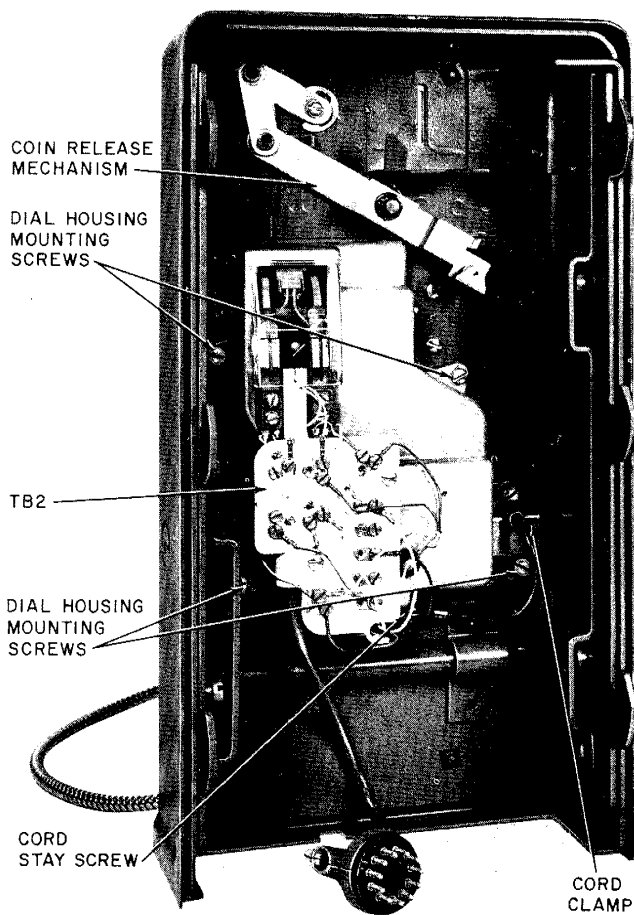


Fig. 19—Cover Unit Assembly (Typical)

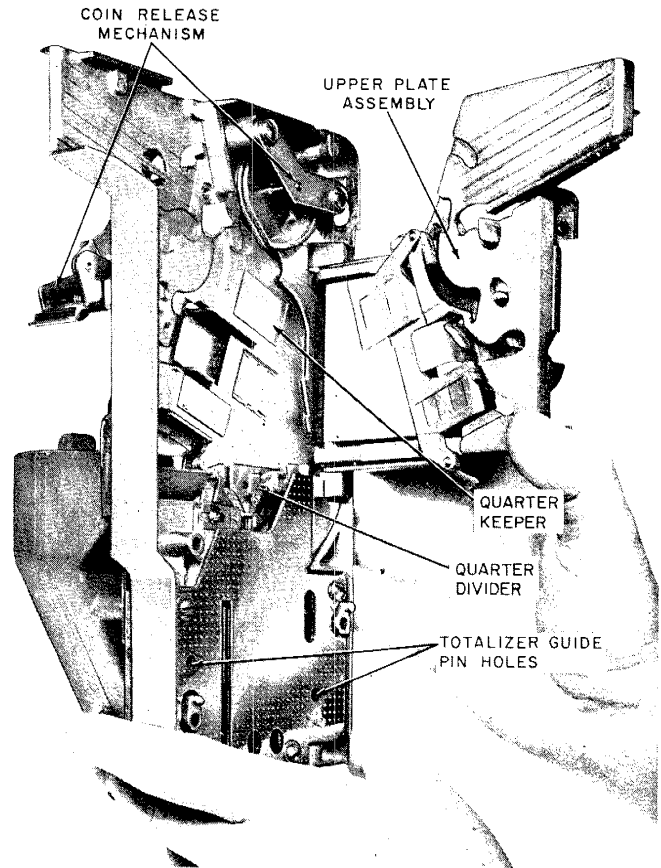


Fig. 20—Coin Chute Assembly

- (4) Install coin chute-totalizer assembly in housing (4.04).
- (5) Coin chute should be tested by depositing coins with cover unit assembly both off and on housing.

#### ELECTRICAL TROUBLES

**5.19** If electrical troubles are indicated refer to Section 506-326-400 (Connections) or Section 506-326-500 (Tests).

#### CLEANING

**5.20** When necessary, the surface of the coin telephone may be cleaned with KS-7860 petroleum spirits or a suitable liquid wax such as Johnson's No. 7700 cleaning and polishing wax emulsion.

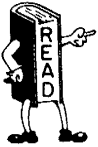
**Warning:** *KS-7860 petroleum spirits is highly flammable. Use safety precautions while it is being used.*



## COIN TELEPHONES—1A- AND 2A-TYPE CONNECTIONS

### 1. GENERAL

1.01 This section is reissued to add information for 2A1 and 2A2 coin telephones.



*This reissue does not change any circuit connections.*

1.02 Fig. 1 shows connections for 1A2 or 2A2 coin telephone.

1.03 Fig. 2 shows connections for 1A1 or 2A1 coin telephone.

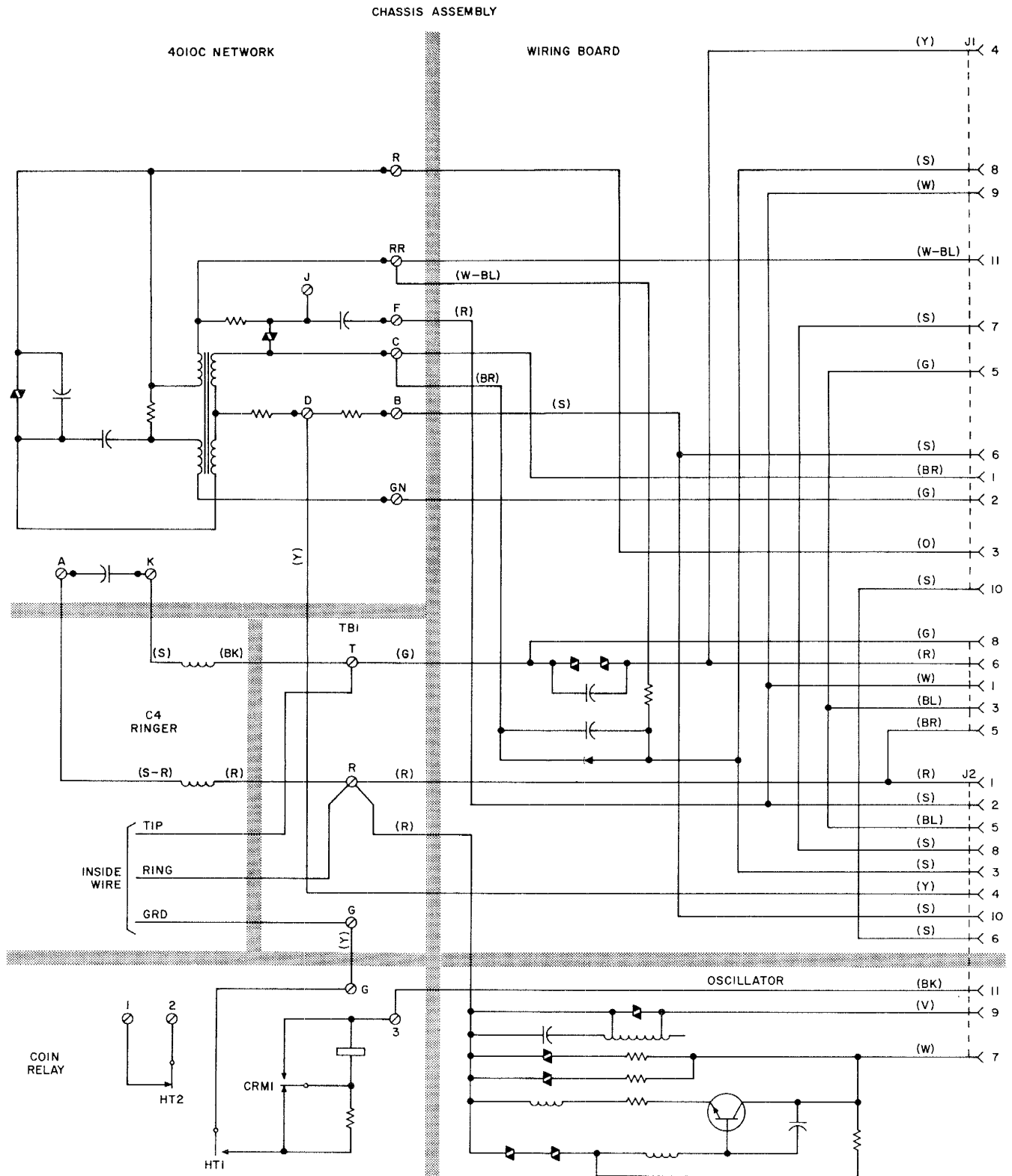


Fig. 1—1A2 or 2A2 Coin Telephone—Connections (Sheet 1)

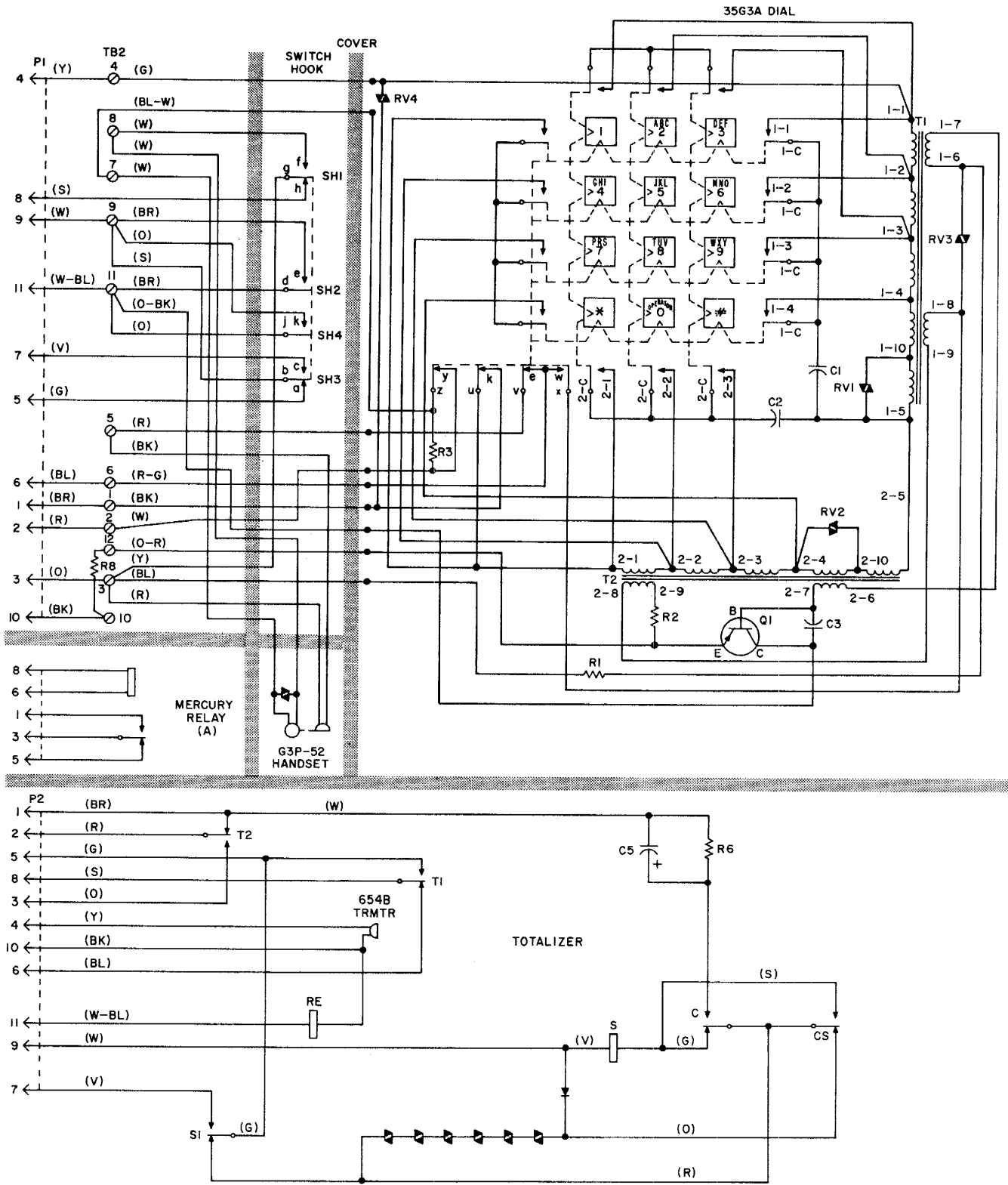


Fig. 1-1A2 or 2A2 Coin Telephone—Connections (Sheet 2)





## COIN TELEPHONE—1A- AND 2A-TYPE OPERATION TESTS AND TROUBLE ANALYSIS

### 1. GENERAL

1.01 This section provides operation tests which should normally be performed at completion of installation.

1.02 This section is reissued to add information on 2A1 and 2A2 coin telephones, and to change title.

1.03 Refer to Section 506-326-200 for installation and maintenance of 1A-type coin telephones. ♦ Refer to Section 506-328-200 for installation and maintenance of 2A-type coin telephones. ♦

1.04 Operation tests covered are:

A. *Totalizer and Coin Relay Operation (On-Hook)*

B. *Coin Relay Bias Margin Test*

C. *Dial Tone Test*

D. *Totalizer Operation (Off-Hook)*

E. *Coin Tone Signaling*

F. *Coin Release Mechanism*

### 2. APPARATUS REQUIRED

(a) P11C Cord

(b) 1011B Test Set or equivalent

(c) Coins: 1 penny, 2 nickels, 1 dime, 2 quarters

(d) 146B Bias Margin Gauge

### 3. PREPARATION

#### STEP

#### ACTION

#### VERIFICATION

Tests A, B, C, D, and E

1 Invert handset on switch hook (Fig. 1) (1A-type only).

*Note:* Prevents armored cord from pushing handset off switch hook when cover is removed.

2 Remove cover unit assembly (1A-type) ♦ or open door and faceplate assembly (2A-type) ♦ and remove plug P1.  
Place cover unit assembly (1A-type) on a firm level surface.

3 Connect P11C cord between plug P1 and jack J1 of chassis assembly.

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**4. METHOD**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
<b>A. Totalizer and Coin Relay Operation (On-Hook)</b>		
4	Deposit quarter in coin chute.	Totalizer operates and then steps back to home position. Coin relay refunds coin.  <i>Note:</i> If coin is not refunded, repeat with a second quarter before assuming failure. Cam shaft could be in such position initially that no response would be obtained from CO.
5	Repeat Step 4 using a dime and then a nickel.	Same as Step 4.
<b>B. Coin Relay Bias Margin Test</b>		
	<i>Note:</i> Make this test when coin relay fails to operate or operates in the wrong direction.	
4	Remove coin relay dust cover.	
5	Remove handset, call test desk and request a bias margin test. (Use central office test circuit where available.)	
6	Slip 146B bias margin gauge (Fig. 2) over left pole piece extension arm from left side of coin relay (Fig. 3).	
7	Request deskman to perform operation appearing in the lower left corner of gauge.	Relay operates to accomplish what is indicated in lower left corner of gauge.
8	Reverse the 146B bias margin gauge by turning it around on the same pole piece extension arm.	
9	Repeat Step 7.	Same as Step 7.
10	Remove 146B gauge.	
11	Hang up handset (inverted on 1A-type).	
<b>C. Dial Tone Test</b>		
4	Remove coin relay dust cover.	
5	Remove handset.	

STEP	ACTION	VERIFICATION
6	Operate hopper trigger.	Dial tone heard.
7	Dial any digit but "0" or "1".	Dial tone should not break.
8	Hang up handset (inverted on 1A-type).	
<b>D. Totalizer Operation (Off-Hook)</b>		
<i>Note:</i> Totalizer set for an initial rate of 10 cents.		
4	Remove handset.	
5	Deposit nickel in coin chute.	Totalizer cam rotates 1 step. No dial tone.
6	Deposit second nickel.	Totalizer cam rotates an additional step and then steps back to home position. Dial tone is heard.
7	Dial any digit but "0" or "1".	Dial tone is broken.
8	Hang up handset (inverted on 1A-type).	Coin relay refunds coins.
9	Remove handset.	
10	Deposit dime in coin chute.	Totalizer cam rotates 2 steps and then steps back to home position. Dial tone is heard.
11	Repeat Steps 7 and 8.	Same as Steps 7 and 8.
12	Remove handset.	
13	Deposit quarter in coin chute.	Totalizer cam rotates 5 steps and then steps back to home position. Dial tone is heard.
14	Repeat Steps 7 and 8.	Same as Steps 7 and 8.
<b>E. Coin Tone Signaling</b>		
4	Connect leads of 1011B test set to tip and ring terminals on TB1.	
5	Place <b>TALK-MONITOR</b> switch of test set in <b>MONITOR</b> position.	
6	Remove handset.	

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<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
7	Deposit dime in coin chute.	Dial tone is heard in coin telephone handset.  <i>Note:</i> Beeps should not be heard in handset of coin telephone.
8	Dial any digit but "0" or "1" with coin telephone dial.	Dial tone breaks.
9	While monitoring with test set, deposit nickel in coin chute.	One beep heard in test set.  <i>Note:</i> Prior to hearing beep, passage of coin down chute is heard in test set.
10	Deposit dime in coin chute.	Two beeps heard in test set. (See Note in Step 9)
11	Deposit quarter in coin chute.	Five rapid beeps heard in test set. (See Note in Step 9)
12	Hang up handset (inverted on 1A-type).	Coin relay refunds all coins.
13	Disconnect 1011B test set.	
14	Replace coin relay dust cover.	
15	Check ringer for maximum volume position of gong.	
16	Remove P11C cord. Replace plug P1 into jack J1. Replace cover unit assembly (1A-type), or close door (2A-type).	
17	Replace handset properly on switch hook.	
18	Dial the dial test number and verify all frequencies and amplitudes (1A2 and 2A2).	
19	Call local operator, have station called, and verify that coin telephone is working correctly.	

**F. Coin Release Mechanism**

- |   |                            |                               |
|---|----------------------------|-------------------------------|
| 1 | Deposit penny.             |                               |
| 2 | Depress coin return lever. | Penny drops into coin return. |

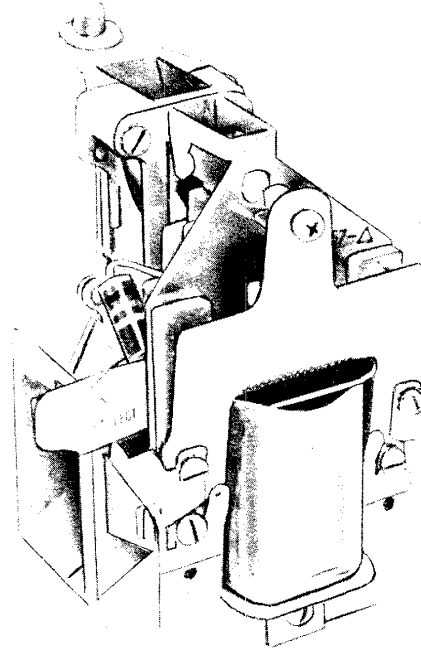
**5. TROUBLE ANALYSIS**

**5.02** Refer to Table A for trouble analysis for the coin telephone.

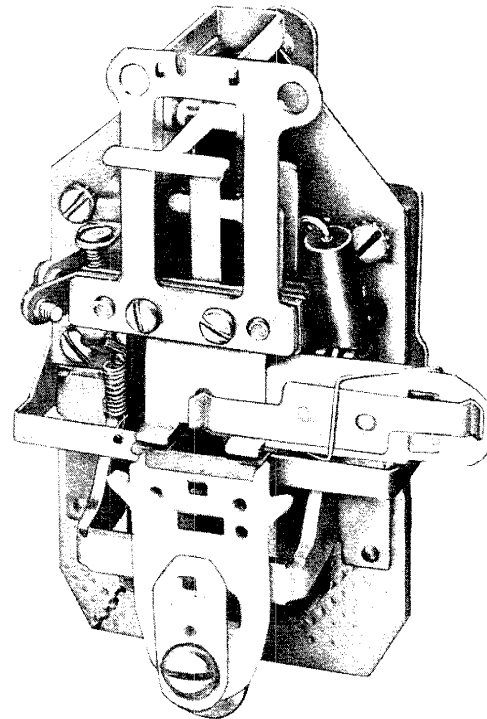
**5.01** On trouble reports of coins collected or returned in error, try to obtain area code and telephone number of called party to facilitate tracing trouble in central office.



Fig. 1—Cover Unit With Handset Inverted (Typical of 1A-Type)



SIDE VIEW



BACK VIEW

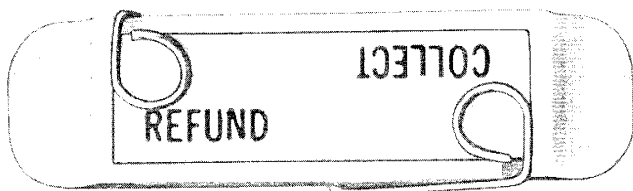


Fig. 2—146B Bias Margin Gauge

Fig. 3—Bias Margin Gauge in Position for Collect Test

**TABLE A**  
**TROUBLE ANALYSIS**  
**(INITIAL RATE SET FOR 10 CENTS)**

TELEPHONE SET CONDITION	FAILURE	* STEP NO.	COIN TELEPHONE		POSSIBLE CAUSE	REMEDIAL ACTION
			1A1 AND 2A1	1A2 AND 2A2		
Handset On-Hook (inverted on 1A-type) Deposit Quarter	No Readout†	1	•	•	Tip and ring reversed	Reconnect as required
		2	•	•	Plugs P1 & P2 reversed	
		3	•	•	Central office overload	Wait, then repeat test
		4	•	•	Switchhook transfer contacts SH1(NC) and SH3(NC) not making	Clean contacts Replace dial and housing assembly
		5	•	•	Coin relay contact HT1 not making	Clean contacts Replace coin relay
		6	•	•	Defective totalizer	Replace defective apparatus
		7	•	•	Defective coin relay	
		8	•	•	Defective chassis wiring	
		9	•	•	Defective wiring in dial and housing assembly	
		10	•	•	Defective A relay	
		11	•	•	Defective handset	
		12		•	Defective dial	
Handset On-Hook (inverted on 1A-type) Deposit Nickel	No Readout†	13	•	•	Switch hook transfer contacts SH3(NC) not making	Clean contacts Replace dial and housing assembly
		14	•	•	Defective wiring in dial and housing assembly	Replace dial and housing assembly
		15	•	•	Central office overload	Wait, then repeat test
Handset On-Hook (inverted on 1A-type) Nickel Deposited, Readout OK	No Refund	16	•	•	Switch hook contacts SH2 or SH4 not breaking	Replace dial and housing assembly
		17	•	•	Defective totalizer	Replace totalizer
		18	•	•	Central office overload	Wait, then repeat test
		19	•	•	Defective CO coin trunk	Refer to test center
Handset Off-Hook Deposit Nickel	Readout obtained, Dial Tone is Heard	20	•	•	TI contacts remain latched after refund	Replace totalizer
		21	•	•	Initial rate set for 5 cents	Reset totalizer rate
		22	•	•	Switch hook transfer contacts SH3(NC) not breaking	Replace dial and housing assembly
		23	•	•	Defective chassis wiring	Replace chassis assembly
		24	•	•	Defective wiring in dial and housing assembly	Replace dial and housing assembly
Handset Off-Hook Initial rate (10 cents) Deposited	No Readout†	25	•	•	Switch hook transfer contacts SH3(NO) or SH2(NO) not making	Clean contacts Replace dial and housing assembly
		26	•	•	Totalizer set for more than initial rate	Reset totalizer rate
		27	•	•	Defective wiring in dial and housing assembly	Replace dial and housing assembly

**TABLE A (Cont)**  
**TROUBLE ANALYSIS**  
**(INITIAL RATE SET FOR 10 CENTS)**

TELEPHONE SET CONDITION	FAILURE	* STEP NO.	COIN TELEPHONE		POSSIBLE CAUSE	REMEDIAL ACTION	
			1A1 AND 2A1	1A2 AND 2A2			
Handset Off-Hook, Initial Rate Deposited, Readout OK	No dial tone (or reduced dial tone level in 1A2 and 2A2)	28	•	•	Switch hook transfer contacts SH1 (NO) not making	Clean contacts	
		29	•		Rotary dial off-normal contacts not breaking	Replace dial and housing assembly	
		30	•	•	Defective totalizer	Replace defective apparatus	
		31	•	•	Defective chassis wiring		
		32	•	•	Defective wiring in dial and housing assembly		
		33	•	•	Defective handset		
		34		•	Defective dial		
	Coins return after readout with no dial tone	35	•	•	Switch hook contacts SH2 and SH4 not making	Clean contacts	
		36	•		Open dial	Replace defective apparatus	
		37	•	•	Defective chassis wiring		
		38	•	•	Defective wiring in dial and housing assembly		
		Totalizer steps continuously (may give bursts of tone)	39	•	•		Totalizer transfer contacts T2 (NC) not making
			40	•	•		Defective chassis wiring
			41	•	•		Defective wiring in dial and housing assembly
Handset Off-Hook Dial Tone OK	Cannot break dial tone	42	•	•	Totalizer contacts T1 not latching	Replace totalizer	
		43	•		Defective dial	Replace defective apparatus	
		44	•	•	Defective chassis wiring		
		45	•	•	Defective wiring in dial and housing assembly		
		46		•	Defective handset		
	Coins return when dial is operated	47	•	•	Defective dial		
Handset Off-Hook, Hopper Trigger Tripped by Hand, Dial Tone Obtained, Dialed One Digit Other than "0" or "1"	Dial tone broken	48	•	•	Totalizer transfer contacts T1 (NO) not making	Replace totalizer	
Handset Off-Hook, Initial Rate Deposited, Readout OK	No dial tone and no refund	49	•	•	Totalizer transfer contacts T2 (NC) not making	Replace totalizer	
		50	•	•	Totalizer steps through zero rate position		

**TABLE A (Cont)**  
**TROUBLE ANALYSIS**  
**(INITIAL RATE SET FOR 10 CENTS)**

TELEPHONE SET CONDITION	FAILURE	* STEP NO.	COIN TELEPHONE		POSSIBLE CAUSE	REMEDIAL ACTION
			1A1 AND 2A1	1A2 AND 2A2		
Handset Off-Hook, Readout OK, Dial Tone OK, Refund OK	No Sidetone	51	•	•	Open transmitter	Replace handset
Operator On Line, Deposit Nickel	No Readout, Operator Cannot Hear Coin Tone	52	•	•	Defective A relay	Replace A relay
Operator On Line, Deposit Additional Coins	Hear Coin Tones in Handset ‡	53	•	•	Defective chassis wiring	Replace chassis assembly
	No Coin Tones Heard by Operator	54	•	•	Totalizer transfer contacts S1 (NC) not making	Replace totalizer
		55	•	•	Defective oscillator	Replace chassis
	Dime Tones Too Fast	56	•	•	Totalizer transfer contacts CS (NC) not making	Replace totalizer
		57	•	•	CS cam not resetting	
	Too Many Coin Tones	58	•	•	Totalizer not stepping properly — T2 (NC) not making	
Quarter Tones Too Slow	59	•	•	Totalizer transfer contacts CS (NC) not breaking		

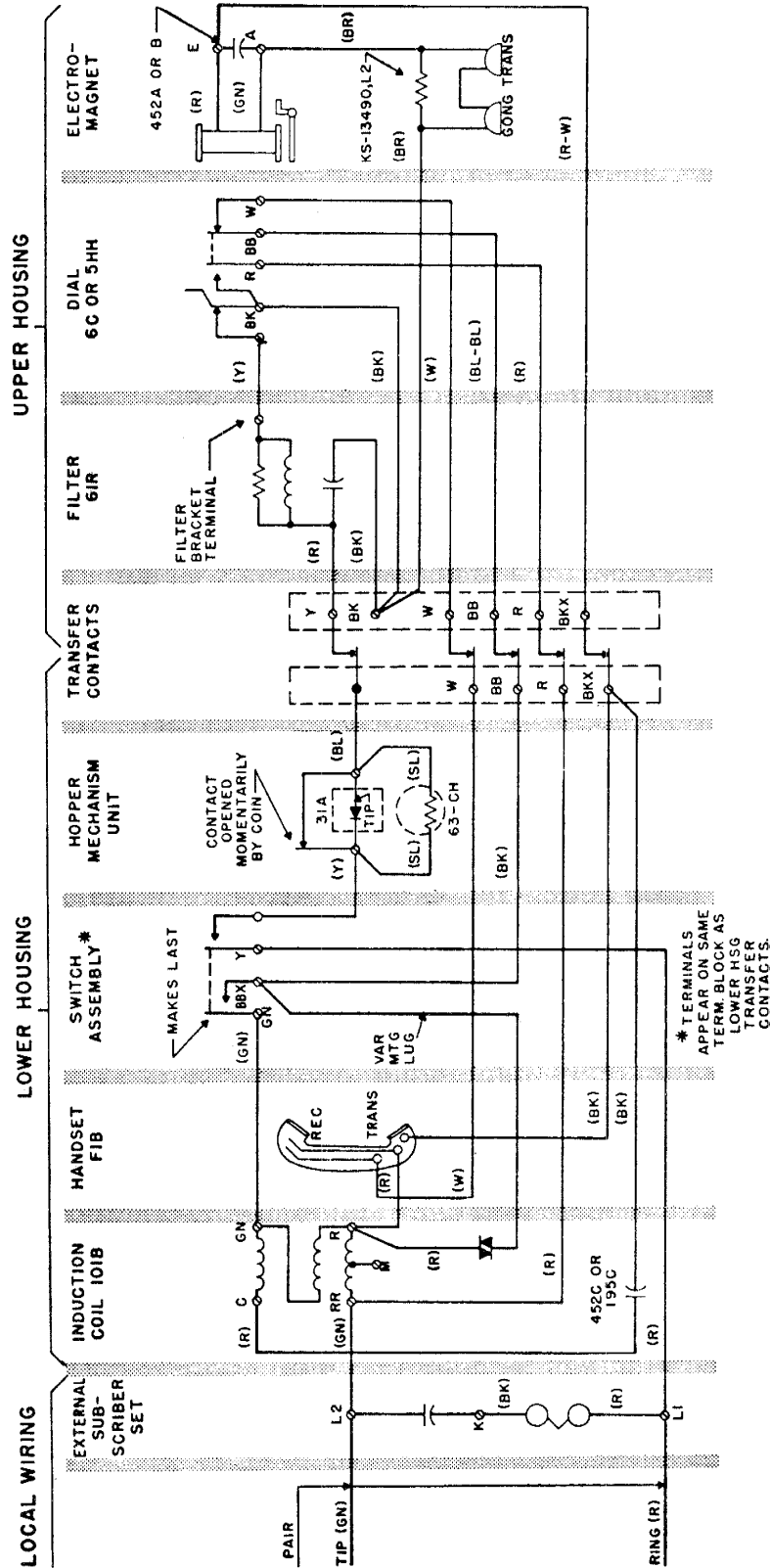
\* Steps should be taken in sequence. Possible cause assumes that preceding tests have been met.

† Readout refers to operation of totalizer and generation of beeps by coin signal oscillator.

‡ A slight tone may be heard on long loops but may not necessarily be a failure.



COIN COLLECTORS — POSTPAY — 193G, H; 198G, H  
COMMUNITY DIAL OFFICE SERVICE — COMMON BATTERY — CONNECTIONS



193G, H AND 198G, H COIN COLLECTORS

Connection with 531A; 534DE, DF; 584DE, DF, and 687A Subscriber Sets



# COIN COLLECTORS — POSTPAY

210G,H; 212G,H; 193GN, HN; AND 198GN, HN

## CONNECTIONS

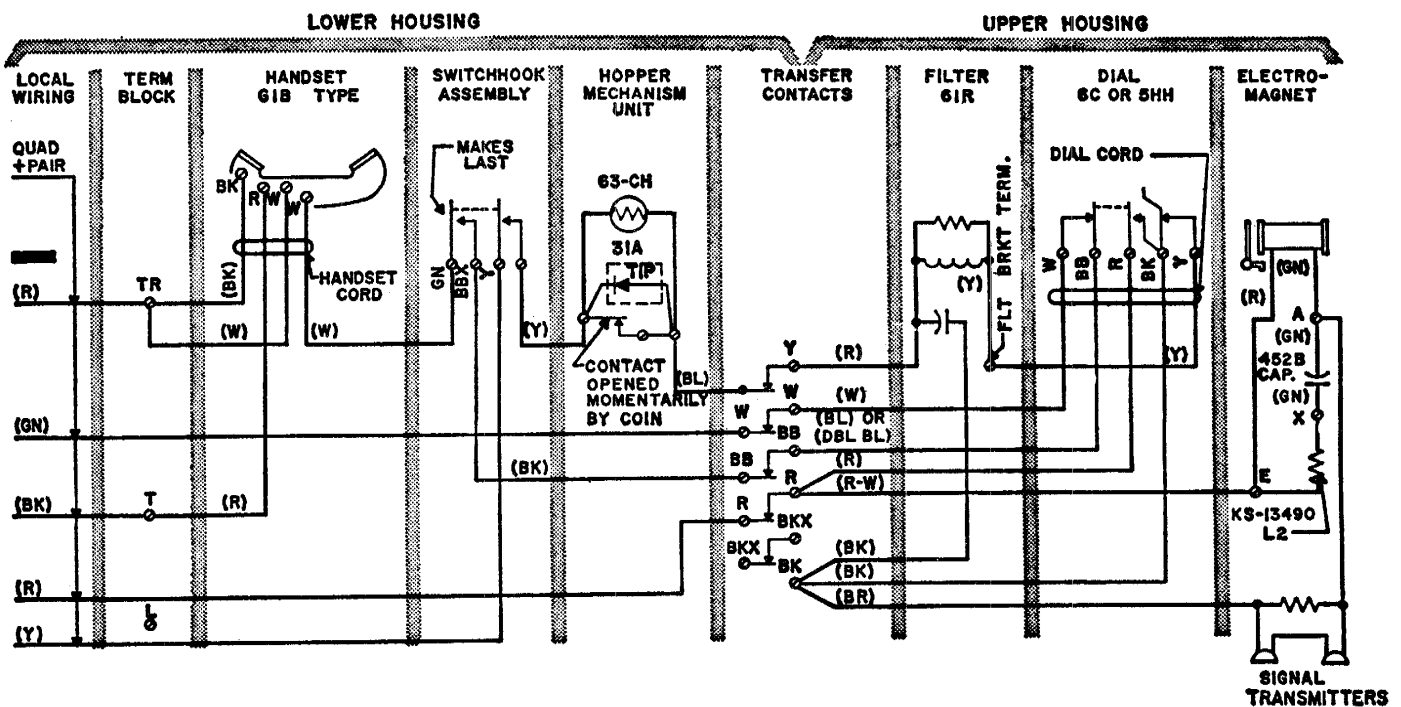


Fig. 1 — Circuit Diagram of 210G, H; 212G, H; 193GN, HN; and 198GN, HN Coin Collectors for Connection with 685A Network-type Subscriber Set



## CLEARANCES FOR DROP WIRE IN THE MEDIUM LOADING AREA

### 1. GENERAL

**1.001** This addendum supplements Section 462-070-016, Issue 1.

**1.002** This addendum is issued to add a paragraph to Part 1 regarding the placing of aerial drop wire over swimming pools.

**1.003** Add the following paragraph:

**1.08** Clearances over public and private swimming pools are not covered by the National Electrical Safety Code. However, for reasons of safety, sanitation, and appearance, aerial drop wire crossings over swimming pools should be avoided.



## CLEARANCES FOR DROP WIRE IN THE MEDIUM LOADING AREA

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3. CLEARANCES CROSSING BELOW POWER WIRES AND CABLES . . . . .	8
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### 1. GENERAL

**1.01** This section contains the recommended clearances for drop wire installed in the medium loading area. The values specified meet (and in some cases exceed) the requirements of the National Electrical Safety Code (Sixth Edition). They apply under conditions of 60° F with no wind or ice loading.

**1.02** Drop wire strung to *minimum* sags in the medium loading area will generally experience some permanent stretch as a result of ice loading. "Construction" values of clearances therefore generally contain an allowance for the amount of extra sag which will be introduced by permanent stretch. Maintenance values of clearances should exist after wire has been through one or more cycles of storm loading and the temperature returns to 60° F. Drop wire strung to *normal* sags will not undergo any permanent stretching, however, unless the storm loading is quite severe. "Construction" and maintenance values of ground clearances are the same when normal stringing sags are used. Drop wire sags are shown in Section 462-400-200.

**1.03** Drop wire tends to elongate as the temperature rises and contracts as the temperature falls. Wire placed during cold weather will, therefore, always have a greater sag during warm weather. In order to avoid having inadequate

ground clearances at standard 60° F conditions, it is necessary to provide extra clearance when wire is placed during cold weather (freezing or below). The amount of increase required is the difference between the 60° F stringing sag and the cold weather stringing sag. No increase is required for temperatures above 32° F, however.

**1.04** When drop wire sags exceed about two or three feet, it will generally be quite advantageous to locate poles or other points of support so as to avoid having the middle of the span occur above the traveled part of the road, alley, or driveway. This will frequently be the case when the pole is within 50 or even 75 feet of the far edge of the road, alley, or driveway (distance "A" in Fig. 1.)

**1.05** When the 50-foot criterion applies (distance A in Fig. 1), this may also permit a reduced clearance. (See Part 2B of this section.) Also, it will usually be possible to base the height of attachment on something less than 100% of mid-span sag. This is also true when the distance from the pole is 75 feet from the pole, but the saving in height of attachment is considerably less. The following table shows the approximate percentage of mid-span sag occurring at distances of 50 and 75 feet from the pole for span lengths up to 300 feet.

POLE 50 FEET FROM FAR EDGE		POLE 75 FEET FROM FAR EDGE	
SPAN LENGTH (FEET)	PER CENT OF MID-SPAN SAG	SPAN LENGTH (FEET)	PER CENT OF MID-SPAN SAG
130-145	95	195-220	95
146-160	90	221-245	90
161-180	85	246-270	85
181-200	80	271-300	80
201-225	75		
226-250	70		
251-275	65		
276-300	60		

*Note:* Table may be used with normal or minimum sags.

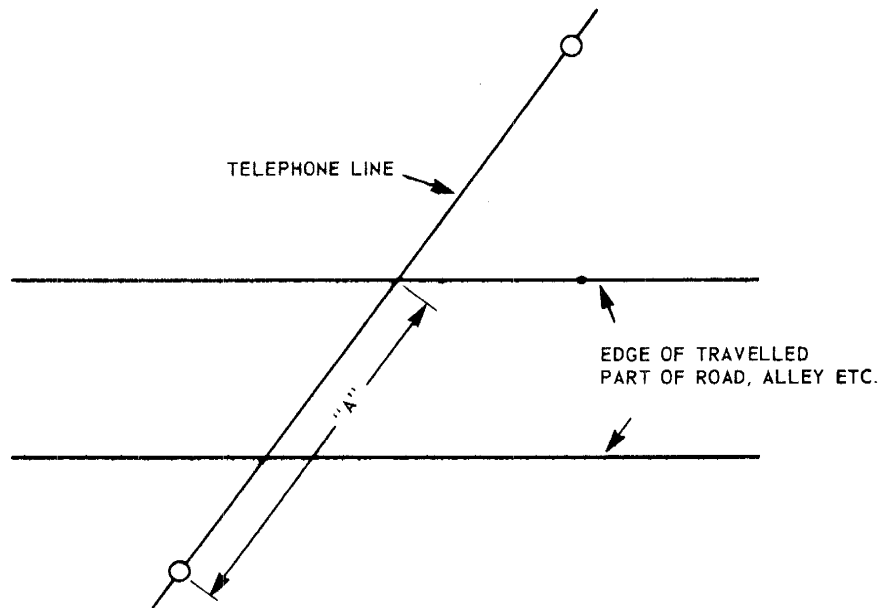


Fig. 1

Example: A 200-foot span crosses a driveway. One of the crossing poles will be within 50 feet of the far edge of the driveway and on ground which is two feet higher mid-span sag with normal stringing tension is 7 feet. At 50 feet from the pole, the sag will be 80 per cent of mid-span sag or about 5 feet 7 inches. In order to obtain a clearance of 10 feet over the driveway, the height of attachment must be 10 feet minus two feet, plus 5 feet 7 inches or 13 feet 7 inches. Height of attachment may be determined by the B Drop Wire rule when minimum sags are used.

**1.06** Clearance requirements for drop wire overhanging the traveled part of roads vary somewhat with the degree of overhang involved. (See tables in Part 2 and Fig. 4.) Eliminating or reducing road overhang will frequently permit smaller ground clearances.

**1.07** Clearances shown in this section should be used unless the work order or local requirements call for other values. The former may occur when engineering forces recognize factors not allowed for in this section or because of local

regulations, ordinances, etc. Clearances for span lengths, voltages and conditions not covered in this section are an engineering responsibility and will be shown on the work order or detail plans.

## 2. CLEARANCES ABOVE GROUND OR RAILS

**2.01** The designation "No Overhang — Back of Obst." in the tables that follow means that the pole line is located in back of a fence, ditch, embankment, etc, so that the ground beneath the line can ordinarily be traveled by pedestrians only. The designation "No Overhang — Not Back of Obst." means that the line is not back of such obstruction and does not overhang the normally traveled part of the road. This category is meant to include ground not ordinarily traveled but which can be reached by vehicles. If farm machinery is likely to pass under the line, provide sufficient clearance so that the wire will be two feet above the highest part of such machinery or the load it will carry. If minimum sags are used and the span length exceeds 170 feet, provide an extra 6 inches initial clearance.



**TABLE 1 — CLEARANCES ABOVE GROUND OR RAILS (AT 60° F)**  
**A. Span Lengths of 250 Feet or Less — Using Normal Sags**

SITUATION	CLEARANCE (CONSTRUCTION OR MAINTENANCE)	
	FT.	IN.
<b>Crossing Above:</b>		
Railroad Tracks		
Generally	27-0	Must be supported on 6M strand for spans over 125 feet.
Special Case (See Fig. 3)	25-0	
Public Roads		
Generally	18-0	See Fig. 2
At Edge	16-0	
Public Alley	15-0	
Resid. Driveways	10-0	
Flat Roof Bldgs.	8-0	
Peak Roof Bldgs., Billboards	2-0	
Neon Signs	4-0	
Waterways	Must be shown on detail plans.	
<b>Running Along:</b>		
Public Roads with		
Major Overhang	18-0	See Fig. 4
Minor Overhang		See Fig. 4
Urban	18-0	
Rural (Lt. Traffic)	14-0	
No Overhang		
Back of Obst.	8-0	See Fig. 5, Par. 2.01
Not Back of Obst.	13-0	See Fig. 6, Par. 2.01
Public Alleys	15-0	

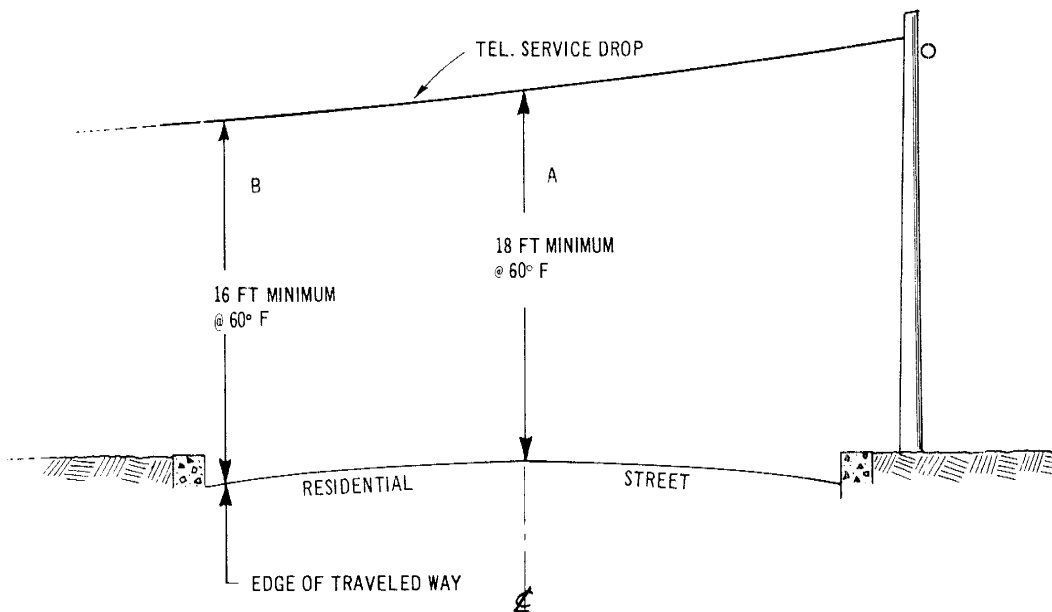


Fig. 2

WIRE CROSSING RAILROAD TRACKS - SPECIAL CASE

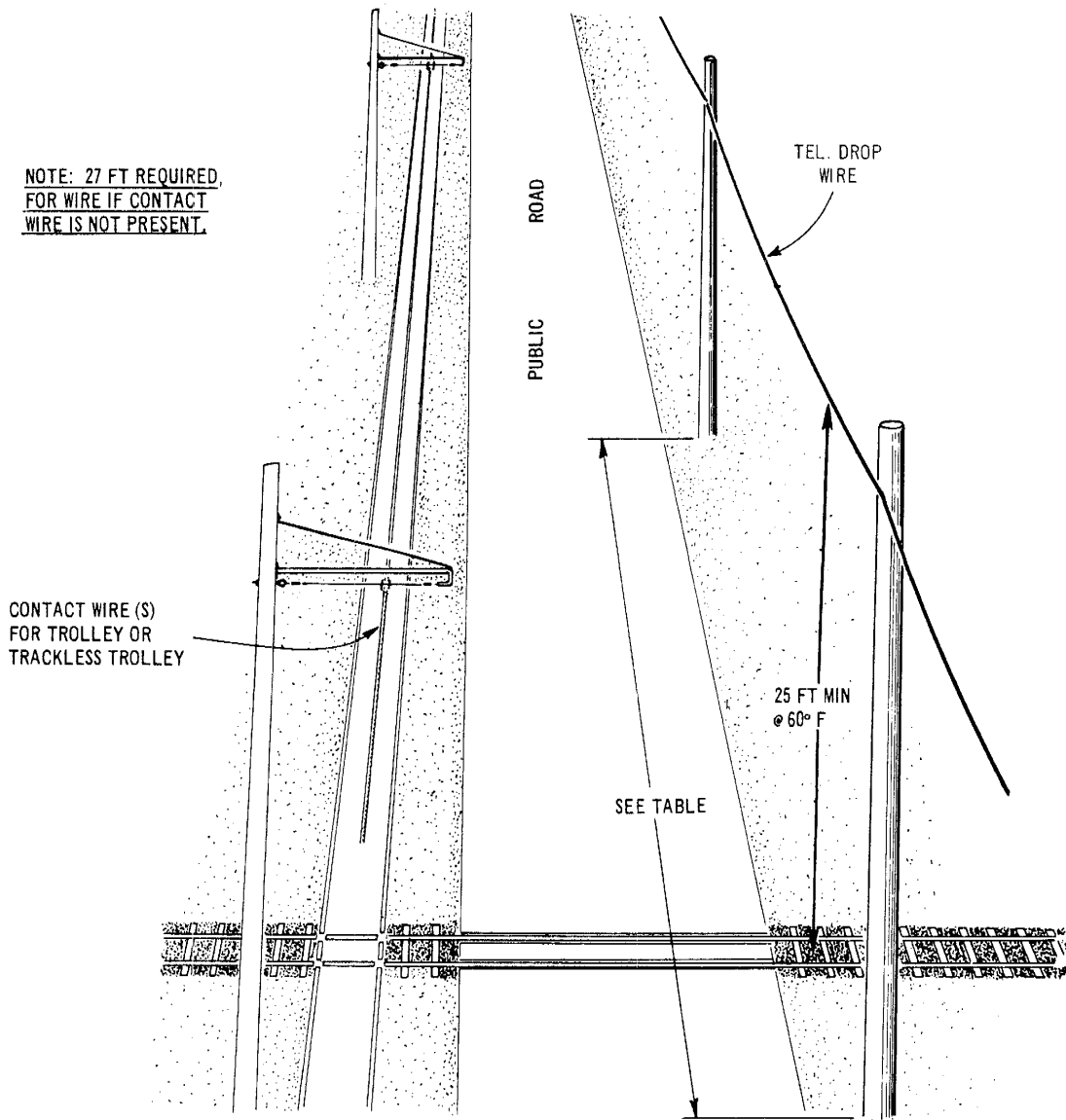


Fig. 3

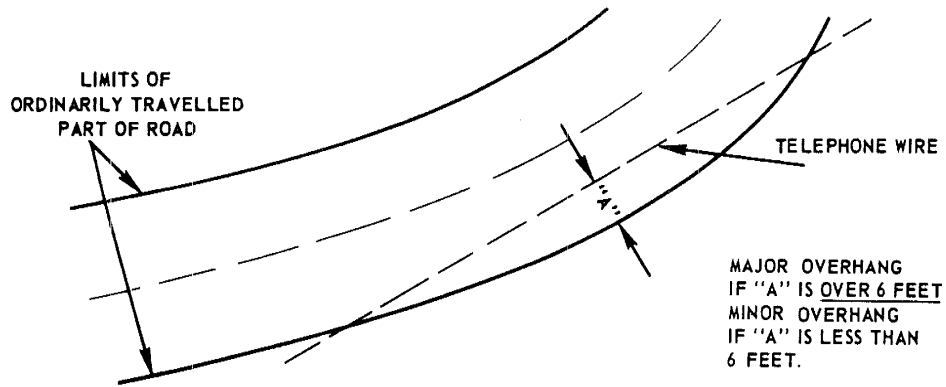


Fig. 4

RUNNING ALONG PUBLIC ROADS - BACK OF DITCHES ETC.

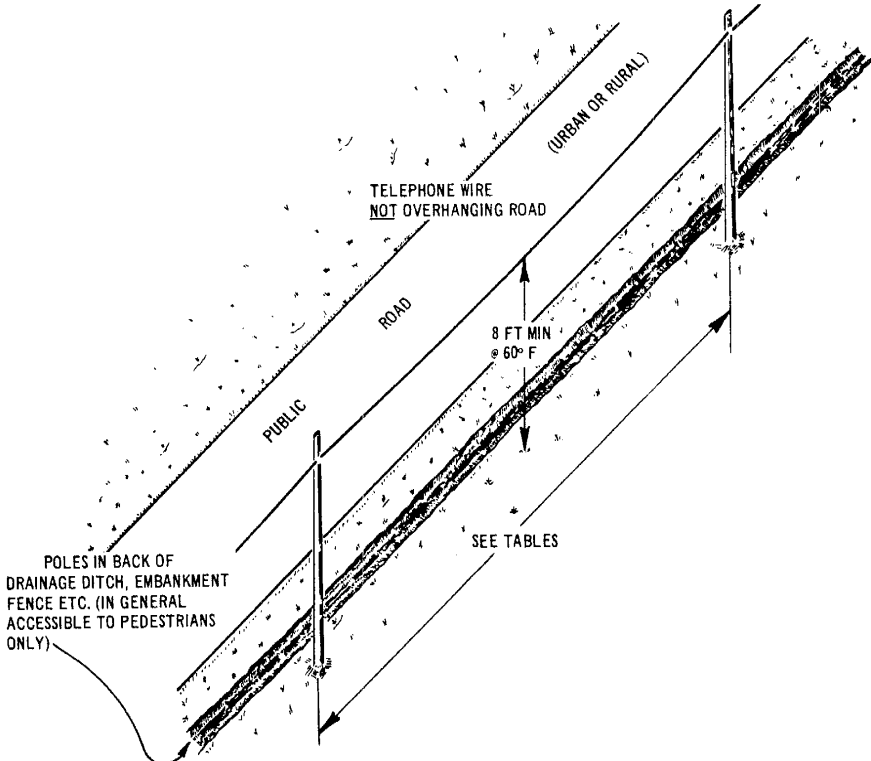


Fig. 5

RUNNING ALONG, BUT NOT OVERHANGING PUBLIC ROADS

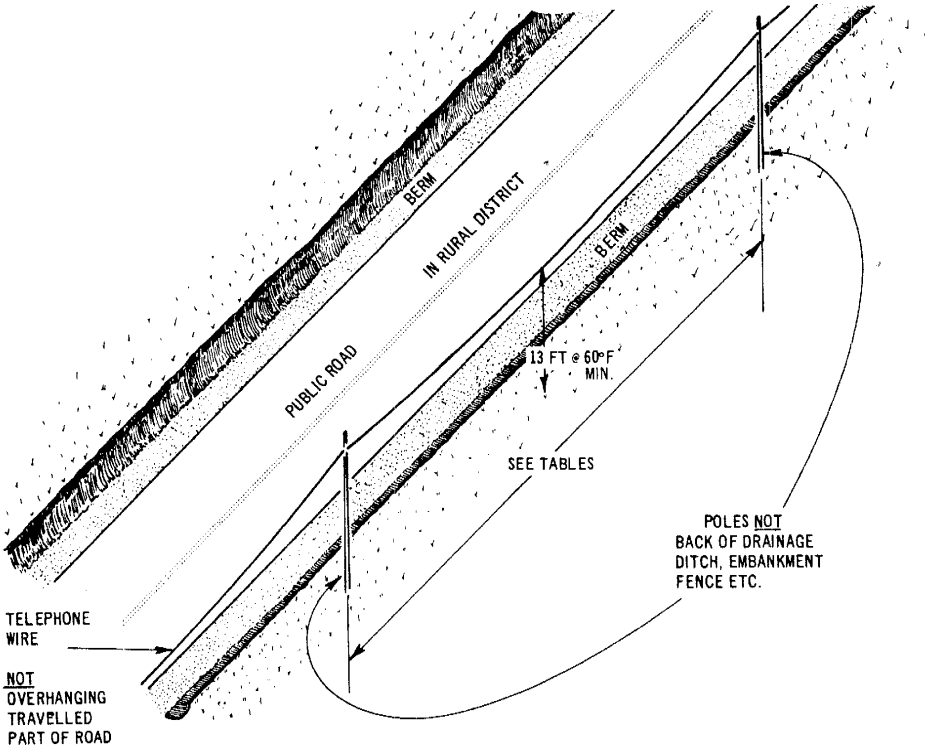


Fig. 6

## 2. CLEARANCES ABOVE GROUND OR RAILS (AT 60° F)

## B. Span Lengths of 250 Feet or Less Using Minimum Sags

SITUATION	REF.	CONSTRUCTION				MAINTENANCE				
		170-LESS ft. in.	171-200 ft. in.	201-225 ft. in.	226-250 ft. in.	170-LESS ft. in.	171-200 ft. in.	201-225 ft. in.	226-250 ft. in.	
<b>Crossing Above:</b> Railroad Tracks Generally Special Case	— Fig. 3	27-0 25-0	Must be supp. on 6M strand for spans over 125 feet.			(27-0) (25-0)	Must be supp. on 6M strand for spans over 125 feet.			
Public Roads Generally# Pole not over 50 ft. from far edge#	— Fig. 1	18-0 18-0	18-6 18-3	19-0 18-3	19-5 18-3	(18-0) (18-0)	(18-2) (18-0)	(18-7) (18-0)	(19-0) (18-0)	
Public Alleys Generally Pole not over 50 ft. from far edge	— Fig. 1	15-0 15-0	15-6 15-3	16-0 15-3	16-5 15-3	(15-0) (15-0)	(15-2) (15-0)	(15-7) (15-0)	(16-0) (15-0)	
Resid. Driveways Generally Pole not over 50 ft. from far edge	— Fig. 1	10-0 10-0	10-6 10-3	11-0 10-3	11-5 10-3	(10-0) (10-0)	(10-2) (10-0)	(10-7) (10-0)	(11-0) (10-0)	
Flat Roof Bldgs.	—	8-0	8-4	8-5	8-5	(8-0)	(8-0)	(8-0)	(8-0)	
Peak Roof Bldgs., Billboards	—	2-0	2-2	2-3	2-3	(2-0)	(2-0)	(2-0)	(2-0)	
Neon Signs	—	4-0	4-4	4-5	4-5	(4-0)	(4-0)	(4-0)	(4-0)	
Waterways	—	Must be shown on detail plans.				Must be shown on detail plans.				
<b>Running Along:</b> Public Roads Major Overhang	Fig. 4	18-0	18-6	19-0	19-5	(18-0)	(18-2)	(18-7)	(19-0)	
Minor Overhang Urban Rural (Lt. Traffic)	Fig. 4 — —	18-0 14-0	18-4 14-4	18-5 14-5	18-5 14-5	(18-0) (14-0)	(18-0) (14-0)	(18-0) (14-0)	(18-0) (14-0)	
No Overhang Back of Obst. Not Back of Obst.	Fig. 5 Fig. 6	8-0 13-0	8-4 13-4	8-5 13-5	8-5 13-5	(8-0) (13-0)	(8-0) (13-0)	(8-0) (13-0)	(8-0) (13-0)	
Public Alleys	—	15-0	15-4	15-5	15-5	(15-0)	(15-0)	(15-0)	(15-0)	

# For service drops over residential streets, these clearances may be reduced 2 feet at the edge of the road if required clearance is obtained at the center of the road (see Fig. 2).

## 2. CLEARANCES ABOVE GROUND OR RAILS (Continued)

## B. Span Lengths of 251-300 Feet Using Minimum Sags

SITUATION	REF.	CONSTRUCTION		MAINTENANCE	
		251-275 ft. in.	276-300 ft. in.	251-275 ft. in.	276-300 ft. in.
<b>Crossing Above:</b> Railroad Tracks Generally Special Case	— Fig. 3	Not recommended for these span lengths			
Public Roads Generally# Pole not over 50 feet from far edge#	— Fig. 1	19-9 18-3	20-0 18-3	(19-3) (18-0)	(19-6) (18-0)
Public Alleys Generally Pole not over 50 feet from far edge	— Fig. 1	16-9 15-3	17-0 15-3	(16-3) (15-0)	(16-6) (15-0)
Resid. Driveways Generally Pole not over 50 feet from far edge	— Fig. 1	11-9 10-3	12-0 10-3	(11-3) (10-0)	(11-6) (10-0)
Flat Roof Bldgs.	—	8-6	8-6	(8-0)	(8-0)
Peak Roof Bldgs., Billboards	—	2-3	2-3	(2-0)	(2-0)
Neon Signs	—	4-5	4-5	(4-0)	(4-0)
Waterways	—	To be shown on detail plans.			
<b>Running Along:</b> Public Roads Major Overhang	Fig. 4	19-9	20-0	(19-3)	(19-6)
Minor Overhang Urban Rural (Lt. Traffic)	Fig. 4 — —	18-9 14-9	19-0 15-0	(18-3) (14-3)	(18-6) (15-6)
No Overhang Back of Obst. Not Back of Obst.	Fig. 5 Fig. 6	8-6 13-6	8-6 13-6	(8-0) (13-0)	(8-0) (13-0)
Public Alleys	—	15-9	16-0	(15-3)	(15-6)

# For service drops over residential streets, these clearances may be reduced two feet at the edge of the road if required clearance is obtained at the center of the road (see Fig. 2).

**SECTION 462-070-016**

**3. CLEARANCES CROSSING BELOW POWER WIRES AND CABLES**

**Drop Wire Strung to Normal or Minimum Sags**

**CONSTRUCTION<sup>1</sup> CLEARANCES  
FOR POWER SPAN LENGTHS OF:**

KIND OF POWER FACILITY	150-LESS ft. in.	151-200 ft. in.	201-250 ft. in.
300 Volts <sup>2</sup> or Less			
Service Wires or Cables	2-0	2-6	3-0
Line Wires — Generally	2-0	2-6	3-0
If within 6 feet of telephone pole <sup>3</sup> (See Section 620-210-012)	4-0	4-6	5-0
301-750 Volts <sup>2</sup> — Phase Wires	4-0	4-6	5-0
751-8700 Volts <sup>2</sup>			
Phase Wires — Generally	4-0	4-6	5-0
If within 6 feet of telephone pole <sup>3</sup> (See Section 620-210-012)	6-0	6-6	7-0
8701-50,000 Volts <sup>2</sup> — Phase Wires	6-0	6-6	7-0
If near telephone pole, see Section 620-210-012			
Grounded Neutrals — Systems of:			
Up to 22,000 Volts to Ground	2-0	2-6	3-0
Over 22,000 Volts to Ground	Same as Associated Phase Wires.		
Other Neutrals	Same as Associated Phase Wires.		
Grounded Metal Sheath Cables, Any Cables Lashed To Grounded Strand — Any Voltage	2-0	2-0	2-0
Spacer Cable <sup>3</sup>			
300 Volts <sup>2</sup> or Less — Generally	2-0	2-0	2-0
If within 6 feet of telephone pole <sup>3</sup>	4-0	4-0	4-0
301-750 Volts <sup>2</sup>	4-0	4-0	4-0
751-8700 Volts <sup>2</sup> — Generally	4-0	4-0	4-0
If within 6 feet of telephone pole <sup>3</sup>	6-0	6-0	6-0
8701-50,000 Volts <sup>2</sup>	6-0	6-0	6-0

1. Maintenance clearances for all span lengths up to 250 feet are the same as construction clearances for span lengths of 150 feet and less.
2. Voltage to ground if power circuit is effectively grounded; voltage between wires if not.
3. Illustrated in Section 620-216-013.
4. *Every effort should be made to avoid these situations and establish a common crossing pole instead.*

## 4. MISCELLANEOUS CLEARANCES

<b>Drop Wire Above:</b>			
Power service drops or power line wires of 300 volts or less, foreign guys, foreign communications facilities, trolley span wires.			
SPAN LENGTH OF DROP WIRE (Ft.)	CLEARANCES IN FEET, INCHES		
	NORMAL SAGS	MINIMUM SAGS	
	CONST. and MTCE.	CONST.	MTCE.
170-less	2-0	2-0	(2-0)
171-200	2-0	2-4	(2-0)
201-250	2-0	2-5	(2-0)
<b>Trolley Contact Wires of 750 Volts — Less</b>			
170-less*	4-0	4-0	(4-0)
161-200*	4-0	4-4	(4-0)
201-250*	4-0	4-5	(4-0)
<b>Drop Wire Below:</b>			
Foreign Guys, Communications Cables† Any span length			
	2-0	2-0	(2-0)
Neon Signs Any span length			
	4-0	4-0	(4-0)
<b>Drop Wire Alongside:</b>			
Neon Signs Any span length			
	2-0	2-0	(2-0)

\* Place wire guard at point of crossing.

† Span length of foreign cable not over 250 feet.





## CLEARANCES FOR DROP WIRE IN THE HEAVY LOADING AREA

### 1. GENERAL

1.001 This addendum supplements Section 462-070-017, Issue 1.

1.002 This addendum is issued to add a paragraph to Part 1 regarding the placing of aerial drop wire over swimming pools.

1.003 Add the following paragraph:

1.08 Clearances over public and private swimming pools are not covered by the National Electrical Safety Code. However, for reasons of safety, sanitation, and appearance, aerial drop wire crossings over swimming pools should be avoided.



## CLEARANCES FOR DROP WIRE IN THE HEAVY LOADING AREA

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### 1. GENERAL

**1.01** This section contains the recommended clearances for drop wire installed in the heavy loading area. The values specified meet (and in some cases exceed) the requirements of the National Electrical Safety Code (Sixth Edition). They apply under conditions of 60°F with no wind or ice loading.

**1.02** Drop wire placed in the heavy loading area will generally experience some permanent stretch as a result of ice loading. "Construction" values of clearances therefore generally contain an allowance for extra sag which will be introduced by this permanent stretch. "Maintenance" values of clearances should exist after the wire has been through one or more cycles of storm loading and the temperature returns to 60°F.

**1.03** Drop wire tends to elongate as the temperature rises and contracts as the temperature falls. Wire placed during cold weather will, therefore, always have a greater sag in warm weather even if no permanent stretch is involved. In order to avoid having inadequate ground clearances at 60°F, it is necessary to provide extra clearance when wire is placed during cold weather (freezing or below). The amount of extra clearance required is the difference between the 60°F stringing sag and the cold weather stringing sag. No increase in clearance

is required when placing drop wire if the temperature is above 32°F, however. Drop wire sags are shown in Section 462-400-200.

**1.04** Clearance requirements for drop wire overhanging the travelled part of roads vary somewhat with the degree of overhang involved. (See tables under Part 2A, 2B of this section and Fig. 3). Eliminating or reducing road overhang will frequently permit smaller ground clearances.

**1.05** When drop wire sags exceed about two or three feet, it will generally be quite advantageous to locate poles so as to avoid having the middle of the crossing span occur above the travelled part of the road, alley, or driveway. This will frequently be the case when the pole is within 50 or even 75 feet of the far edge of the road, alley or driveway, (distance "A" in Fig. 1).

**1.06** When the 50-foot criterion applies, this may permit a reduced clearance above the road, alley, or driveway. (See Part 2 of this section.) Also, it will usually be feasible to base the height of attachment on something less than 100 per cent of the midspan sag. This is also true when the distance from the pole is 75 feet, but the saving in height of attachment is considerably less. The following table shows the percentage of midspan sag existing at distances of 50 and 75 feet from the pole for span lengths up to 300 feet.

POLE 50 FEET FROM FAR EDGE		POLE 75 FEET FROM FAR EDGE	
SPAN LENGTH (FEET)	PER CENT OF MIDSPAN SAG	SPAN LENGTH (FEET)	PER CENT OF MIDSPAN SAG
130-145	95	195-220	95
146-160	90	221-245	90
161-180	85	246-270	85
181-200	80	271-300	80
201-225	75		
226-250	70		
251-275	65		
276-300	60		

*Note:* Table may be used with normal or minimum sags.

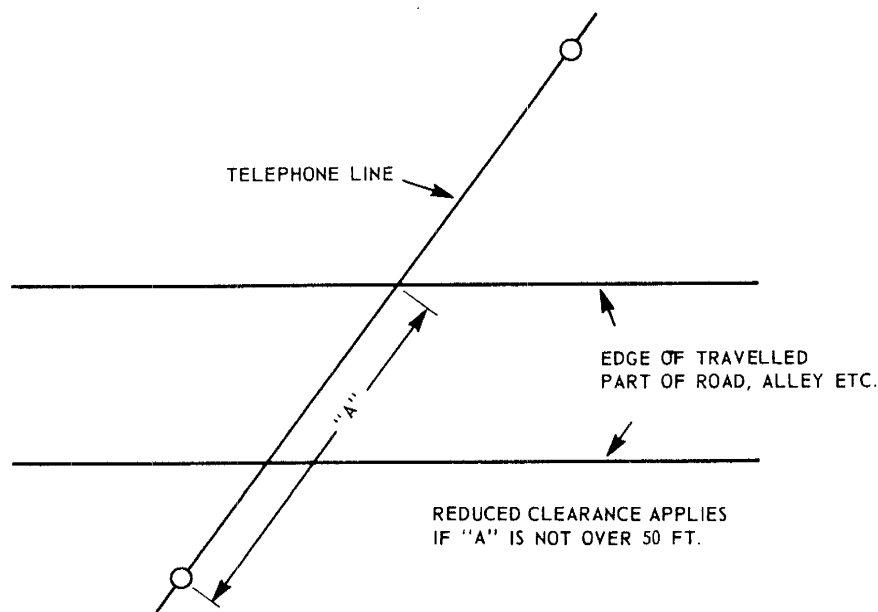


Fig. 1

Example: A 200-foot span crosses a driveway. One of the crossing poles will be within 50 feet of the far edge of the driveway. Normal midspan sag will be 7 feet. At 50 feet from the pole, the sag will be 80 per cent of midspan sag or about 5 feet 7 inches. In order to provide a clearance of 11 feet 8 inches, the minimum height of pole attachment would be 11 feet 8 inches plus 5 feet 7 inches or 17 feet 3 inches (assuming no difference in ground elevation). (Use the B drop wire rule when minimum sags are employed.)

**1.07** Clearances shown in this section should be used unless the work order or local requirements calls for other values. This may occur when engineering forces recognize factors not allowed for in this section or because of local ordinances, etc. Clearances for span lengths, voltages and other conditions not covered in this section are an engineering responsibility and will be shown on the work order or detail plans.

## 2. CLEARANCES ABOVE GROUND OR RAILS

**2.01** The designation "No Overhang — Back of Obst." in the tables that follow means that the pole line is located back of a fence, ditch, embankment, etc., so that the ground beneath the line can ordinarily be travelled by pedestrians only. The designation "No Overhang — Not Back of Obst." means that the line is not back of such obstruction and does not overhang the normally travelled part of the road. This category is also meant to include ground not ordinarily travelled but which can be reached by vehicles. If farm machinery is likely to pass under the line, provide sufficient clearance so that the wire will be 2 feet above the highest part of such machinery or the load it will carry. Initial clearance at 60°F should be *increased* by the *difference* between construction and maintenance clearance shown in the table for road crossings of the same length.

## CLEARANCES ABOVE GROUND OR RAILS (at 60°F)

## A. USING NORMAL SAGS

## Span Lengths of 175 Feet and Less

SITUATION	REF.	CONSTRUCTION					MAINTENANCE		
		75-LESS ft. in.	76-100 ft. in.	101-125 ft. in.	126-150 ft. in.	151-175 ft. in.	125-LESS ft. in.	126-150 ft. in.	151-175 ft. in.
<b>Crossing Above:</b>									
Railroad Tracks									
Generally	—	27-0	27-3	25-0†	25-0†	25-0†	(27-0)†	25-0†	25-0†
Special Case	Fig. 2	25-0	25-3	25-0†	25-0†	25-0†	(25-0)†	25-0†	25-0†
Public Roads									
Generally#	—	18-0	18-3	18-6	19-3	20-2	(18-0)	(18-5)	(19-0)
Pole not over 50 ft from far edge#	Fig. 1	18-0	18-3	18-6	18-11	19-3	(18-0)	(18-1)	(18-3)
Public Alleys									
Generally	—	15-0	15-3	15-6	16-3	17-2	(15-0)	(15-5)	(16-0)
Pole not over 50 ft. from far edge	Fig. 1	15-0	15-3	15-6	15-11	16-3	(15-0)	(15-1)	(15-3)
Resid. Driveways									
Generally	—	10-0	10-3	10-6	11-3	12-2	(10-0)	(10-5)	(11-0)
Pole not over 50 ft. from far edge	Fig. 1	10-0	10-3	10-6	10-11	11-3	(10-0)	(10-1)	(10-3)
Flat Roof Bldgs.	—	8-0	8-3	8-6	8-10	9-2	(8-0)	(8-0)	(8-0)
Peak Roof Bldgs., Billboards	—	2-0	2-2	2-3	2-5	2-7	(2-0)	(2-0)	(2-0)
Neon Signs	—	4-0	4-3	4-6	4-10	4-10	(4-0)	(4-0)	(4-0)
Waterways	—	Must be shown on detail plans.							
<b>Running Along:</b>									
Public Roads									
Major Overhang	Fig. 3	18-0	18-3	18-6	19-3	20-2	(18-0)	(18-5)	(19-0)
Minor Overhang	Fig. 3								
Urban	—	18-0	18-3	18-6	18-10	19-2	(18-0)	(18-0)	(18-0)
Rural (Lt. Traffic)	—	14-0	14-3	14-6	14-10	15-2	(14-0)	(14-0)	(14-0)
No Overhang									
Back of Obst.	Fig. 5	8-0	8-3	8-6	8-10	9-2	(8-0)	(8-0)	(8-0)
Not back of Obst.	Fig. 6	13-0	13-3	13-6	13-10	14-2	(13-0)	(13-0)	(13-0)
Public Alleys	—	15-0	15-3	15-6	15-10	16-2	(15-0)	(15-0)	(15-0)

# For Service drops, over residential streets, these clearances may be reduced 2 feet at the edge of the road if required clearance is obtained at the center of the road. See Fig. 4.

† Must be supported on 6M strand for spans over 100 feet; clearance of 25 feet permitted when supported on strand.

WIRE CROSSING RAILROAD TRACKS - SPECIAL CASE

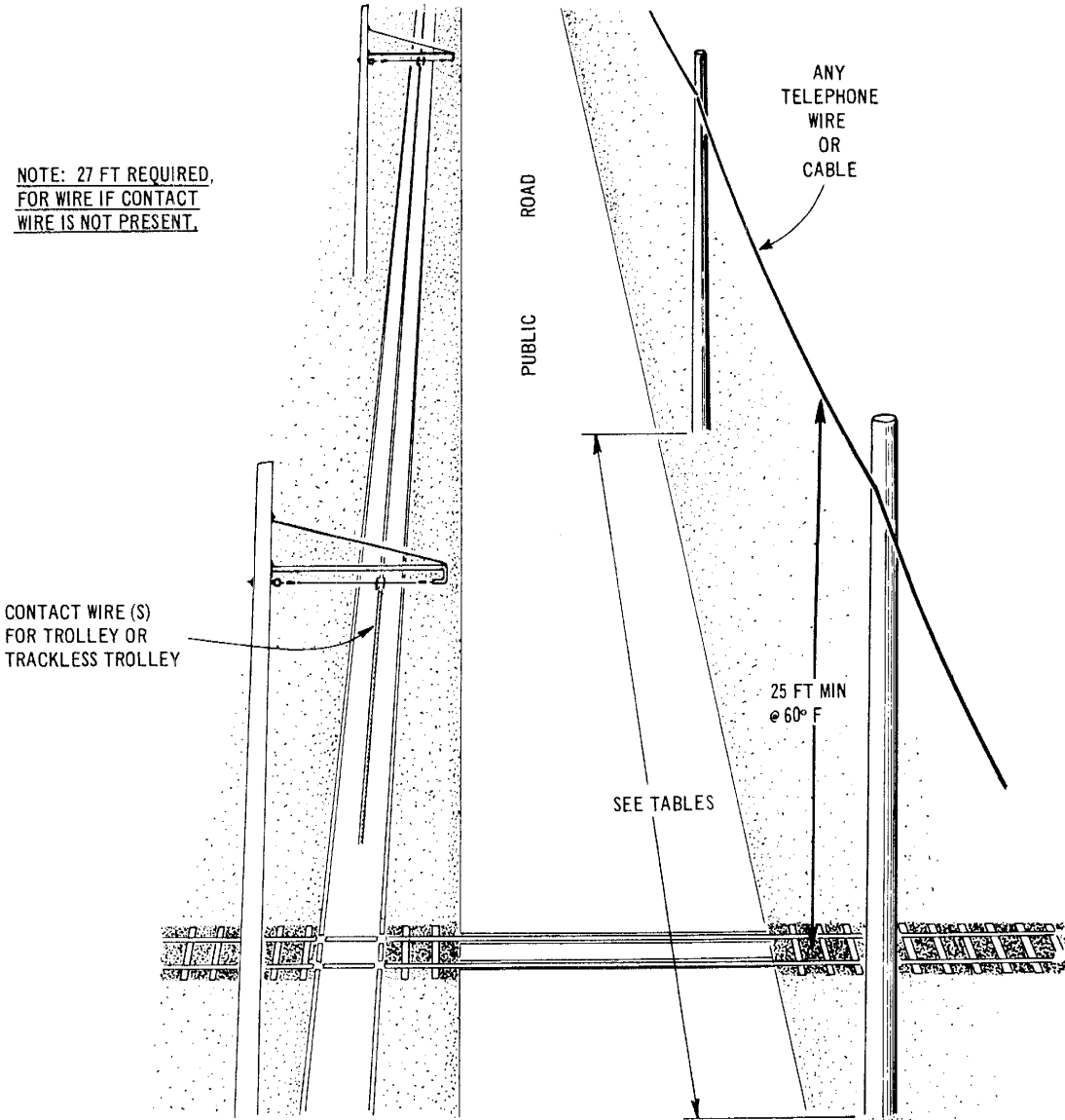


Fig. 2

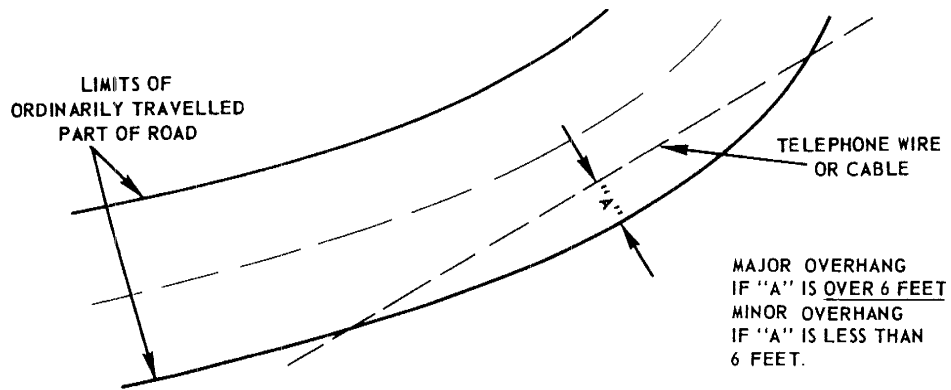


Fig. 3

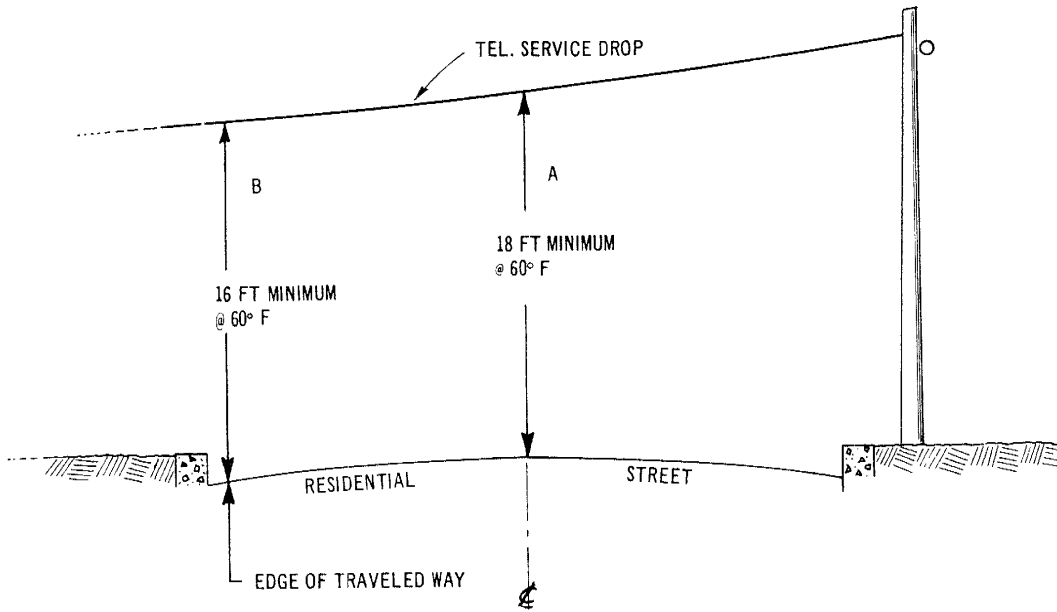


Fig. 4

RUNNING ALONG PUBLIC ROADS - BACK OF DITCHES ETC.

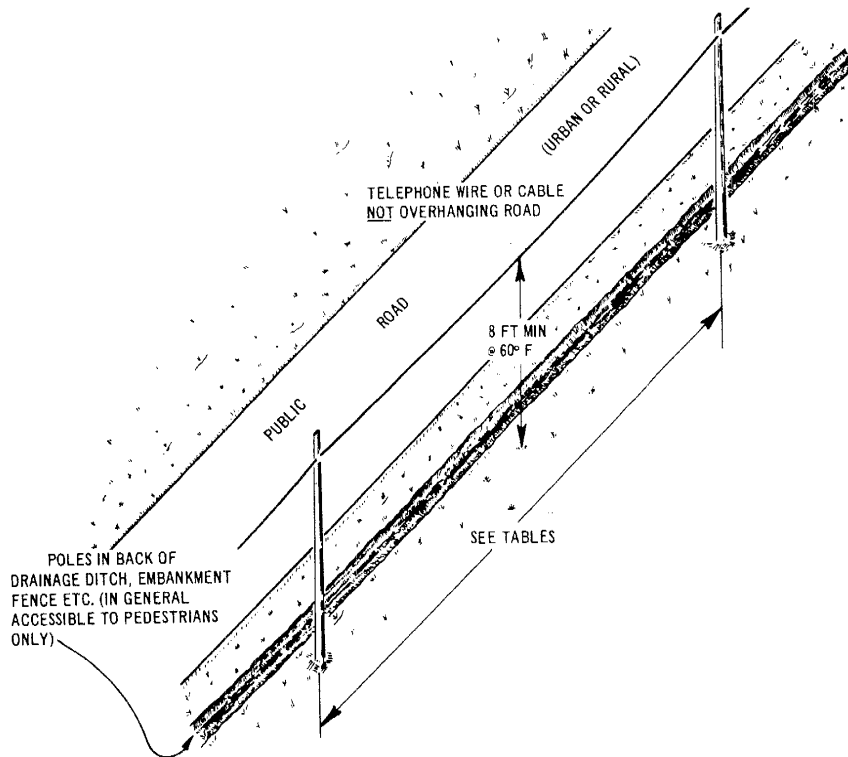


Fig. 5

RUNNING ALONG, BUT NOT OVERHANGING PUBLIC ROADS  
(NOT BACK OF OBSTRUCTION)

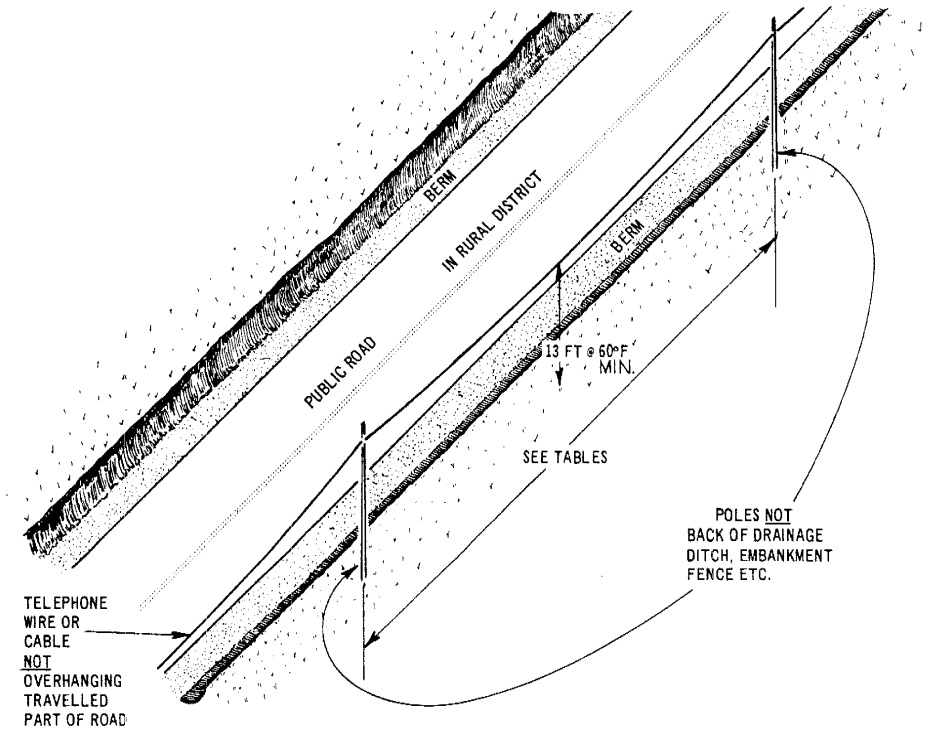


Fig. 6



## 2. CLEARANCES ABOVE GROUND OR RAILS (at 60°F)

## A. USING NORMAL SAGS (Cont.)

## Span Lengths of 176-250 Feet

SITUATION	REF.	CONSTRUCTION			MAINTENANCE		
		176-200 ft. in.	201-225 ft. in.	226-250 ft. in.	176-200 ft. in.	201-225 ft. in.	226-250 ft. in.
<b>Crossing Above:</b> Railroad Tracks Generally Special Case	— Fig. 2	Not recommended for these span lengths. Not recommended for these span lengths.					
Public Roads Generally# Pole not over 50 feet from far edge#	— Fig. 1	21-3 19-8	22-4 20-1	23-5 20-5	(19-9) (18-7)	(20-6) (18-10)	(21-3) (19-0)
Public Alleys Generally Pole not over 50 feet from far edge	— Fig. 1	18-3 16-8	19-4 17-1	20-5 17-5	(16-9) (15-7)	(17-6) (15-10)	(18-3) (16-0)
Resid. Driveways Generally Pole not over 50 feet from far edge	— Fig. 1	13-3 11-8	14-4 12-1	15-5 12-5	(11-9) (10-7)	(12-6) (10-10)	(13-3) (11-0)
Flat Roof Bldgs.	—	9-6	9-10	10-2	(8-0)	(8-0)	(8-0)
Peak Roof Bldgs., Billboards	—	2-9	2-11	3-1	(2-0)	(2-0)	(2-0)
Neon Signs	—	4-10	4-11	5-1	(4-0)	(4-0)	(4-0)
Waterways	—	Must be shown on detail plans.					
<b>Running Along:</b> Public Roads Major Overhang	Fig. 3	21-3	22-4	23-5	(19-9)	(20-6)	(21-3)
Minor Overhang Urban	Fig. 3 —	19-9	20-4	20-11	(18-3)	(18-6)	(18-9)
Rural (Lt. Traffic)	—	15-9	16-4	16-11	(14-3)	(14-6)	(14-9)
No Overhang Back of Obst.	Fig. 5	9-6	9-10	10-2	(8-0)	(8-0)	(8-0)
Not back of Obst.	Fig. 6	14-6	14-10	15-2	(13-0)	(13-0)	(13-0)
Public Alleys	—	16-9	17-4	17-11	(15-3)	(15-6)	(15-9)

# For service drops, these clearances may be reduced 2 feet at the edge of the road, if the required clearance is obtained at the center of the road. See Fig. 4.

## 2. CLEARANCES ABOVE GROUND OR RAILS (at 60°F)

## B. USING MINIMUM SAGS

## Span Lengths of 150 Feet and Less

SITUATION	REF.	CONSTRUCTION				MAINTENANCE		
		75-LESS ft. in.	76-100 ft. in.	101-125 ft. in.	126-150 ft. in.	100-LESS ft. in.	101-125 ft. in.	126-150 ft. in.
<b>Crossing Above:</b>								
Railroad Tracks								
Generally	—	27-3	27-6	25-0†	25-0†	(27-0)	25-0†	25-0†
Special Case	Fig. 2	25-3	25-6	25-0†	25-0†	(25-0)	25-0†	25-0†
Public Roads								
Generally#	—	18-3	18-6	19-5	20-8	(18-0)	(18-7)	(19-4)
Pole not over 50 feet from far edge#	Fig. 1	18-3	18-6	19-3	20-1	(18-0)	(18-5)	(18-10)
Public Alleys								
Generally	—	15-3	15-6	16-5	17-8	(15-0)	(15-7)	(16-4)
Pole not over 50 feet from far edge	Fig. 1	15-3	15-6	16-3	17-1	(15-0)	(15-5)	(15-10)
Resid. Driveways								
Generally	—	10-3	10-6	11-5	12-8	(10-0)	(10-7)	(11-4)
Pole not over 50 feet from far edge	Fig. 1	10-3	10-6	11-3	12-1	(10-0)	(10-5)	(10-10)
Flat Roof Bldgs.	—	8-3	8-6	8-10	9-4	(8-0)	(8-0)	(8-0)
Peak Roof Bldgs., Billboards	—	2-2	2-3	2-5	2-8	(2-0)	(2-0)	(2-0)
Neon Signs	—	4-3	4-6	4-6	4-8	(4-0)	(4-0)	(4-0)
Waterways	—	Must be shown on detail plans.						
<b>Running Along:</b>								
Public Roads								
Major Overhang	Fig. 3	18-3	18-6	19-5	20-8	(18-0)	(18-7)	(19-4)
Minor Overhang	Fig. 3							
Urban	—	18-3	18-6	18-10	19-4	(18-0)	(18-0)	(18-0)
Rural (Lt. Traffic)	—	14-3	14-6	14-10	15-4	(14-0)	(14-0)	(14-0)
No Overhang								
Back of Obst.	Fig. 5	8-3	8-6	8-10	9-4	(8-0)	(8-0)	(8-0)
Not Back of Obst.	Fig. 6	13-3	13-6	13-10	14-4	(13-0)	(13-0)	(13-0)
Public Alleys	—	15-3	15-6	15-10	16-4	(15-0)	(15-0)	(15-0)

† Must be supported on 6M strand for spans over 100 ft.

# For Service drops, over residential streets, these clearances may be reduced 2 feet at the edge of the road if required clearance is obtained at the center of the road. See Fig. 4.

## 2. CLEARANCES ABOVE GROUND OR RAILS (at 60°F)

## B. USING MINIMUM SAGS (Cont.)

## Span Lengths of 151-200 Feet

SITUATION	REF.	CONSTRUCTION		MAINTENANCE	
		151-175 ft. in.	176-200 ft. in.	151-175 ft. in.	176-200 ft. in.
<b>Crossing Above:</b> Railroad Tracks Generally Special Case	— Fig. 2	Not recommended for these span lengths Not recommended for these span lengths			
Public Roads Generally# Pole not over 50 feet from far edge#	— Fig. 1	22-0 20-9	23-5 21-4	(20-0) (19-1)	(20-5) (19-1)
Public Alleys Generally Pole not over 50 feet from far edge	— Fig. 1	19-0 17-9	20-5 18-4	(17-0) (16-1)	(17-5) (16-1)
Resid. Driveways Generally Pole not over 50 feet from far edge	— Fig. 1	14-0 12-9	15-5 13-4	(12-0) (11-1)	(12-5) (11-1)
Flat Roof Bldgs.	—	10-0	11-0	(8-0)	(8-0)
Peak Roof Bldgs., Billboards	—	3-0	3-6	(2-0)	(2-0)
Neon Signs	—	5-0	5-6	(4-0)	(4-0)
Waterways	—	Must be shown on detail plans			
<b>Running Along:</b> Public Roads Major Overhang	Fig. 3	22-0	23-5	(20-0)	(20-5)
Minor Overhang Urban Rural (Lt. Traffic)	Fig. 3 — —	20-0 16-0	21-3 17-3	(18-0) (14-0)	(18-3) (14-3)
No Overhang Back of Obst. Not Back of Obst.	Fig. 5 Fig. 6	10-0 15-0	11-0 16-0	(8-0) (13-0)	(8-0) (13-0)
Public Alleys	—	17-0	18-3	(15-0)	(15-3)

# For service drops, over residential streets, these clearances may be reduced 2 feet at the edge of the road if required clearance is obtained at the center. See Fig. 4.

## 3. CLEARANCES CROSSING BELOW POWER WIRES AND CABLES

## Drop Wire Strung to Normal or Minimum Sags

CONSTRUCTION<sup>1</sup> CLEARANCES  
FOR POWER SPAN LENGTHS OF:

KIND OF POWER FACILITY	100-LESS ft. in.	101-150 ft. in.	151-175 ft. in.
300 Volts <sup>2</sup> or less			
Service Wires or Cables	2-0	2-6	2-9
Line Wires — Generally	2-0	2-6	2-9
If within 6 feet of telephone pole <sup>3</sup> (See Section 620-210-012)	4-0	4-6	4-9
301-750 Volts <sup>2</sup> — Phase Wires	4-0	4-6	4-9
751-8700 Volts <sup>2</sup> — Phase Wires — Generally	4-0	4-6	4-9
If within 6 feet of telephone pole <sup>3</sup>	6-0	6-6	6-9
8701-50,000 Volts <sup>2</sup> — Phase Wires — Generally	6-0	6-6	6-9
If near telephone pole see Section 620-210-012			
Grounded Neutrals — Systems of:			
Up to 22,000 Volts to ground	2-0	2-6	2-9
Over 22,000 Volts to ground	Same as Associated Phase Wires.		
Other Neutrals	Same as Associated Phase Wires.		
Grounded Metal Sheath Cables or Any Cable Lashed to Grounded Strand — Any Voltage	2-0	2-0	2-0
Spacer Cables <sup>4</sup>			
300 Volts <sup>2</sup> or Less — Generally	2-0	2-0	2-0
If within 6 feet of telephone pole <sup>3</sup>	4-0	4-0	4-0
301-750 Volts <sup>2</sup>	4-0	4-0	4-0
751-8700 Volts <sup>2</sup> — Generally	4-0	4-0	4-0
If within 6 feet of telephone pole <sup>3</sup>	6-0	6-0	6-0
8701-50,000 Volts <sup>2</sup>	6-0	6-0	6-0
If near telephone pole see Section 620-210-012			

- Maintenance clearances for span lengths of 101 to 175 feet are the same as construction clearances for span lengths of 100 feet and less.
- Voltage to ground if power circuit is effectively grounded; voltage between wires if not.
- Every effort should be made to avoid these situations and establish a common pole crossing instead.*
- Illustrated in Section 620-216-013.

## 4. MISCELLANEOUS CLEARANCES

<b>Drop Wire Above:</b> Power service drops or power line wires of 300 volts or less, foreign guys, foreign communications facilities, trolley span wires.				
Span Length of Drop Wire (Ft.)	CLEARANCES IN FEET, INCHES			
	NORMAL SAGS		MINIMUM SAGS	
	CONST.	MTCE.	CONST.	MTCE.
75-less	2-0	(2-0)	2-3	(2-0)
76-100	2-3	(2-0)	2-6	(2-0)
101-125	2-6	(2-0)	2-10	(2-0)
126-150	2-10	(2-0)	3-4	(2-0)
151-175	3-2	(2-0)	4-0	(2-0)
<b>Trolley Contact Wires 750 Volts — Less</b>				
75-less*	4-0	(4-0)	4-3	(4-0)
76-100*	4-3	(4-0)	4-6	(4-0)
101-125*	4-6	(4-0)	4-10	(4-0)
126-150*	4-10	(4-0)	5-4	(4-0)
151-175*	5-2	(4-0)	6-0	(4-0)
<b>Drop Wire Below:</b>				
Foreign Guys, Communications Cables†				
Any span length	2-0	(2-0)	2-0	(2-0)
Neon Signs				
Any span length	4-0	(4-0)	4-0	(4-0)
<b>Drop Wire Alongside:</b>				
Neon Signs				
Any span length	2-0	(2-0)	2-0	(2-0)

\* Place wire guard at point of crossing.

† Span length of foreign cable not over 175 feet.



## DROP AND BLOCK WIRING

### DROPS FROM OPEN AND RURAL WIRE LINES

#### 1. GENERAL

**1.01** This section covers methods of bridling to open wire.

**1.02** This information was formerly covered in Section 625-240-200 (G32.129.1) which is canceled.

**1.03** Fuseless protectors for stations will be specified by service orders or other local instructions.

#### 2. DISTRIBUTING DROPS FROM OPEN WIRE LINES

**2.01** Distribute drops from a drive hook in the pole if climbing space, joint use, and ground clearances permit, and there is adequate clearance between the drops and existing or future open wires. Otherwise distribute drops from crossarms as outlined in 2.02.

**2.02** Distribute drops from crossarms as follows:

(a) Crossarms Other Than DE Type: Distribute from a drop wire hook where not more than two drops will be run from the same point on the crossarm. Distribute from a guard arm hook where more than two drops will be run. Not more than five drops shall be attached to one guard arm hook.

(b) DE Crossarm: Distribute drops from drop wire hooks attached to the sides of the crossarm.

#### 3. INSTALLING DROP WIRE AND GUARD ARM HOOKS ON CROSSARMS

**3.01** Attach drop wire hook to crossarm with a 1-1/2 inch No. 18 RH galvanized wood screw. On a crossarm equipped with insulator pins, center the hook on side of crossarm and between pins as covered in 4.10 or closer to the pole if adequate clearances can be obtained and climbing space is not obstructed. On a crossarm on which the open wires are terminated on dead-end brackets, locate the hook midway between

the two outer bracket positions and 1-1/8 inches above bottom of crossarm. Shift location of hook as necessary to avoid checks or cracks in crossarm. Drill lead hole for the No. 18 wood screw with an 11/64-inch drill point.

**3.02** Place guard arm hook in a 9/16- or 5/8-inch clearance hole drilled in the side of the crossarm (3-1/4 inches thick). Center the hole between top and bottom of the arm and between pins or closer to the pole if adequate clearances can be obtained and climbing space is not obstructed.

#### 4. WIRING AT CROSSARMS AND POLES

##### General

**4.01** Terminate parallel drop wire at a 101B wire terminal and run twisted pair wire between the terminal and the open wire. Follow this method when making new installations, re-installations, rearrangements, and repairs.

**4.02** If the drop is run with HD wire, the 101B wire terminal is not required, as this wire may be connected directly to the open wire.

**4.03** Locate the 101B terminal on pole side of crossarm with lower edge 3/4 inch above bottom of crossarm. Locate the first terminal to be placed between the first and second wires from the pole so that it will be readily accessible. Space additional terminals 2-1/2 inches apart on DE crossarms and 3-1/2 inches apart on other crossarms.

*Note:* To avoid splicing out parallel drop wires installed prior to placing the 101B terminal or to comply with distances specified in Part 7, the terminal may be located between any pin positions.

**4.04** The binding posts of the 101B terminal will accommodate three parallel drop wires and the bridle wire to the open wire. (The superseded 101A terminal will accommodate one less parallel drop wire.) Section 462-240-120 covers 101A and 101B wire terminals.

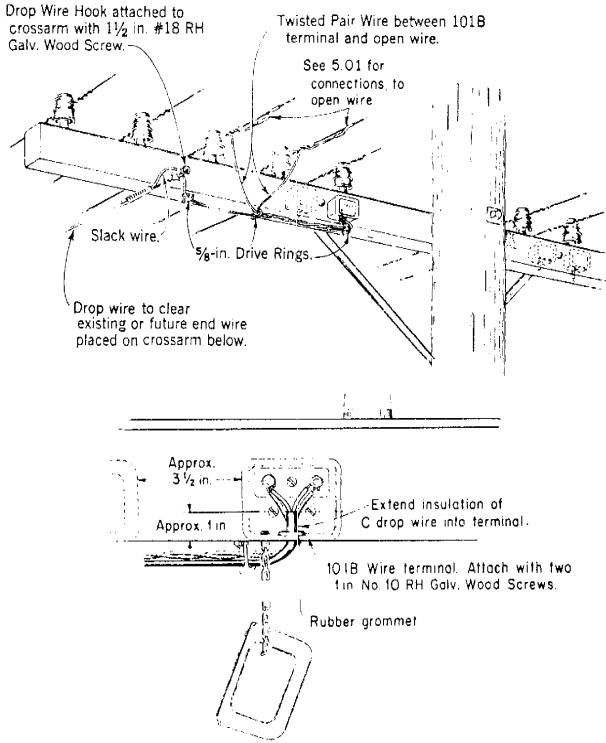


Fig. 1 - Where Drop Wire Is Distributed from Crossarms Other than DE Type

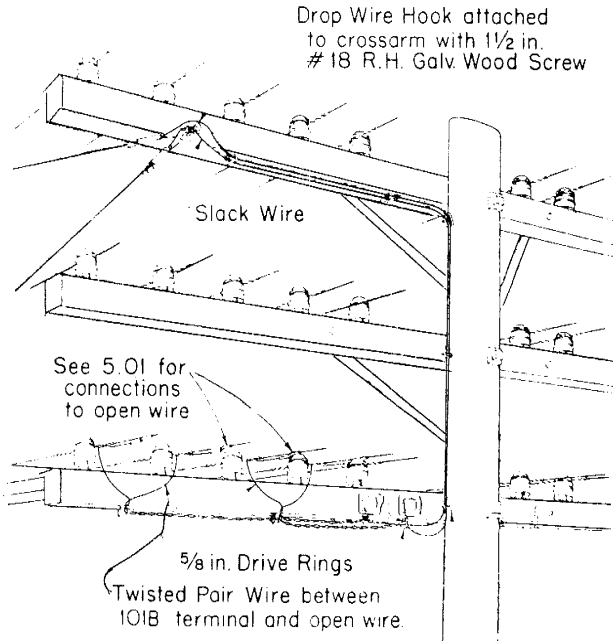


Fig. 2 - Where Drop Wire Is Distributed from a Higher Crossarm on a Pole

4.05 Terminate twisted pair wire under the bottom washers on the binding posts, and the first parallel drop wire between the second and third washers and so on.

4.06 If four drop wires are to be bridged to the same open wire, install two 101B terminals and bridle from each terminal to separate bridging sleeves or bridging connectors spaced approximately 2 inches apart on the open wire.

4.07 Install 5/8-inch drive rings on underside of crossarm near the point where the drop is attached and at points where wires extend to the open wire at the 101B terminals. Install additional rings as required to limit ring spacings to approximately 20 inches.

4.08 Use B bridle wire for bridling between 101B terminals and open wire except where the use of D or E block wire is specified as in Part 7 or by local instructions. Use bridging sleeves or bridging connectors for connection to open wire.

4.09 At double crossarms equipped with insulator pins follow the general wiring method specified for single crossarms, locating the 101B terminal preferably on the side of the crossarm toward the bridging sleeves or bridging connectors. Locate the wire run on the underside of the same crossarm.

**Crossarms Equipped with Insulator Pins**

4.10 The wiring arrangement on crossarms equipped with insulator pins is illustrated in Fig. 1, 2, and 3.

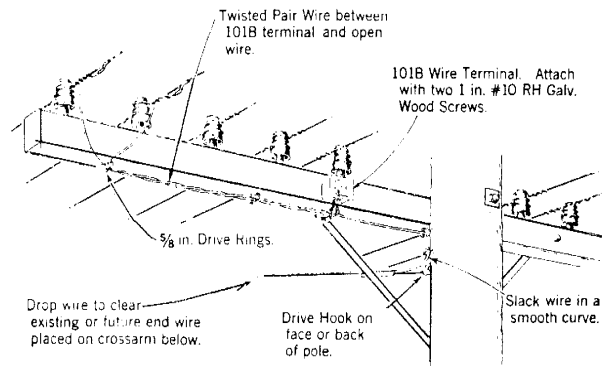
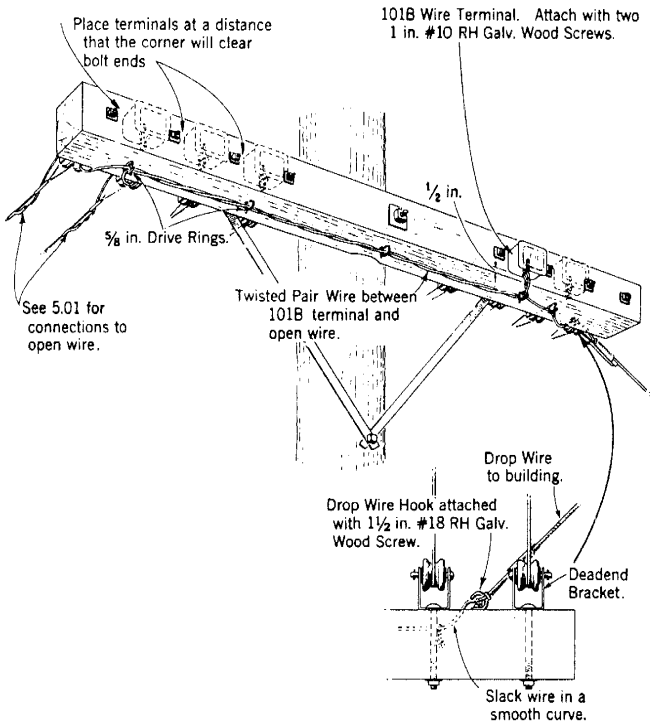


Fig. 3 - Where Drop Wire Is Distributed from a Pole

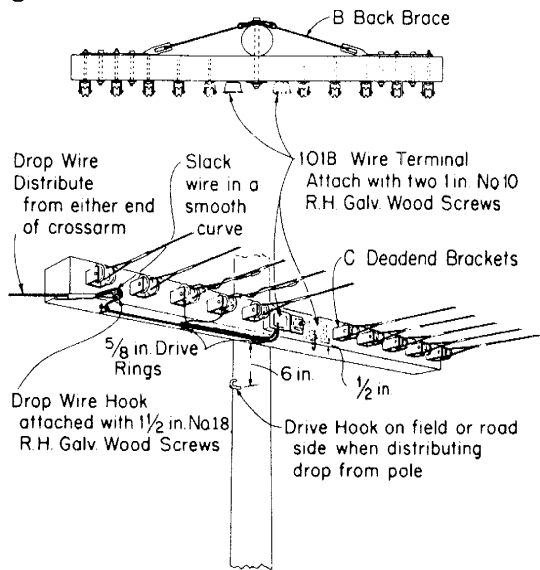


**4.11 Crossarms Equipped with Deadend Brackets (Fig. 4).**

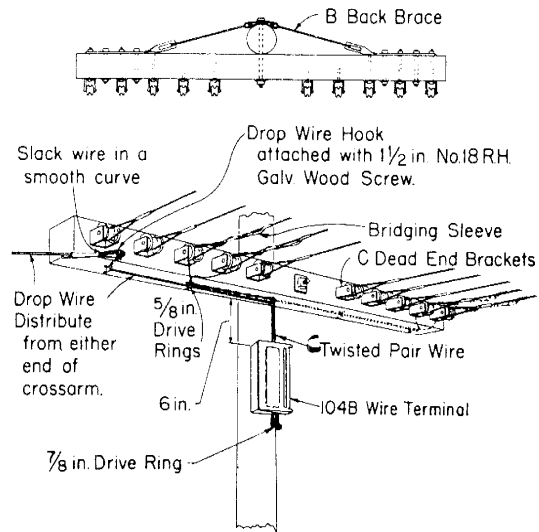


**Fig. 4 — Wiring Arrangement on DE Crossarms Not Having Back Braces**

**4.12 The wiring arrangement on DE crossarms equipped with back braces is illustrated in Fig. 5 and 6.**



**Fig. 5 — For Not More than Two Drops Use 101B Wire Terminals Placed on Line Wire Side of Crossarm**

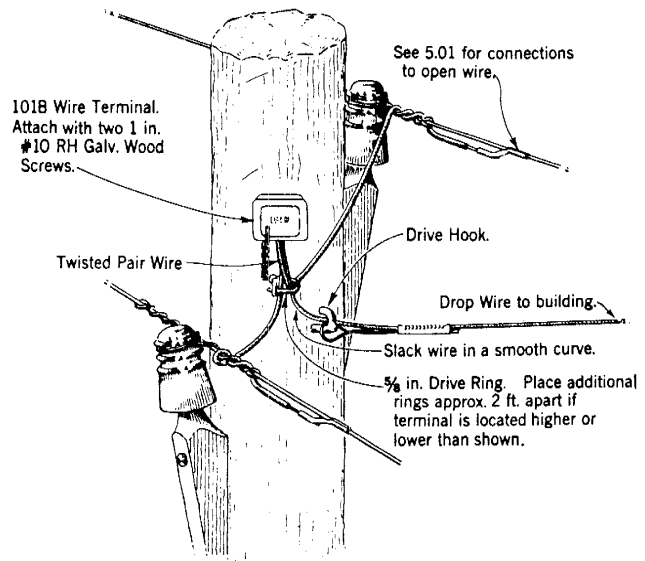


**Fig. 6 — For More than Two Drops Use a 104B Wire Terminal Mounted on Pole 6 Inches Below Arm**

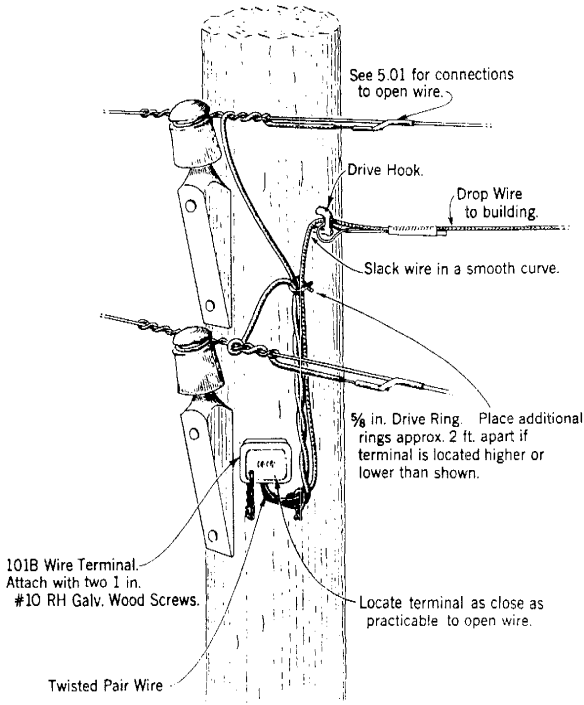
**4.13 At double crossarms equipped with dead-end brackets, follow the general wiring method shown in Fig. 4, locating the 101B terminal on the outer side of the crossarm not equipped with deadend brackets. Locate the wire run on the underside of the same crossarm.**

**Poles Equipped with Wooden Pole Brackets**

**4.14 The wiring arrangements on line poles equipped with wooden pole brackets are illustrated in Fig. 7 and 8.**



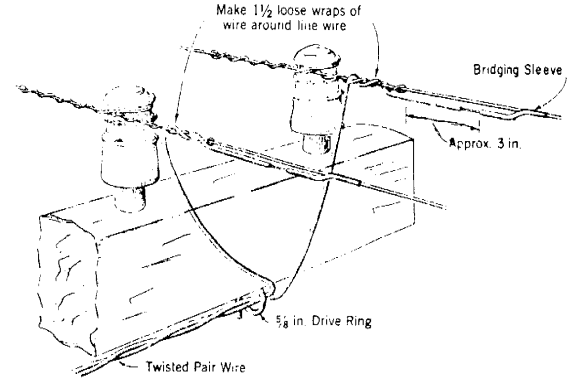
**Fig. 7 — Where Pole Brackets Are Located on Opposite Sides of Pole**



**Fig. 8 — Where Pole Brackets Are Located on Same Side of Pole**

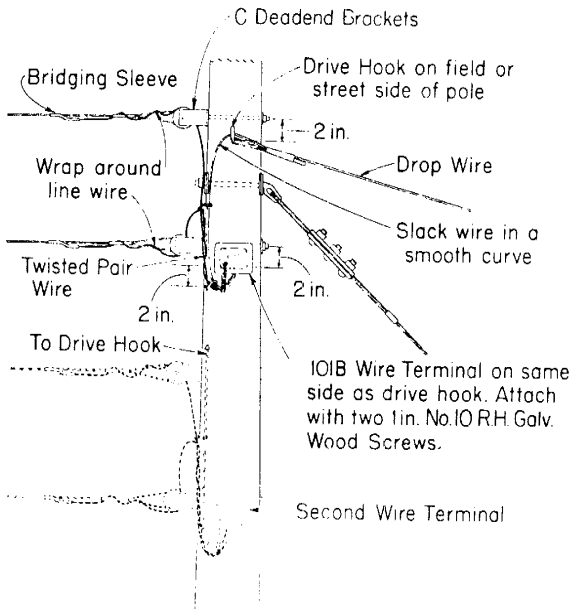
**5. CONNECTING TWISTED PAIR WIRE TO OPEN WIRE**

**5.01** In general, connect twisted pair wire to open wire attached to glass insulators or deadend brackets as illustrated in Fig. 10, 11, and 12. As an alternate, bridging connectors may be used in lieu of bridging sleeves. However, in localities where corrosion of the bridge wire occurs adjacent to the bridging connector, connect to open wire as covered in 5.02 or 5.03 depending on the severity of corrosion.

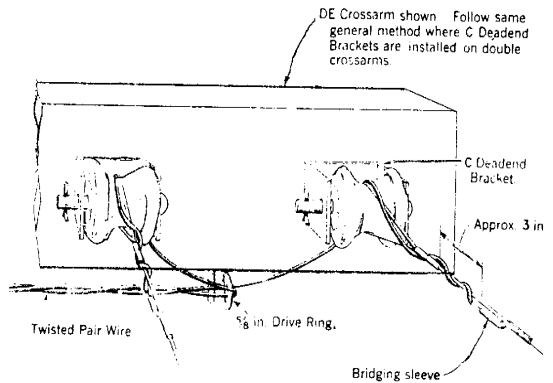


**Fig. 10 — Where Line Wires Are Tied to Pin-Type Insulators**

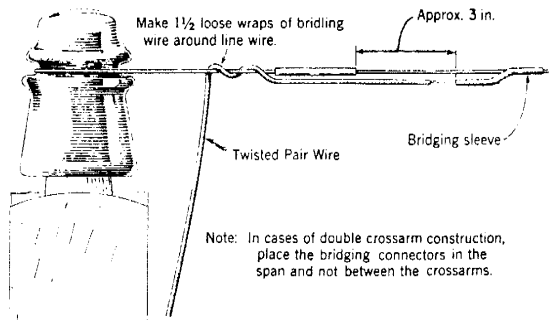
**4.15 Poles Equipped with Deadend Brackets (Fig. 9)**



**Fig. 9 — Where Lines Are Terminated on Deadend Brackets Attached to Face or Back of a Pole**



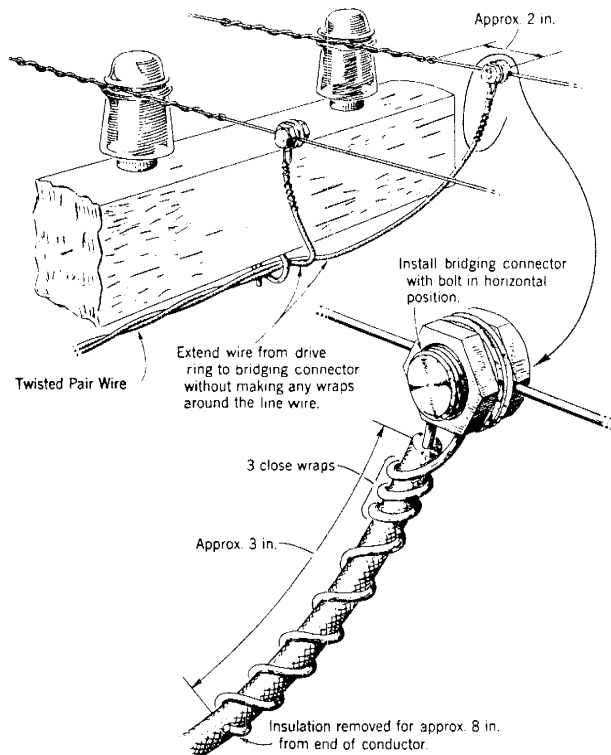
**Fig. 11 — Where Line Wires Are Terminated on Deadend Brackets**



**Fig. 12 — Where Line Wires Are Terminated on Pin-Type Insulators**

**5.02** Where corrosion of the bridle wire occurs between the end of the conductor insulation and the bridging connector, provide a bypass in making the connection to the open wire as covered below. For the more severe corrosive conditions, follow the method outlined in 5.03.

- (1) Provide a sufficient length of twisted pair wire to extend from the 101B terminal to approximately 8 inches beyond the bridging connectors.
- (2) Remove the insulation for approximately 8 inches from each bridle conductor at the open wire end.
- (3) Thoroughly clean the conductors for approximately 2 inches beyond the end of the insulation.
- (4) Extend bridle wire directly from last drive ring to bridging connectors without making any wraps around the line wire.
- (5) Connect each conductor at the open wire by means of a bridging connector installed with the bolt in a horizontal position and extend the excess length of bare conductor back on the insulated portion in spiral wraps as illustrated in Fig. 13 and 14.



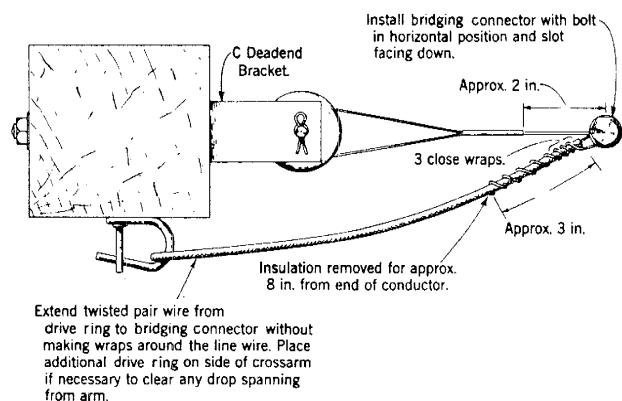
**Fig. 13 – Where Line Wires Are Tied to Pin-Type Insulators**

connector. The last wrap shall be close to the end of the rubber insulation but shall not make contact with the bare conductor.

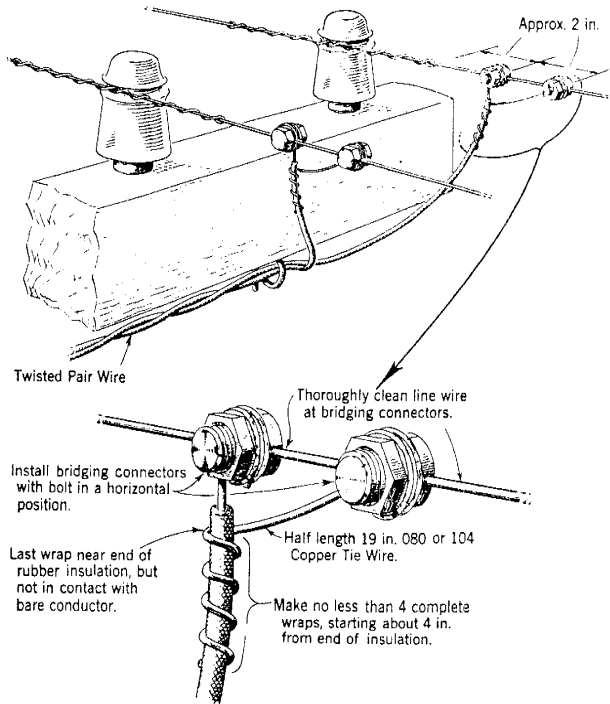
**5.03** Where exposure conditions are so severe that the bypass method covered in 5.02 does not provide sufficient permanence because of rapid corrosion of the spiral wrap, a more durable bypass may be provided as follows:

- (1) Provide a sufficient length of twisted pair wire to extend from the 101B terminal to the bridging connectors.
- (2) Extend bridle wire directly from last drive ring to bridging connectors without making any wraps around the line wire, and connect each conductor to bridging connector installed with the bolt in a horizontal position.
- (3) Starting approximately 4 inches from bridging connector, make at least four spiral wraps of a half-length of 19-inch 080 or 104 copper tie wire around each bridle conductor in the direction toward the bridging con-

- (4) Extend tie wire to an additional bridging connector as illustrated in Fig. 15.



**Fig. 14 – Where Line Wires Are Terminated on Deadend Brackets**



**Fig. 15 — Tie Wire Extended to Additional Bridging Connectors**

**5.04** Where corrosion of bridle wire occurs between end of conductor insulation and a bridging sleeve, provide a bypass in the manner described in 5.03 using a bridging connector for attaching the tie wire to the line wire.

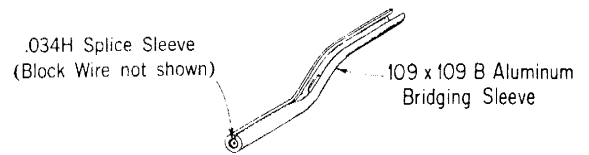
**5.05** Connect bridle wire to tree wire, using one of the methods covered for bare line wire, depending on the exposure conditions involved. Remove sufficient insulation from the tree wire to permit making the connection as specified for bare line wire.

**6. INSTALLATION OF WIRE VIBRATION DAMPER**

**6.01** Install vibration dampers as covered in Section 623-030-103 where open wires vibrate to such an extent as to cause breakage of twisted pair wires at bridging points or to produce a vibration noise at a building to which a drop wire is attached.

**7. BRIDLING WHEN FUSELESS PROTECTORS ARE USED AT STATION**

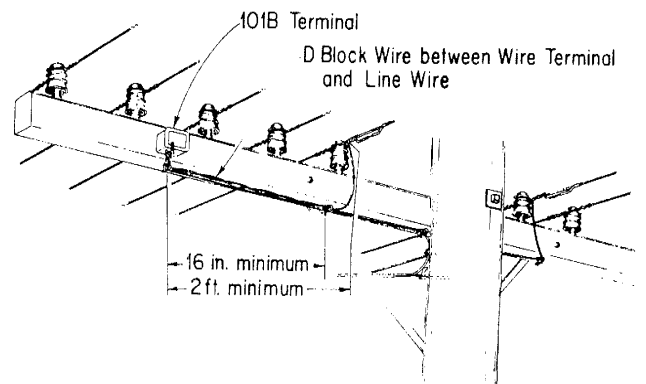
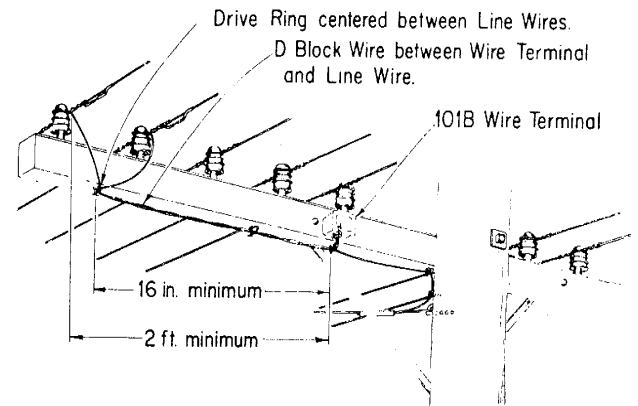
**7.01** Where stations served from open wire or rural wire will use the fuseless protector, 123A1A, a length of D or E block wire not less



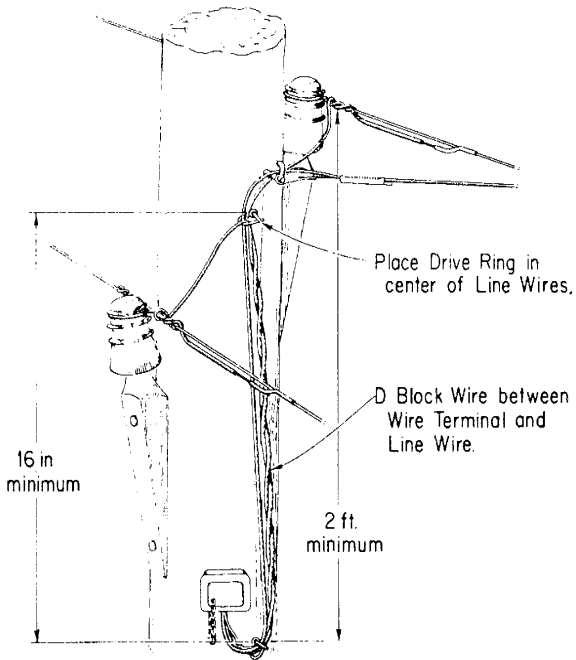
- Note: 1. Crimp H Splice Sleeve to D Block Wire with Sleeve Pressing Tool, and flatten ridges.  
 2. Insert .034H Splice Sleeve with D Block Wire in 109 x 109 B Aluminum Bridging Sleeve.  
 3. Crimp Bridging Sleeve with Q Groove of QC Nicopress Tool.  
Do Not Use Sleeve Rolling Tool

**Fig. 16 — B Aluminum Bridging Sleeve**

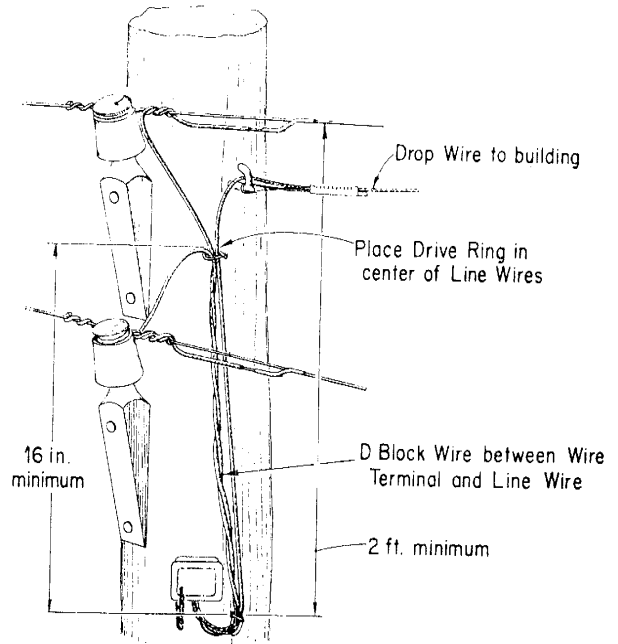
than 2 feet shall be used between the drop wire and open or rural wire in accordance with the examples in Fig. 17 through 20. Bridging to 109 size steel wire or 104 size copper steel wire may be made with bridging connectors or a combination of a 109 by 109B aluminum bridging sleeve and an 034 H splice sleeve as illustrated in Fig. 16.



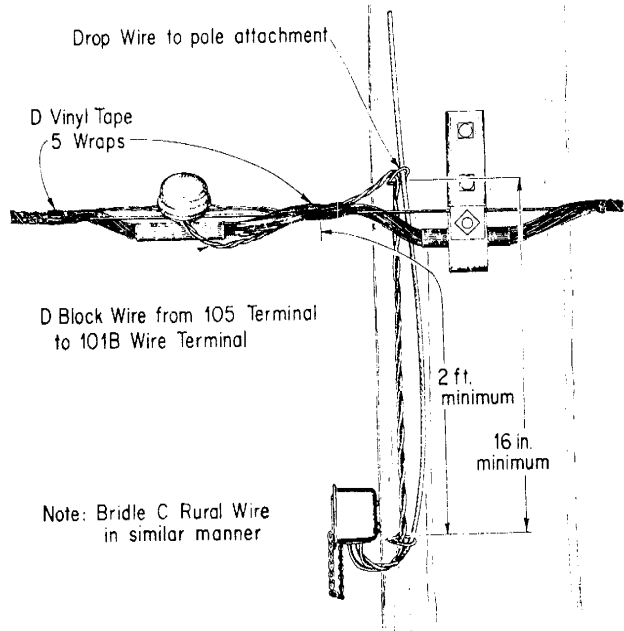
**Fig. 17 — Open Wire on Crossarm**



**Fig. 18 — Open Wire on Brackets, Same Side of Pole**



**Fig. 19 — Open Wire on Brackets**



**Fig. 20 — Rural Wire B, D, and E**



## DROP AND BLOCK WIRING STRAND ATTACHMENTS

### 1. GENERAL

1.01 This section covers the use of span clamps for attaching drop wire to suspension strand, and the methods of running drop wire from span clamps to poles.

1.02 This section is reissued to include the description and use of the E Span Clamp which supersedes the D Span Clamp.

1.03 The E Span Clamp (Fig. 1) was designed to be used on suspension strand and the jacketed strand of self-supporting cable. *However, when the E Span Clamp is used on suspension strand supporting lashed lead sheath cable, a B Cable Guard must be placed around the cable beneath the Span Clamp to provide mechanical protection from the jaws of the clamp (Fig. 5).*

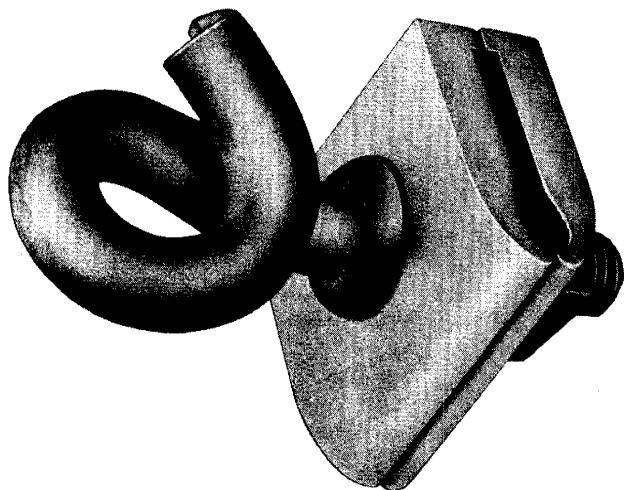


Fig. 1—E Span Clamp

### USE

1.04 Span Clamps should be used only when it is impractical to attach the customer's drop wire directly from a pole. Some of the conditions which will necessitate the use of span clamps are:

- (a) Right-of-way difficulty in crossing private property
- (b) To avoid trees, clothes lines, and other obstructions
- (c) Where guard arms would otherwise be necessary to provide pole climbing space
- (d) Where a number of attachments to a masonry building can be avoided.

### 2. PLACING SPAN CLAMP

2.01 Span clamps are placed on suspension strand as follows (Fig. 2):

◆ *Note:* The precautions covered in Section 627-295-500 must be observed when a span clamp is to be placed by a craftsman working from a ladder or other strand supported device.◆

- (1) Place the clamp on the strand so the hook will be in a vertical position facing the building to be served and the open eye of the hook will face away from the pole to which the drop wire will be attached.
- (2) On lashed cables, position the span clamp between adjacent wraps of lashing wire so the wire will not be under the jaws of the clamp.
- (3) ◆ On lashed lead sheath cables, place a B Cable Guard on the cable beneath the span clamp to protect the sheath from the jaws of the clamp.◆
- (4) Securely tighten the span clamp nut to the strand.

*Note:* The possibility that the drop wire clamp will become detached from the span clamp is eliminated by placing the span clamp so the open eye of the clamp is away from the pole to which the drop is running.

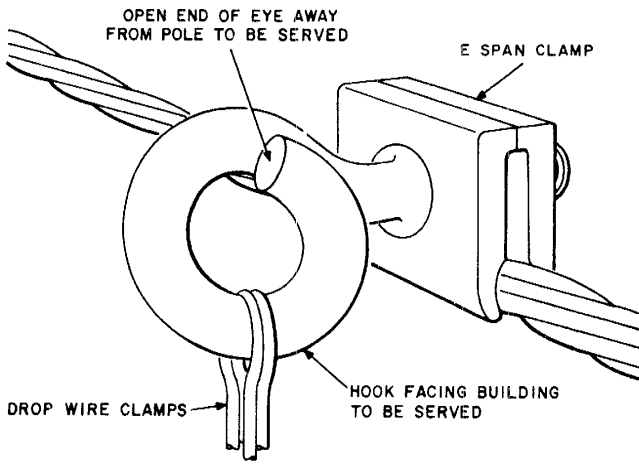


Fig. 2—E Span Clamp on Strand

2.02 Where the span clamps are placed on 2.2M suspension strand which supports lashed or ring-supported block cable, it will be necessary to place a serving of 0.045 lashing wire on the strand before installing the clamp. The wraps should be spaced about 1/4 inch apart and cover about a 3-inch length of strand. After the clamp is tightened on the wire-wrapped strand, cut off the excess length of wire serving which falls outside the ends of the clamp. On lashed block cable, protect the cable sheath under the clamp with a B cable guard.

3. RUNNING DROP WIRE FROM SPAN CLAMP TO POLE

3.01 Do not place more than two drop wires on the span clamp.

3.02 Where the distance between the span clamp and cable suspension bolt is over 3 feet, support the drop wire run as shown in Fig. 3 and 4.

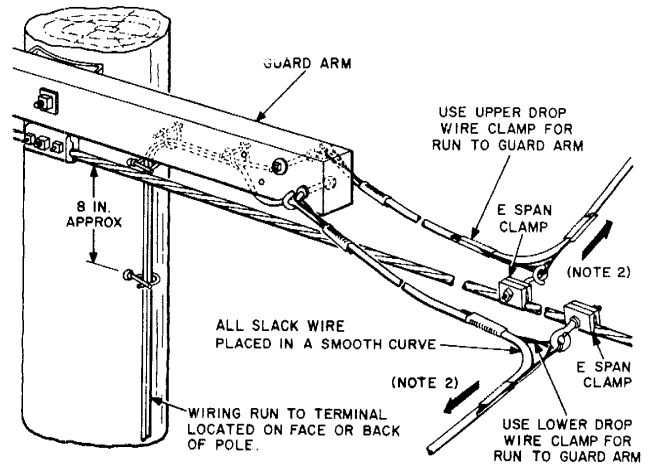
3.03 The following procedure should be used to obtain maximum separation between the drop wire and the cable (Fig. 3 and 4):

(a) If the open end of the span clamp hook is pointing *upward*, use the upper drop wire clamp to support the pole span, and the lower clamp to support the building span.

(b) If the open end of the span clamp hook is pointing *downward*, use the upper drop wire

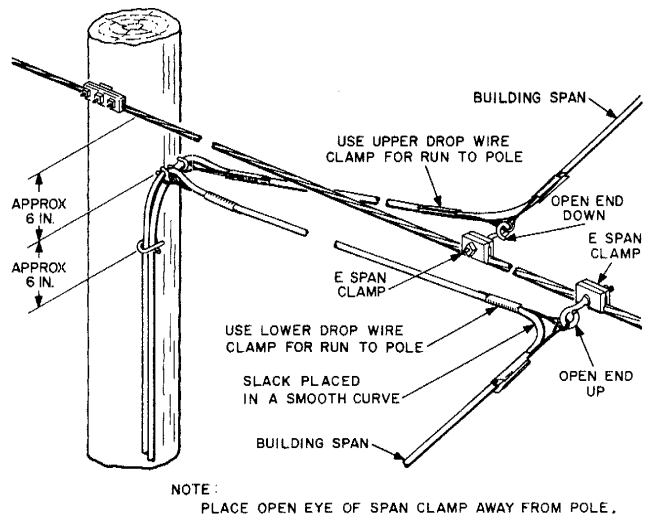
clamp to support the building span, and the lower clamp to support the pole span.

3.04 Where the distance between the span clamp and cable suspension bolt is 3 feet or less, support the drop wire span as indicated in Fig. 5 and 6.



- NOTES:
1. ATTACH DROP WIRE TO POLE INSTEAD OF GUARD ARM WHERE REQUIRED GROUND CLEARANCE CAN BE OBTAINED.
  2. IF THE SECOND DROP IS TO BE INSTALLED LATER IN THIS DIRECTION, SAME SPAN CLAMP MAY BE USED.
  3. PLACE OPEN EYE OF SPAN CLAMP AWAY FROM POLE.

Fig. 3—Spans to Guard Arm



- NOTE:
- PLACE OPEN EYE OF SPAN CLAMP AWAY FROM POLE.

Fig. 4—Spans to Drivehook on Pole



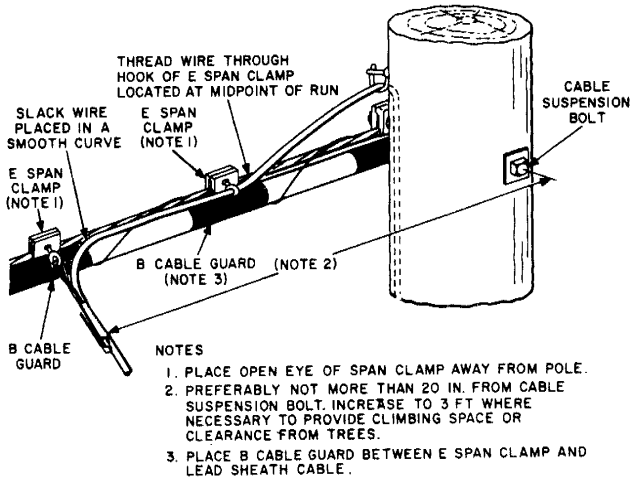


Fig. 5—Span Clamp Within 3 Feet of Cable Suspension Bolt (Lashed Cable)

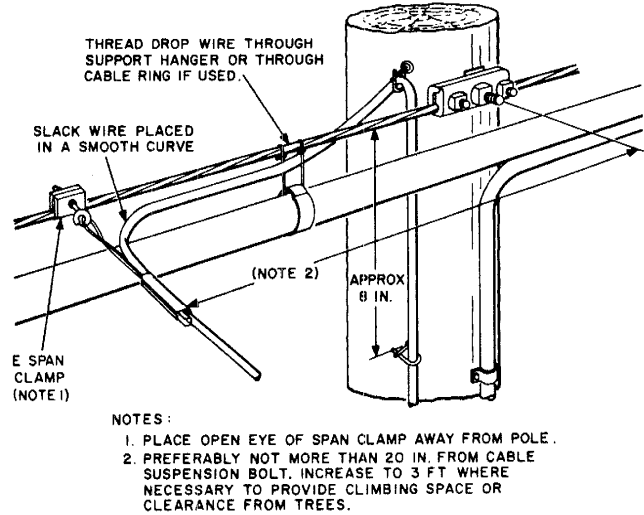


Fig. 6—Span Clamp Within 3 Feet of Cable Suspension Bolt (Ring-Supported Cable)



DROP AND BLOCK WIRING  
FASTENING AND EQUIPPING FIRST ATTACHMENTS FOR  
DROP WIRE RUNS ON BUILDINGS

1. GENERAL

- 1.001 This Addendum supplements Section 462-350-213.
- 1.002 This Addendum is being issued to revise methods of fastening and equipping first attachments to agree with requirements in Massachusetts.

3. RULES

The following changes apply to Part 3 of the Section.

(a) 3.01(a)(2) - revised

- 3.01 (a) (2) In states except Massachusetts NP, C and E Drop Wires and B and C Multiple Drop Wires working out of metal sheath cable shall be supported on uninsulated building attachments on all types of building walls. (Where station protection is required, the B and C Multiple Drop Wire shall be fully protected in accordance with Bell System Practices and N.E.T.&T. Co. Addenda covering Station Protection.)

In Massachusetts NP, C and E Drop Wires and B and C Multiple Drop Wires working out of metal sheath cable shall be supported on insulated building attachments on flammable building walls. (Where station protection is required, the B and C Multiple Drop Wire shall be fully protected in accordance with Bell System Practices and N.E.T.&T. Co. Addenda covering Station Protection.)



## DROP AND BLOCK WIRING

### FASTENING AND EQUIPPING FIRST ATTACHMENTS OF DROP WIRE RUNS TO BUILDING

#### 1. GENERAL

1.01 This section specifies:

- The rules to be followed in planning drop wire runs to buildings
- The methods of fastening and equipping first attachments
- The fastener to be used on various type surfaces.

1.02 This section is reissued to:

- Revise format of text
- Revise Tables A, B, C, and D
- Revise Fig. 5 and 7
- Add information on selection of fasteners and attachments.

1.03 The attachments to be used in any installation depend on a number of factors, such as:

- Loading areas
- Number of drops to be placed
- Angle at which drop approaches building
- Insulated or noninsulated attachments.

1.04 Drop wire attachments for use on all types of walls in heavy loading areas are listed in the section entitled Attaching Devices for Walls in Heavy Loading Areas.

1.05 Drop wire attachments for use on all types of walls in medium and light loading areas are listed in the section entitled Attaching Devices for Walls in Medium and Light Loading Areas.

1.06 The use of insulated or noninsulated attachments is covered in the section entitled Station Protection Required for Various Conditions of Plant and Exposure.

1.07 In order to obtain secure attachments and to avoid damage to building surfaces it is essential that the specific instructions covered in the section entitled Attachments and Fasteners, Description of Surfaces Encountered, be followed. Of particular importance are the clearance and lead holes for fasteners.

1.08 When attaching galvanized attachments on buildings with aluminum siding in highly corrosive areas (industrial and marine) observe the following:

- Apply a coating of KS-14681, List 1 anti-rust compound to the siding at the point of contact to prevent corrosive action.
- For method of application refer to division 080.

**Caution: It is possible for foreign voltage to be present on buildings covered with metal siding. Test siding with B voltage tester before starting any work.**

#### 2. RULES

2.01 In planning drop wire runs to buildings observe the following instructions:

- (a) Locate the first building attachment so that the drop span will have the required clearance from light or power wires, trolley wires, other foreign wires, and metallic objects.
- (b) Locate the first building attachment so as to avoid tree interference, keeping in mind the future growth of existing trees. It is preferable to make a longer wire run on the building if by so doing the trees can be cleared.
- (c) Locate the first building attachment so that the drop span can be placed with adequate sag.
- (d) *Where practical*, locate the first building attachment, when two or more drop wires to a building are involved, preferably at the same

point, bearing in mind that the locations of the initial and subsequent attachments should be such as to provide satisfactory wire runs in the span and on the building.

(e) *Where practical*, locate the first building attachment so the drop wire will make a direct vertical run to the last attachment, provided that the drop wire in the span would have adequate clearance from trees, would not be objectionable if it crosses adjacent property, or would not cross portions of vacant lots on which buildings are likely to be erected.

(f) *Where practical*, locate the first building attachment so that ice and snow falling from the roof will not strike the drop wire. If the drop wire in the span must pass under the

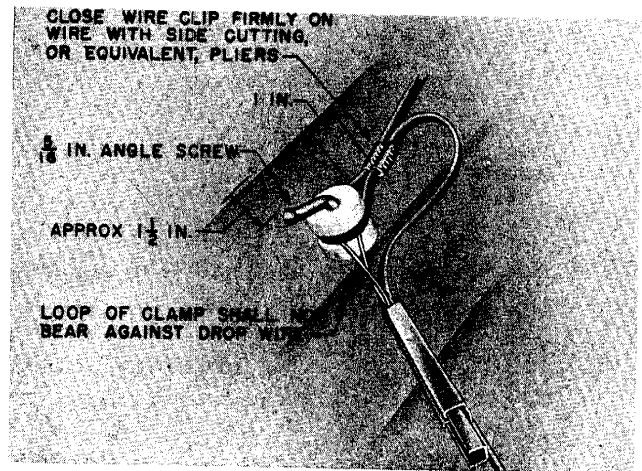
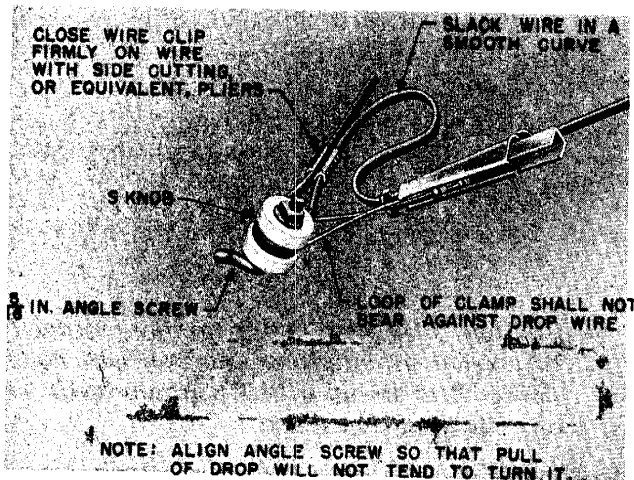
sloping part of a roof, make the first attachment as near the eaves as possible.

(g) Locate the first attachment so that anchors will not be placed less than 10 inches to a corner or top of a wall, except in turning corners.

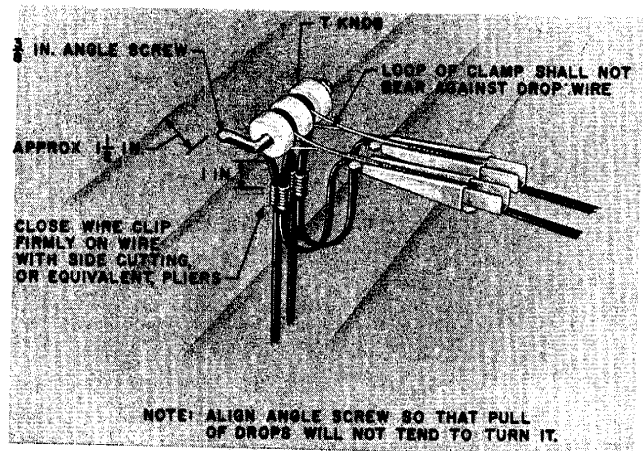
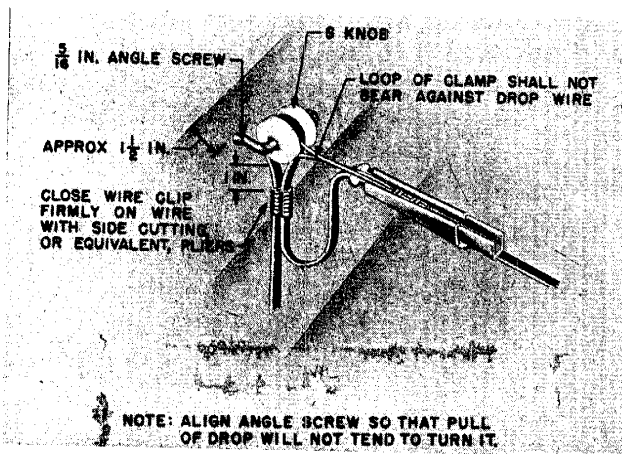
**3. TYPICAL FIRST ATTACHMENTS TO BUILDINGS AND STEEL STRUCTURES (Fig. 1 through 9)**

**3.01** Tables A, B, C, and D list anchoring devices of first attachments used on various surfaces.

**3.02** Table E lists equipping information for first attachments.



**Fig. 1 — First Attachment, Angle Screw (Drop Wire Run in Horizontal Direction on Building)**



**Fig. 2 — First Attachment, Angle Screw (Drop Wire Run in Vertical Direction on Building)**

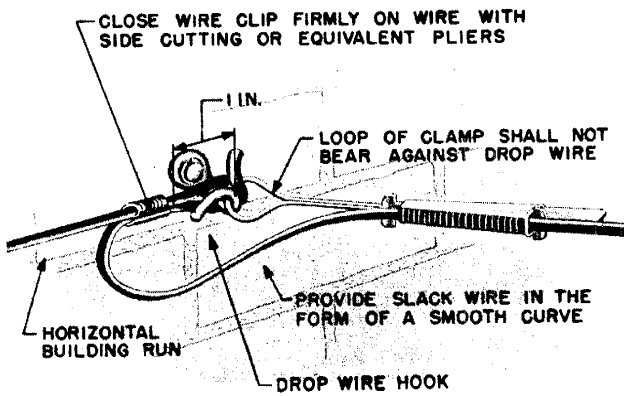


Fig. 3 — First Attachment, Drop Wire Hook

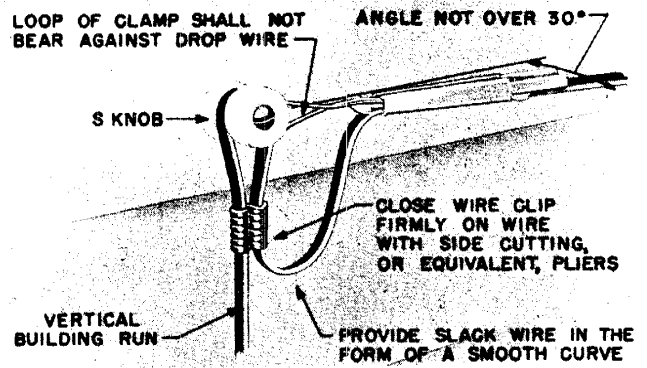


Fig. 4 — First Attachment, S Knob

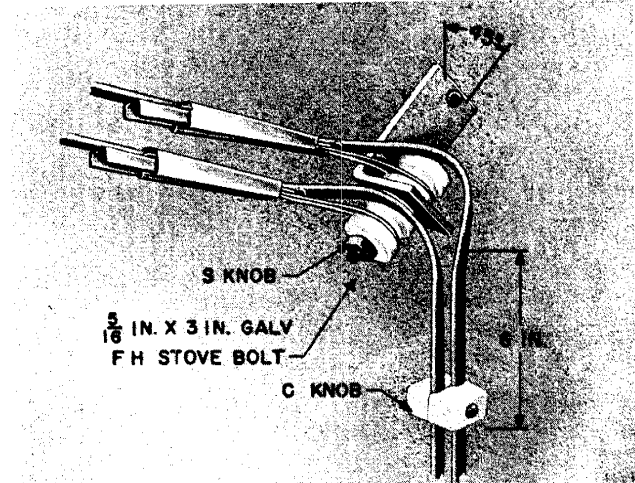
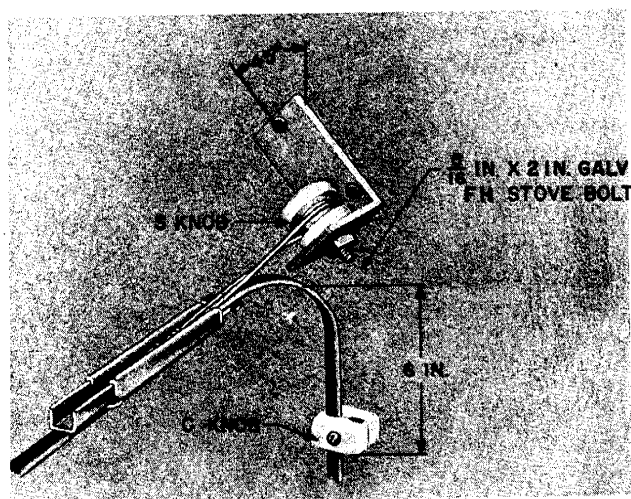
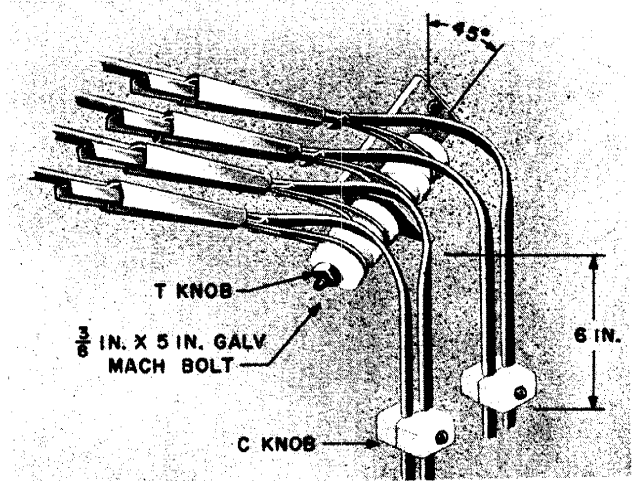
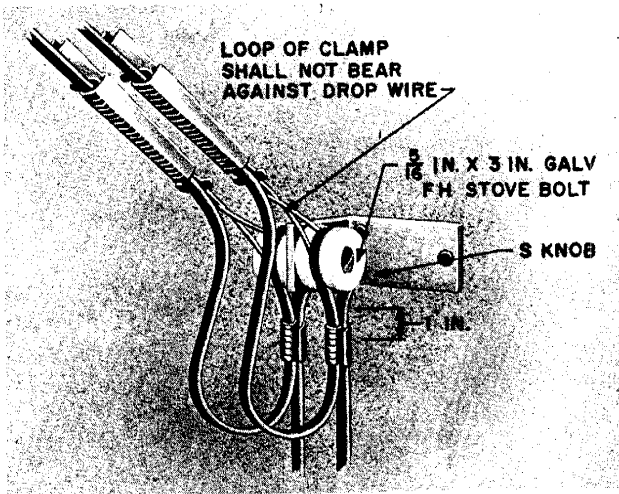


Fig. 5 — First Attachment, House Bracket (Drop Wire Run in Vertical Direction on Building)

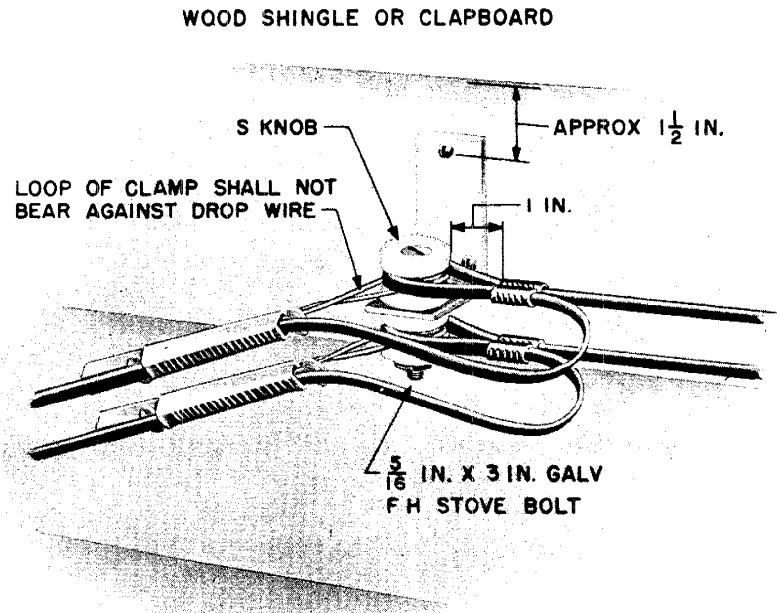


Fig. 6 — First Attachment, House Bracket (Drop Wire Run in Horizontal Direction on Building)

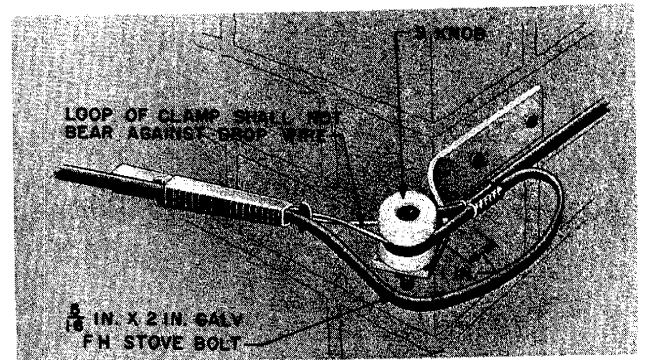
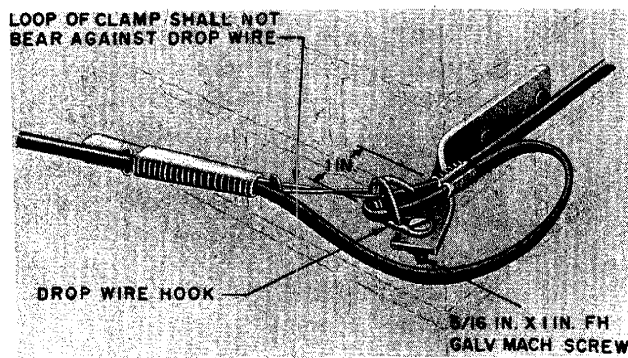


Fig. 7 — First Attachment, Corner Bracket



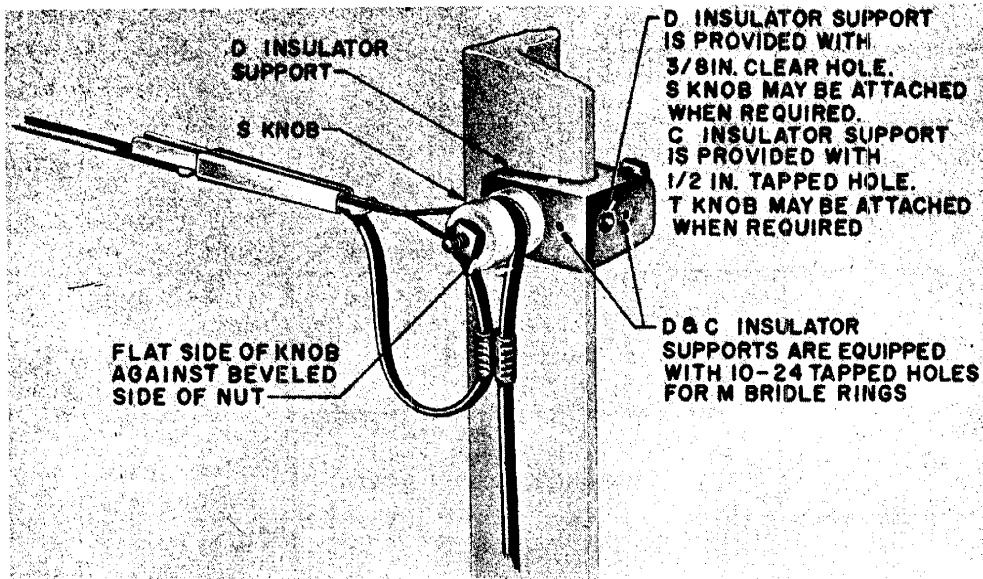


Fig. 8 -- First Attachment D or C Insulator Support

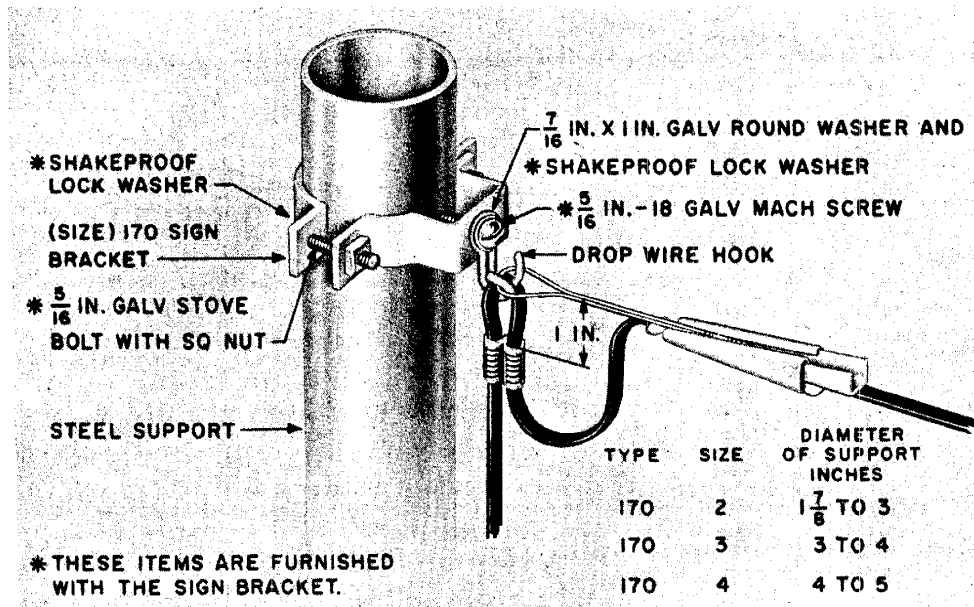


Fig. 9 -- First Attachment, Sign Bracket, 170 Type

**TABLE A**  
**FASTENERS FOR DROP WIRE HOOK**

Wall Type	Fasteners		Remarks
	Quantity	Type	
Wood Siding	1	2-in. No. 18 RH galvanized wood screw	Place screw in studding.
Stucco on Wood	1	2-in. No. 18 RH galvanized wood screw	Place screw in studding.
Rigid Composition Shingles	1	2-in. No. 18 RH galvanized wood screw	Drill clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer*	1	5/16-in. by 1-3/4-in. B drive anchor	Locate anchor in center of brick. Second drop wire hook should be located in separate brick.
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	1	6-in. No. 18 RH galvanized wood screw	Pass screw through the seam be- tween bricks. Penetrate wood backing approximately 1 inch.
Hollow Tile	1	5/16-in. by 5-in. RH galvanized toggle bolt	Place 7/16 in. by 2-in. galvan- ized square washer between wall and drop wire hook.

\* Do not use corner or top row of bricks.

**TABLE B**  
**FASTENERS FOR S AND T KNOBS**

Wall Type	Attach- ment Knob	Fasteners		Remarks	
		Quantity	Type		
Wood Siding	S	1	2-1/2 in. No. 18 FH galvanized wood screw	Place screw in studding.	
	T	1	3-1/2 in. No. 18 FH galvanized wood screw		
Stucco on Wood	S	1	3-in No. 18 FH galvanized wood screw	Use 3-1/2 in.	If necessary to penetrate studding.
	T	1	3-1/2 in. No. 18 FH galvanized wood screw	Use 4-1/2 in.	
Rigid Composition Shingles	S	1	3-1/2 in. No. 18 FH galvanized wood screw	Drill clearance hole to avoid splitting shingle.	
	T	1	4-1/2 in. No. 18 FH galvanized wood screw		
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	S	1	7-in. No. 18 FH galvanized wood screw	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.	
	T	1	7-in. No. 18 FH galvanized wood screw		
Hollow Wall	S	1	5/16 in. by 5 in. RH galvanized toggle bolt	Place flat side of S knob against bolt head.	
	T	1	5/16 in. by 6 in. FH galvanized toggle bolt		

**TABLE C**  
**FASTENERS FOR HOUSE BRACKETS**

Wall Type	Fasteners		Remarks
	Quantity	Type	
Wood Siding	3	2-in. No. 14 RH galvanized wood screws	Place screw in studding.
Stucco on Wood	3	2-1/2 in. No. 14 RH galvanized wood screws	Place screw in studding.
Rigid Composition Shingles	3	3-in. No. 14 RH galvanized wood screws	Drill clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer	2	5/16 in. by 1-1/4 in. B drive anchor	
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	2	6-in. No. 14 RH galvanized wood screws	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
Hollow Wall	2	1/4 in. by 3 in. or 4 in. RH galvanized toggle bolt	

**TABLE D**  
**FASTENERS FOR CORNER BRACKETS**

Wall Type	Fasteners		Remarks
	Quantity	Type	
Wood Siding	2	2-in. No. 14 RH galvanized wood screws	Place screw in studding.
Stucco on Wood	2	2-1/2 in. No. 14 RH galvanized wood screws	Place screw in studding.
Rigid Composition Shingles	2	3-in. No. 14 RH galvanized wood screws	Drill clearance hole to avoid splitting shingle.
Masonry or Substantial Brick Veneer	2	5/16 in. by 1-1/4 in. B drive anchor	
Thin Wall Brick Veneer (Less Than 3-3/4 Inch Thickness)	2	6-in. No. 14 RH galvanized wood screws	Pass screw through the seam between bricks. Penetrate wood backing approximately 1 inch.
Hollow Wall	2	1/4 in. by 3 in. or 4 in. RH galvanized toggle bolt	

**TABLE E**  
**EQUIPPING DROP WIRE ATTACHMENTS WITH S KNOB, T KNOB, OR DROP WIRE HOOK**

Attachments		Equipped with			Hardware	Remarks
		S Knob	T Knob	Drop Wire Hook		
Angle Screw	5/16 in.	1			Nut furnished	Place flat side of knob against beveled side of nut.
	3/8 in.		1			
House Bracket		1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of first knob against house bracket.
		2*			5/16 in. by 3 in. FH galvanized stove bolt	Place flat side of second knob against beveled side of nut.
			1		3/8 in. by 3 in. galvanized machine bolt	Place flat side of first knob against bolt head.
			2*		3/8 in. by 5 in. galvanized machine bolt	Place flat side of second knob against nut.
				1	5/16 in. by 1 in. FH galvanized machine screw	Obtained locally.
Corner Bracket		1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of knob against corner bracket.
		2*			5/16 in. by 3 in. FH galvanized stove bolt	Place flat side of top knob against bolt head and place nut against flat side of lower knob.
			1		3/8 in. by 3 in. galvanized machine bolt	Place flat side of knob against bolt head.
				1	5/16 in. by 1 in. FH galvanized machine screw	Obtained locally.
Insulator Supports	D	1			5/16 in. by 2 in. FH galvanized stove bolt	Place flat side of knob against beveled side of nut.
	C		1		3/8 in. by 3 in. galvanized machine bolt	
	D			1	5/16 in. by 1 in. FH galvanized machine screw	Obtained locally.
	C					
Sign Bracket, 170 Type				1	5/16 in. by 3/4 in. RH galvanized machine screw	Machine screw and lock washers furnished. Obtain 7/16 in. by 1 in. galvanized round washer locally.

\* Locate one knob above and one knob below bracket.

#### **4. FIRST ATTACHMENTS ON LOW BUILDINGS**

**4.01** Parts 4, 5, and 6 provide information on typical first attachments on low buildings using house fixtures provided by customers to obtain necessary ground clearance for drop wire.

**4.02** Where house clearance fixtures are required but have not been provided or where joint use of a fixture is impracticable, refer the matter to your supervisor.

**4.03** Where clearance fixtures are provided but the required minimum ground clearance for drops cannot be obtained, refer the matter to your supervisor.

#### **5. PRECAUTIONS**

**5.01** Observe the following precautions when planning attachment to a subscriber-owned clearance fixture.

- (a) Avoid climbing on roofs of subscriber premises.
- (b) Before making attachment, inspect fixtures, but do not make an attachment if there is any doubt as to the strength or firmness of the fixture.
- (c) On joint-use fixtures observe location of the power service drops in order to avoid body contact. Wear rubber gloves when making attachment to the fixture. Obtain a separation of at least 1 foot between telephone and power wires.

#### **6. CLEARANCE FIXTURES AND METHODS OF ATTACHMENT**

**6.01** Fig. 10 through 15 show types of clearance fixtures commonly provided by subscribers and the recommended methods of making drop wire attachment. Where other types of fixtures are provided and different methods of making drop wire attachments are required, local instructions should be issued.

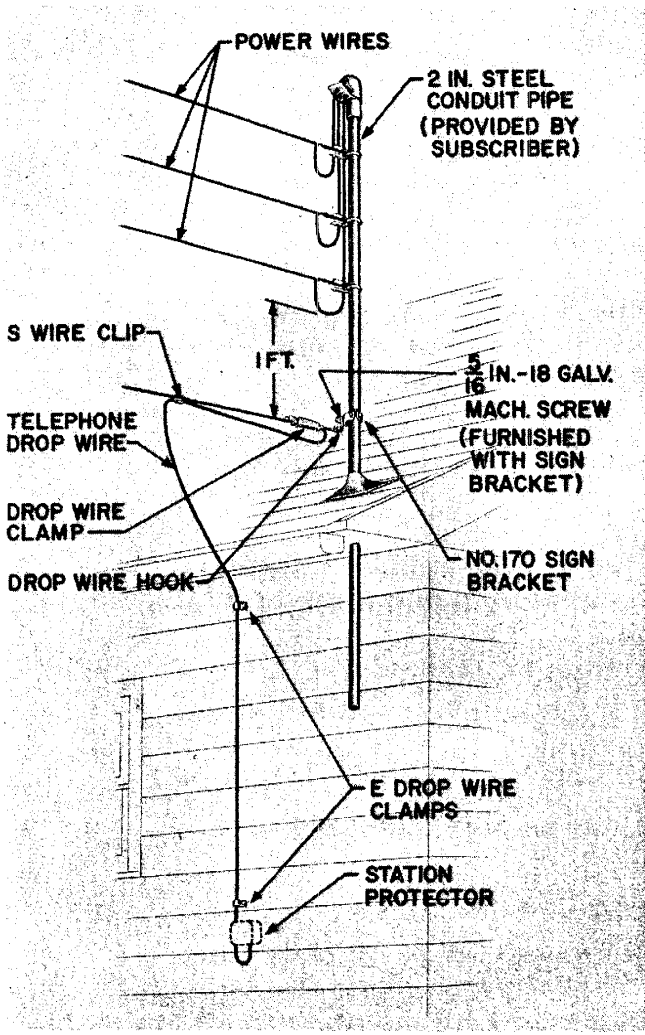


Fig. 10 — Drop Wire Attached to Power Fixture

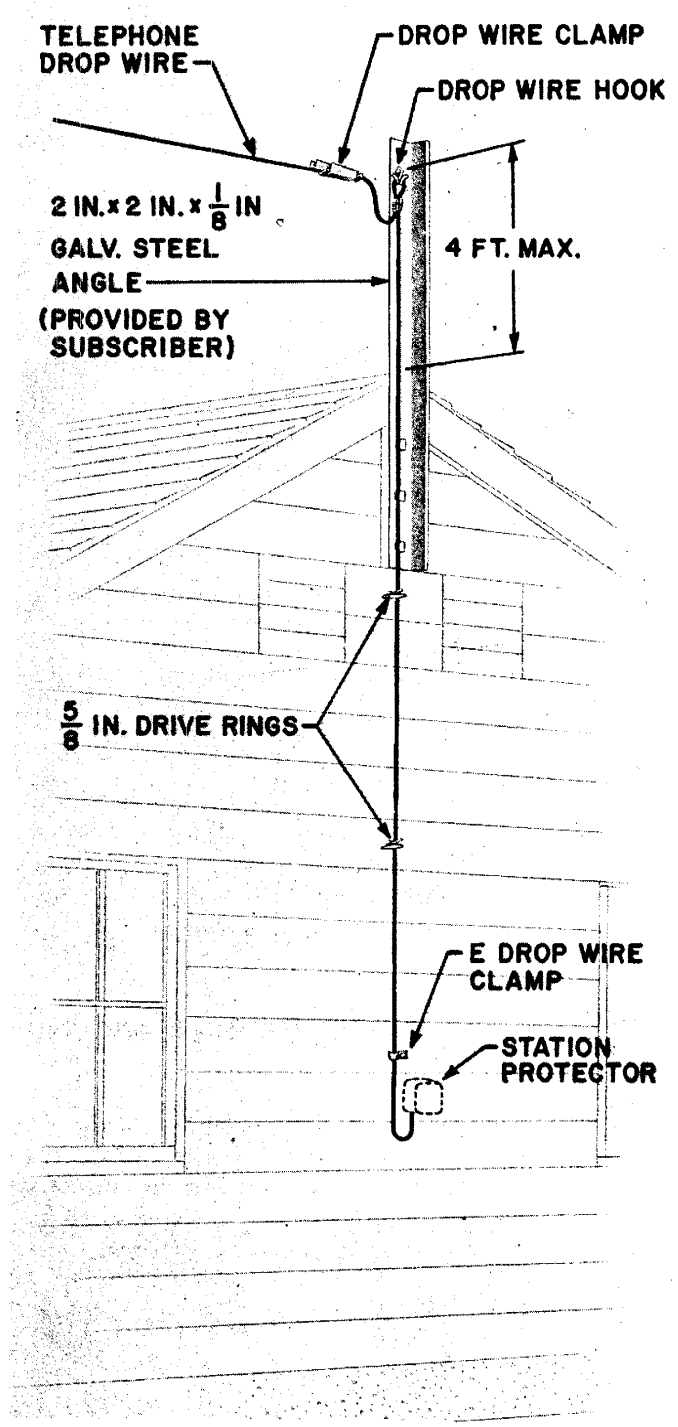


Fig. 11 — Drop Wire Attached to 2-Inch Angle Iron

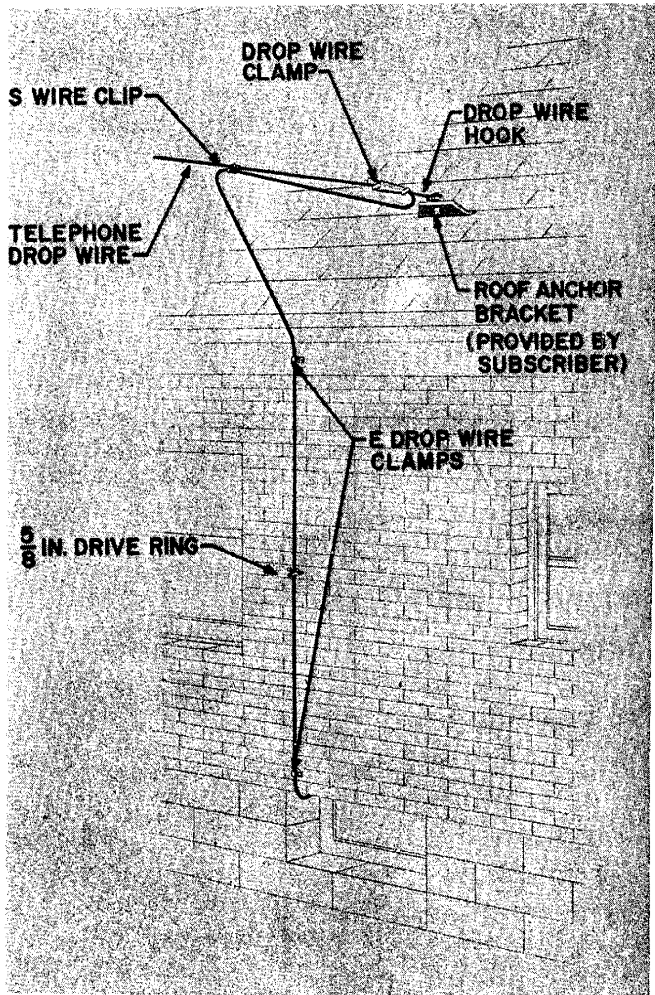


Fig. 12 — Drop Wire Attached to Roof Anchor Bracket

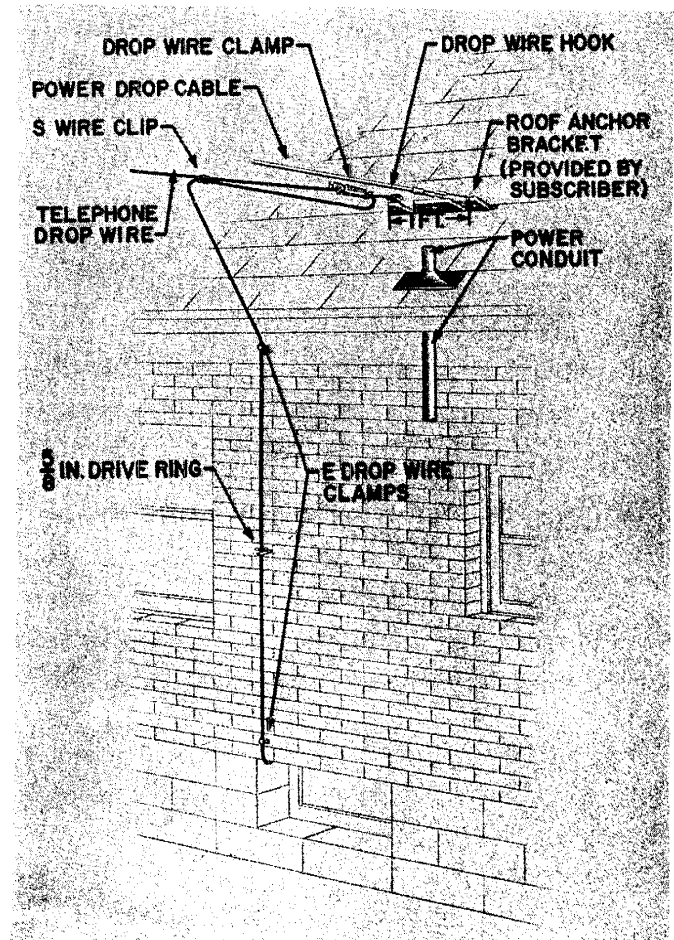


Fig. 13 — Drop Wire and Power Cable Attached to Roof Anchor Bracket

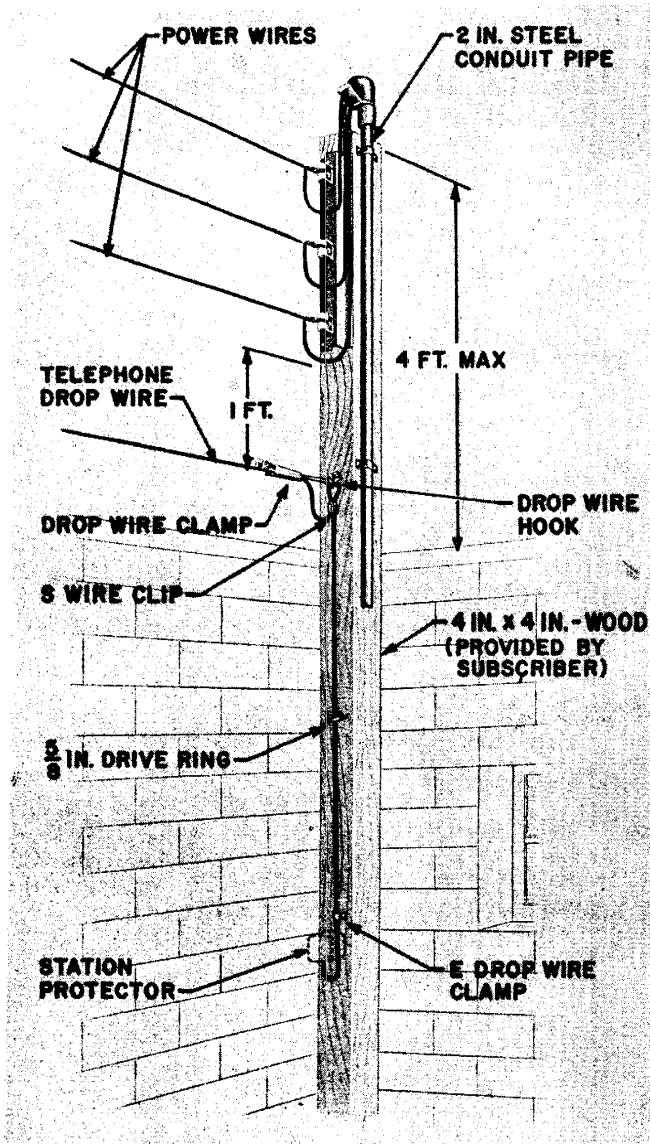


Fig. 14 — Drop Wire Attached to Subscriber Pole

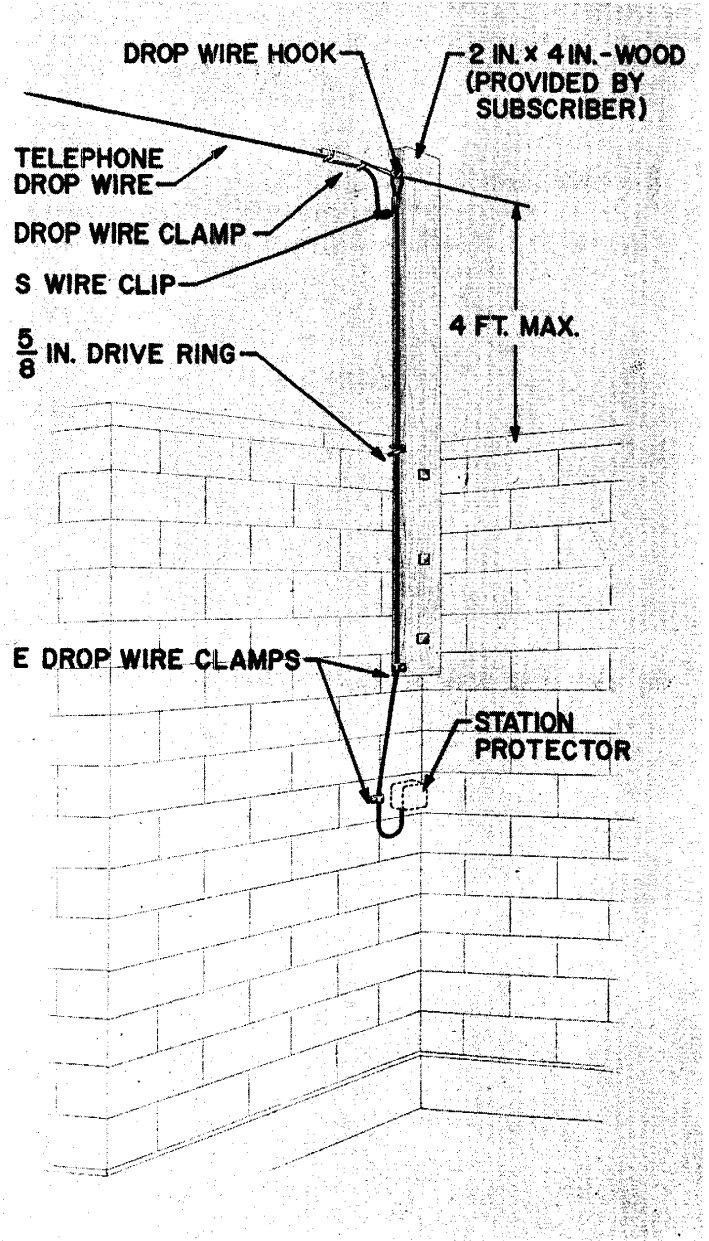


Fig. 15 — Drop Wire Attached to 2-Inch by 4-Inch Wood Beam



DROP AND BLOCK WIRING  
FASTENING AND EQUIPPING INTERMEDIATE AND LAST  
ATTACHMENTS OF DROP AND BLOCK WIRE RUNS ON BUILDINGS

1. GENERAL

1.001 This Addendum supplements Section 462-350-214.

1.002 This Addendum is being issued to revise methods of fastening and equipping intermediate and last attachments to agree with requirements in Massachusetts.

5. INTERMEDIATE ATTACHMENTS ON BUILDINGS

The following changes apply to Part 5 of the Section.

- (a) 5.02 - revised sentence
- (b) 5.04 - added paragraph

5.02 Revise second sentence to read:

Drive rings on wood frame buildings in states except Massachusetts. In Massachusetts drop or block wiring shall be separated from flammable building walls such as wood, stucco on wood, or metallic siding on wood and supported by insulated building attachments.

5.04 (Added paragraph): In Massachusetts exposed drop wire runs that require fused or fuseless protection and are attached to a flammable surface should be supported with insulated building attachments.

6. INTERMEDIATE ATTACHMENT INSIDE BUILDINGS

The following change applies to Part 6 of the Section.

- (a) 6.02 - added paragraph

6.02 (Added paragraph): In Massachusetts exposed runs that require fused or fuseless protection and attach to flammable surfaces should be supported with insulated attachments.

12. LAST ATTACHMENTS

The following change applies to Part 12 of the Section.

- (a) 12.02 - added paragraph

12.02 (Added paragraph): In Massachusetts on exposed or unexposed wires that pass through a flammable surface, use the C Knob.

13. BUILDING ENTRANCE HOLES FOR DROP AND BLOCK WIRES

The following change applies to Part 13 of the Section.

- (a) 13.02 - revised sentence

13.02 (Revise the last sentence): In place of plastic tube at building entrance hole on stations not requiring fused protection, except in Massachusetts.



## DROP AND BLOCK WIRING

### FASTENING AND EQUIPPING INTERMEDIATE AND LAST ATTACHMENTS OF DROP AND BLOCK WIRE RUNS ON BUILDINGS

#### 1. GENERAL

##### 1.01 This section specifies:

- The rules to be followed in planning drop and block wire runs on buildings.
- The methods of fastening and equipping intermediate and last attachments.
- The methods of running drop and block wire on building walls and structures.
- The methods of running drop and block wire inside of buildings.

##### 1.02 This section is reissued to:

- Revise format of text.
- Revise information on fasteners.
- Revise information on attachments.

##### 1.03 The attachments to be used in any installation depend on a number of factors, such as:

- Loading areas.
- Number of drops to be placed.
- Type of surface to be attached to.
- Insulated or noninsulated attachments.

##### 1.04 Drop wire attachments for use on all types of walls in heavy loading areas are listed in the section entitled Attaching Devices for Walls in Heavy Loading Areas.

##### 1.05 Drop wire attachments for use on all types of walls in medium and light loading areas are listed in the section entitled Attaching Devices for Walls in Medium and Light Loading Areas.

##### 1.06 The use of insulated or noninsulated attachments is covered in the section entitled Station Protection Required for Various Conditions of Plant and Exposure.

**1.07** In order to obtain secure attachments and to avoid damage to building surfaces it is essential that the specific instructions covered in the section entitled Attachments and Fasteners, Description of Surfaces Encountered, be followed. Of particular importance are the clearance and lead holes for fasteners.

**1.08** Plan the wire run so that the locations of the point of entrance and the location of the station protectors, where the latter are required, will conform to the rules covered in the section entitled Station Protection, Installation.

**1.09** Do not use block wire as any part of the connection between exposed plant and the protectors, except when used as the bridle fuse wire on stations served from open wire, C rural, or 19-gauge multiple line wire with a 123A1A protector. Block wire may be used on the station side of protector.

**Caution:** *It is possible for foreign voltage to be present on buildings covered with metal siding. Test siding with B voltage tester before starting any work.*

#### 2. RULES

**2.01** In planning drop and block wire runs on buildings observe the following instructions:

- Locate the drop or block wire run on the building with a view to permanency, accessibility, and appearance.
- Locate runs preferably on the rear and side walls of a building.
- Locate the run so as to require the minimum length of wire and as few turns as practicable. Keep runs horizontal or vertical.
- Locate horizontal runs above the reach of the public.

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- Locate vertical runs preferably in the angle formed by intersecting walls if this would not increase the length of the run appreciably.
  - Locate the run so as to avoid light and power wires and so that it will encounter a minimum number of other obstructions.
  - Avoid runs on tin, sheet metal, or other materials requiring frequent repairs or renewals.
  - Avoid locating runs on walls which are likely to be added to or on intermediate structures of a deteriorated or temporary construction. Select alternate route.
  - Avoid vertical runs within 2 feet of a downspout where ice conditions are severe.
  - Do not make attachments to chimneys.
  - On building walls finished with stucco, rigid composition shingles, thin-wall brick veneer, and similar materials, locate attachments on wood trim if practicable and if the trim is sufficiently substantial to provide adequate support for the drop wire.
- 2.02** Reuse an existing block wire at a reinstallation wherever practicable. Inspect the wire carefully and if necessary:
- (1) Tighten all loose rings and replace missing rings.
  - (2) Remove excess slack in run.
  - (3) Place protection where necessary around leaders, electrical conduits, and other obstructions.
  - (4) If the insulation is weatherworn to such an extent as to indicate that the service is likely to be impaired in the near future because of low insulation, replace the portion which would be likely to introduce trouble.
- (5) Remove strings or other foreign matter which may detract from wire run appearance.
- ### 3. SPACING OF ATTACHMENTS
- 3.01** Space drop wire attachments 9 feet apart or less on horizontal runs and 12 feet apart or less on vertical runs.
- 3.02** Space block wire attachments 4 feet apart or less on horizontal runs and 8 feet apart or less on vertical runs.
- 3.03** Locate attachments so that fasteners will not be placed closer than 10 inches to the corner or the top of a wall, except in turning corners.
- 3.04** Place additional attachments as required to keep exposed wires terminated at fused-type protectors from touching flammable surfaces.
- 3.05** Where windows are available for making attachments on vertical runs, place an attachment at each floor.
- 3.06** When establishing a wire run on a building wall where cable has been placed, the wire run should, in general, parallel the cable run.
- (a) When paralleling cable is attached to building wall by cable clamps, place rings in every third cable clamp where clamps are 17 inches apart and in every other cable clamp where clamps are 26 inches apart.
  - (b) When paralleling cable is placed on strand, place separate cable rings for block wires and space them at double the spacing of the cable rings.
- ### 4. WIRE CARRYING CAPACITIES OF DRIVE RINGS, WIRE LOOPS, BRIDLE RINGS, AND INSULATED SCREW EYES
- 4.01** Table A indicates the fastener to be used on drop and block wire attachments on various types of walls.

**TABLE A**  
**FASTENERS FOR INTERMEDIATE ATTACHMENTS ON DROP AND BLOCK WIRE**

Attachment		Fastener		Type of Construction		Remarks
		Quantity	Type			
B Wire Loops	No. 1/2 No. 5/8 No. 7/8 No. 1-1/4	1	D Masonry Fastener	No. 3	Concrete	Fasteners for hand-type drive tools
				No. 4	Mortar	
				No. 5	Cinder Cement	
Drive Rings	1/2 in.	1	3/16 in. x 5/8 in. D Drive Anchor	Masonry or substantial brick veneer		
	5/8 in. and 7/8 in.	1	1/4 in. x 1 in. D Drive Anchor			
	5/8 in. L* 7/8 in. L* 1-1/4 in. 1-1/4 in. L*	1	1/4 in. x 1 in. D Drive Anchor			
C Bridle Rings	7/8 in.	1	No. 12 D Plastic Anchor	Masonry or substantial brick veneer		
	1-1/4 in. 1-5/8 in.	1	No. 16 D Plastic Anchor			
	3 in.					
B or M Bridle Rings		1	B beam clip insulator support	Angle irons, I beams, etc		
C Knob (used only where fused protectors are required)		1	2-1/2 in. No. 10 RH galvanized wood screw	Exposed woodwork (outdoors)	Locate screw ap- proximately 1 in. above bottom shingle or clap- board.	
		1	2 in. No. 8 RH blued wood screw	Exposed woodwork (indoors)		
		1	3 in. No. 10 RH galvanized wood screw	Stucco on wood		
E Drop Wire Clamp		1	B Masonry Fastener	No. 3	Concrete	Fasteners for hand-type drive tools
				No. 4	Mortar	
				No. 5	Cinder Cement	
		1	3/16 in. x 1 in. B Plastic Anchor	Brick		
	1	1 in. No. 8 RH galvanized wood screw	Wood siding or shingle and Metallic siding on wood	Locate screw ap- proximately 1 in. above bottom shingle or clap- board.		
	1	3/16 in. x 3 in. toggle bolt	Hollow wall			

\* The L type is equipped with longer shank.

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**4.02** Table B indicates the drop, block, and multiple drop wire capacity of wire loops, drive rings, bridle rings, and insulated screw eyes.

**5. INTERMEDIATE ATTACHMENTS ON BUILDINGS**

**5.01** Make all vertical or horizontal attachments on a straight line. For best results, stretch a chalk line between the two points of the run, check that the line is tight and snap it squarely against the wall. Use this as a guide line.

**5.02** Drop or block wires extending from unexposed plant should be supported with the following attachments:

- Drive rings on wood frame building.

- B wire loops and a suitable D masonry fastener on masonry surfaces.

- Toggle bridle rings on hollow surfaces.

- Bridle rings as a substitute for drive rings when:

(a) Drive rings are likely to split wood-work.

(b) An intermediate support is needed for greater wire carrying capacity.

**5.03** Drive rings equipped with a D drive anchor or C bridle rings equipped with a D plastic anchor may be used on masonry surfaces if they can be used in situations to better advantage than B wire loops.

**TABLE B**

Type of Ring or Insulated Screw Eye	Size	Maximum Number of Wires		
		NP, C, or E Drop Wire	Block Wire	Multiple Drop Wire
Drive Rings	1/2	2	3	0
	5/8 and 5/8 L*	6	9	1
	7/8 and 7/8 L*	16	22	2
	1-1/4 and 1-1/4 L*	30	40	5
B Wire Loops†	No. 1/2	2	3	0
	No. 5/8	6	9	1
	No. 7/8	16	22	2
	No. 1-1/4	30	40	5
C Bridle Rings	7/8	6	9	1
	1-1/4	16	22	2
	1-5/8	30	40	5
	3	100	140	16
B or M Bridle Ring	1-1/4	16	22	2
Insulated Screw Eyes	5/8 S and L*	4		0
	1 S and L*	10		1

\* L represents longer shank.

† Install with suitable D masonry fasteners.

5.04 Exposed drop wire runs that require fused protection and that are to be attached to a flammable surface should be supported with:

- Insulated screw eyes.
- C knob may be used if not more than two wires are to be placed.

5.05 Fig. 1 through 9 illustrate spacing of typical wire runs using a variety of attachments.

6. INTERMEDIATE ATTACHMENT INSIDE BUILDINGS

6.01 Drop wire runs between the point of entrance and the station protector should be kept as short as practicable.

6.02 Exposed runs that require fused protection and attach to flammable surfaces should be supported with insulated attachments.

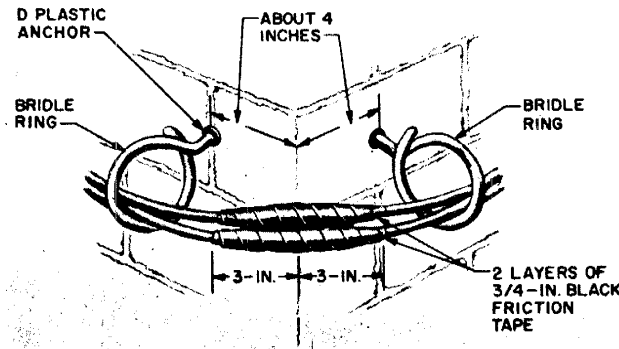


Fig. 1 — Bridle Ring

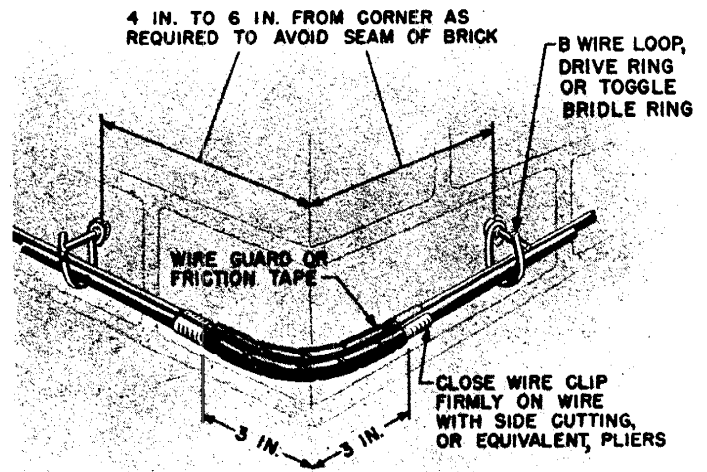
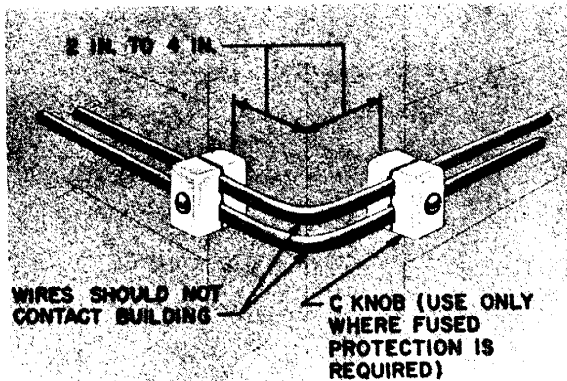


Fig. 2 — Intermediate Building Attachment at Outside Corner

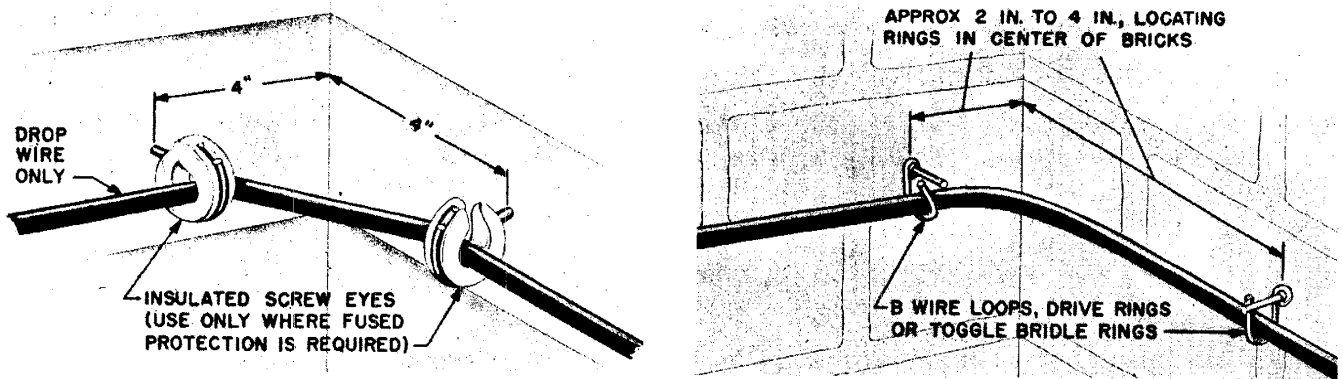


Fig. 3 — Intermediate Building Attachments at Inside Corners

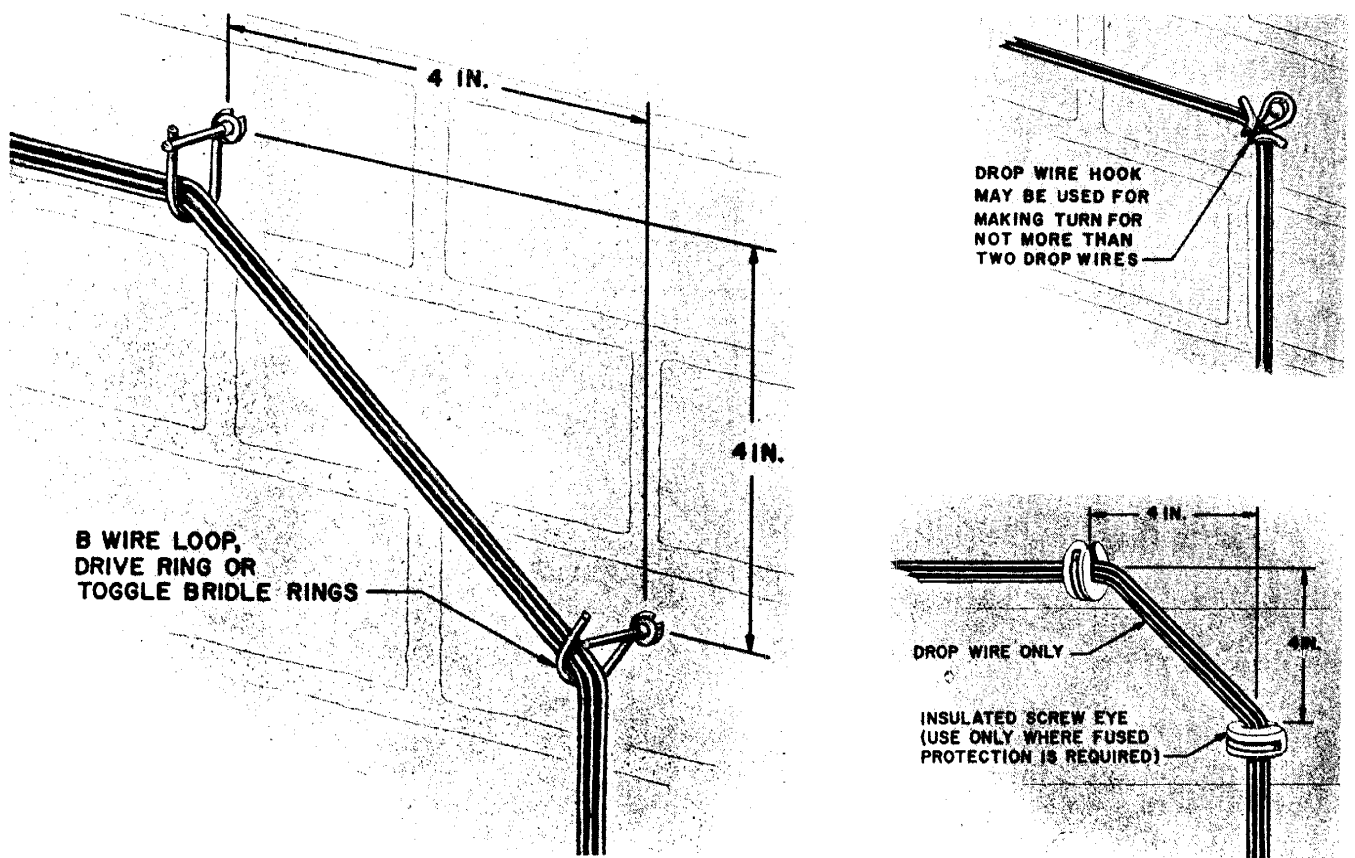


Fig. 4 — Intermediate Building Attachments to Change Direction of Wire Run



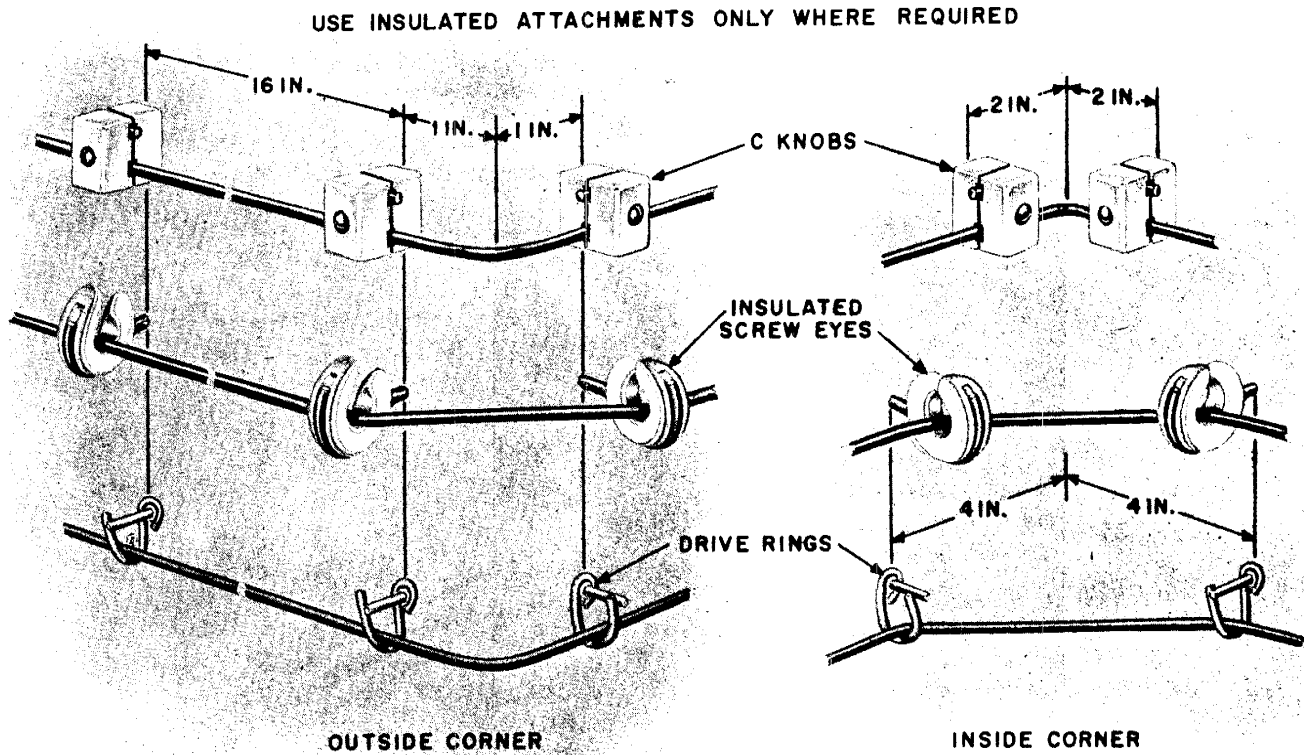


Fig. 5 — Attachments Inside of Building

**6.03** Space attachments 16 inches apart on runs between the point of entrance and the protector or connecting block. Spacing will vary at corners with type of attachment used. (See Fig. 5.)

**6.04** Where drop or block wires are extended from unexposed plant, or where block wire is extended from the station side of a fuseless protector, the method of fastening between the point of entrance and the connecting block or subscriber set is the same as for fastening station wire.

## 7. PARALLELING CABLE RUN

**7.01** When establishing a wire run on a building wall where cable has been placed, the wire run should be attached as described below:

(a) *Cable run attached with clamps* (Fig. 6)

Place a drive ring or a C bridle ring in every third cable clamp where clamps are 17 inches apart and in every other clamp when they are 26 inches apart.

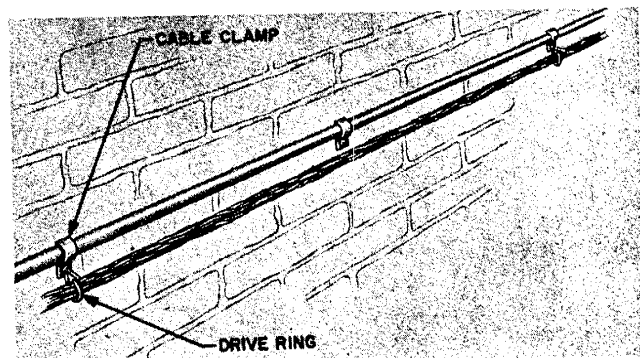


Fig. 6 — Drive Ring or Bridle Ring Run Paralleling Cable Attached with Cable Clamps

(b) *Cable run supported by strand* (Fig. 7)  
 Attach cable rings on the outside of the cable run and space them at double the spacing of the cable ring.

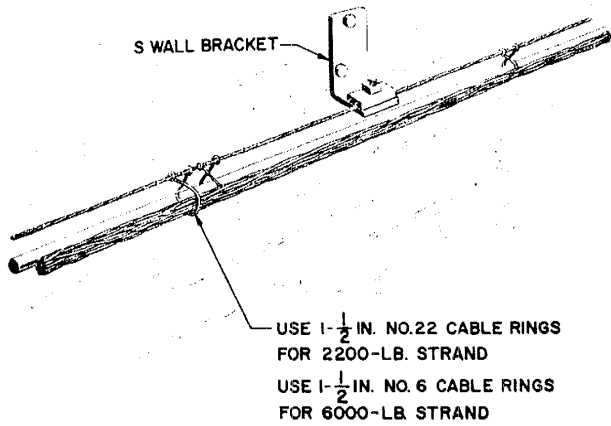


Fig. 7 — Wire Run in Cable Rings Paralleling Cable Supported with Strand

8. ATTACHING TO STEEL STRUCTURES

8.01 Manufacturing buildings, warehouses, piers, etc, require special means of attaching. Methods of attaching which have proven practicable in such cases are illustrated below.

(a) The B beam clip (Fig. 8) equipped with either a drive ring or the B or M bridle ring is used to support wire runs on I beams, angle irons, etc, on beam thickness of 1/8 inch to 1/2 inch.

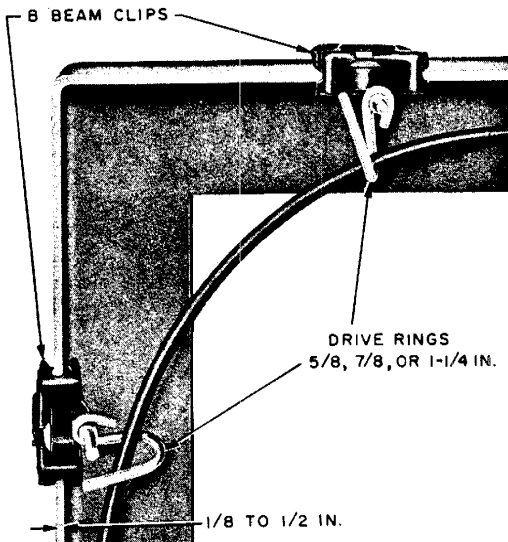


Fig. 8 — B Beam Clips

(b) B, C, or D insulator supports equipped with C or T knobs, bridle rings, or a one bolt clamp can be used in various applications to attach to I beams, angle irons, etc.

- B insulator support (Fig. 9) will accommodate B or M bridle rings only. It can be attached to steel structures up to 3/4 inch in thickness.

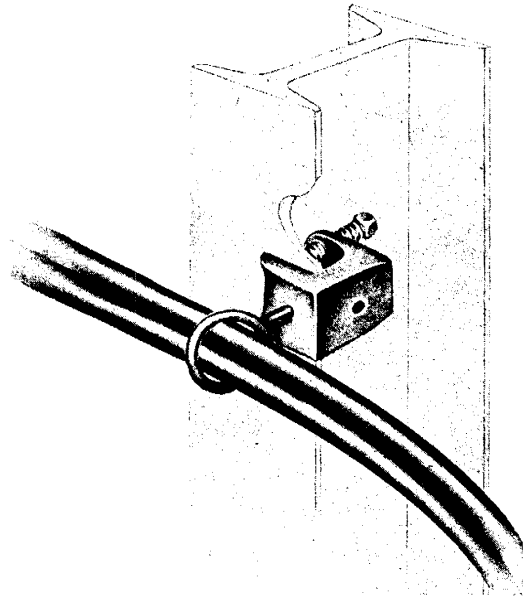


Fig. 9 — B Insulator Support and Bridle Ring

- C insulator support (Fig. 10) will accommodate T knobs, one bolt clamps, and B or M bridle rings. It can be attached to steel structures up to 1 inch in thickness.

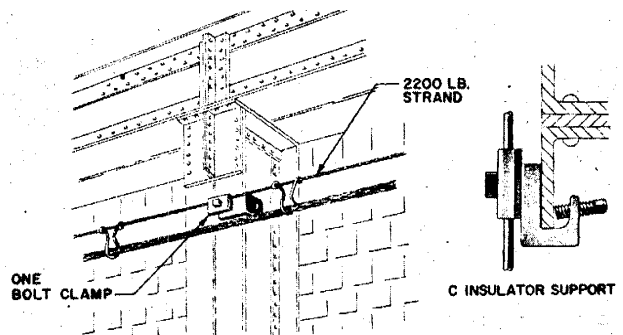


Fig. 10 — C Insulator Support and One Bolt Clamp

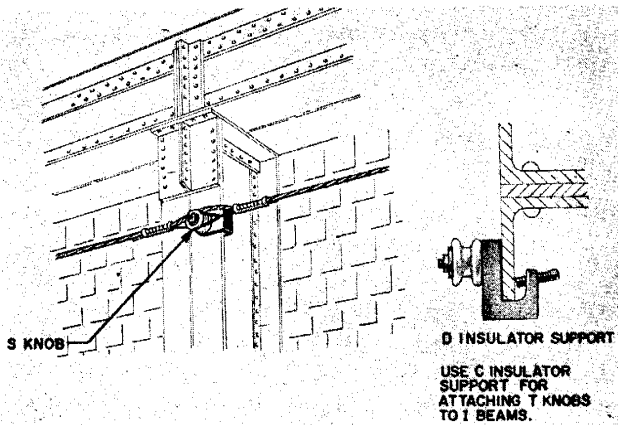


Fig. 11 - D Insulator Support and S Knob

- D insulator support (Fig. 11) will accommodate S knobs or B or M bridle rings. It can be attached to steel structures up to 3/4 inch in thickness.

**9. AERIAL BLOCK WIRE SPANS**

- 9.01** Block wire must not be used in aerial spans that will introduce an exposure.
- 9.02** Where aerial span crosses driveway or private property, provide proper clearances.
- 9.03** Where span is 5 feet or less, bridle wire may be run without special supports, that is, without being attached to knobs or drop wire hooks at the ends of the span. Where a good appearance is not essential and the run is out of the reach of children, this distance of unsupported bridle wire may be increased to 12 feet. Where span is longer than this distance, use construction specified in 9.04 through 9.06.

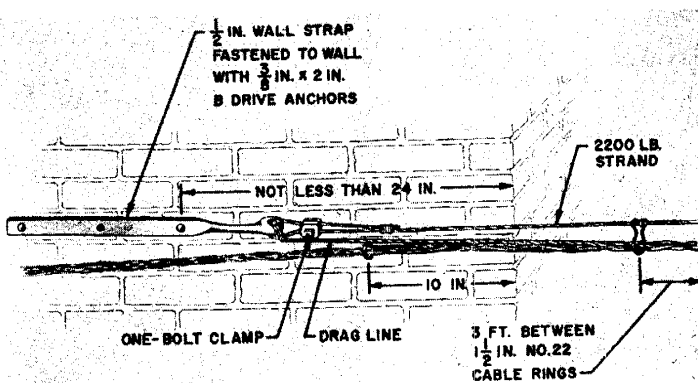


Fig. 13 - Span in Line with Wall

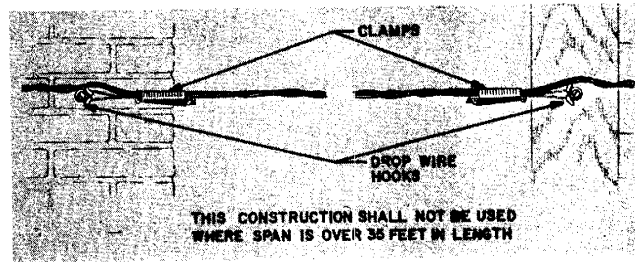


Fig. 12 - Span Less than 35 Feet in Length

- 9.04** Where only a few bridle wires will be run and the span is 35 feet or less in length, the construction shown in Fig. 12 may be employed.
- 9.05** Where span is more than 35 feet in length, use either drop wire attached at each end on drop wire hooks or bridle wire supported on 2200-pound strand as specified in 9.06.
- 9.06** Where span exceeds lengths specified in 9.03 or 9.04, bridle wire may be run in 1 1/2-inch No. 22 cable rings attached to 2200-pound strand. Space cable rings 3 feet apart. Place a drag line in the rings of the crossing span at the time they are attached. The drag line should always be replaced after it has been used for pulling wires across the aerial block wire span. This may be done at the time of pulling in additional wires by attaching a new drag line to the existing line and pulling the new line into the rings at the same time the wire is pulled in. Tie the drag line at the end of the strand. (See Fig. 13, 14, and 15.)

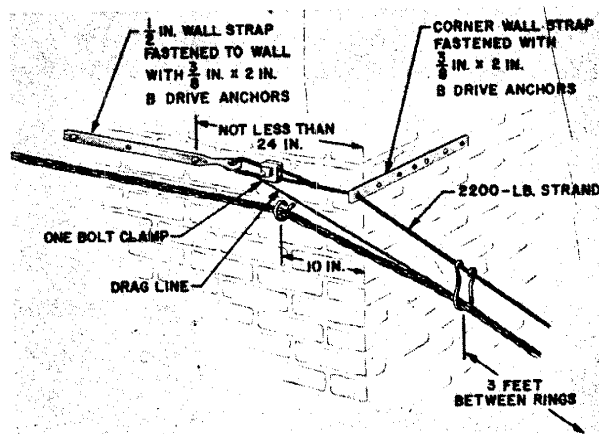


Fig. 14 - Span from Corner of Wall

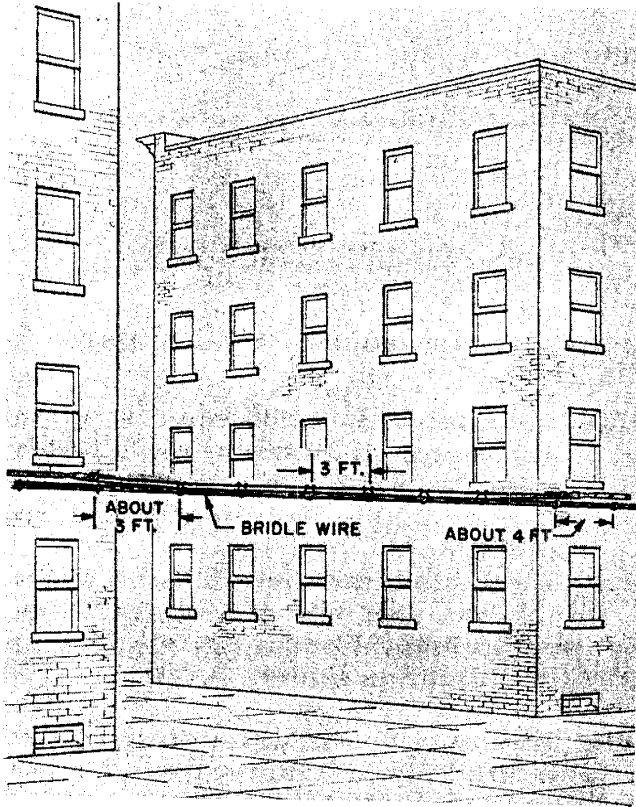


Fig. 15 -- Strand Run

9.07 Fasten 1/2-inch wall strap to wooden building with two 3/8- by 4-inch coach screws installed in studding. Bore 1/4-inch lead holes for drive screws.

**10. EQUIPPING AND INSTALLING W LEADER BRACKET**

10.01 The W leader bracket is a metal strap designed to be installed over small obstructions such as pipes, rain spouts, etc, on walls. The bracket will clear obstructions extending 5

inches from wall surfaces. The W leader bracket has a single-tapped hole in the center for equipping it with a B or M bridle ring.

**11. PARTY LINE TAPS**

11.01 In making a party line connection, a bridge may be made at the most accessible point in an existing wire run, provided that this point is 50 feet or more away from the terminal or if there is no space available on the binding posts for terminating the new party. If the most convenient point for bridging in the run is within 50 feet of the terminal, run the wire to the terminal, provided that there is space available on the binding posts.

**12. LAST ATTACHMENTS**

12.01 The last attachment should be located within 18 inches of the building entrance hole.

12.02 Use the C knob on exposed wires that pass through a flammable surface. The E drop wire clamp is used in unexposed wires.

12.03 Fig. 16 and 17 illustrate typical arrangements of last attachments.

**13. BUILDING ENTRANCE HOLES FOR DROP AND BLOCK WIRES**

13.01 Use plastic tubes at building entrance holes for drop wire where fused protection is required and the wire passes through a flammable surface. Place tube as shown in Fig. 18. Cut plastic tubes with a hack saw or diagonal pliers. Do not use split tubes at entrance holes.

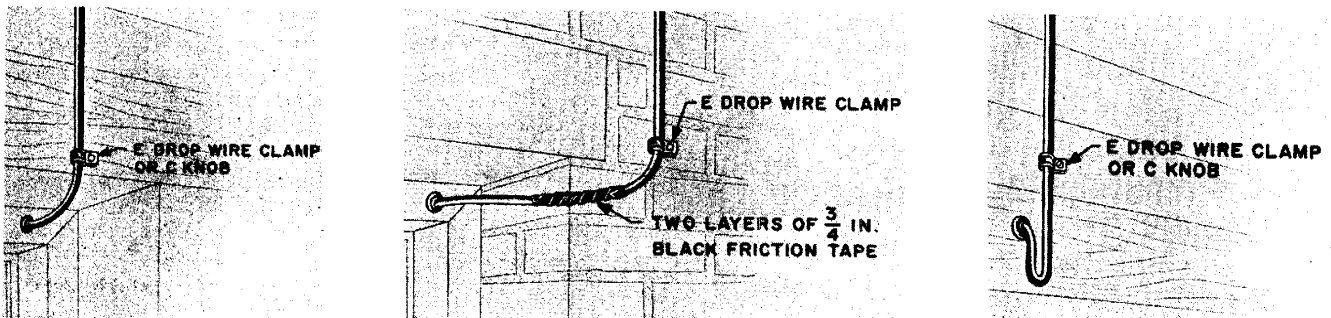


Fig. 16 -- Last Attachment, Building Entrance Slopes Upward from Outside

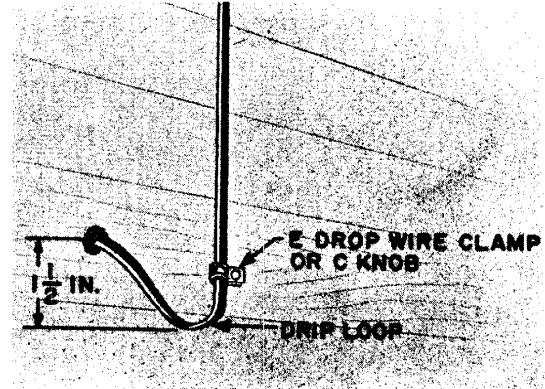
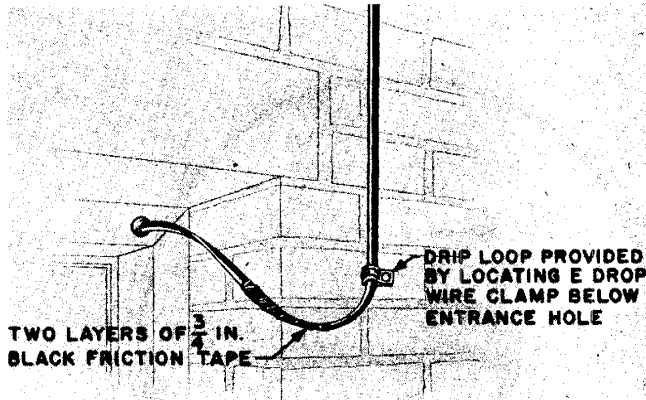


Fig. 17 – Last Attachment, Building Entrance Hole Does Not Slope Upward from Outside

**13.02** The B entrance plug (Fig. 19) is intended primarily for use with NP, C, or E drop wires and is furnished in  $\frac{1}{2}$ - and  $\frac{3}{4}$ -inch diameter sizes. This plug may be used:

- To seal unused entrance holes in buildings to prevent entrance of rain, wind, insects, etc.

- To mechanically protect wire against abrasion.
- In place of plastic tube at building entrance hole on stations not requiring fused protection.

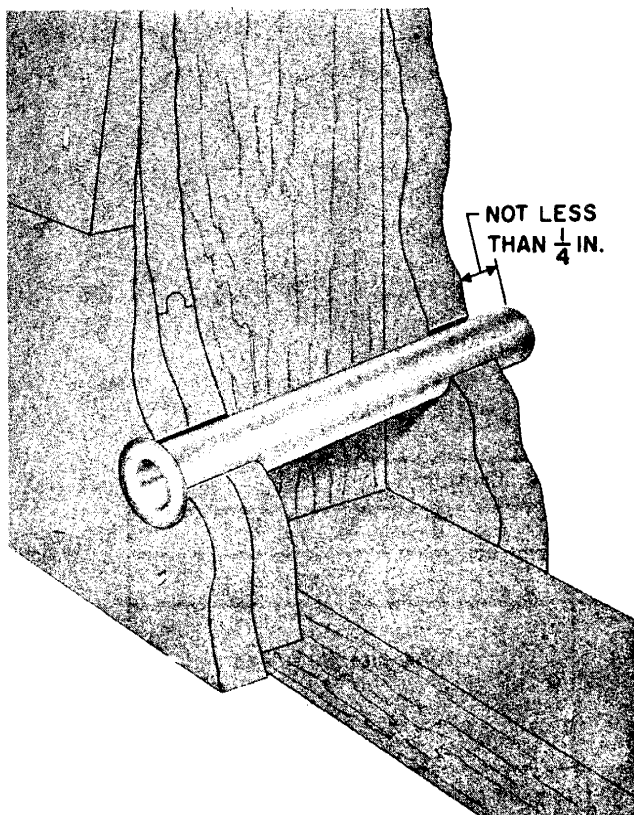


Fig. 18 – Placing Tube

**13.03** B entrance plug may be added to existing drop wire by separating partial split provided on inside surface of plug.

**13.04** When drilling building entrance holes, consider the following:

- Drill holes away from side where appearance is most important.
- Slope holes upward from outside.
- Use seams when drilling through masonry.
- Exercise care to avoid splintering wood or cracking masonry or brick.
- Drill clearance hole on all types of shingle siding.

**13.05** Sizes of building entrance holes for wires and plastic tubes are shown in Table C.

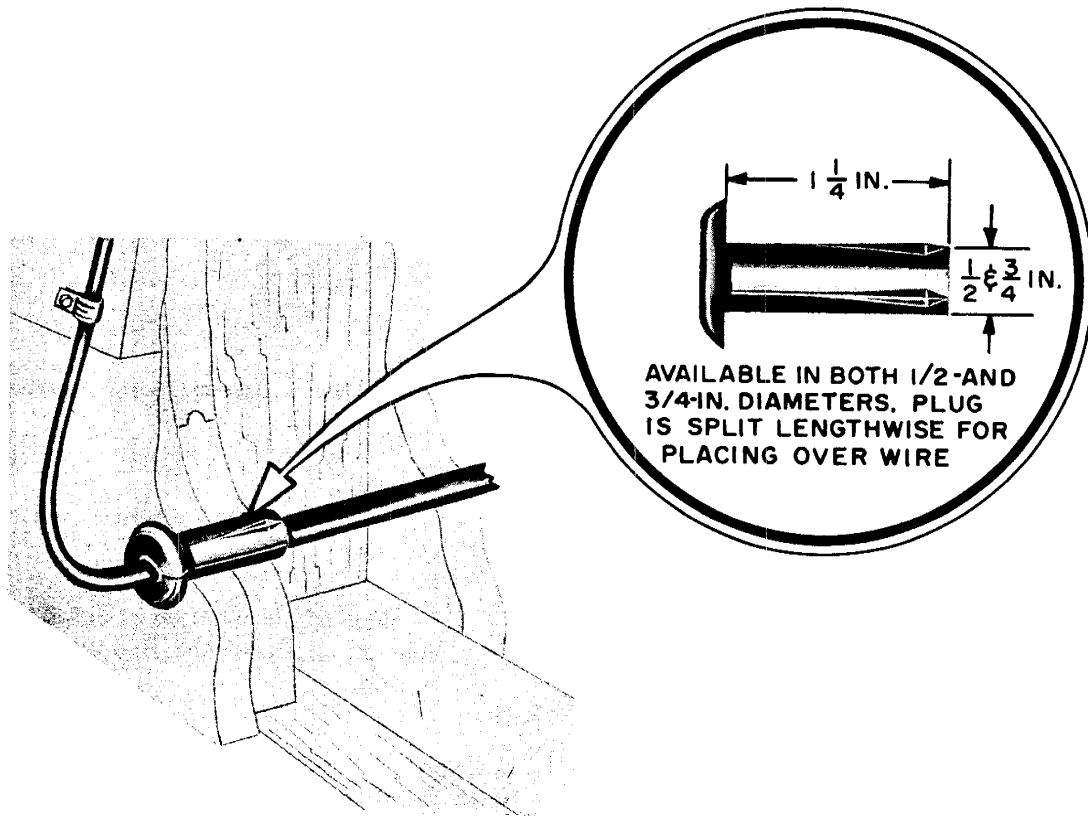


Fig. 19 - B Entrance Plug

TABLE C  
SIZES OF BUILDING ENTRANCE HOLES  
FOR DROP AND BLOCK WIRES AND PLASTIC TUBES

Type	Wire, Quantity						
	D block (bridle)				2	3	4
NP, C, or E drop	1	2	3	1	2	3	4
	Plastic Tube Required			Tube Not Required			
Tube Size, Inch	3/8	1/2	5/8				
Entrance Hole Size, Inch	1/2	5/8	3/4	3/8	1/2	5/8	3/4

Note: When porcelain tubes are used, the size of the hole must be increased.

**DROP AND BLOCK WIRING**  
**PLACING DROP WIRE WHERE POWER**  
**EXPOSURE IS LESS THAN 300 VOLTS**

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**1. GENERAL**

**1.01** The procedures outlined herein apply specifically to the conditions usually encountered where the drop wire *will not* cross over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 volts or more. The basic principles presented in this section should also be observed in those cases where conditions necessitate a departure from the usual procedures.

**1.02** This section is reissued to include the use of the B Handline Carrier.

**1.03** This section covers the installation of drop wire with the use of a handline to avoid accidents caused when tensioning the drop wire from a position on a pole or ladder.

**1.04** Drop wire shall not be placed over secondary electric service wires if other means of installing the wire are practical.

**1.05** Refer to Section 462-400-206 for the method of placing a drop wire over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 volts or more. The methods of raising and lowering drop wire and replacing a drop wire by pulling the new wire into the span with the old wire as it is pulled out of the span are covered in Sections 462-800-311 and 462-800-312.

**2. PRECAUTIONS**

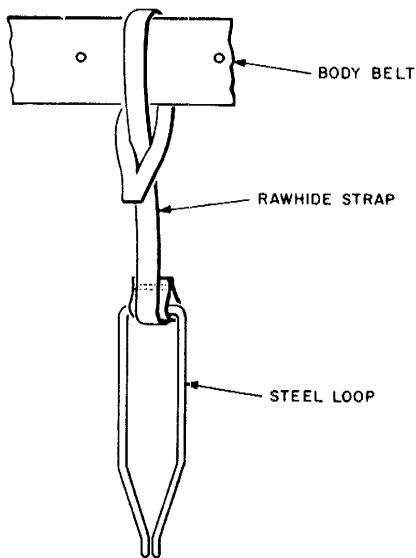
**2.01** Obtain assistance before placing a drop wire over streets, highways, or elsewhere, if traffic, trees, or other conditions are such that one man cannot do the work safely.

**2.02** *Insulating gloves shall be worn by all employees when performing all operations in which the handline or the drop wire may come in contact with power wires or power cables.*

**2.03** The handline used for raising a drop wire under the conditions outlined in this section shall be free from metallic strands and shall preferably be dry. However, if weather conditions are such that it is impracticable to keep the handline dry, a wet handline may be used for placing drop wire over secondary electric service wires operating at less than 300 volts.

**2.04** In general, one 50-foot and one 100-foot 3/8-inch handline will be needed for the operations outlined in this section and Section 462-400-206. The handlines should be served at the ends to prevent unraveling.

↳ **2.05** When it is necessary to carry a handline up a pole or ladder, secure one end of the rope to a B Handline Carrier (Fig. 1) attached to a body belt. The steel loop of the B Handline Carrier is designed to release the handline if it is placed under tension while the employee is climbing a pole or ladder. If no B Handline Carrier is available, double the end of the handline back on itself for a distance of approximately 1 foot and place this loop under the side or back of the body belt so that it will be readily released if placed under tension.



↳ Fig. 1 — B Handline Carrier

**2.06** Never release the drop wire support from a wire span while working inside the angle formed by the wire.

**2.07** Avoid working from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

**2.08** When a drop wire is to be attached to a span clamp, place the foot of an extension ladder on the field side of the suspension strand and not in the street or highway. If there is no street or highway adjacent to the span clamp,

place the ladder preferably against the opposite side of the strand from the drop wire run to the building.

**2.09** If conditions are such that the handline or the drop wire to which it is attached may become disengaged from a drive hook, crossarm, or slides along the strand or guard arm while performing the work outlined in this section, enclose the handline or drop wire with a temporary guide loop. This loop consists of a short length of wire or houseline placed over the handline or drop wire with the ends of the guide securely tied as follows:

- (a) Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.
- (b) Crossarm: Tie the ends to adjacent pins or insulators.
- (c) Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.
- (d) Strand: Tie the ends to the strand or the lashed cable and strand on each side of the handline or drop wire, or place the handline or drop wire through the hook of a B Span Clamp.

### 3. PLACING WIRE OVER STREET OR HIGHWAY — NO TREE INTERFERENCE

**3.01** Where a drop wire to be placed over a street or highway will not cross over trolley or trolley-bus contact wires, power wires or power cables operating at over 300 volts, and there is no tree interference, place the wire as follows:

**Caution:** Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel.

- (1) Install the first building attachment and secure the drop wire to this support. Complete the building run in a standard manner. Keep the drop wire reel on the ground near

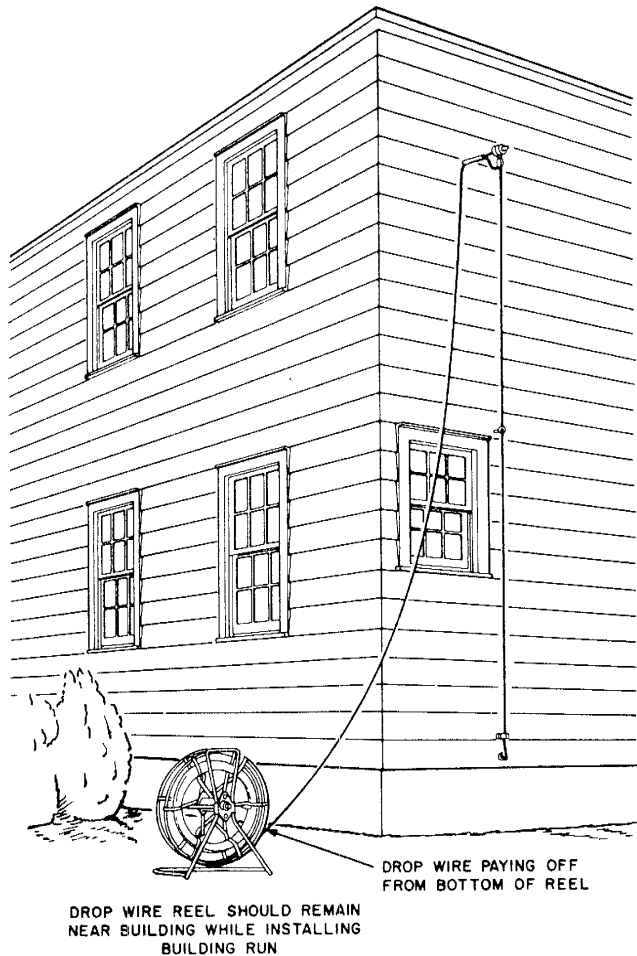


the building to avoid accidents resulting from vehicles striking the wire or pedestrians tripping on it as shown in Fig 2.

(2) Place a handline over the strand, guard arm, drive hook, or crossarm so that both ends reach the ground, with no excess length in that portion of the handline toward the building. If practicable, the handline may be formed into a coil at one end and thrown over the strand. After the handline has been placed, tie it to the base of the pole or the lower rungs of the ladder to avoid interference with pedestrians or vehicles. If it is necessary to climb the pole or ladder to place the handline, install any drop wire support that is needed.

(3) Roll or carry the drop wire reel from the building to the building side of the street or highway, paying out the wire along the ground with sufficient slack to ensure that the wire rests flat on the ground.

(4) When no traffic is approaching, roll or carry the drop wire reel across the street or highway to the previously placed handline, paying out the wire so that it rests flat on the ground. If a metal or hard rubber-tired vehicle passes over the wire, carry the drop wire reel back to the building side of the highway and pull the wire from the highway. Inspect the wire for possible injury and replace any portions that are found to be damaged.



**Fig. 2 — Drop Wire Attached to Building**

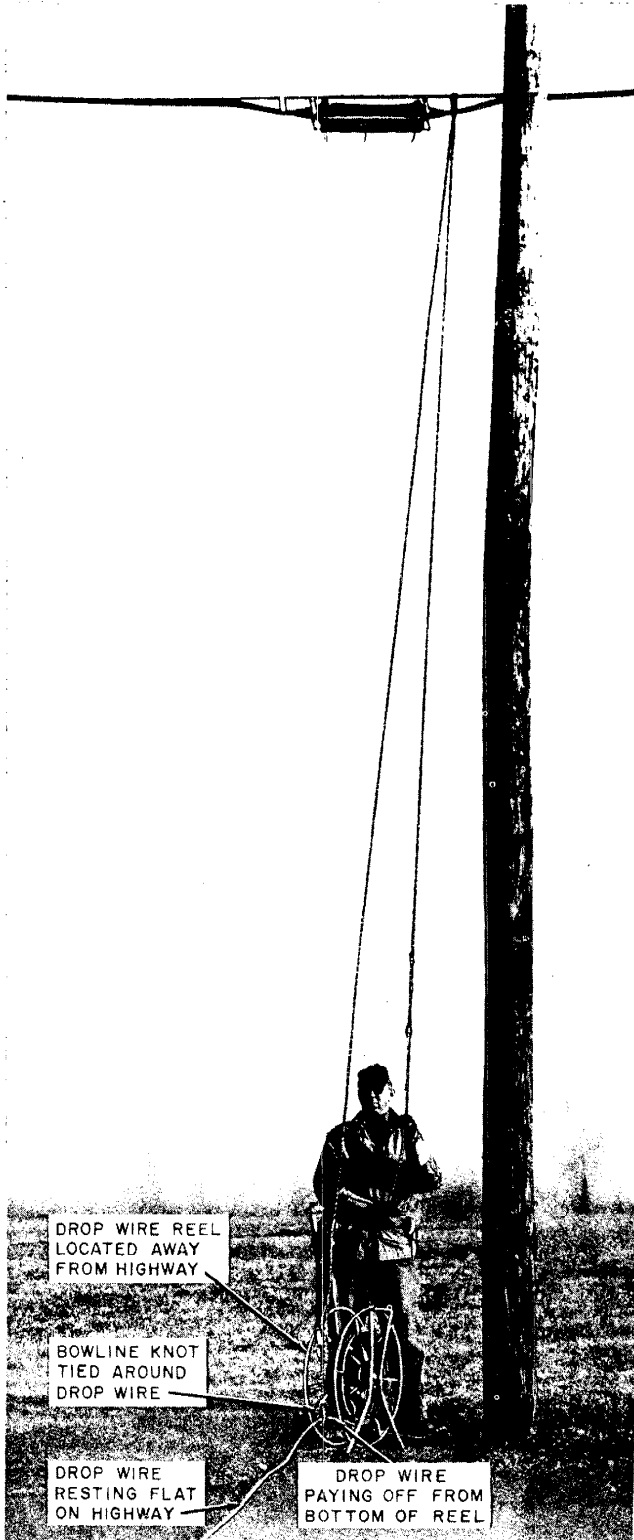


Fig. 3 — Bowline Knot Placed Around Drop Wire

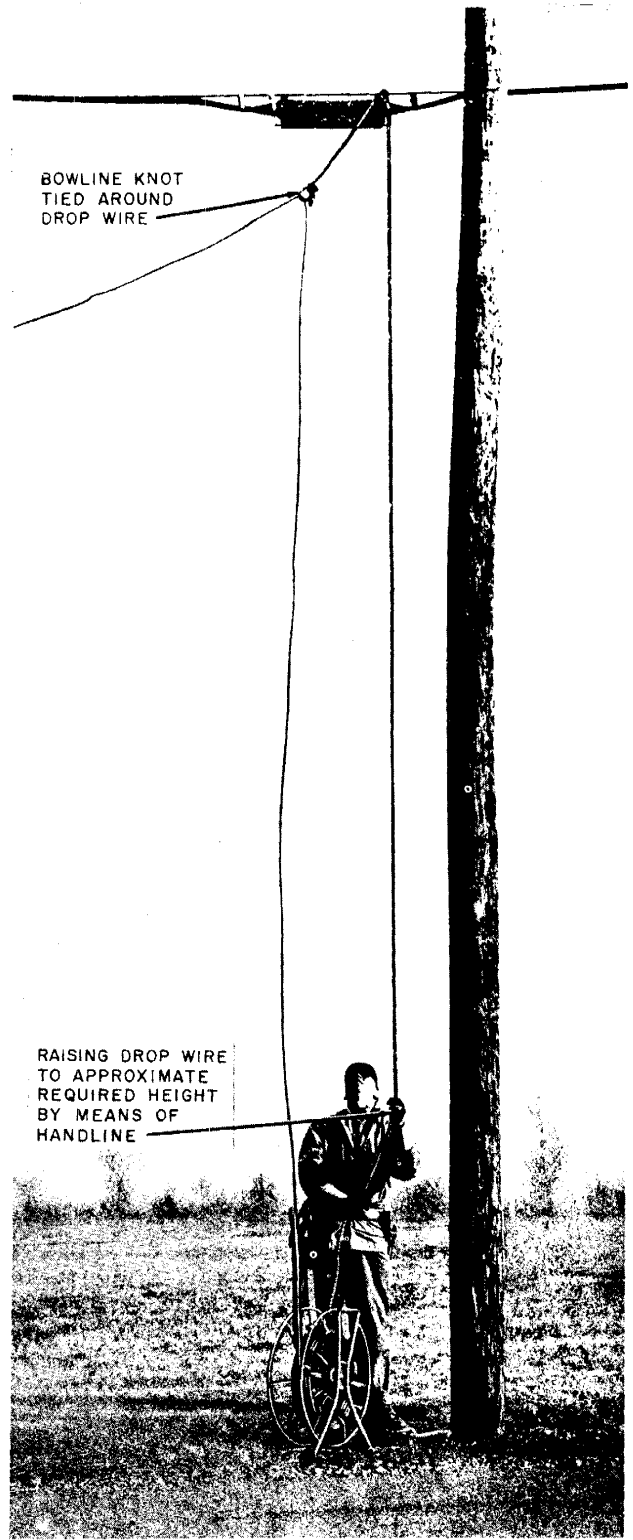
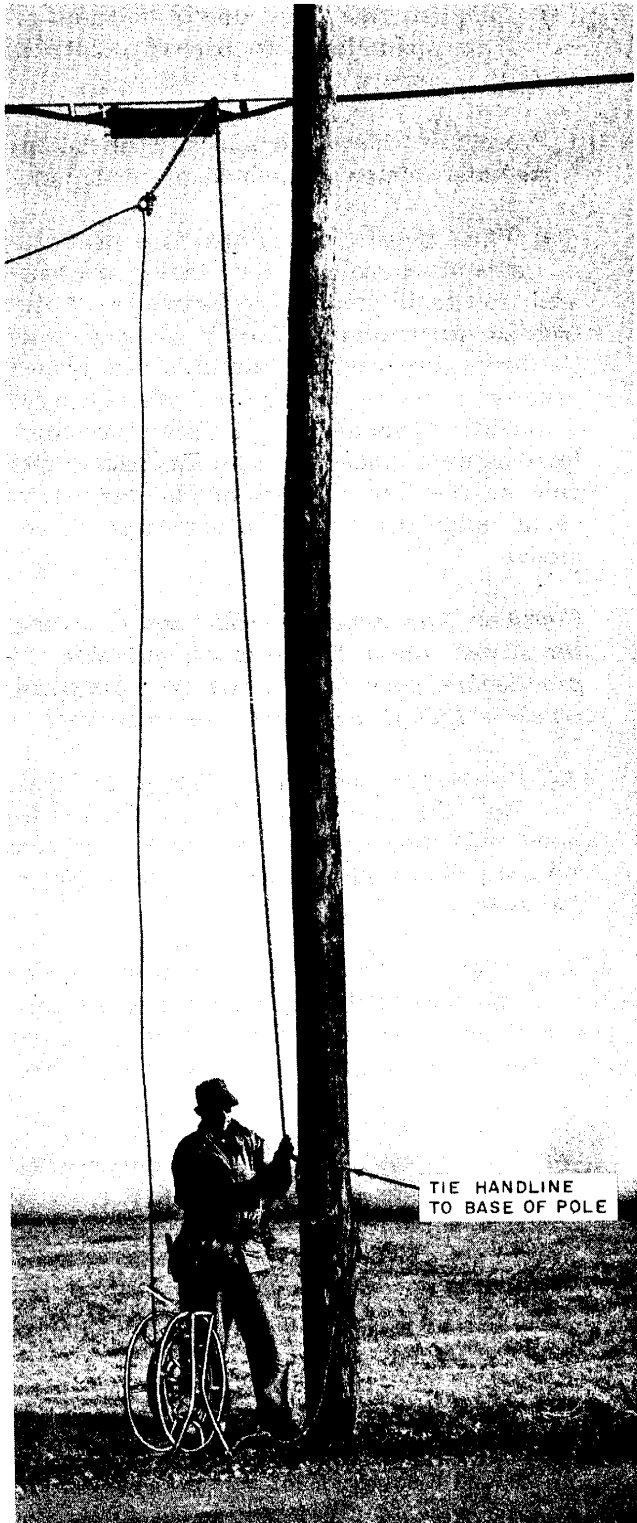


Fig. 4 — Raising Drop Wire



**Fig. 5 — Drop Wire Raised to Approximate Height**

(5) Release the handline from the base of the pole or ladder and tie a bowline knot in the end of the handline toward the building and around the drop wire at the reel as shown in Fig. 3, being careful not to raise the wire above the highway. Wind any excess length of drop wire on the reel.

(6) Set the brake of the drop wire reel so that when the wire is raised by the handline there will be sufficient tension on the wire to enable it to be pulled up to the approximate required height in the span over the street or highway.

(7) After checking to make sure that the drop wire reel is in a stable position and that its brake is properly set, grasp the free end of the handline. When no vehicles or pedestrians are approaching, raise the drop wire as shown in Fig. 4. If it is necessary to remove excess slack from the wire span as it is being raised, pull the wire at the reel end to obtain the desired slack and wind the excess length of wire on the reel.

(8) After the drop wire has been raised to the approximate required height, lash the handline near the base of the pole or, at a span clamp, to the lower rungs of the ladder as shown in Fig. 5.

(9) Climb the pole or, if at a span clamp, the ladder, and attach the drop wire to the pole or strand in a standard manner without removing the handline from the drop wire. When attaching the drop wire to a span clamp, bear in mind that the strand is forced out of line by the ladder resting against it and make any adjustments that are necessary to avoid excessive tension in the wire span when working from the ladder and also to ensure proper sag and clearance after removal of the ladder.

(10) Remove the handline from the drop wire. Cut the wire, leaving a sufficient length to reach the terminating point, and complete the connection in a standard manner.

- Γ (11) Attach the handline and remaining drop wire to the B Handline Carrier or under the body belt as previously mentioned and carry them down the pole in this manner. **Do not drop them to the ground.**

**4. PLACING WIRE OVER STREET OR HIGHWAY — TREE INTERFERENCE**

**4.01** Placing drop wire through trees shall be avoided whenever practicable. However, if trees cannot be avoided, the method outlined in 3.01 shall be modified as follows:

**Caution: Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel.**

(a) Procedure where tree is located on the same side of the street or highway as the building.

(1) Place the drop wire reel on the side of the tree toward the pole line. If the tree overhangs the street, the reel shall not be placed in the street unless it is properly guarded by means of a telephone company truck or something equivalent.

(2) Place the handline among the branches of the tree in the desired location for the drop wire, and pull the wire into position among the branches. A wire raising tool may be used to facilitate this operation.

**Caution: The handline and drop wire shall not overhang the street unless they are properly guarded. If practicable, park the telephone company truck so that it will shield the handline and the drop wire.**

(3) Attach the drop wire to the building, as covered in 3.01(1), making sure that the wire rests flat on the ground between the tree and the building.

(4) Complete the wire run to the pole or to the span clamp as covered in 3.01(2) to (10) inclusive.

(b) Procedure where tree is located in the immediate vicinity of the pole or span clamp.

(1) When placing the handline over the strand, guard arm, drive hook, or cross-arm, locate it among the branches of the tree as illustrated in Fig. 6 in order that the drop wire may be raised to the proper position. A wire raising tool may be used to facilitate this operation. After the handline has been placed, tie it to the base of the pole or the lower rungs of the ladder to avoid interference with pedestrians or vehicles.

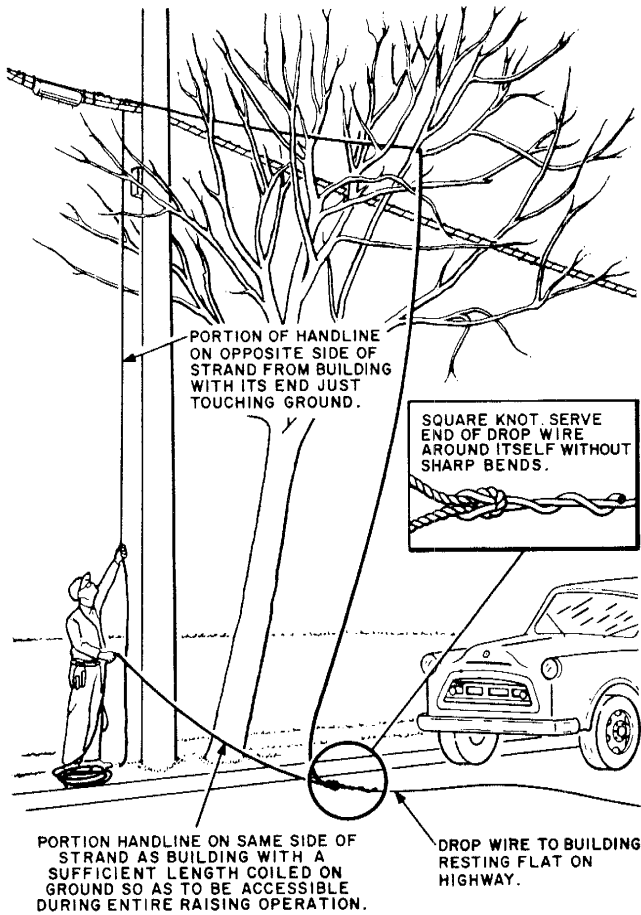
**Caution: The handline shall not overhang the street unless it is properly guarded. If practicable, park the telephone company truck so that it will shield the handline.**

(2) Proceed as covered in 3.01 or 4.01 (a) (1), (2), (4), depending on the conditions, except that the wire shall be raised at the pole or strand end of the span as follows:

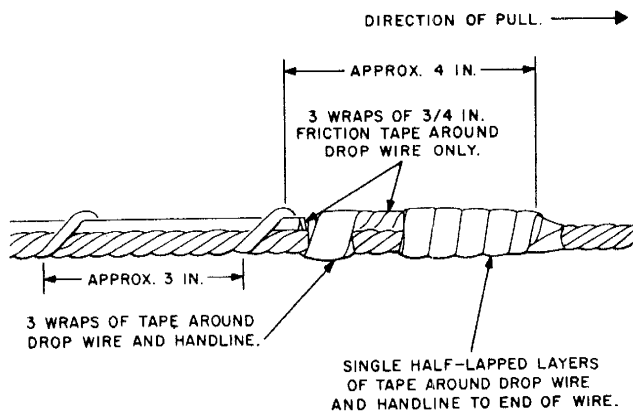
a. With the drop wire crossing the street and resting flat on the ground, remove sufficient wire from the drop wire reel to reach the terminating point and cut the wire.

b. Tie the end of the drop wire to the handline as shown in Fig. 6 at a point in that portion of the handline toward the building which will permit access to both ends of the handline from his position on the ground during the entire raising operation.

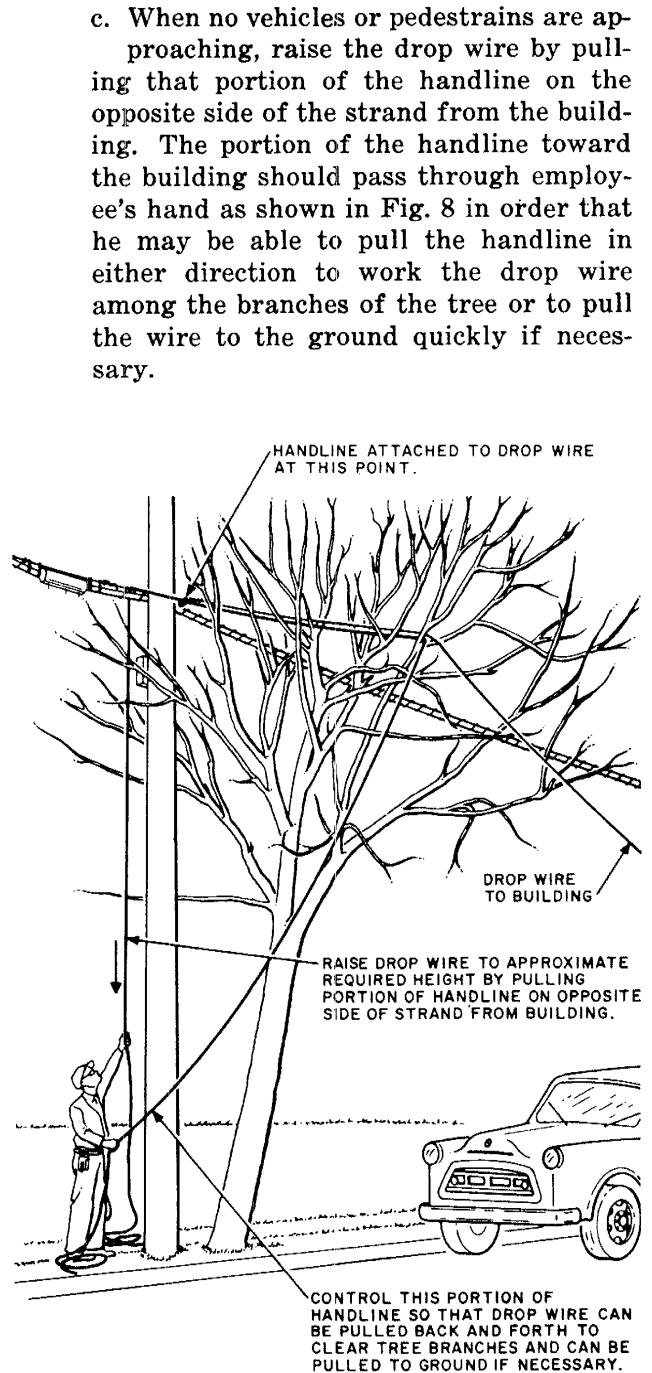
**Note:** If the handline has been placed over a drive hook or other support on which a square knot would snag, fasten the wire to the handline as shown in Fig. 7.



**Fig. 6 — Drop Wire Tied to Handline**



**Fig. 7 — Alternate Tie to Prevent Snagging**



**Fig. 8 — Raising Drop Wire**

c. When no vehicles or pedestrians are approaching, raise the drop wire by pulling that portion of the handline on the opposite side of the strand from the building. The portion of the handline toward the building should pass through employee's hand as shown in Fig. 8 in order that he may be able to pull the handline in either direction to work the drop wire among the branches of the tree or to pull the wire to the ground quickly if necessary.

d. After the drop wire has been raised to the approximate required height, tie the handline to the base of the pole, or, if at a span clamp, to the lower rungs of the ladder and proceed as outlined in 3.01 (9) and (10).

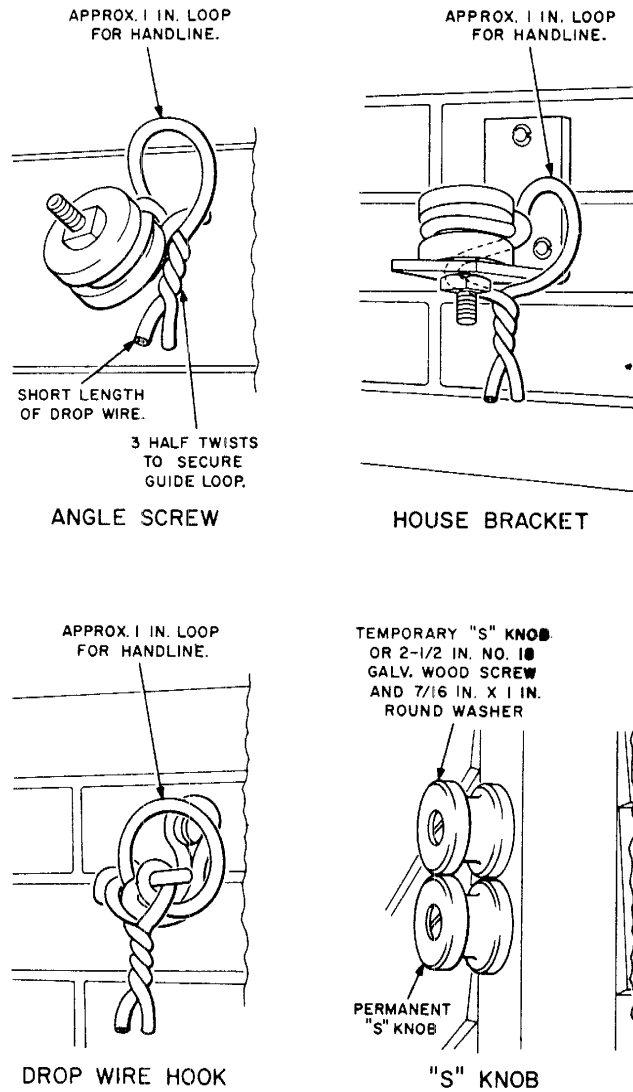


Fig. 9 — Temporary Guide Loop

## 5. PLACING WIRE OTHER THAN OVER STREET OR HIGHWAY

**5.01** When placing a drop wire other than over a street or highway, follow the methods outlined in 3. or 4. if these procedures are necessary in order to raise the wire safely, such as when spanning from one building to another. Otherwise, place the wire as follows:

*Caution: Before proceeding with the following operations, fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel.*

(1) Install the first building attachment and complete the wire run on the building, keeping the drop wire reel near the building to prevent accidents resulting from vehicles striking the wire or pedestrians tripping on it.

*Note:* If obstructions are encountered between the building and the pole or span clamp, locate the drop wire reel on the pole line side of the obstruction; place the wire over or through the obstruction, and then attach the wire to the building, making sure that the wire rests flat on the ground between the obstruction and the building.

(2) Roll or carry the drop wire reel from the building to the pole or span clamp location, paying out the wire so that it rests flat on the ground.

(3) Tie a bowline knot in one end of the handline around the drop wire at the reel. The length of the handline shall be greater than the distance from the ground to the drop wire attachment point.

(4) Set the brake of the drop wire reel so that when the wire is raised by the handline there will be sufficient tension in the wire to enable it to be pulled to the approximate required height in the span.

(5) Loop the other end of the handline to a B Handline Carrier or under the body belt ← as described in 2.05 and climb the pole or, if at a span clamp, the ladder.

(6) Place the handline over the strand, guard arm, drive hook, or crossarm from the side toward the building.

(7) Raise the drop wire to the approximate required height by pulling the handline over the strand or other support and then lash the handline to the pole or strand.

(8) Attach the drop wire to the pole or strand in a standard manner without removing the handline. When attaching the drop wire to a span clamp, bear in mind that the suspension strand is forced out of line by the ladder resting against it. Make any adjustments that are necessary to avoid excessive tension in the wire span when working from the ladder and also to ensure proper sag and clearance after removal of the ladder.

(9) Remove the handline from the drop wire. Cut the wire, leaving a sufficient length to reach the terminating point, and complete the connection in a standard manner.

**5.02** Place a drop wire between two buildings in the same manner as for a pole-to-building run, providing as much sag as practicable in the wire span. A temporary guide loop, such as shown in Fig. 9, should be installed on the first building attachment at which the wire span is to be raised, to prevent accidental disengagement of the handline from the building attachment. Support the tension in the wire by lashing the handline, which was used in raising the wire, to a substantial and secure support near the base of the building and then install the second drop wire clamp of the span.





## DROP AND BLOCK WIRING

### PLACING DROP WIRE

### VOLTAGES OF 300 TO 750 INVOLVED

#### 1. GENERAL

**1.01** This information was formerly covered in Section 625-400-206 (G32.137.2) which is canceled.

**1.02** This section covers the method of placing drop wire under the conditions usually encountered where the drop wire will cross over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 to 750 volts. The basic principles presented in this section should also be observed in those cases where conditions necessitate a departure from the usual procedure.

*Note:* Under no condition shall a drop wire be placed over power wires or power cables operating at more than 750 volts. Such cases shall be referred through the lines of organization to the plant engineer for disposition.

**1.03** The method outlined herein is such that the drop wire is first attached to the building and is then placed over the trolley contact or power wires or power cables by means of a handline while the employees remain on the ground and so perform the work that the drop wire does not come in contact with the power circuits during the entire placing operation. This method is also intended to avoid the possibility of accidents caused by tensiing the wire from a ladder at the building or vehicles striking the wire or the handline as it is being raised from the ground.

**1.04** Drop wire shall not be placed over trolley or trolley-bus contact wires, or over power cables operating at 300 to 750 volts, if other means of installing the wire are practicable.

**1.05** Drop wire shall not be attached to a span clamp under the conditions covered by this section unless the span clamp is accessible from the pole.

**1.06** Refer to Section 462-400-205 for the methods of placing a drop wire where no trolley or trolley-bus contact wires or power wires or power cables operating at 300 volts or more are involved. The methods of lowering a drop wire, raising a lowered drop wire, and replacing a drop wire by pulling the new wire into the span as the old wire is pulled out of the span are covered in Sections 462-800-311 and 462-800-312.

#### 2. PRECAUTIONS

**2.01** In general, two men shall be employed when raising a drop wire over trolley or trolley-bus contact wires, or over power wires or power cables operating at 300 to 750 volts. Obtain additional assistance before raising a drop wire over streets, highways, or elsewhere if traffic, tree, or other conditions are such that two men cannot do the work safely.

**2.02** Rubber gloves shall be worn when placing a drop wire over trolley or trolley-bus contact wires, or over power wires or power cables and until the drop wire has been attached at both ends of the crossing span in a standard manner.

**2.03** The handline used for raising a drop wire under the conditions outlined in this section shall be free from metallic strands and shall be dry. A wet handline must not be used in the vicinity of power circuits operating at 300 volts or more, except as indicated in the following note.

*Note:* When it is necessary to maintain service or establish emergency service during rainstorms, a wet handline may be used over trolley or trolley-bus contact wires and other power circuits operating at 300 to 750 volts, provided that rubber gloves, rubber boots, and rubber raincoats are worn.

**2.04** When it is necessary to carry a handline up a pole or ladder, double the end of the handline back on itself for a distance of approximately 1 foot and place this loop under the right or left side or back of the body belt or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

**2.05** Never release the drop wire supports from a wire span while working inside the angle formed by the wire.

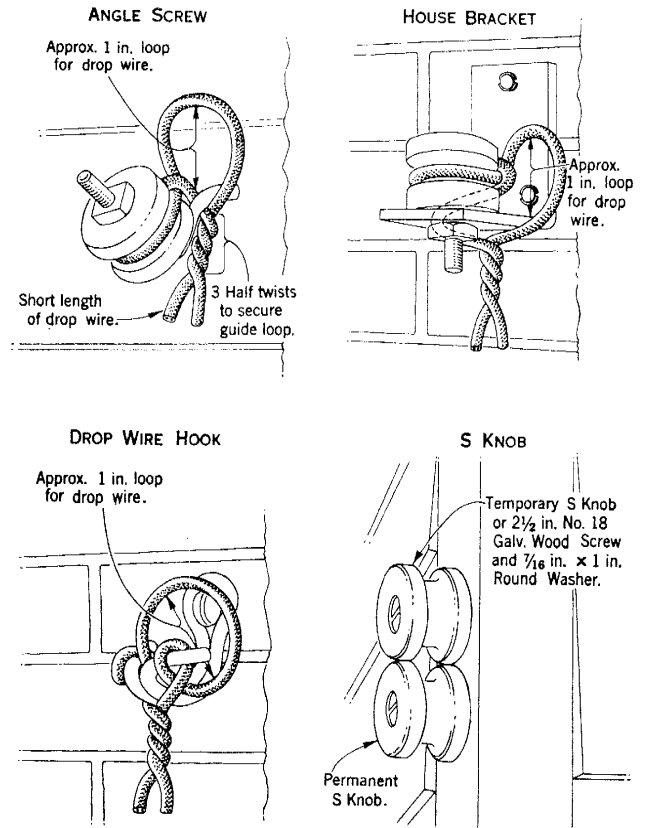
**2.06** Avoid working from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

**2.07** If conditions are such that the handline, or the drop wire to which it is attached, may become disengaged from a drive hook or crossarm or may slide along the strand or guard arm while doing the work outlined in this section, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or houseline placed over the handline or drop wire with the ends of the guide securely tied as follows:

- Drive Hooks: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.
- Crossarm: Tie the ends to adjacent pins or insulators.
- Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.
- Strand: Tie the ends to the strand or the strand and lashed cable on each side of the handline or drop wire, or place the handline or drop wire through the hook of a B span clamp.

**3. PLACING WIRE OVER TROLLEY CONTACT OR POWER WIRES OR POWER CABLES**

*Caution: When it is necessary to place a drop wire over trolley or trolley-bus contact wires or over power wires or power cables, the crossing span shall be placed independently of any additional spans of wire that may be required to establish service.*



**Fig. 1 – Temporary Guide Loop**

**3.01** Place the drop wire over trolley or trolley-bus contact wires or over power wires or power cables as outlined below:

**Man No. 1**

- (1) Install the first building attachment or, if the drop wire is to be attached to a pole on the building side of the trolley contact or power wires or power cables, the pole attachment.
- (2) Attach a temporary guide loop to the first building attachment such as shown in Fig. 1, to prevent the drop wire from becoming accidentally disengaged from the building attachment during the placing operations.

*Note:* If the drop wire is to be attached to a pole between the trolley contact or power wires or power cables and the building, place the temporary guide loop on the pole attachment instead of at the building.

(3) Place the drop wire reel, equipped with a coil of new wire, near the foot of the ladder on the side away from the wire span and in a stable position.

**Caution:** Fasten the inner end of the coil of drop wire securely to one of the spokes of the drop wire reel.

(4) Set the brake of the drop wire reel so that when the wire is pulled by the handline there will be sufficient tension in the wire to prevent it from sagging onto the trolley contact or power wires or power cables.

(5) With the wire paying off from the bottom of the reel, pass the wire over the first building attachment and through the temporary guide loop at this attachment until the end of the wire reaches the ground.

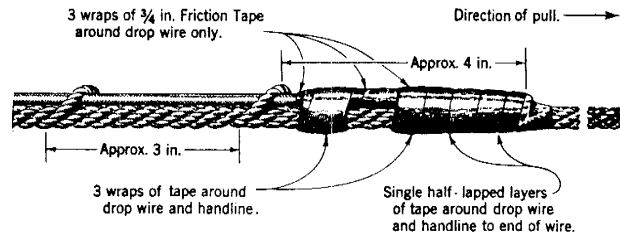
(6) Man No. 2 lashes one end of the handline to the base of the pole. The handline shall be of a sufficient length to extend vertically from the ground to the strand or pole attachment and then horizontally at least 25 feet beyond the trolley contact or power wires or power cables.

(7) Man No. 1 goes into the street or highway to control traffic, assisted by the police if necessary.

(8) Man No. 2 places the free end of the handline over the strand, guard arm, drive hook, or crossarm. If practicable, the handline may be formed into a coil at one end and thrown over the strand.

(9) Standing on the ground, Man No. 2 now throws the free end of the handline over the trolley contact or power wires or power cables and ties this end of the handline to the end of the drop wire by means of a square knot, serving the end of the wire around itself without sharp bends. If the handline has been placed over a drive hook or other support on which the square knot would snag, fasten the handline to the wire as shown in Fig. 2.

**Note:** If a tree is involved, place the handline among the branches of the tree in the desired location for the drop wire. A wire raising tool may be used to facilitate this operation.



**Fig. 2 – Alternate Tie to Prevent Snagging**

(10) Man No. 2 next reels up all slack in the handline and drop wire onto the drop wire reel, thereby raising the handline clear of the trolley contact or power wires or power cables. If the end of the drop wire attached to the handline would be pulled back through the temporary guide loop at the first building attachment in this operation, Man No. 2 shall stop reeling up slack, make sure that the drop wire reel is in a stable position and that its brake is properly set, return to the pole end of handline, and pull the remaining slack out of the handline and wire span so that the handline is clear of the power circuits. He then reties the handline to the pole and returns to the drop wire reel.

(11) Man No. 1 who has been in the street or highway directing traffic during operations (8) to (10), inclusive, goes to the pole and pulls the handline, observing carefully to see that there is sufficient tension in the wire paying off the drop wire reel to prevent the wire from sagging onto the power circuits. Man No. 2 controls the action of the drop wire reel to ensure that there is adequate tension in the wire as it is pulled from the reel.

(12) After Man No. 1 has pulled a sufficient length of drop wire over the strand, guard arm, drive hook, or crossarm for terminating or splicing purposes, he shall lash the handline to the base of the pole.

**Note:** If the handline or drop wire catches while it is being pulled over the strand, guard arm, drive hook, or crossarm, Man No. 2 remains at the drop wire reel and keeps the wire under sufficient tension to prevent it from sagging onto the power circuits. Man No. 1 lashes the handline to the base of the pole and proceeds to free the handline or drop wire.

**SECTION 462-400-206**

(13) Man No. 1 crosses the highway to building and, while Man No. 2 maintains tension in the wire span, Man No. 1 fastens the drop wire to the first building attachment with a drop wire clamp and then removes the temporary guide loop.

*Note:* While Man No. 1 is fastening the drop wire to the first building attachment, Man No. 2 shall not attempt to maintain any more tension in the wire than is necessary to

prevent it from sagging onto the trolley contact or power wires or power cables. The proper tensioning of the drop wire shall be done from the pole attachment side of the power circuits.

(14) Both men now go to the pole and, while Man No. 1 maintains the proper tension in the handline, Man No. 2 climbs the pole, fastens the drop wire in a standard manner and then removes the handline.

## DROP AND BLOCK WIRING POLE-TO-BUILDING AND POLE-TO-POLE RUNS

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### 2. DISTRIBUTING DROPS FROM TERMINAL POLES

#### 1. GENERAL

1.01 This section covers the methods of making pole-to-building and pole-to-pole runs of drop wire. Drops from open wire lines are covered in the 462-240 layer.

1.02 This section is reissued to include information on the use of drive hooks below the strand for drop runs to buildings.

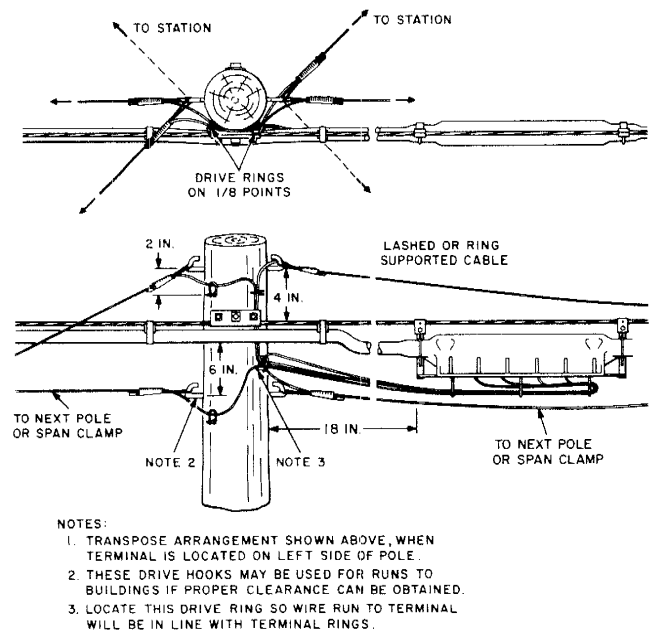
1.03 The requirements applying to clearances between telephone wires and foreign wires and equipment, clearances above ground, and climbing space on jointly used poles shall be observed in running drop wires.

1.04 Stringing operations related to the procedures described herein are covered in other layers of this division 462.

1.05 Drop wire should be strung to normal stringing sags unless ground clearances make it necessary to use the minimum stringing sags as outlined in Section 462-400-200.

2.01 At Terminal Poles Not Requiring Guard Arms: Distribute drop wires from drive hooks placed on the face or back of poles. On pole-to-building spans, generally, use drive hooks located above the suspension strand. On spans from pole-to-pole and from pole-to-span clamp, use the drive hook located below the cable. Existing drive hooks below the strand may also be used for drop runs to buildings if proper clearances can be obtained. Pass the drop wire through the drive hook only in case no sharp bends will be placed in the wire.

2.02 The wiring arrangements for strand mounted and pole mounted terminals are indicated in Fig. 1, 2, and 3.



**Fig. 1—Strand Mounted Terminal**

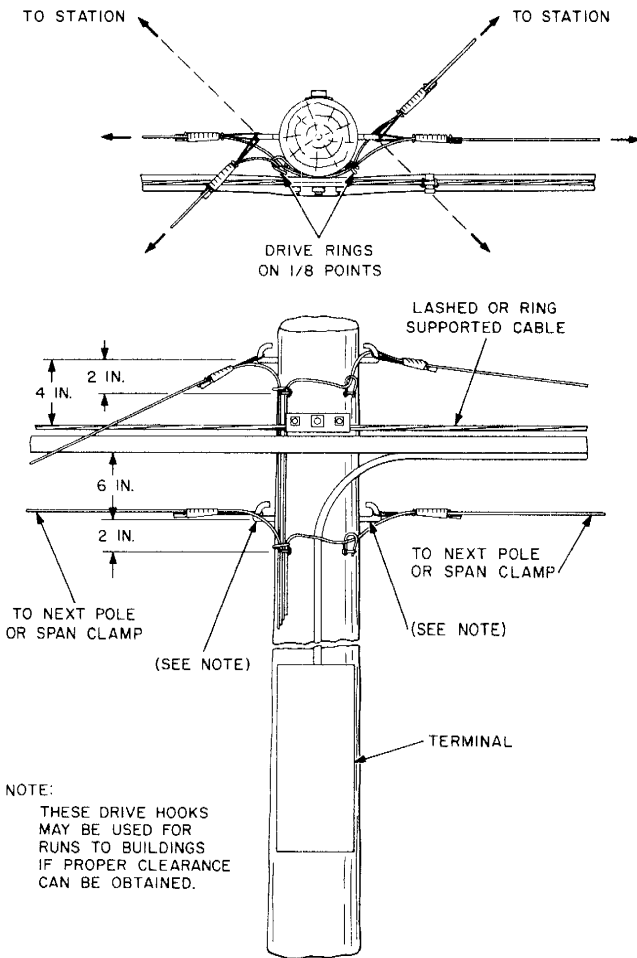


Fig. 2—Terminal Mounted on Cable Side of Pole

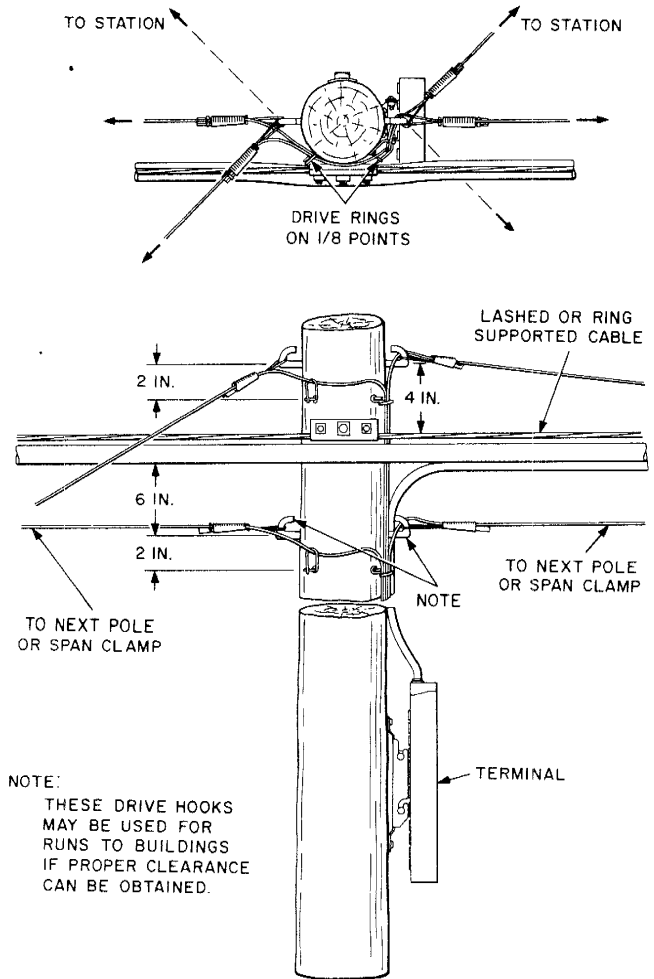


Fig. 3—Terminal Mounted on Face or Back of Pole

**2.03** Run wiring on pole in a neat manner and with enough slack to avoid sharp bends at fixtures. Where drop wire passes through a drive hook, provide slack in the form of a smooth curve.

**2.04** At Terminal Poles Requiring Guard Arms: Follow the procedures covered in 462-300-200.

**3. DROP WIRE RUNS ALONG THE LEAD**

**General**

**3.01** For transmission and maintenance reasons, observe local instructions as to the maximum

number of drops permissible and limit the length of a drop wire run to 500 feet.

**3.02** Attach drop wire runs to poles along the lead by means of drive hooks. However, existing pole brackets may be used if they are located as specified for drive hooks.

**Lead Carrying Aerial Cable**

**3.03** Run drop wire below the cable as shown in Fig. 4.

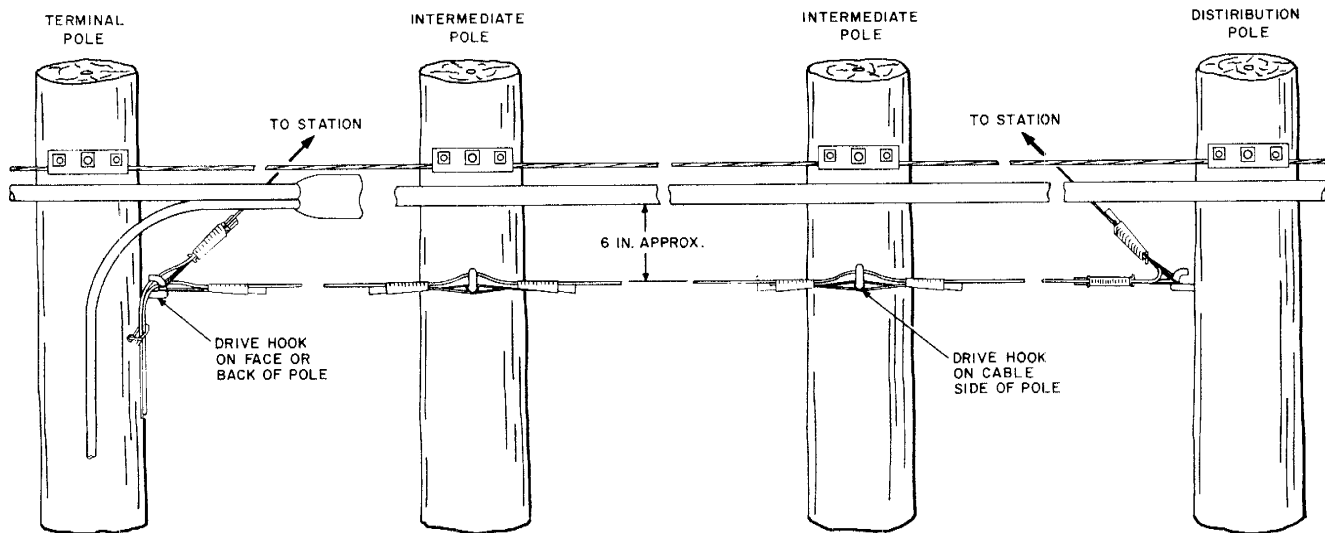


Fig. 4—Drop Wire Run Along Lead Carrying Cable

**3.04** Where stringing the wire with minimum sag would fail to provide the required ground clearance, then the drop wire may be placed above the suspension strand. Locate drive hooks at such height that the drop wire does not whip against the strand or cable and proper joint use clearances are obtained.

**3.05** On straight line poles or inside corner poles where the pull of the wire is away from the pole, use a single drive hook to support the drop wire.

**3.06** On outside corner poles where the angle would cause the drop wire to rub against the pole, use two drive hooks to support the wire as shown in Fig. 5.

**Note:** In all cases the method used to support the wire on jointly used poles should leave clear climbing space as outlined in 620-216-014.

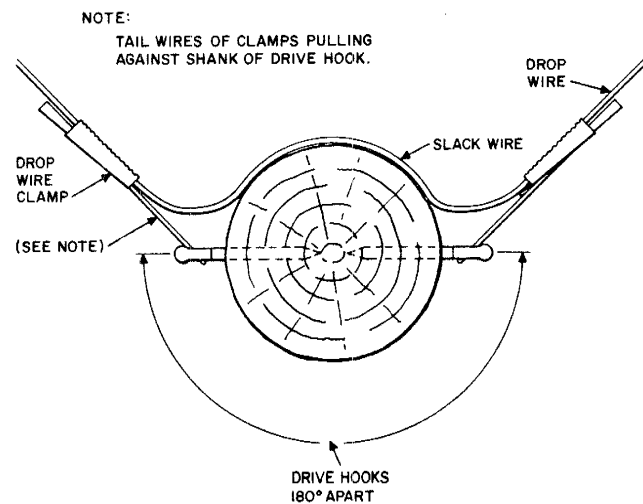


Fig. 5—Turning Outside Corner

Lead Not Carrying Aerial Cable

3.07 Run drop wires as illustrated in Fig. 6.

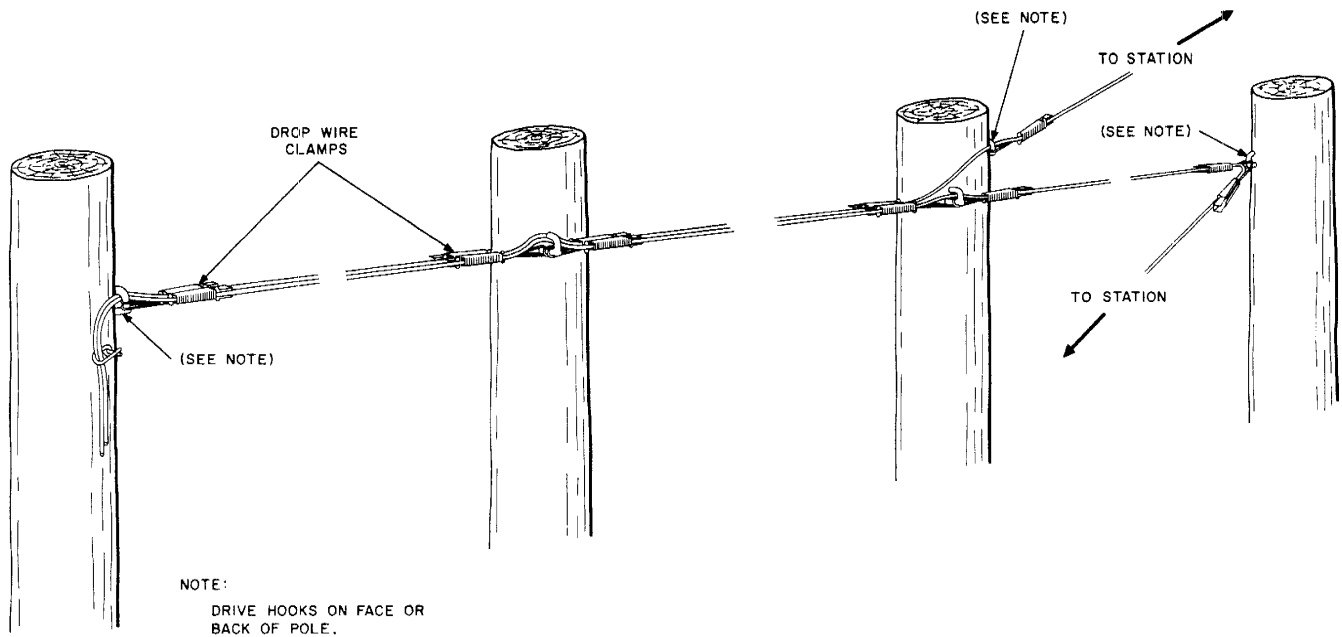


Fig. 6—Drop Wire Run Along Lead Without Cable

Distributing Wires from Pole Other Than Terminal Pole

3.08 Distribute drop wires as illustrated in Fig. 7.

3.09 On jointly used poles or poles which are likely to become jointly used, drop wires may be distributed from guard arm hooks where a guard arm is required to provide proper climbing space.

4. PARTY-LINE TAPS ON DROP WIRE RUNS ALONG THE LEAD

Tap at Intermediate Points

4.01 To make an intermediate party tap along the lead, proceed as follows:

- (1) Install a 101B wire terminal on the pole directly below the drive hook.
- (2) Place a second drive hook on the face or back of the pole at the same level as the existing hook supporting the through drop wire.

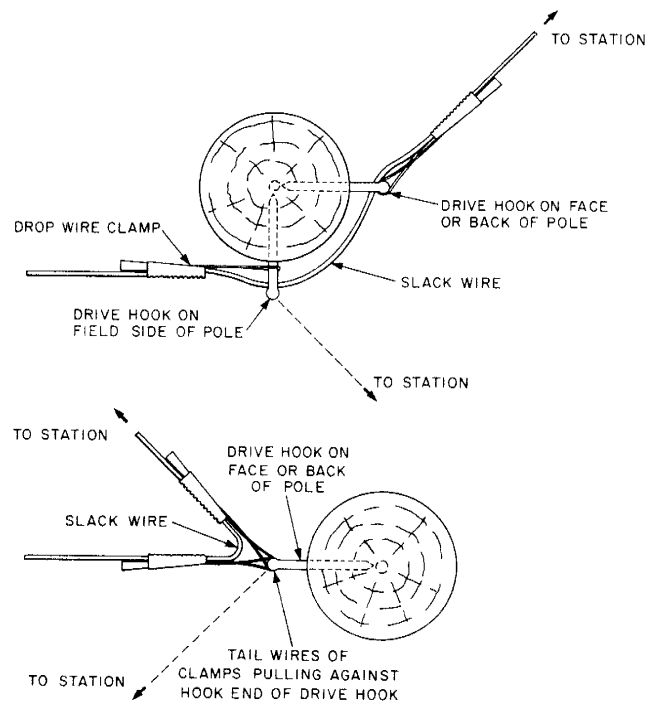


Fig. 7—Distributing Wires From Pole Without Terminal



(3) After testing to make sure the line is not in use, cut the through drop wire about 2 feet from the first drive hook. The drop wire puller can be used to hold the wire before the cut is made.

(4) Splice a piece of drop wire to the short end of the through drop wire supported by the drop wire puller. Install a drop wire clamp on the spliced wire and place it on the new drive hook on the face or back of the pole.

(5) Place drive rings on pole and run the wire through them and terminate the two ends of the through drop wire on the binding posts of the wire terminal. Terminate the bridging drop wire in the wire terminal on top of the through wire connections. The complete party line tap is illustrated in Fig. 8.

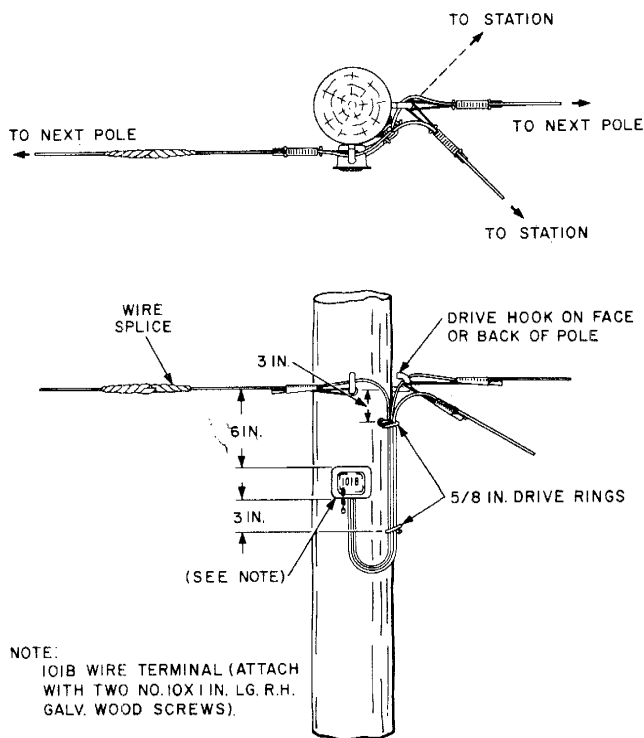


Fig. 8—Completed Party Line Tap

### Tap at End of Run

**4.02** If the drop wire run along the lead is to be extended to an additional station, proceed as follows:

- (1) Place a 101B wire terminal on the pole and cut the existing subscriber circuit into it.
- (2) Terminate the drop wire extension in the 101B wire terminal to make the bridging connection.
- (3) Splice out the existing drop loop and terminate it in the wire terminal. The complete arrangements are similar to those shown in Fig. 8.

**4.03** In disconnecting a party line tap, lift its termination in the 101B wire terminal. Tag and cap the free end of the wire and bend it back upon itself about the lower ring and tape securely to the supporting wire.

### 5. RUNNING DROP WIRE PAST CABLE TERMINALS

**5.01** Avoid drop wire runs past a cable terminal by endeavoring to obtain a reassignment to a nearer terminal.

**5.02** Where a disconnected drop wire passing a terminal is to be reused, obtain an assignment to the nearer terminal if practicable.

### 6. ATTACHING DROP WIRE TO METAL TROLLEY OR STREET LIGHTING POLES

**6.01** Drop wire attachments to metal trolley, traffic signaling, or street lighting poles should be avoided. However, if it is unavoidable, refer the case to your supervisor for specific approval before attachments are made.

**Installation**

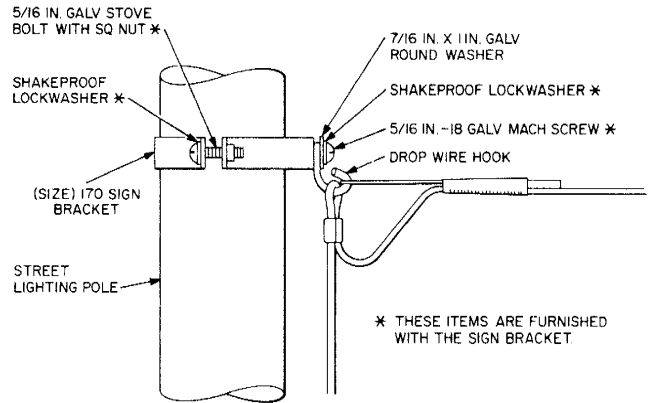
**6.02** Attach drop wire to metal street lighting, traffic signaling, or trolley pole by means of a drop wire hook fastened to a type 170 or 188 sign bracket as illustrated in Fig. 9 and 10. The diameter of the pole determines the type of sign bracket to be used, as follows:

Type of Sign Bracket	Diameter of Pole
2-170	1-7/8 to 3 inches
3-170	3 to 4 inches
4-170	4 to 5 inches
6-188	5 to 8 inches
10-188	8 to 12 inches

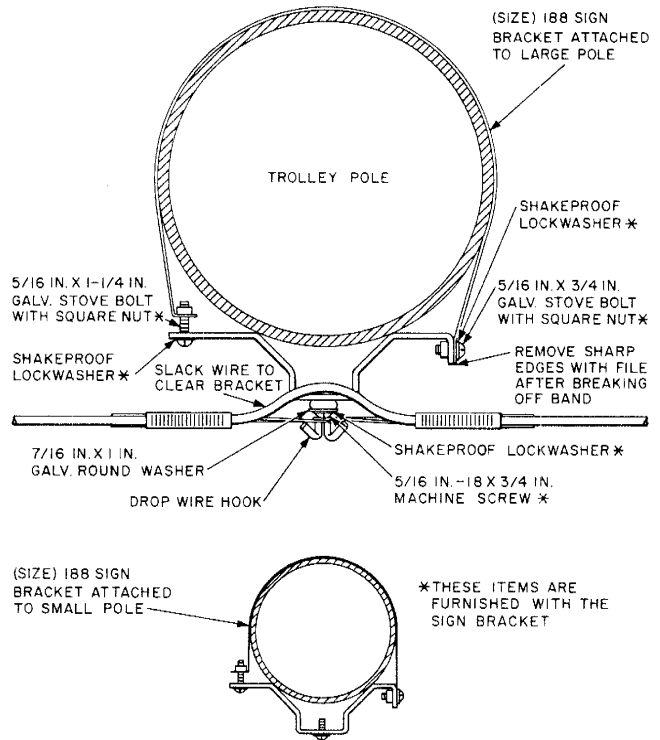
**6.03** The principal points to be observed in installing the type 188 sign bracket are as follows:

- (1) Attach the perforated band to the straight end of the bracket leaving the nut at the end of the 1-1/4 inch stove bolt.
- (2) Place the bracket against the pole, wrap the band snugly around the pole, and attach the free end of the bracket, inserting the 3/4-inch stove bolt in the nearest hole.
- (3) Tighten the 3/4-inch bolt securely and then tighten the 1-1/4 inch bolt as much as possible without stripping the threads or bending the bracket excessively. If the bracket is not secure after the 1-1/4 inch bolt has been tightened, back off the nut to the end of the bolt, relocate the 3/4-inch bolt to the next hole to take up the slack in the band and then retighten the 1-1/4 inch bolt.
- (4) Remove the excess length of the band by bending it back and forth until it breaks at the bracket. Remove sharp edges at break with a file.

**6.04** Only one drop wire shall be attached to a sign bracket.



**Fig. 9—Attachment To Type 170 Sign Bracket**



**Fig. 10—Attachment To Type 188 Sign Bracket**

## DROP AND BLOCK WIRING

### SEPARATION AND MECHANICAL PROTECTION

CONTENTS	PAGE
1. GENERAL . . . . .	1
2. GENERAL PRECAUTIONS . . . . .	1
3. DEFINITION OF TERMS . . . . .	1
4. SEPARATIONS . . . . .	1
5. MECHANICAL PROTECTION . . . . .	2

#### 1. GENERAL

1.01 This section specifies minimum separations required between foreign conductors and telephone wiring in or on buildings and in spans to buildings. It also describes mechanical protection required between telephone wiring and pipes, gutters, masonry, etc.

1.02 This section is reissued to include separation requirements originally contained in Section 461-200-201. Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 In general, separations are required for electrical reasons. However, uncovered steam and hot water pipes, stationary metal gratings, etc, also must be considered because of excessive heat or abrasion.

#### 2. GENERAL PRECAUTIONS

2.01 All wire installed in explosive atmospheres shall be placed in accordance with the instructions pertaining to that equipment.

2.02 Wire shall not be placed in pipe or conduit containing electric light and power wires or cables. Wires shall not be placed in the same outlet box or junction box, unless separated from the electric light and power wires by a suitable insulating partition.

2.03 Whenever practicable, avoid running telephone wire in the same conduit, molding, or runway with signal circuits which are operated by battery or from a step-down transformer. Strict adherence to this recommendation will minimize the possibility of interference by either or both parties during placing or maintenance activities.

2.04 Cold water pipes sweat under certain conditions; therefore, cross wire *over* rather than under the pipes.

#### 3. DEFINITION OF TERMS

3.01 The following definitions are for terms used in Tables A, B, and C:

- Bare Wire—A conductor having no covering or insulation whatsoever.
- Open Wiring—A wiring method using cleats, knobs, tubes, and flexible tubing for the protection and support of insulated conductors run in or on buildings, and not concealed by the building structure.
- Service Drop—The overhead service conductors between the last pole or other aerial support and the first attachment to the building.
- Nonmetallic Sheathed Cable—An assembly of two or more insulated conductors having an outer sheath of moisture resistant, flame retardant, nonmetallic material.

#### 4. SEPARATIONS



*The separations shown in Tables A, B, and C are minimum requirements. Greater separations shall be provided where readily obtainable.*

4.01 Separations specified in Tables A, B, and C apply to crossings and parallel runs.

## SECTION 462-450-205

**4.02** In Tables A and B the specified separations must be obtained for parallel runs.

**4.03** The specified separations must be obtained at crossings designated *No Alternative* in Tables A and B.

**4.04** Separations and protection requirements for wiring which is placed on outside walls of buildings and is to be extended to off-premises stations, outdoor stations, loud ringing bells, etc, are the same as those specified for drop and block wire and are shown in Table B.

**4.05** Separations of less than 6 feet between drop, block, and station wiring, or telephone ground wires and lightning wires or rods are permissible under the following conditions:

(a) Where telephone, power, and lightning rod ground connections are made to a common grounding medium as specified in 460-100-201.

(b) Where separate driven ground rods are used for telephone, power, and lightning rod installations, **and the ground rods are bonded together** as specified in 460-100-201.

**Note:** *In no case shall the separation be less than 4 inches.*

**4.06** Tables A and B list the minimum separations between telephone wiring and foreign conductors or metallic objects outside or inside buildings.

**4.07** Table A applies only to telephone wiring between the protector (fuseless or fused) and the telephone equipment and to telephone wiring requiring no protector.

**4.08** Table B applies only to telephone wiring (drop or block) attached to the building and feeding a protector (fuseless or fused).

**4.09** Table C lists the minimum separations that shall be obtained between drop wire in the span to a building and foreign conductors or metallic objects.

## 5. MECHANICAL PROTECTION

**5.01** Where it is not practicable to obtain recommended minimum separation at crossings other than those shown as *No Alternative* in Tables A and B, or where wire or cable runs are subject to mechanical damage, abrasion, or excessive heat, a protective covering is required as shown in Fig. 1. The protective covering should be used as follows:

- B Plastic Tube, P Wire Guard, or two layers of vinyl tape extending 2 inches beyond each side of object being crossed.

- P Wire Guard, B Plastic Tube, or two layers of vinyl tape shall be used in all cases where telephone wiring is subject to abrasion or mechanical damage. E Wire Guard (plastic tubing) may be used in place of vinyl tape or P Wire Guard on station wiring within buildings where improved appearance is desired. (See Fig. 2.)

**5.02** Where plastic-insulated station wire passes through wall or floor adjacent to wall or baseboard, protection with vinyl tape or E Wire Guard is not required unless wire is subject to mechanical damage or abrasion.

**5.03** Where station wiring passes over floor away from wall or baseboard, protect it from mechanical damage with overfloor ducts and associated fittings as covered in Section 461-350-100.

**5.04** Fig. 3 through 14 are typical examples of wiring that requires protection.



**Do not run wires or cables through removable gratings.**

**TABLE A — SEPARATION AND PHYSICAL PROTECTION FOR WIRING BETWEEN  
PROTECTOR AND TELEPHONE EQUIPMENT**

This table applies only to telephone wiring from fuseless or fused protector to telephone equipment and to telephone wiring requiring no protector. Minimum separations between telephone wiring outside or inside buildings, and type of plant involved, are as follows. Separations apply to crossings and to parallel runs.

TYPE OF PLANT INVOLVED		MINIMUM SEPARATIONS	PROTECTION REQUIRED IF MINIMUM SEPARATIONS CANNOT BE OBTAINED <sup>1</sup>
Electric Supply	<i>Bare light or power wire of any voltage</i>	5 ft <sup>2</sup>	No Alternative <sup>2</sup>
	Open wiring not over 300 volts	2 in.	See Note 3
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires	None	
Radio and Television	Antenna lead-in and ground wires	4 in.	See Note 3
Signal or Control Wires	Open wiring or wires in conduit or cable	None	
Communication Wires	Community television systems coaxial cables with shields at ground potential	None	
Telephone Drop or Block Wire	Using fused protectors	2 in.	See Note 3
	Using fuseless protector or where no protector required	None	
Telephone Ground Wire		None	
Sign	Neon signs and associated wiring from transformer	6 in. <sup>4</sup>	SK station wire with shield grounded or lead cable with sheath grounded. Ground requirements same as for signaling ground. See Section 638-210-100.
Lightning System	Lightning rods and wires	6 ft	See 4.05
Pipe	Steam or hot water or heating ducts	See Note 5	See Note 5
Stationary Grating, Metal Shutter Grillwork, etc.		P Wire Guard, or two layers of vinyl tape required in all cases to resist abrasion.	

**Note 1:** Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

**Note 2:** *Power is to be turned off if working above bare wire.* Ladders shall be placed to maintain a 5-foot minimum clearance.

**Note 3:** B Plastic tube; E or P wire guard; or two layers of vinyl tape extending 2 inches beyond each side of object being crossed.

**Note 4:** To prevent accidental breakage, avoid neon sign location if alternate run is possible.

**Note 5:** Excessive heat may damage plastic-insulated wires, therefore avoid heating ducts and other heat sources.

**TABLE B — WIRING BETWEEN BUILDING ATTACHMENT AND TELEPHONE PROTECTOR**

This table applies only to telephone wiring (drop or block) attached to buildings and feeding a fuseless or fused protector. Minimum separations between telephone wiring outside or inside buildings, and type of plant involved, are as follows. Separations apply to crossings and to parallel runs.

TYPE OF PLANT INVOLVED		MINIMUM SEPARATIONS	PROTECTION REQUIRED IF MINIMUM SEPARATIONS CANNOT BE OBTAINED <sup>1</sup>
Electric Supply	<i>Bare light or power wire of any voltage</i>	5 ft <sup>2</sup>	No Alternative <sup>2</sup>
	Service drops or open wiring not over 750 volts	4 in.	P Wire Guard extending 2 inches beyond each side of object being crossed
	Wires in conduit, or in armored or nonmetallic sheath cable, or power ground wires	2 in.	
Radio and Television	Antenna lead-in and ground wires	4 in.	
Signal Wire	Open wiring or wires in conduit or cable	2 in.	
Communication Wires	Foreign open wiring and wires in conduit or cable	2 in.	
	Between exposed and unexposed Telephone Company wires		
	Community television systems coaxial cables with shields at ground potential	None	
Metallic Object	Downspouts and gutters	2 in.	
	Stationary Gratings, etc.	P Wire Guard or two layers of vinyl tape required in all cases to resist abrasion	
Telephone Ground Wire		None	
Sign	Neon signs and associated wiring from transformer	6 in.	P Wire Guard, 12 inches long <sup>3</sup>
Lightning System	Lightning rods and wires	6 ft	See 4.05
Telephone Ground Rods to Other Ground Rods		6 ft	No Alternative

**Note 1:** Applies only to crossings. For parallel runs the indicated minimum separations must be maintained.

**Note 2:** *Power is to be turned off if working above bare wire.* Ladders shall be placed to maintain a 5-foot minimum clearance.

**Note 3:** To prevent accidental breakage, avoid neon sign location of alternate run is possible.

TABLE C — DROP WIRE SPANS TO BUILDINGS			
Minimum separations between drop wire spans to buildings and type of plant involved, are as follows:			
TYPE OF PLANT INVOLVED		DROP WIRE SPAN TO BUILDING MINIMUM SEPARATION	
		CROSSING	PARALLEL
Electric Supply	Service drops or open wiring not over 750 volts	2 ft	1 ft
	Wires in conduit, or in armored or nonmetallic sheath cable	4 in.	4 in.
Radio and Television	Antenna lead-in and ground wires	2 ft	1 ft
Signal Wires	Open wiring	2 ft	1 ft
	Wires in conduit or cable	4 in.	4 in.
Communication Wires	Foreign open wiring	2 ft	1 ft
	Foreign wires in conduit or cable	4 in.	4 in.
	Community television systems coaxial cables with shields at ground potential	4 in.	4 in.
Metallic Objects	Rain spouts, gutters, etc	4 in.	4 in.
Ground Wires	Ground wires (except radio, television, and lightning ground wires)	4 in.	4 in.
Lightning	Lightning wires and rods	6 ft	6 ft
Signs	Neon sign and associated wiring from transformer	1 ft	1 ft

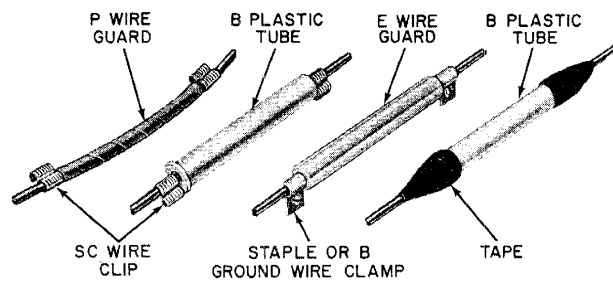


Fig. 1—Securing Wire Guards

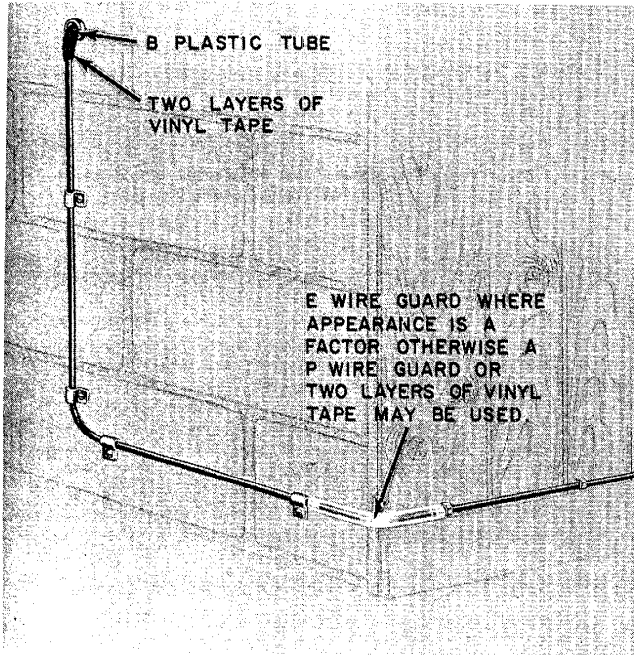


Fig. 2—Use of Vinyl Tape or E Wire Guard

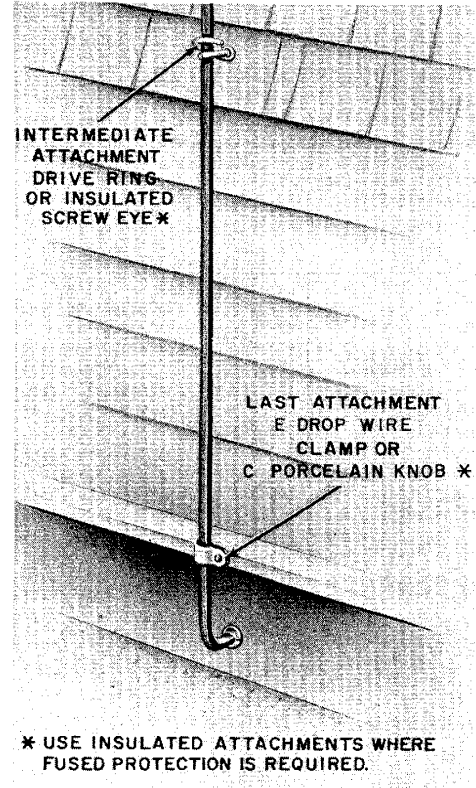


Fig. 4—Crossing Wood or Stucco on Wood Building Projection

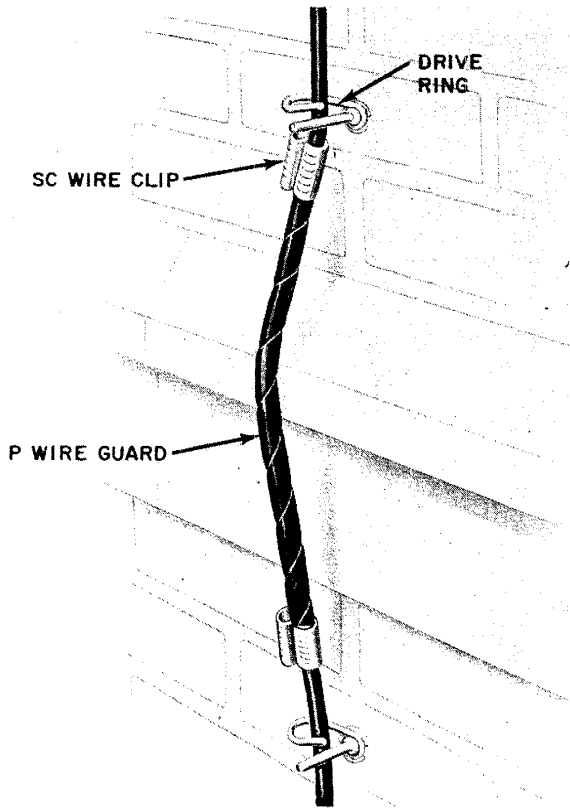


Fig. 3—Crossing Masonry Building Projection

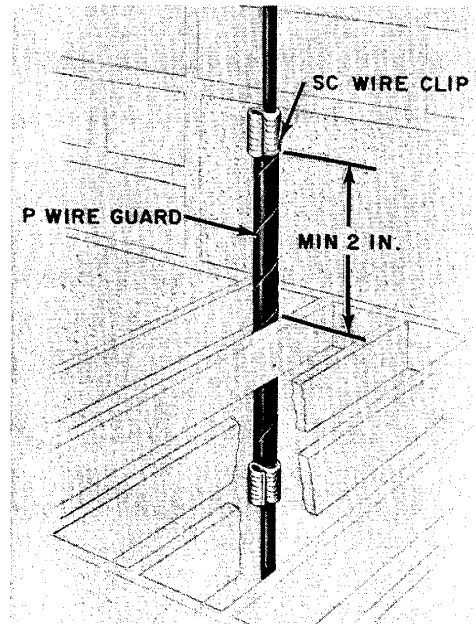


Fig. 5—Protecting Wire Run Through Stationary Metal Grating



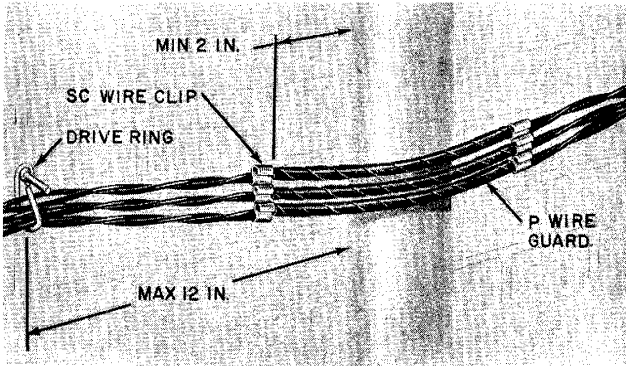


Fig. 6—Block Wires Crossing Over Pipe

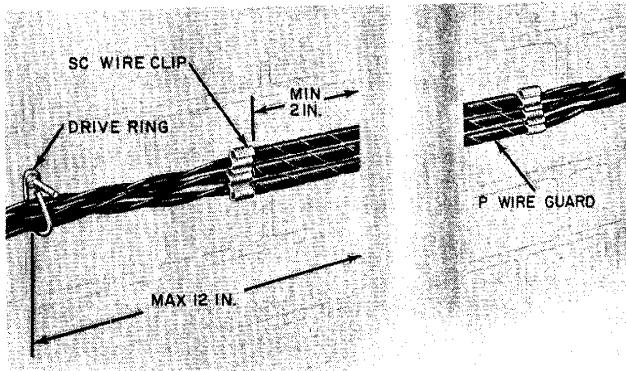


Fig. 7—Block Wires Crossing Behind Pipe

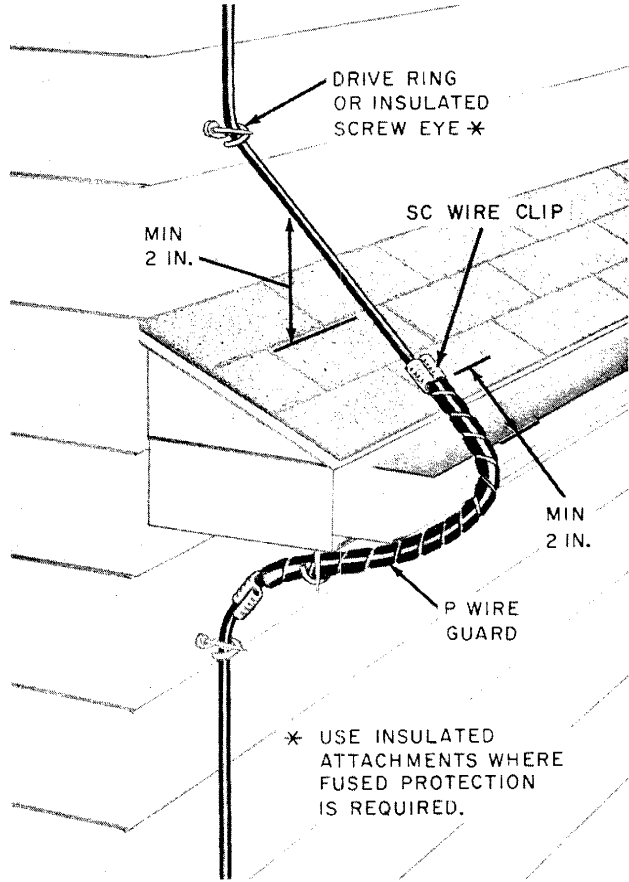


Fig. 9—Crossing Building Overhangs and Gutters

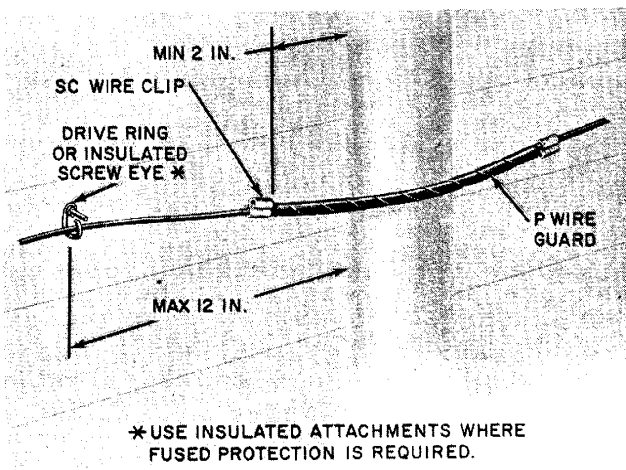


Fig. 8—Drop Wire Over Pipe

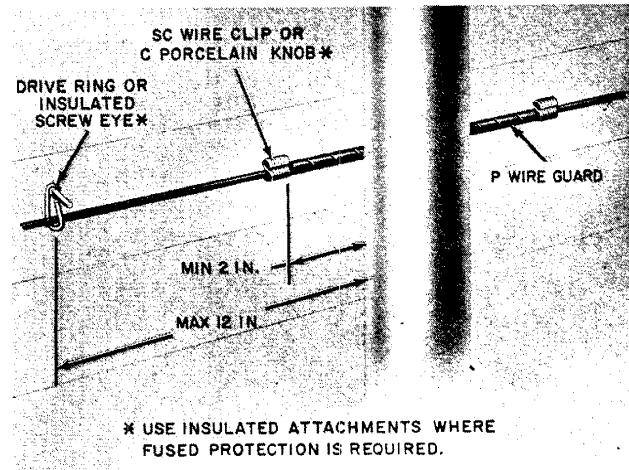


Fig. 10—Drop Wire Crossing Behind Pipe

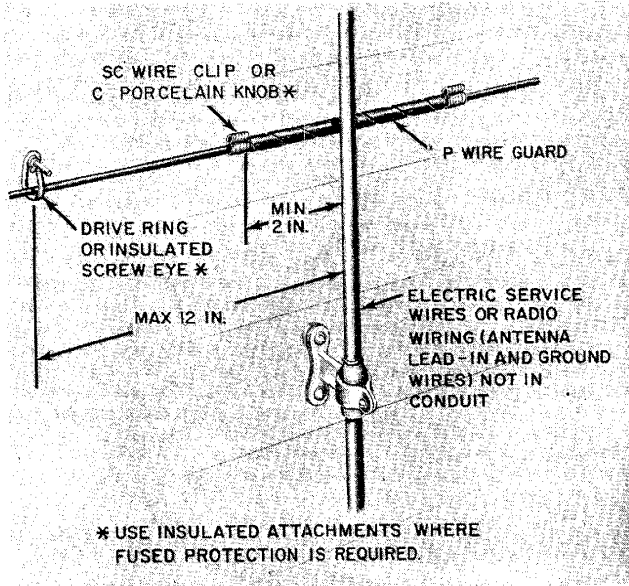


Fig. 11—Drop Wire Crossing Behind Foreign Wire

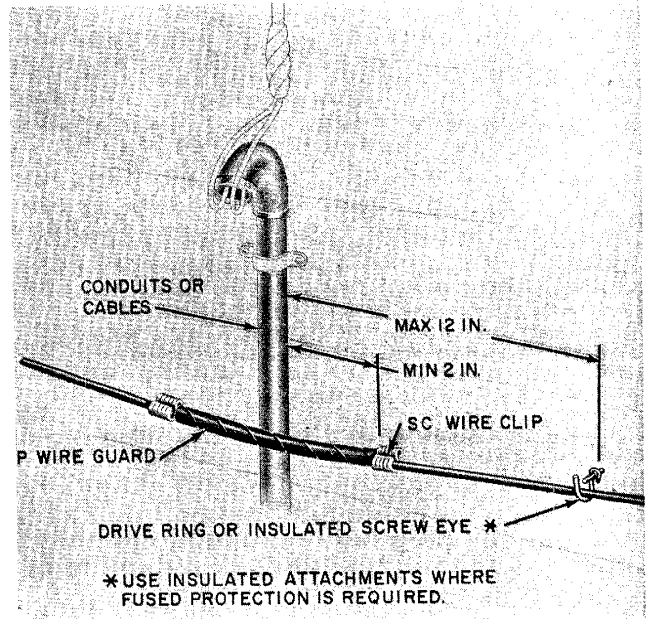


Fig. 13—Drop Wire Crossing Over Conduit

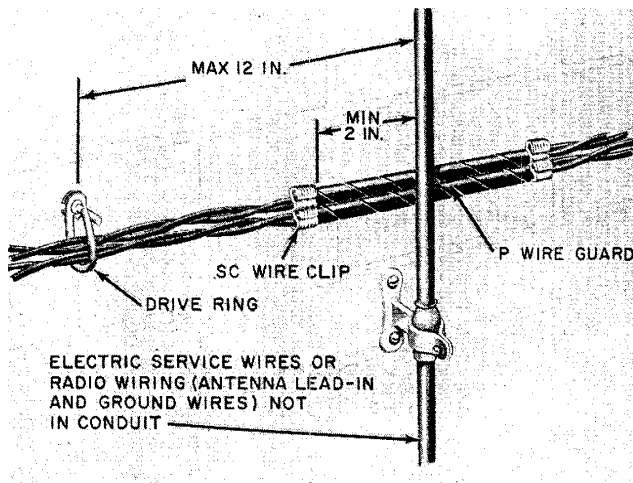


Fig. 12—Block Wire Crossing Behind Foreign Wire

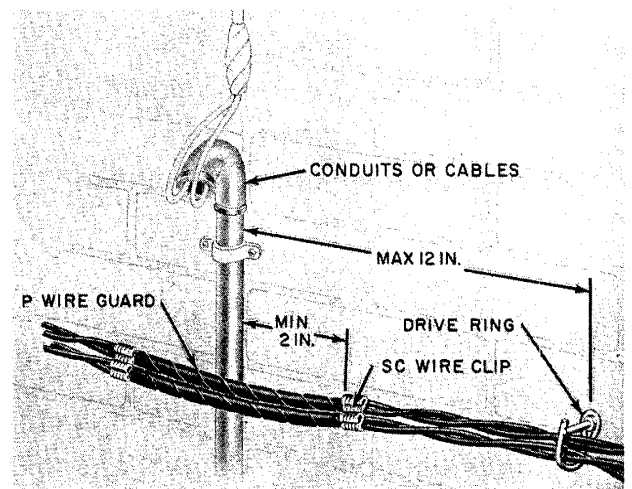


Fig. 14—Block Wire Crossing Over Conduit

**REPLACING PAGE ADDENDUM**

**Filing Instructions:**

1. REMOVE FROM THE SECTION THE PAGES NUMBERED THE SAME AS THOSE ATTACHED TO THIS PINK SHEET.
2. INSERT THE ATTACHED PAGES INTO THE SECTION IN THEIR PLACE.
3. PLACE THIS PINK SHEET AHEAD OF PAGE 1 OF THE SECTION.

**DROP WIRE**

**PLACING WIRE FOR MOBILE HOMES**

**1. GENERAL**

**1.001** This addendum supplements Section 462-460-200, Issue 4. The attached pages must be inserted in the section in accordance with the filing instructions above.

**1.002** This addendum is issued to revise 1.04 by deleting the information regarding obtaining permission to attach wire to mobile homes.

**Attached:**

Page 1 dated November 1968, revised

Page 2 dated November 1968, reissued



## DROP WIRE

### PLACING WIRE FOR MOBILE HOMES

#### 1. GENERAL

1.01 This section covers general information for the placing of drop wire for mobile homes.

1.02 This section is reissued to specify the use of insulator supports in grounding of the mobile home chassis and to elaborate on various other grounding precautions associated with drop wire installations.

1.03 Placing drop wire, station wire, and protectors on mobile homes should be on the same basis as installations for permanent buildings with the exceptions noted.

1.04 Prior to proceeding with installation, a preliminary survey of the area should be made. Makeshift pole lines, insufficient clearances, etc, should definitely be avoided. Necessary arrangements for facilities such as private poles and digging and backfilling trenches for buried wire should be made by the outside plant engineer.

1.05 Where such negotiated arrangements have not been made by the engineer or conditions are found unsatisfactory, refer the matter to the supervisor.

1.06 Where attachments are made on joint-use poles and posts, the standard separations between power and telephone wires must be provided as for permanent residences.



*Defects in electrical equipment or wiring in a mobile home may energize the unit and present an electrical hazard to persons in or near it. If a hazardous condition is found to exist, the craftsman must proceed no further until the condition has been corrected and the supervisor informed of the condition. The craftsman should inform the occupant or the trailer park manager, if available, of any hazardous condition found.*

#### 2. TESTING MOBILE HOME

2.01 Before the craftsman makes bodily contact with *any* metal portion of the mobile home, the following tests should be made:

- (a) Test metallic mobile home body for possibility of being energized.
- (b) Test chassis of mobile home for possibility of being energized.

2.02 The craftsman should use the best available ground (water pipe, ground rod, etc) for making test.

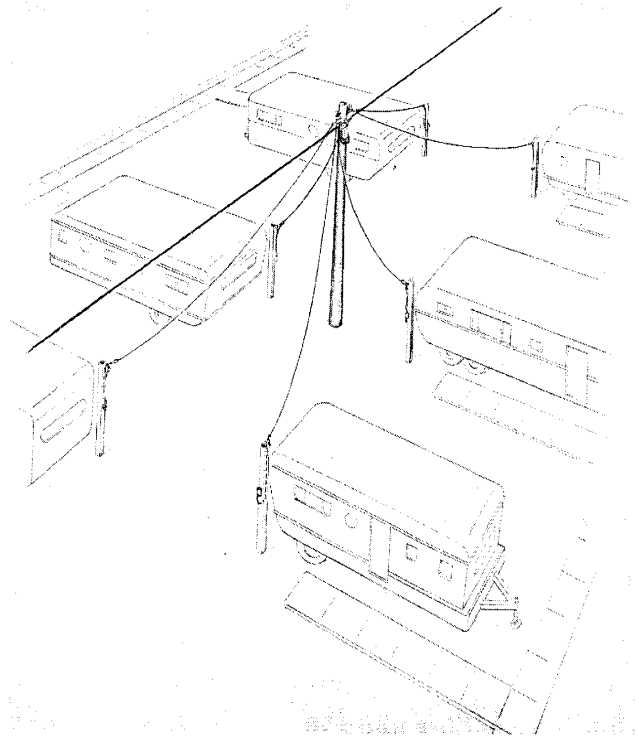
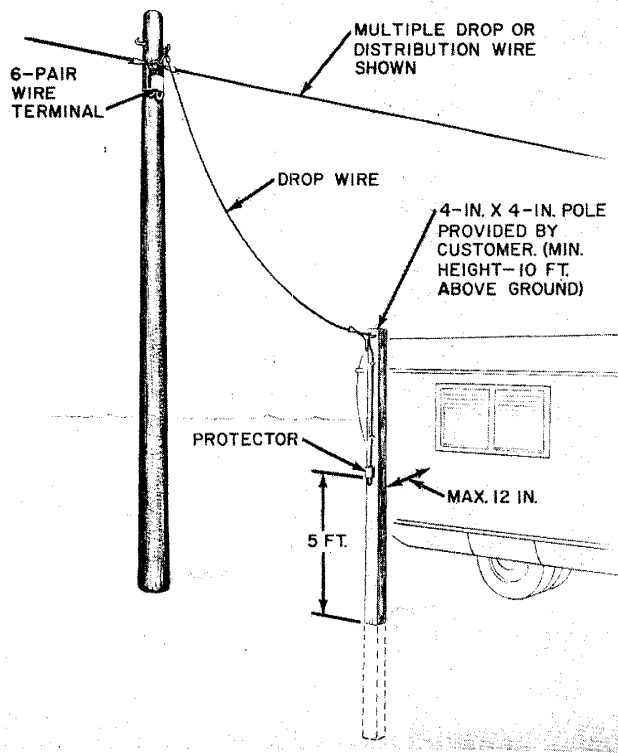


Fig. 1—Typical Aerial Service Connections

2.03 To verify presence or absence of hazardous voltage on a mobile home body or chassis, use the B Voltage Tester in the same manner as when verifying the presence of voltage on ground leads on joint-use poles as described in Section 620-105-010. If it is necessary to cut through paint to ensure good contact between mobile home and B Voltage Tester, select an inconspicuous location to avoid marring the appearance of the mobile home. *Use rubber gloves and avoid bodily contact with the mobile home during this operation.*

**THINK** *If the B Voltage Tester indicates that any part of the mobile home is energized, do not proceed until the condition is corrected and the supervisor is informed. (See 1.06.)*

### 3. INSTALLING SERVICE DROPS

3.01 The distribution plant serving a trailer park may be any of the following types, depending on the number of lines required:

- Drop wire—multiple or single
- Distribution wire
- Aerial cable
- Buried cable.

Service to an individual trailer may be either an aerial drop wire or a buried wire. Typical service connections to trailers are shown in Fig. 1 and 2.

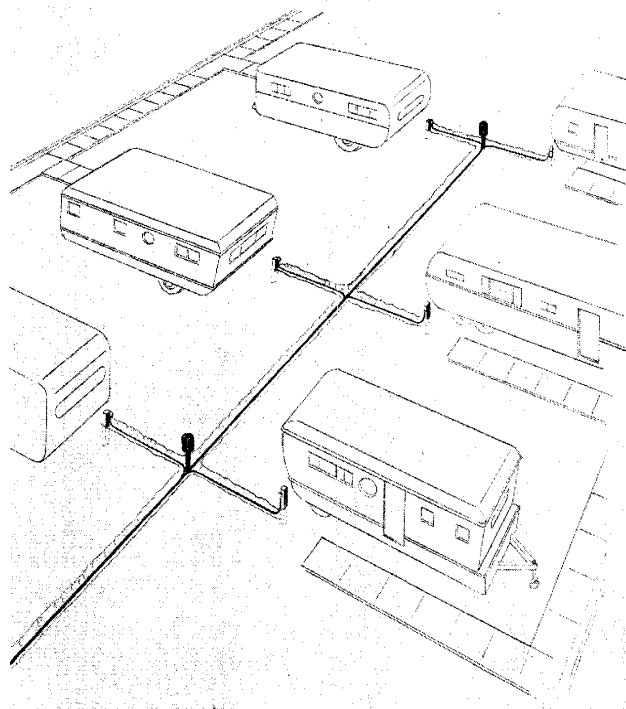
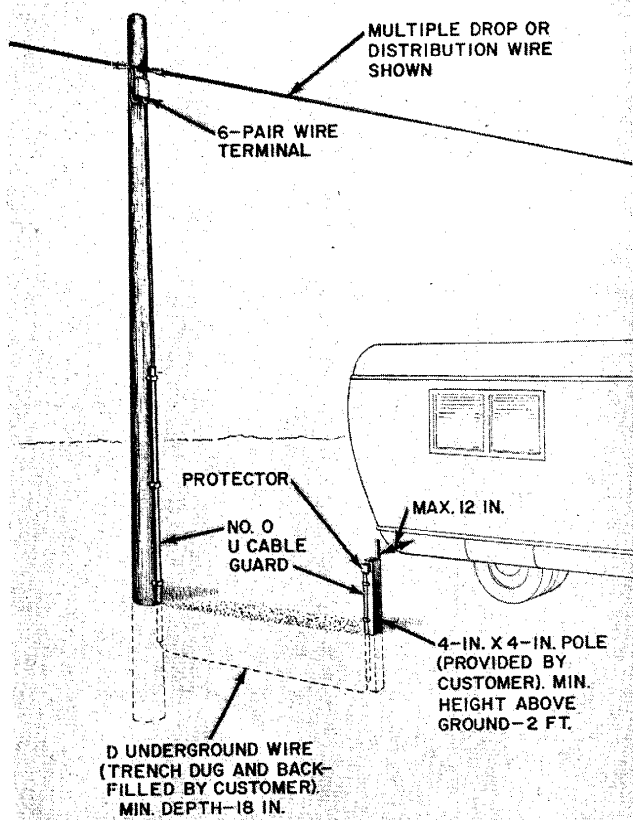


Fig. 2—Typical Buried Service Connections

**4. INSTALLING STATION WIRE AND CABLE**

**4.01** Installations generally vary, depending on the type of facilities provided by the customer. Typical grounding arrangements are shown in Fig. 3 and 4.

**4.02** The protector should be located as near as possible to the mobile home on a private post or mounted on the outside surface of the mobile home. When mounting protector on the outside surface, use 79-type or other suitable backboard. This backboard may also be used for the drop or block wire attachment.

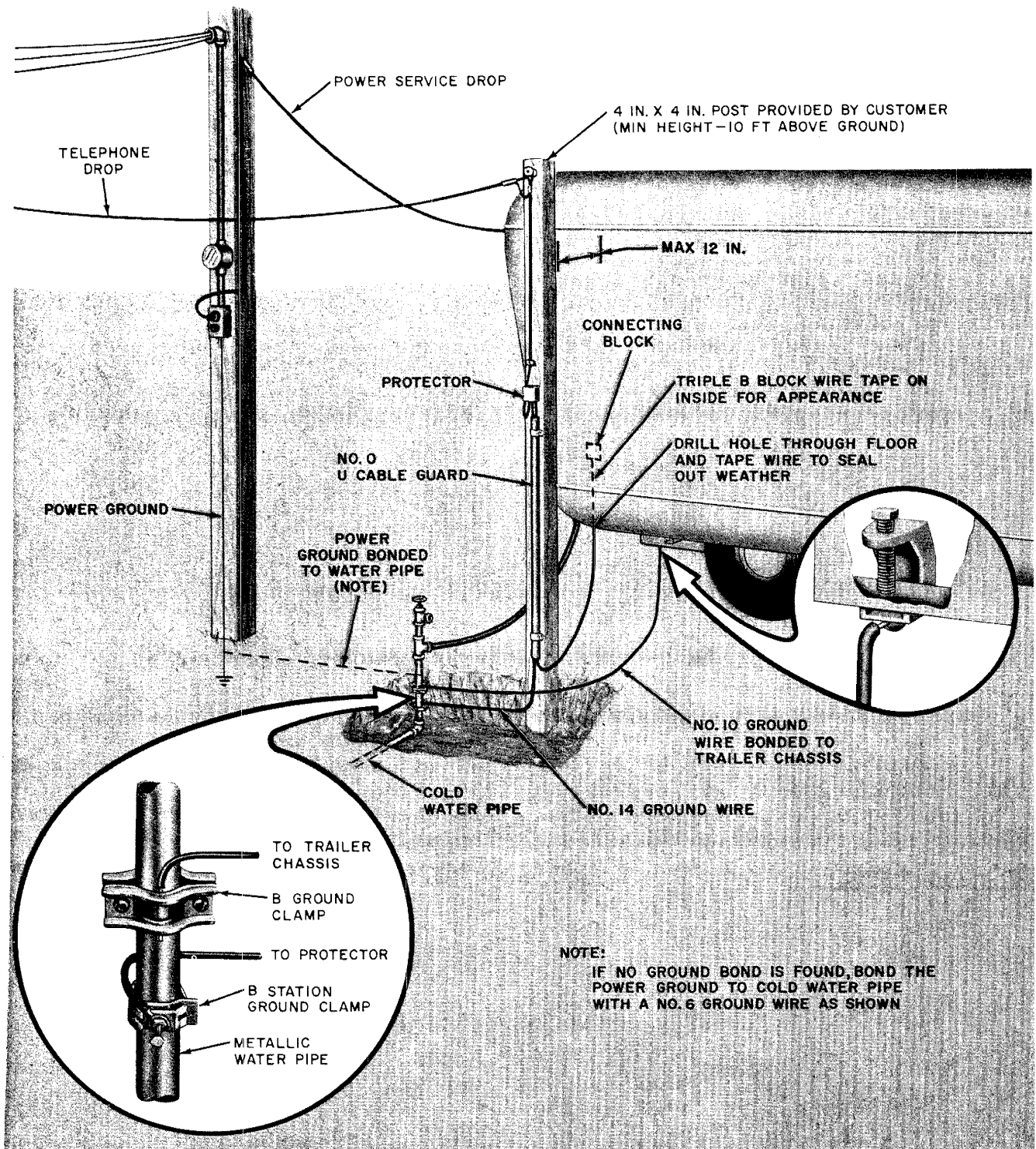


Fig. 3—Grounding Methods—Aerial Distribution



NOTE:

IF NO GROUND BOND IS FOUND, BOND THE POWER CONDUIT TO COLD WATER PIPE WITH A NO. 6 GROUND WIRE AS SHOWN

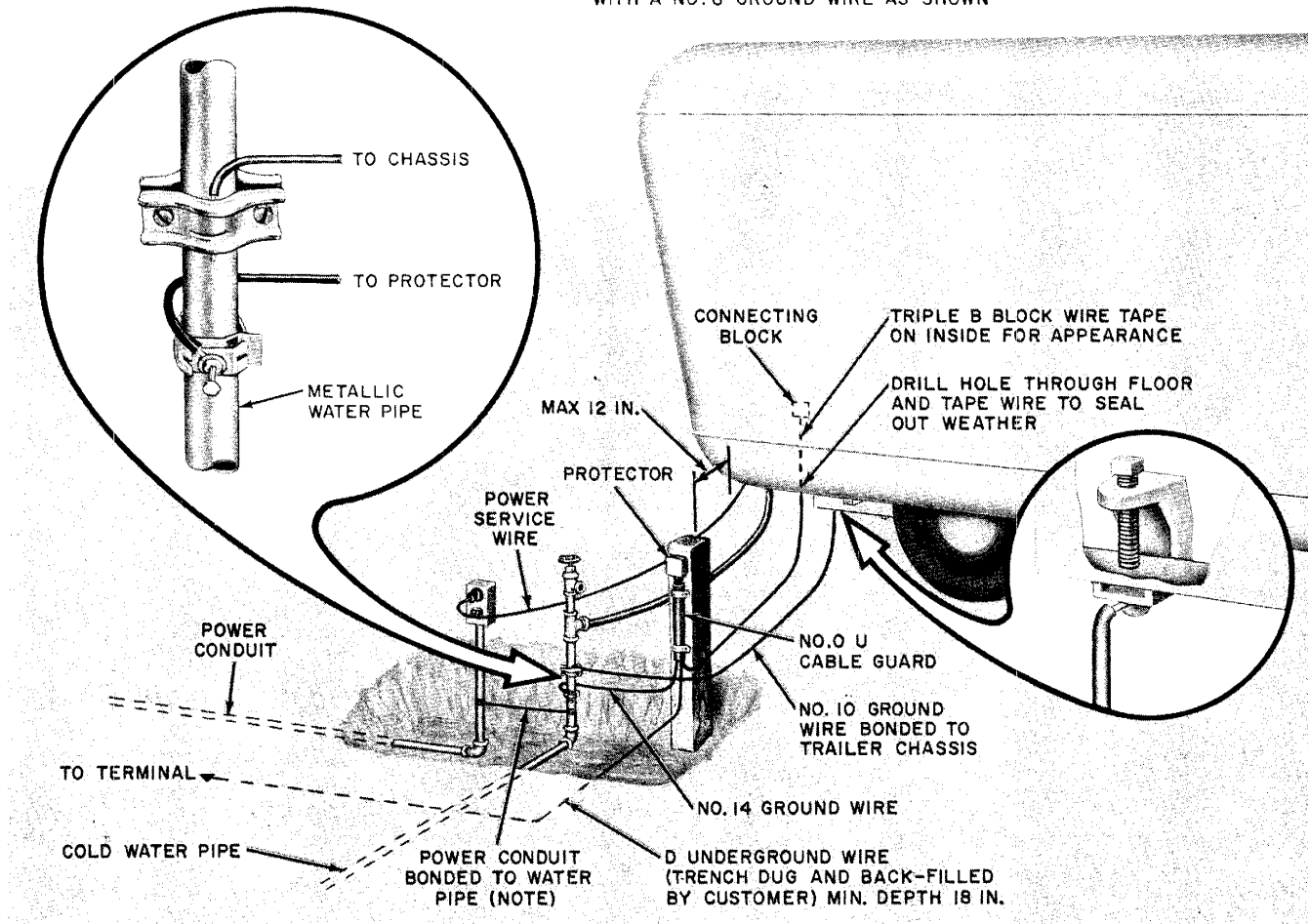


Fig. 4—Grounding Methods—Buried Distribution

**Grounding**

4.03 Refer to Section 460-100-201 for selection and installation of protector grounds and wiring of protector. For a mobile home the best ground is the power ground system. Using a #14 ground wire, connect the protector to the power ground rod, ground wire, power service conduit, or a water pipe serving as a power ground. A typical installation of this type is shown in Fig. 3 and 4. If the power ground is not present or available, ground the protector to a driven ground

rod or a metallic water pipe of which at least 10 feet is buried as shown in Fig. 5 and 6. *It is particularly important to have the power and telephone grounds bonded together. If for any reason separate ground rods are used, bond them together.*

**Bonding Mobile Home**

*Caution: The mobile home chassis must be bonded directly to the telephone protector or to the station ground.*

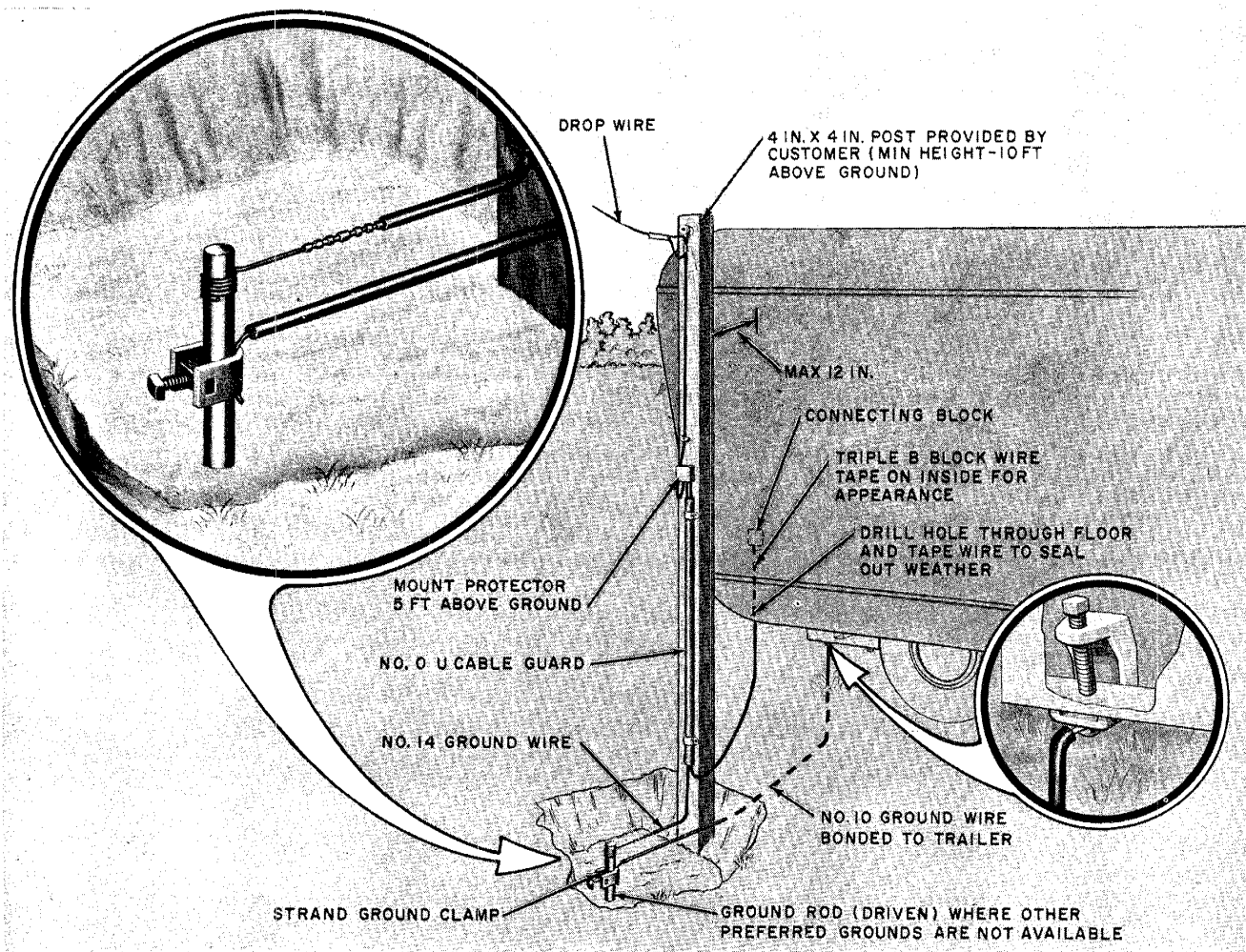


Fig. 5—Grounding—Drop Wire Distribution

**4.04** Use a suitable size B, C, or D Insulator Support to bond the mobile home chassis to the protector ground terminal or station ground. Attach the insulator support to a flange on the structural member of the mobile home chassis (Fig. 3 through 6). Attach the #10 ground wire to the insulator support with a 3/4-inch 10-24 round-head machine screw, zinc- or cadmium-plated, and a suitable size zinc- or cadmium-plated flat washer. The ground wire should be installed in a manner to provide the best possible mechanical protection.

**4.05** Bonding should be completed before any installation work is started.

#### Wiring

**4.06** The inside wiring and cabling of mobile homes should be on the same basis as for permanent structures. In some cases, short lengths of conduit for telephone wiring are provided between the bottom of the mobile home and outlet locations. Where such facilities are not provided, entrance holes should generally be drilled in the floor, the wire pulled through, taped to seal out weather, and terminated on a connecting block on the inside wall. On mobile homes that are moved often and require telephone service, it may be desirable to place permanent wiring inside to a protector mounted on the outside.





## DROP AND BLOCK WIRING DISPOSITION OF WIRE AT TERMINAL OR POLE ON DISCONTINUANCE OF SERVICE

### 1. GENERAL

**1.01** This section covers methods for disposing of drop and block wire disconnected at cable and wire terminals and protector mountings in connection with the discontinuance of service. The treatment of bridle wire connected to open wire that is not in service is covered in Section 638-320-200.

**1.02** This section also covers the use of B drop wire caps for protecting the skinned wire ends and the identification tags placed around the wire ends. Although the illustrations in this section show drop and block wires, the drop wire caps may also be used on multiple drop wire, HD wire, etc.

**1.03** This information was formerly covered in Section 625-470-241 (G32.175.2) which is canceled.

**1.04** Suitable tags, locally provided, are wrapped around the ends of disconnected drops as a means of identifying each drop in connection with plant orders to restore service. The tag should indicate the address of the customer served and other pertinent information as determined by local service practices.

**1.05** Turn down fingertight, the top nuts of the binding posts vacated by disconnected drops.

**1.06** Where a cable pair becomes spare on disconnecting a drop and it appears in a cross-connecting terminal in the cable run, the associated cross connection should be removed in accordance with local instructions.

### 2. PLACING B DROP WIRE CAP ON END OF DISCONNECTED DROP WIRE

**2.01** Proceed as follows:

- (1) Press the two conductors of the free end of wire together and wrap an identification tag around them.

- (2) Insert the tagged wire end into the open end of a B drop wire cap as far as it will go.
- (3) Place several wrappings of friction tape around the open end of the cap and the wire, thereby sealing the cap opening.
- (4) Bend the capped wire end against the supporting part of the wire and continue the tape wrappings to secure the free wire end.
- (5) These operations are illustrated in Fig. 1, 2, 3, and 4.

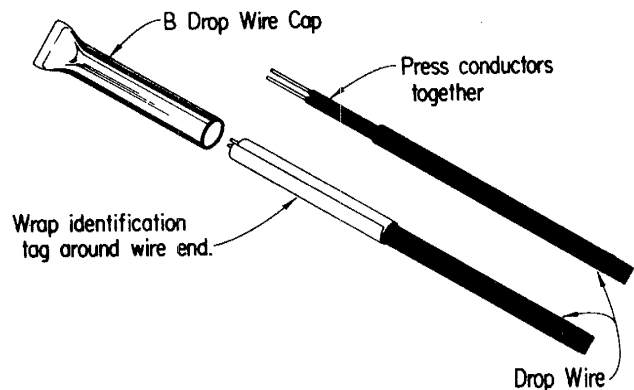


Fig. 1 — Place Identification Tag Around Wire End

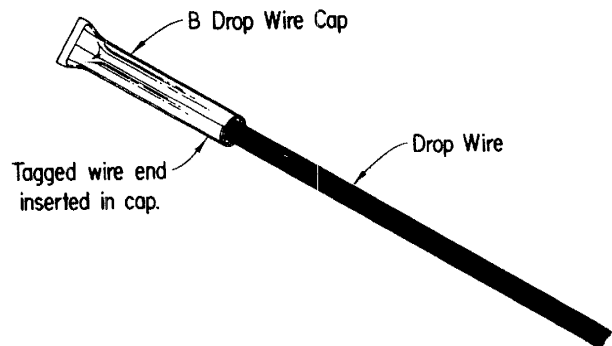


Fig. 2 — Insert Tagged Wire End in Cap

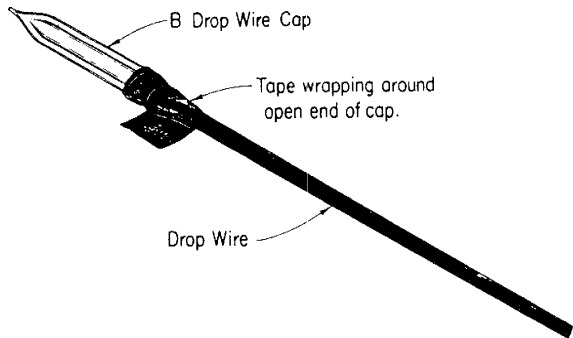


Fig. 3 — Wrap Tape Around Open End of Cap

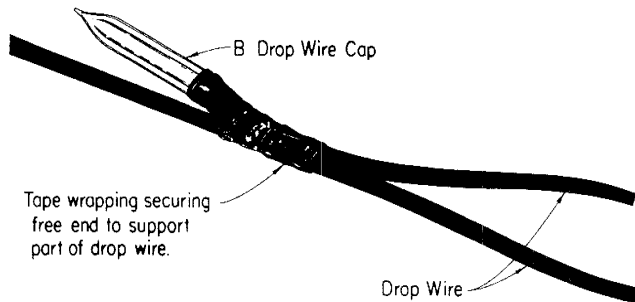


Fig. 4 — Secure Free End to Supporting Part of Drop Wire

**3. DISCONNECTING DROP WIRE AT DISTRIBUTION CABLE TERMINALS**

**3.01 Pole Mounted Terminals:** Dispose of disconnected drop as follows:

- (1) Pull the free end of wire out of the terminal.
- (2) Lay wire back on itself at the first ring below the terminal, tag and cap the free end and then secure the free end to the supporting part of the wire as shown in Fig. 5 and 6.

**3.02 Strand and Sheath Mounted Terminals:** Dispose of disconnected wire at 49-, N-, and T-type terminals as follows:

- (1) Pull free end of wire out of the terminal.
- (2) Lay wire back on itself at the wiring ring, which will allow the free end to fall outside the terminal wiring rings.

(3) Tag and cap the wire end and secure it to the supporting part of the wire as shown in Fig. 7.

**3.03 Wall Mounted Terminals**

(a) **Vertically Mounted Terminals:** Dispose of disconnected drop in the manner described in 3.01 for pole mounted terminals.

(b) **Horizontally Mounted Terminals:** Dispose of disconnected drops in the manner described in 3.02 for strand mounted terminals. The complete treatment is illustrated in Fig. 8.

**4. DISCONNECTING DROP WIRE AT WIRE TERMINALS**

**4.01 Party Line Taps in Drop Wire Runs Along a Lead:** Pull the free end of wire out of the wire terminal, tag and cap it and secure to the supporting part of the drop as shown in Fig. 9. If the party line extending beyond the wire terminal pole is disconnected, treat its free

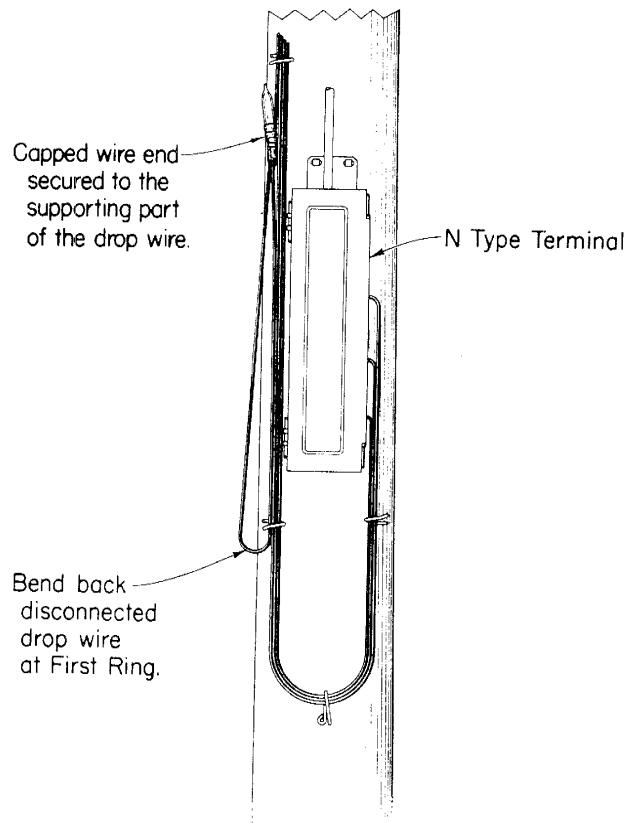


Fig. 5 — N-Type Terminal, Pole Mounted

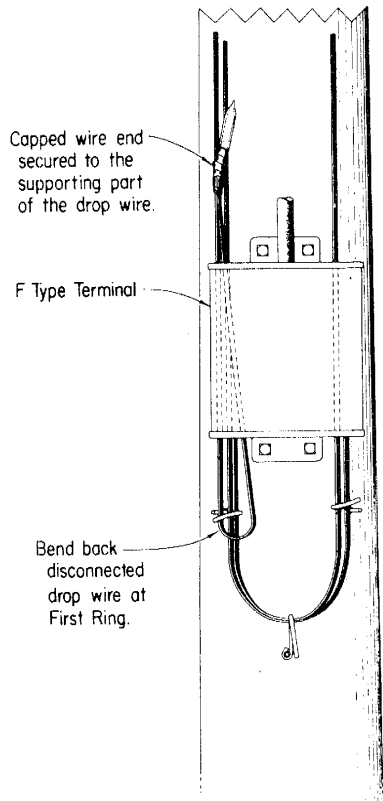


Fig. 6 – F-Type Terminal, Pole Mounted

end at this point the same as for the intermediate party line.

**4.02 Drops from Open Wire Lines:** Pull disconnected drop from the wire terminal mounted on the crossarm or pole. Lay wire back on itself at drive ring located below the wire terminal, tag and cap the free end and secure it to the supporting part of the drop as shown in Fig. 10.

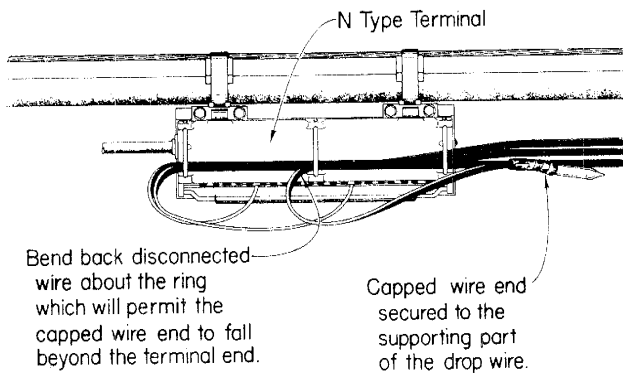


Fig. 7 – N-Type Terminal, Strand and Sheath Mounted

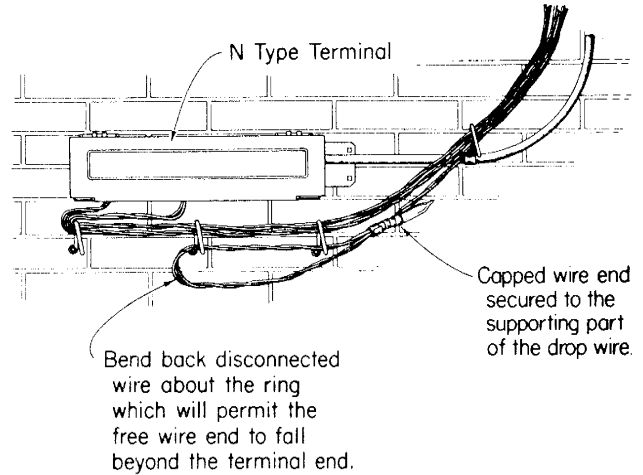


Fig. 8 – N-Type Terminal, Horizontally Mounted

**5. DISCONNECTING DROP WIRE AT 116D PROTECTOR**

**5.01** Where a drop is connected through 116D protector to a cable terminal, disconnect the drop at the terminal. Pull the free end of wire out of the terminal, tag, cap, and support it in the manner described in 3.

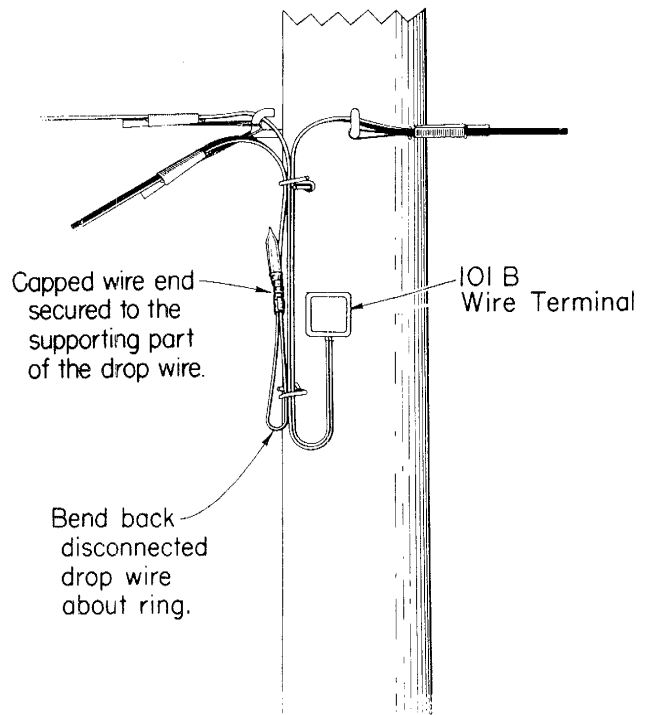


Fig. 9 – 101B Wire Terminal, Pole Mounted

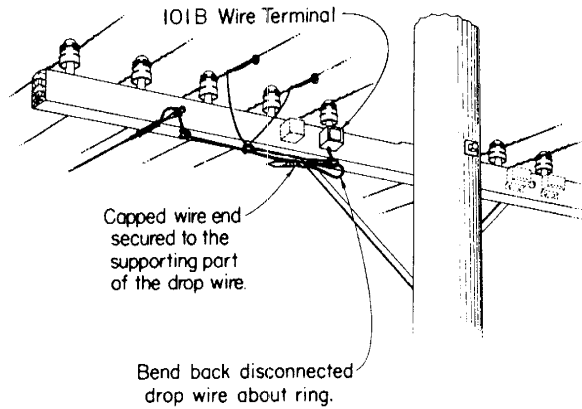


Fig. 10 — Wire Terminal Mounted on Crossarm

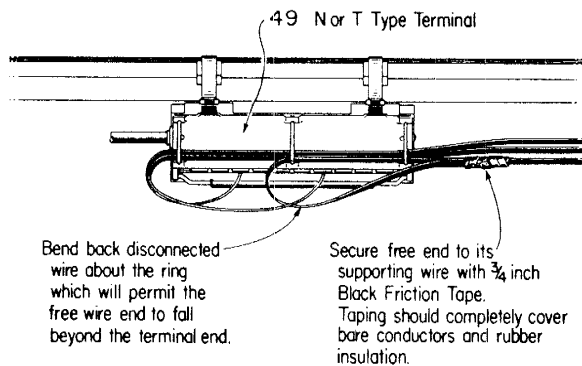


Fig. 11 — Strand and Cable Mounted Terminal

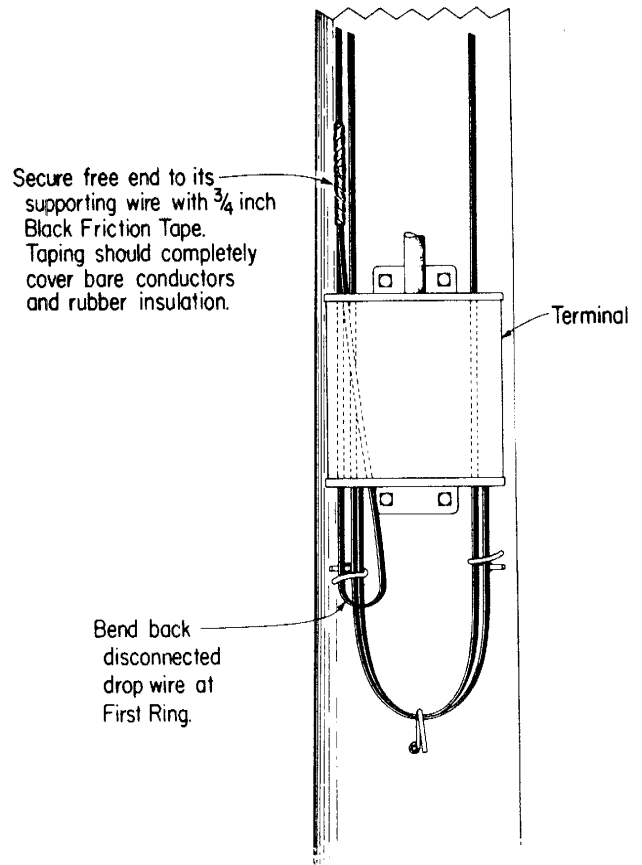


Fig. 12 — Pole and Wall Mounted Terminal

**6. DISCONNECTING DROP WIRE AT CROSS-CONNECTING TERMINALS**

**6.01** Disconnect the drop wire, tag and cap the end. Bend the wire back on itself and secure the free end inside the terminal. Remove the cross-connection associated with the disconnected drop.

**7. TAPING END OF DISCONNECTED DROP WIRE**

**7.01** Where B drop wire caps are not available, wire ends may be taped with friction tape in the manner indicated in Fig. 11 and 12. The method for disposing of disconnected wire at various types of terminals is similar to that covered in parts 3, 4, 5, and 6 for capped wire ends.



## DROP AND BLOCK WIRING

### MULTIPLE DROP WIRE

#### DESCRIPTION

#### 1. GENERAL

**1.01** Multiple drop wire is used for making multiple drop connections where fuseless-type protection or no station protection is required.

**1.02** This section is reissued to include limitations on the length of C Multiple Drop Wire runs.

**1.03** Information on B Multiple Drop Wire and C Multiple Drop Wire of earlier design is included.

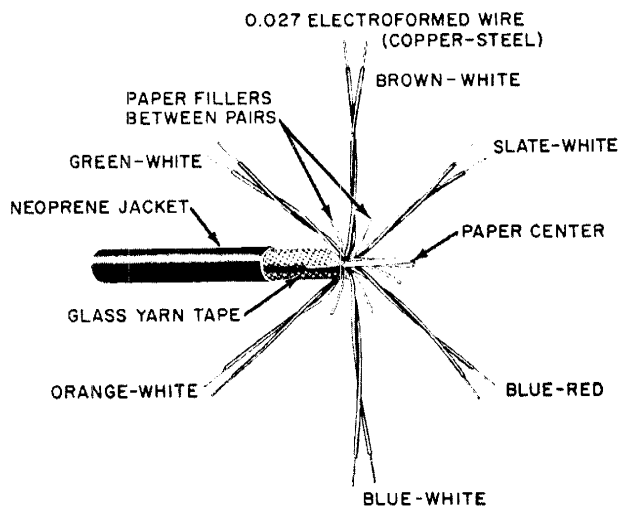
#### 2. DESCRIPTION OF MULTIPLE DROP WIRE

**2.01** Multiple drop wire is a self-supporting type consisting of six twisted pairs of conductors. Each conductor is rubber-insulated and neoprene-jacketed. The insulation of one conductor of each pair is of a distinctively different color to provide ring and tip identification, as well as pair identification. The six pairs are cabled together, and wrapped with glass yarn tape into a tight core. The assembly is encased in a black neoprene jacket.

**2.02** The color identification of the C Multiple Drop Wire is as follows:

PAIR NO.	TIP	RING
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Slate
6	Red	Blue

**2.03** Fig. 1 illustrates the makeup of C Multiple Drop Wire.



**Fig. 1—C Multiple Drop Wire (Present Design)**

**2.04** The color identification of the C Multiple Drop Wire of earlier manufacture is as follows:

PAIR NO.	TIP	RING
1	Black	Brown
2	Black	White
3	Black	Yellow
4	Black	Green
5	Black	Red
6	Black	Blue

**2.05** Makeup of this wire is shown in Fig. 2.

**2.06** Fig. 3 illustrates the makeup of B Multiple Drop Wire which was superseded by the C Multiple Drop Wire.

2.07 The B Multiple Drop Wire supplied during the early production period differs from the present standard in that five pairs were cabled around a center pair. The makeup of this wire is shown in Fig. 4.

2.08 C Multiple Drop Wire weighs approximately 14 pounds per hundred feet; B Multiple Drop Wire weighs approximately 16 pounds per hundred feet. The early design of B Multiple Drop Wire weighed 14 pounds per 100 feet.

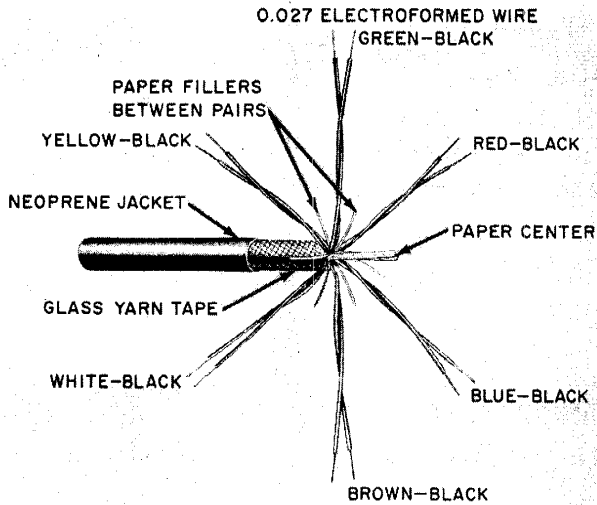


Fig. 2—C Multiple Drop Wire (Early Design)

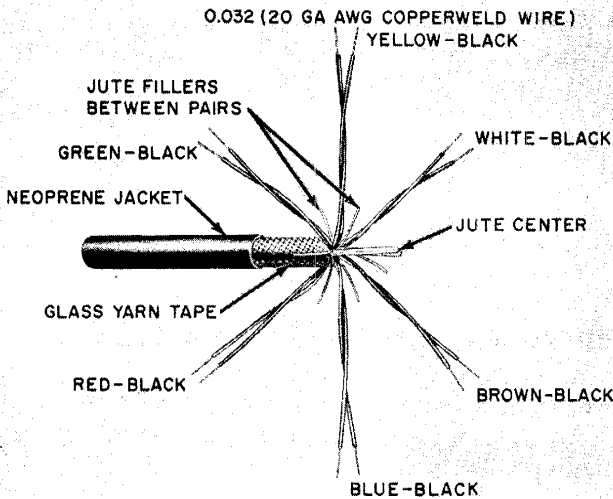


Fig. 3—B Multiple Drop Wire

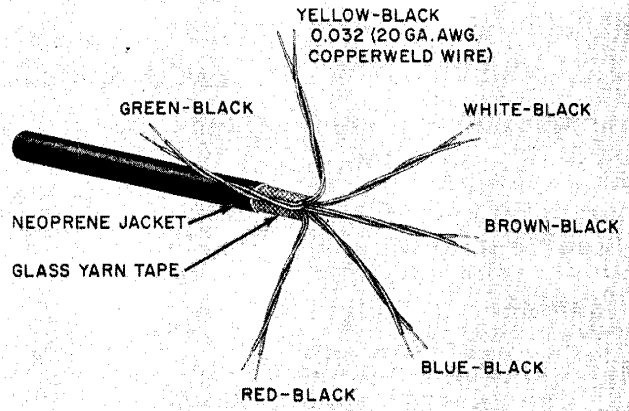


Fig. 4—B Multiple Drop Wire (Early Design)

2.09 The approximate breaking strength of C Multiple Drop Wire is 1200 pounds; the breaking strength of B Multiple Drop Wire is 1700 pounds. The early design of B Multiple Drop Wire had a breaking strength of 1200 pounds. Stringing sags, which remain common for all types, are shown in Section 462-500-011.

SPAN LIMITATIONS

2.10 Multiple drop wire can be used in spans up to 300 feet. However, due to transmission limitations, it should not be used in runs exceeding 370 feet in length.

3. ASSOCIATED MATERIALS AND APPARATUS

3.01 Materials and apparatus required in connection with the installation of multiple drop wire and their uses are as follows:

- D Drop Wire Clamp — For supporting the wire at span attachments.
- Drop Wire Puller — For pulling the wire to proper tension and snubbing it.
- 116A or 116C Protector — A 6-pair fuseless station protector for inside or outside mounting.
- 104-Type Wire Terminal — A 6-pair wire terminal similar to the 116A or 116C Protector but without protectors.

B Drive Hook	— Pole attachment.
Drop Wire Hook	— First building attachment.
No. 18 RH Galv Wood Screw 2-1/2 inch or longer	— For fastening drop wire hook to studing of frame building.
5/16-inch by 1-3/4 inch Hammer Drive Anchor	— For fastening drop wire hook on masonry walls.
No. 9 Cable Clamp	— For second and last building attachments. May also be used as intermediate attachments.
5/8-inch Drive Ring	— For intermediate building attachments.
No. 10 Ground Wire	— For grounding the 116A or 116C protector to water pipe.

**4. CUTTING MULTIPLE DROP WIRE**

**4.01** Use 6-inch SW diagonal pliers for cutting across multiple drop wire. It will be necessary to make several cuts with the pliers to complete the operation. Make an initial cut in the wire with the points of the pliers and bend the wire back at the cut to expose the inside conductors. Then cut a few conductors at a time until the cut is completed.

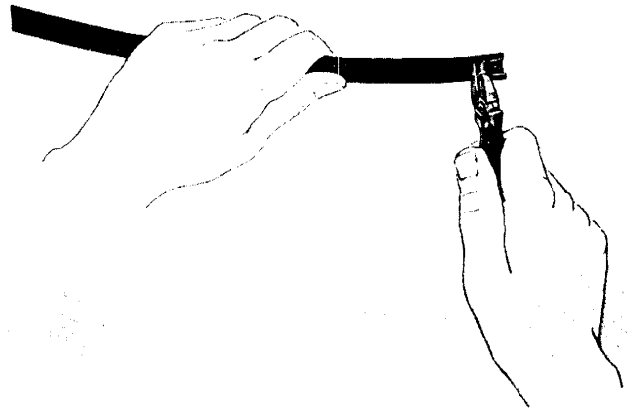
**4.02** Eight-inch side-cutting pliers can also be used for cutting multiple drop wire. It may require several presses of the pliers to cut through the wire.

**5. REMOVING OUTER JACKET ON MULTIPLE DROP WIRE**

**5.01** In terminating multiple drop wire at terminals and protectors, it is necessary to remove the outer jacket so the pairs can be fanned out. Strip the jacket as follows:

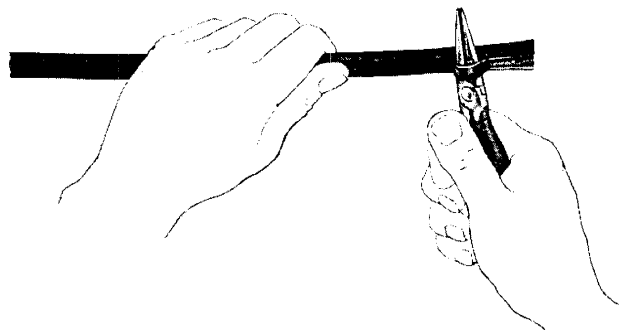
(a) Make two longitudinal cuts opposite each other on the multiple drop wire by means of the large groove of the C Braid Stripper.

(b) Grip the jacket at the wire end with diagonal pliers and roll the jacket back on itself as illustrated in Fig. 5.



**Fig. 5—Rolling the Jacket with Diagonal Pliers**

(c) Release the rolled back portion of jacket and grip it again with long-nose pliers. Again roll the jacket back on itself until it pulls free of the glass yarn tape. Then pull the jacket off with a strong steady pull over the required distance from the wire end (Fig. 6).



**Fig. 6—Rolling the Jacket on Itself with Long-Nose Pliers**

(d) Repeat operations of Steps (b) and (c) for the remaining segment of jacket.

(e) Unwrap the glass yarn tape around the wire core and fan out the pairs for conductor skinning and terminating. Cut off excess yarn tape and filler.



## DROP AND BLOCK WIRING

### MULTIPLE DROP WIRE

#### PLACING

#### 1. GENERAL

**1.01** This section covers methods for placing multiple drop wire in spans and on building walls.

**1.02** This information was formerly covered in Section 625-500-200 (G32.138.2) which is canceled.

#### 2. PLANNING MULTIPLE DROP WIRE RUNS

**2.01** In planning multiple drop wire runs on building walls, observe the following suggestions:

- (a) Select a location for the first attachment which will keep the drop wire clear of trees. In some cases an adjacent building may be used for the first attachment as a means of avoiding trees.
- (b) Locate ring runs with a view to permanency and accessibility. Avoid runs requiring the use of long ladders.
- (c) Make all runs horizontal or vertical insofar as practicable. Horizontal runs should be placed out of reach of the public, particularly children.
- (d) Locate wire runs with a minimum of obstructions.
- (e) Where necessary to cross or parallel electric wiring, rain spouts, or other obstructions, the minimum separation covered in Section 620-220-011 for drop wiring should be observed.

**2.02** Multiple drop wire is supplied on large reels. It will be necessary to make a preliminary survey of a proposed installation to determine the length of wire required so as to

avoid excess wire loss. The required length of wire can be cut from reel in garage or storeroom and, if not over 250 feet, it can be coiled on the drop wire reel. If length is over 250 feet, coil the wire in a hand coil of convenient size. Should a number of installations be located close together, it may be desirable to take the reel of wire to the job and distribute as required.

#### 3. MULTIPLE DROP WIRE RUNS ON BUILDINGS

**3.01 First Building Attachment**—Use a drop wire hook as the first building attachment for multiple drop wire in pole-to-house spans. Attach hook to masonry walls with 5/16 by 1-3/4 inch hammer drive anchor; and to wood, stucco on wood, and metal on wood walls with No. 18

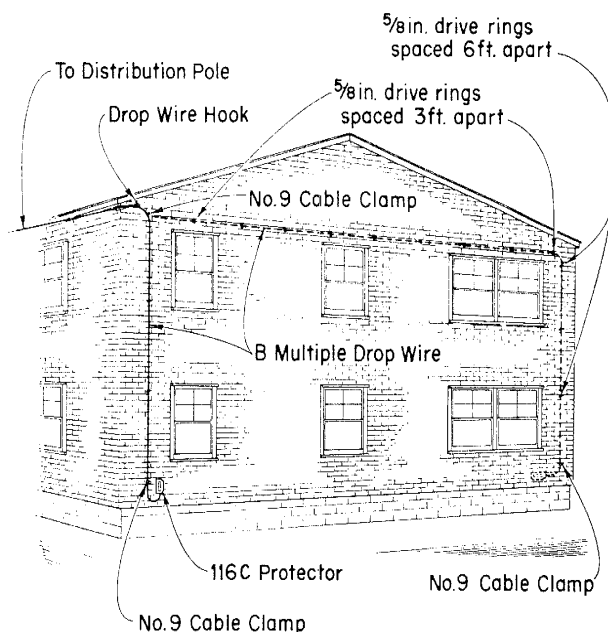


Fig. 1 — Complete Wire Run on Building

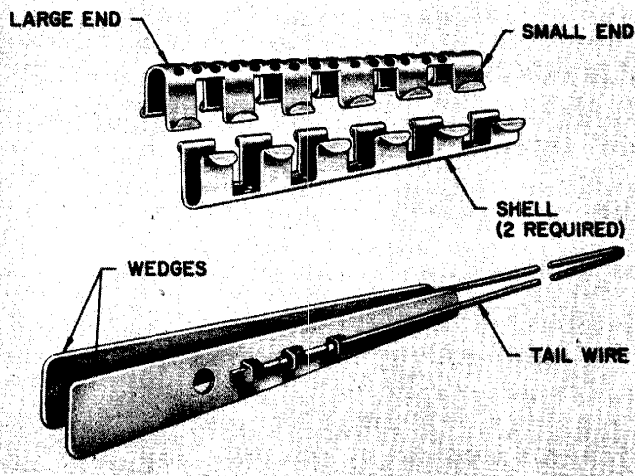


Fig. 2 — D Drop Wire Clamp

RH galvanized wood screw 2-1/2 inches or longer. The screw should penetrate the house studding at least 1-1/4 inch. Only one multiple drop wire should be supported on a drop wire hook.

**3.02 Second Building Attachment** — Clamp the cable to the wall close to the drop wire hook attachment with a No. 9 cable clamp. Attach clamp to walls as follows:

Wood walls — 1-1/2 inch No. 14 galvanized RH wood screws

Masonry walls — 1/4- by 1-inch hammer drive anchor

Stucco on wood }  
 Metal on wood } 2-inch No. 14 galvanized  
 Rigid composition } RH wood screw

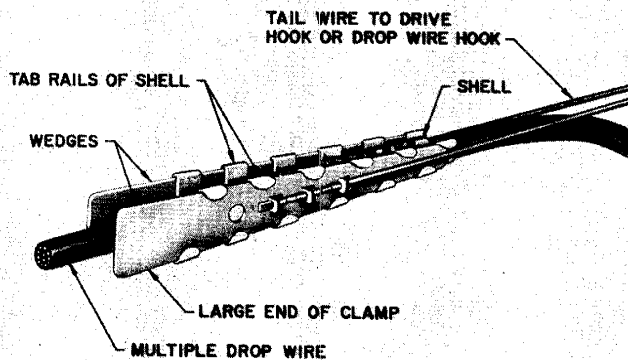


Fig. 3 — Complete Assembly of Clamp on Wire

**3.03 Intermediate Building Attachments** — Use 5/8-inch drive rings about 3 feet apart as intermediate attachments. It will be necessary to spread the opening in the rings slightly in order to insert the multiple drop wire.

**3.04 Last Building Attachment** — Place a No. 9 cable clamp on the multiple drop wire 6 inches from point of entrance to protector, wire terminal, or building after pulling the wire taut in the ring run. Attach clamp to wall as indicated in 3.02.

**3.05** The multiple drop wire may be terminated in 6-pair wire terminal or 6-pair protector on the outside wall or inside the building.

**3.06** Complete wire run on outside building wall is illustrated in Fig. 1.

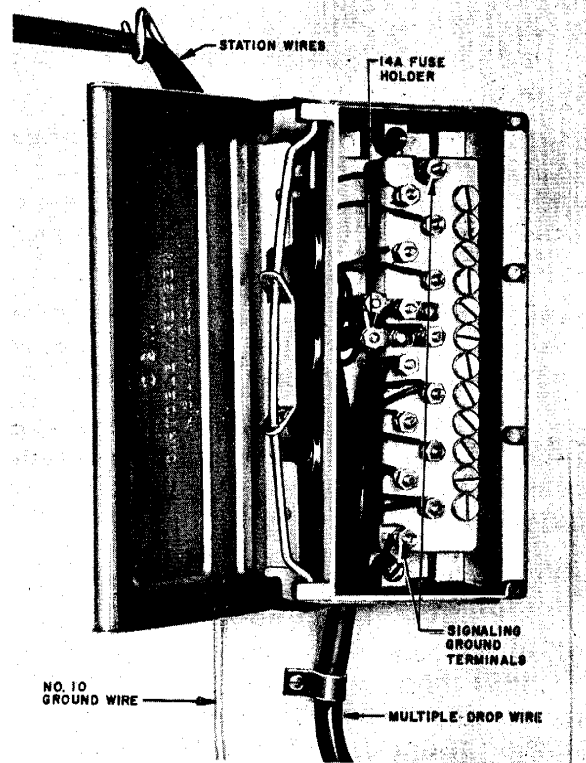


Fig. 4 — Wiring of 116C Protector

**4. MULTIPLE DROP WIRE RUNS ALONG A LEAD**

**4.01** Follow the methods prescribed for individual drop wires in pole-to-pole runs.

**5. DISTRIBUTING MULTIPLE DROP WIRE FROM TERMINAL POLES**

**5.01** Distribute multiple wire in the manner described for individual drop wires.

**6. PLACING D DROP WIRE CLAMPS ON MULTIPLE DROP WIRE**

**6.01** The D clamp is designed primarily for use on multiple drop wire. It consists of two identical semicircular shells and two flat wedges held together by a tail wire. The clamp is illustrated in Fig. 2.

**6.02** Install the clamp on the wire in the following manner:

- (1) Interlock the two shells on the wire with the large ends toward the span.
- (2) Press the shells together and slide the wedges into the tab rails on the sides of the shells. Tap the wedges with pliers to seat them firmly.
- (3) Place the tail wire over the drive hook or drop wire hook.
- (4) Complete assembly of clamp on wire is illustrated in Fig. 3.

**7. TERMINATING MULTIPLE DROP WIRE IN CABLE TERMINALS**

**7.01** Remove the outer jacket and glass yarn tape back to the first of the three drive or bridle rings associated with a pole- or wall-mounted terminal. For sheath-mounted terminals, stop jacket at terminal wiring ring nearest the pole. Fan out the pairs, run them through the rings, and terminate them in the terminal in the manner followed for block wire.

**8. TERMINATING MULTIPLE DROP WIRE IN 116-TYPE PROTECTORS**

**8.01** The 116C protector, shown in Fig. 4, consists of a metal housing equipped with a hinged metal cover and containing twelve No.

2A1A protector units, six pairs of line terminals, and two terminals for signaling ground connections. Also furnished is a clamp fixture for terminating ground wire to housing to provide protector ground. The signaling ground terminals are located at each end of the terminal block.

**8.02** The 116C protector is arranged for fastening to mounting surface without requiring a separate mounting bracket.

**8.03** Wiring of 116C protector is shown in Fig. 4.

**8.04** Insert the multiple wire into either end of the protector as desired. It will greatly facilitate conductor terminations if the end of the multiple wire is stripped of its outer jacket before inserting the wire into the protector housing.

**8.05** The 116C protector (Fig. 4) and the 116A protector (Fig. 5) are shown served by a multiple drop wire, but they can also be served by separate drop wires.

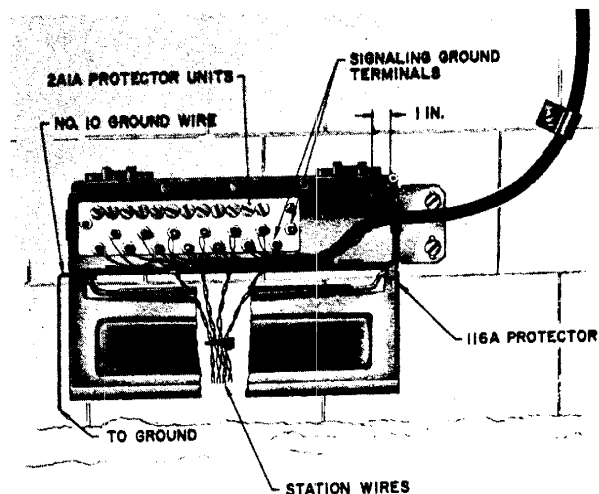


Fig. 5 - Wiring of 116A Protector

## SECTION 462-500-200

**8.06** All drop wire conductors should be terminated during the initial installation. Place the individual wires under the bottom nut of each binding post. Station wires entering the protector through the wire holes are terminated between the washers below the top nut. The signaling ground terminals are bonded internally to the protector ground terminal.

**8.07** The 116A protector is equipped with a housing which is similar to that of the 10-pair N-type distribution terminals. Mount the protector on walls in manner prescribed for N-type terminals. This protector has been superseded by the 116C protector.

**8.08** Wiring of 116A protector is illustrated in Fig. 5.

### **9. INSTALLING 60-TYPE FUSES ON 116-TYPE PROTECTORS**

**9.01** Sneak current fuses, when specified, may be added to the 116-type protector. A 14A fuse holder is used to mount the 60-type fuse on the protector (see Fig. 4).

### **10. TERMINATING MULTIPLE DROP WIRE IN 104B WIRE TERMINALS**

**10.01** A 6-pair wire terminal similar in design to the 116C protector is used where station protectors are not required. The terminal block is similar to the block in the 116C protector except for the omission of the 2A1A protector units and ground clamp. The wiring of the wire terminal will be the same as for the 116C protector except that the ground wire connection when required for station ringers is made on one of the ground posts. Use a No. 14 ground wire for this purpose.



## DEDICATED PLANT— WIRING ACCESS POINTS

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### 1. GENERAL

1.01 This section describes the method of wiring an access point in dedicated plant.

1.02 This section is reissued to:

- Revise Fig. 2 to include a stub cable and a 170-type adapter.
- Revise Fig. 3 to illustrate the new 5-type closure.
- Revise Fig. 6 to illustrate wiring arrangement of the E Backboard used in conjunction with G Cable Closure which replaces the nongastight 38-Y-B Cable Closure.
- Revise Fig. 7 to illustrate wiring arrangement of the F Backboard used in conjunction with H Cable Closure which replaces the nongastight 38-Y-C Cable Closure.
- Add illustration to illustrate wiring arrangement of the D Backboard used in conjunction with UP-1200 Cable Closure.
- Delete references to B Drop Wire Cap.

1.03 Under the dedicated plant plan, a pair is permanently assigned to a specific residence or non-key business address from a central office. Once dedicated, the pair will remain permanently assigned to a customer's location, whether working or idle.

1.04 Subscriber drop, block, or buried service wires should not be terminated in an access point.

1.05 Access points can be distinguished from control points by:

(a) A green B Cable Tie placed around the **THROUGH** cable of a strand-mounted access point. A red B Cable Tie identifies a control point.

(b) A marker with a letter *A* on a green background installed on pole- and wall-mounted closures, building cabinets, and buried closures. Control points are identified by a letter *C* on a red background.

1.06 Access points have been designed so that personnel entering an access point will find the **OUT** cable pairs placed through the rear holes of the wiring brackets, and the method of connecting the **IN** and **OUT** pairs the same regardless of the type of closure. This has been done to facilitate good housekeeping. The closure should always look neat after the workman leaves the job.

1.07 A talk pair is provided for calling testboard and other locations which will reduce test pick damage to the conductors.

### 2. DEFINITIONS

2.01 **Access Points** provide a means of connecting pairs in distribution cables to spare pairs in main or branch feeder cables. Cables entering access points from the central office or a preceding control point are termed **IN** or **THROUGH** cables

(Fig. 1). Cables leaving access points toward subscribers are termed **OUT** cables. Cables which originate in the access point assume the address of the access point, and the cable pair numbers assigned to the pairs in these cables begin at one (1) and continue up to the total number of pairs originating at this location. **THROUGH** feeder cables leaving access points do not change designations.

**2.02 Continuous PIC Sheath Count** provides binder group identification by the use of colored wire ties installed at the time of construction

of the access point. Table A lists an example of continuous PIC sheath count in an access point with one or more **IN** and **OUT** cables.

**3. TYPES OF ACCESS POINTS**

**3.01** A workman visiting the following types of access points will find that the **OUT** cable units have been positioned in the wiring brackets and identified by a continuous PIC sheath count. The access point may have a number of pairs connected or no pairs connected.

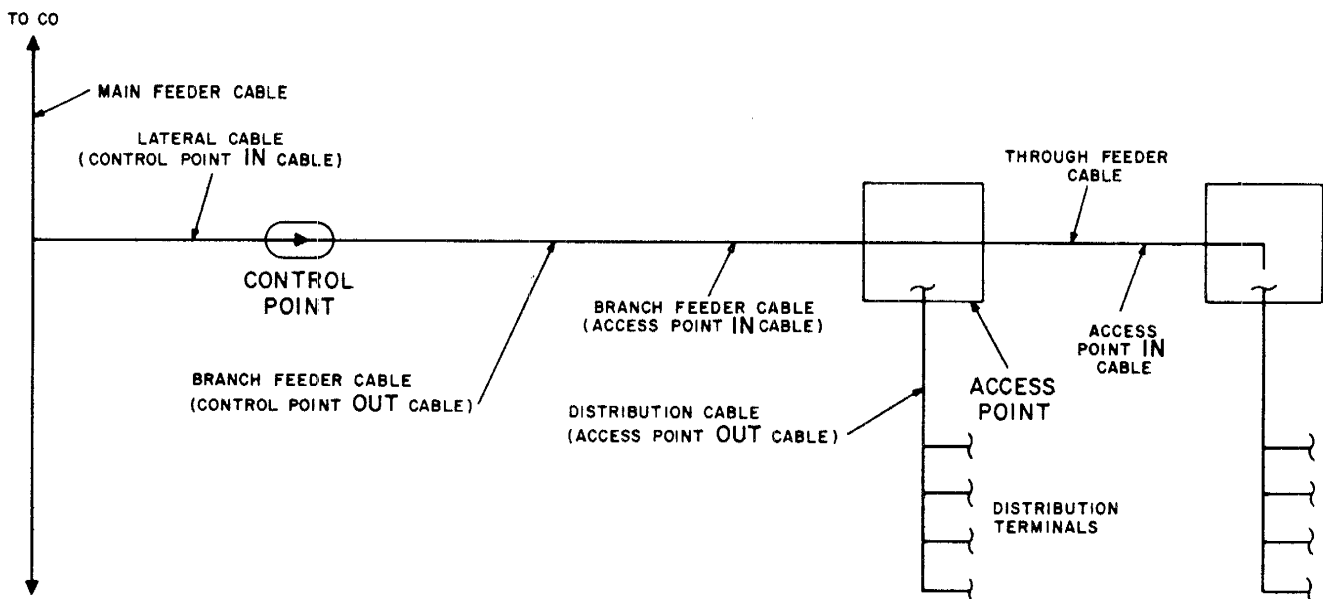


Fig. 1—Simplified Dedicated Plant Distribution System

**TABLE A — EXAMPLE OF A CONTINUOUS PIC SHEATH COUNT  
IN AN ACCESS POINT**

OUT CABLES <sup>1</sup>					IN CABLES <sup>2</sup>				
CABLE NO.	CABLE PIC SHEATH COUNT	BINDER GROUP	CONTINUOUS PIC SHEATH COUNT	COLOR OF WIRE ON CONTINUOUS BINDER GR	CABLE NO.	CABLE PIC SHEATH COUNT	BINDER GROUP	CONTINUOUS PIC SHEATH COUNT	COLOR OF WIRE ON CONTINUOUS BINDER GR
1	1-25	Bl-W	1-25	Bl-W	1	1-25	Bl-W	1-25	Bl-W
1	26-50	O-W	26-50	O-W	1	26-50	O-W	26-50	O-W
1	51-75	G-W	51-75	G-W	1	51-75	G-W	51-75	G-W
1	76-100	Br-W	76-100	Br-W	1	76-100	Br-W	76-100	Br-W
2	1-25	Bl-W	101-125	S-W	1	101-125	S-W	101-125	S-W
2	26-50	O-W	126-150	Bl-R	1	126-150	Bl-R	126-150	Bl-R
2	51-75	G-W	151-175	O-R	1	151-175	O-R	151-175	O-R
2	76-100	Br-W	176-200	G-R	1	176-200	G-R	176-200	G-R
3	1-25	Bl-W	201-225	Br-R	2	1-25	Bl-W	201-225	Br-R
3	26-50	O-W	226-250	S-R	2	26-50	O-W	226-250	S-R
4	1-25	Bl-W	251-275	Bl-Bk	2	51-75	G-W	251-275	Bl-Bk
4	26-50	O-W	276-300	O-Bk	2	76-100	Br-W	276-300	O-Bk
					2	101-125	S-W	301-325	G-Bk
					2	126-150	Bl-R	326-350	Br-Bk
					2	151-175	O-R	351-375	S-Bk
					2	176-200	G-R	376-400	Bl-Y

**Note 1:** *OUT* cable number and pairs are: (1)100-pair, (2)100-pair, (3)50-pair, (4)50-pair.

**Note 2:** *IN* cable number and pairs are: (1)200-pair and (2)200-pair.

(a) *Strand-Mounted Access Point*—The 1B1 Closure (Fig. 2) is used as a strand-mounted access point.

(b) *Pole- and Wall-Mounted Access Points*—The 5-type closures (Fig. 3) and the 29-type cabinets (Fig. 4) are used to enclose pole- and wall-mounted access points.

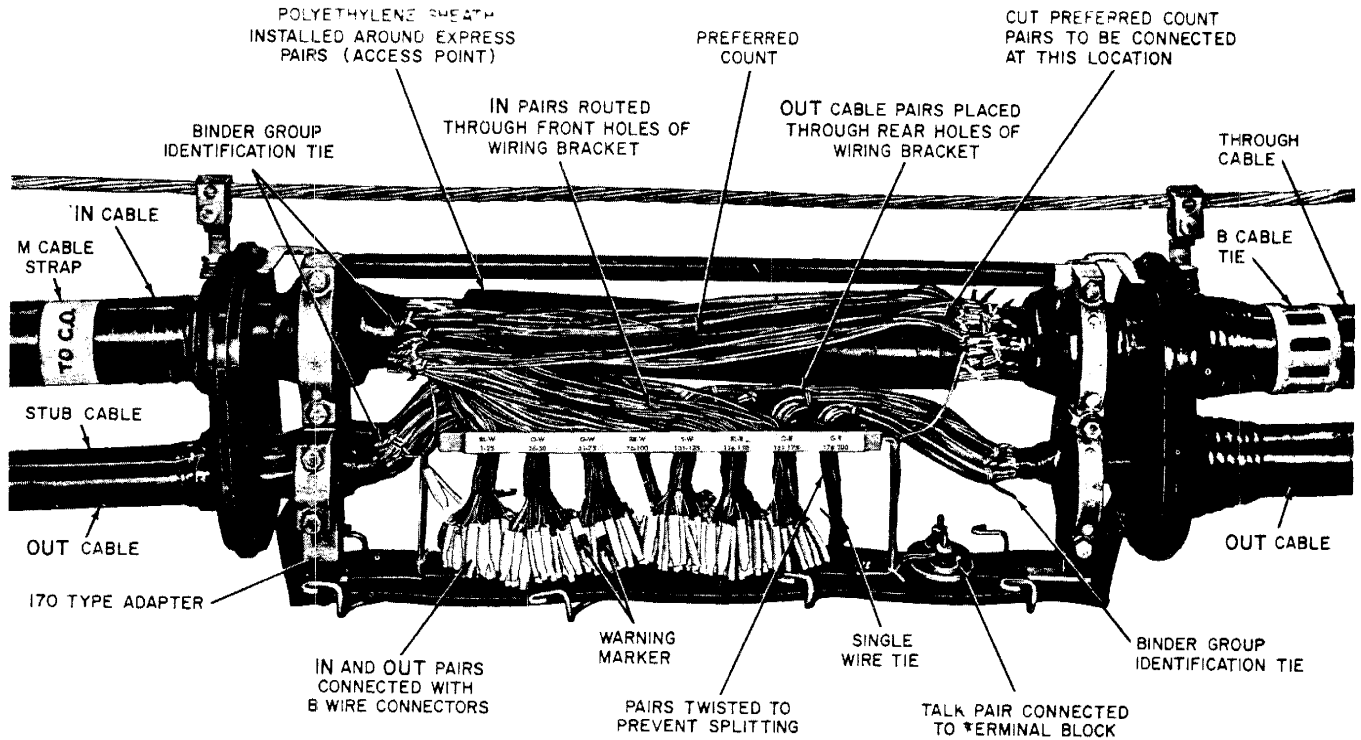


Fig. 2—1B1 Closure

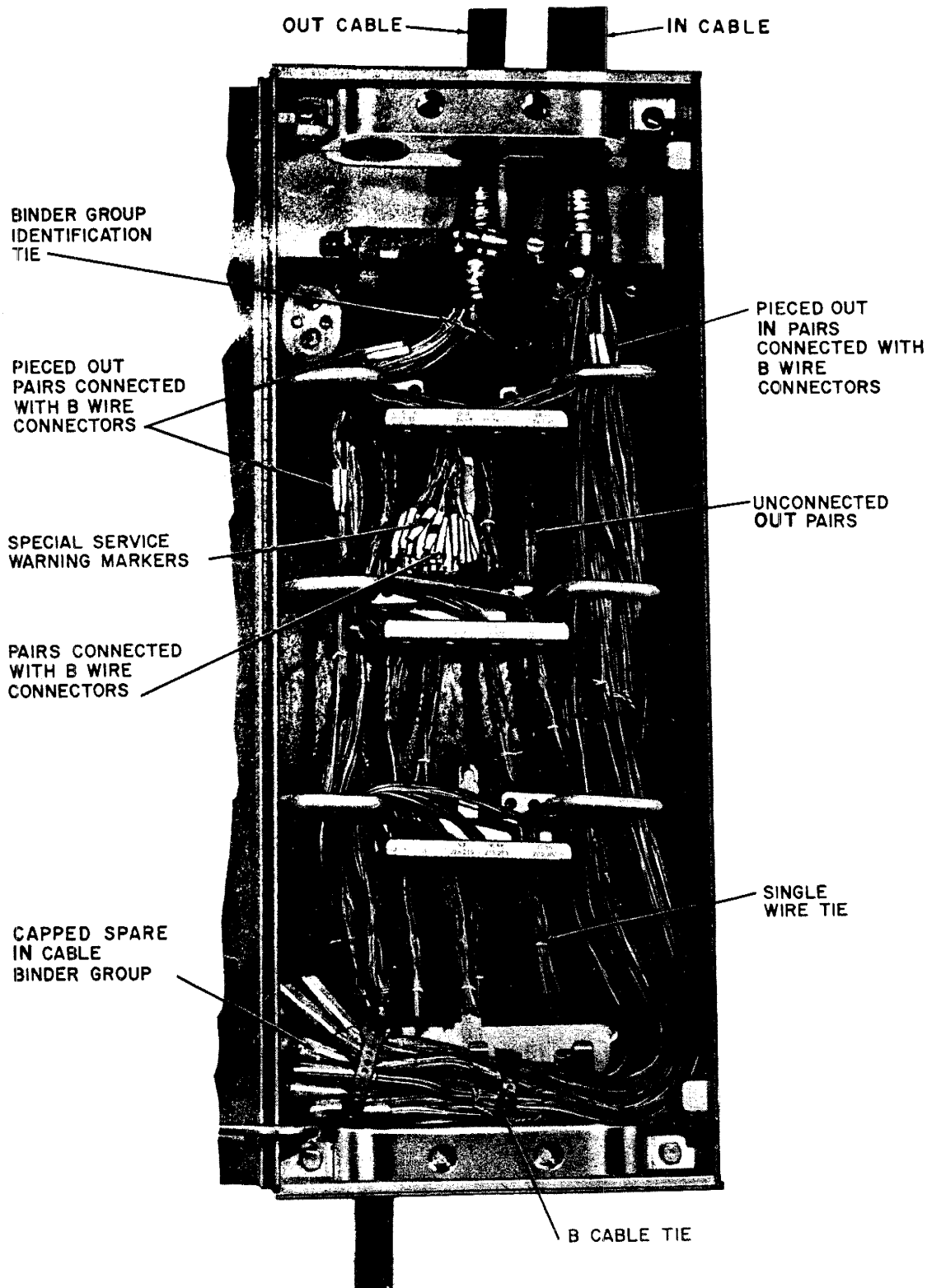


Fig. 3—5-Type Closure

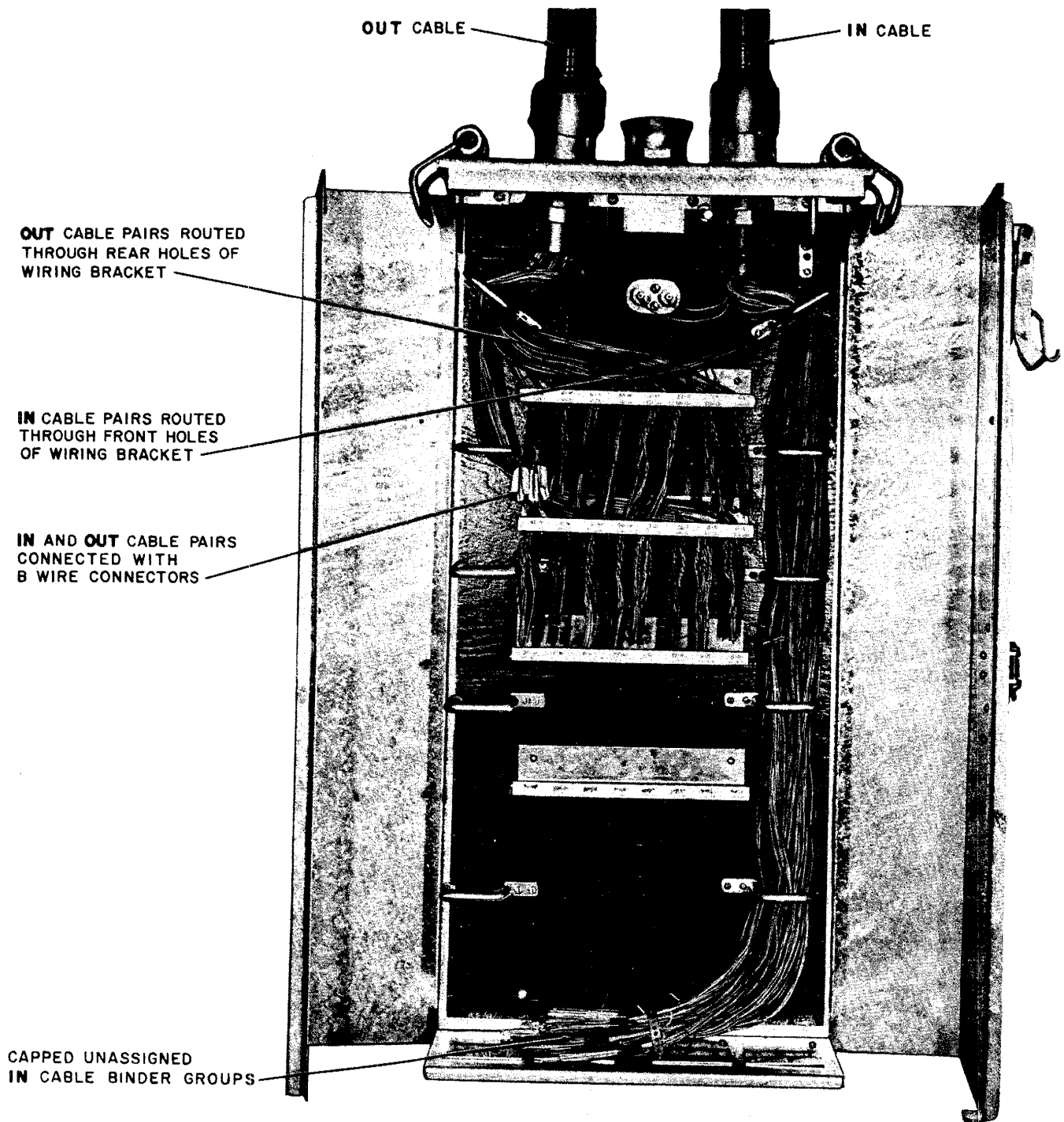


Fig. 4—29-Type Cabinet

(c) **Building Access Points**—The 31-type cabinets (Fig. 5) are used for enclosing building access points. J-type cable terminal sections are used to enclose the ends of a single or group of 31-type cabinets.

(d) **Access Points in Buried Plant**—The E Backboard (Fig. 6), the F Backboard (Fig. 7), and the D Backboard (Fig. 8), used in conjunction with the G, H, and UP-1200 Cable Closures, respectively, are used for access points

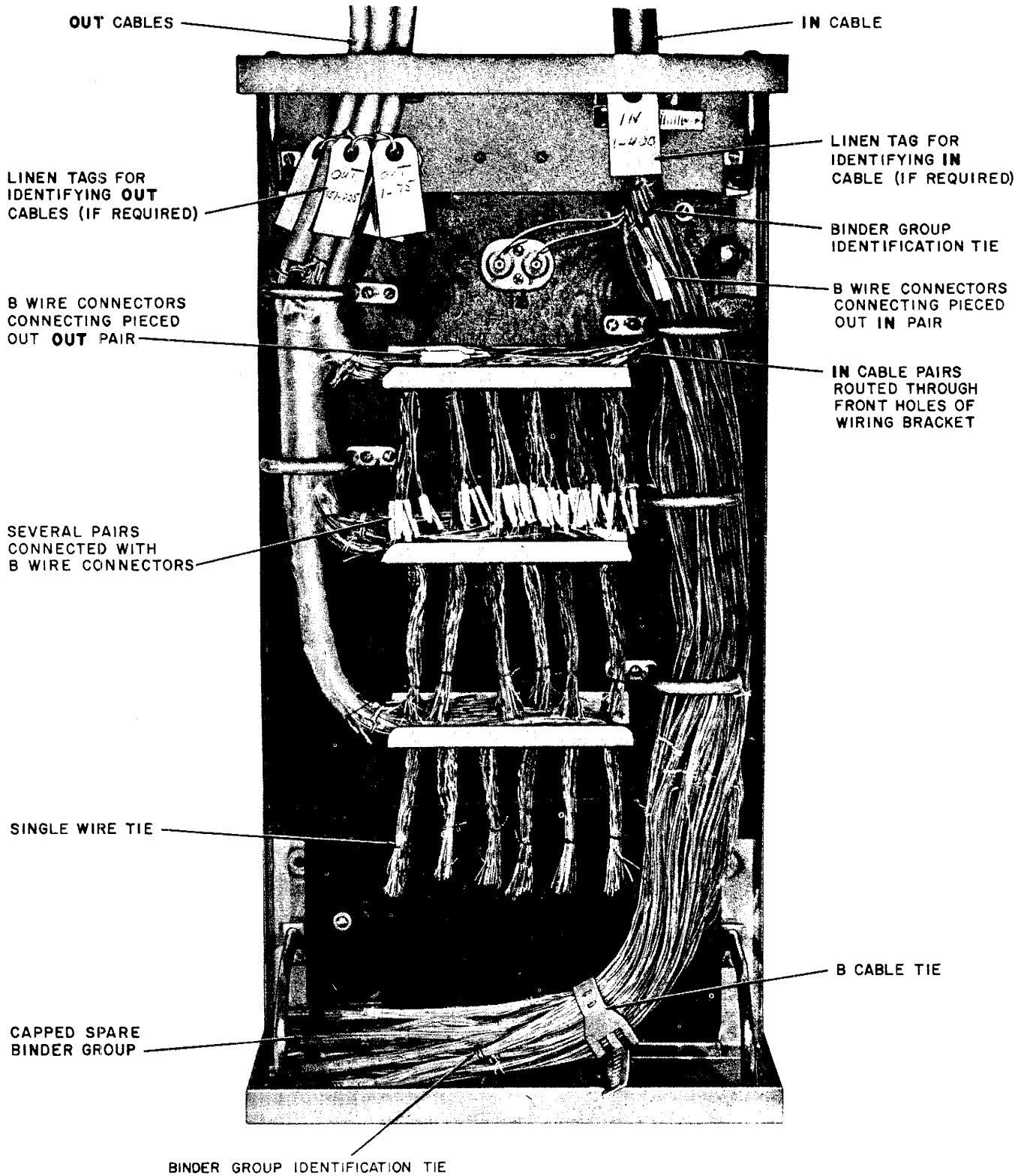


Fig. 5—31-Type Cabinet

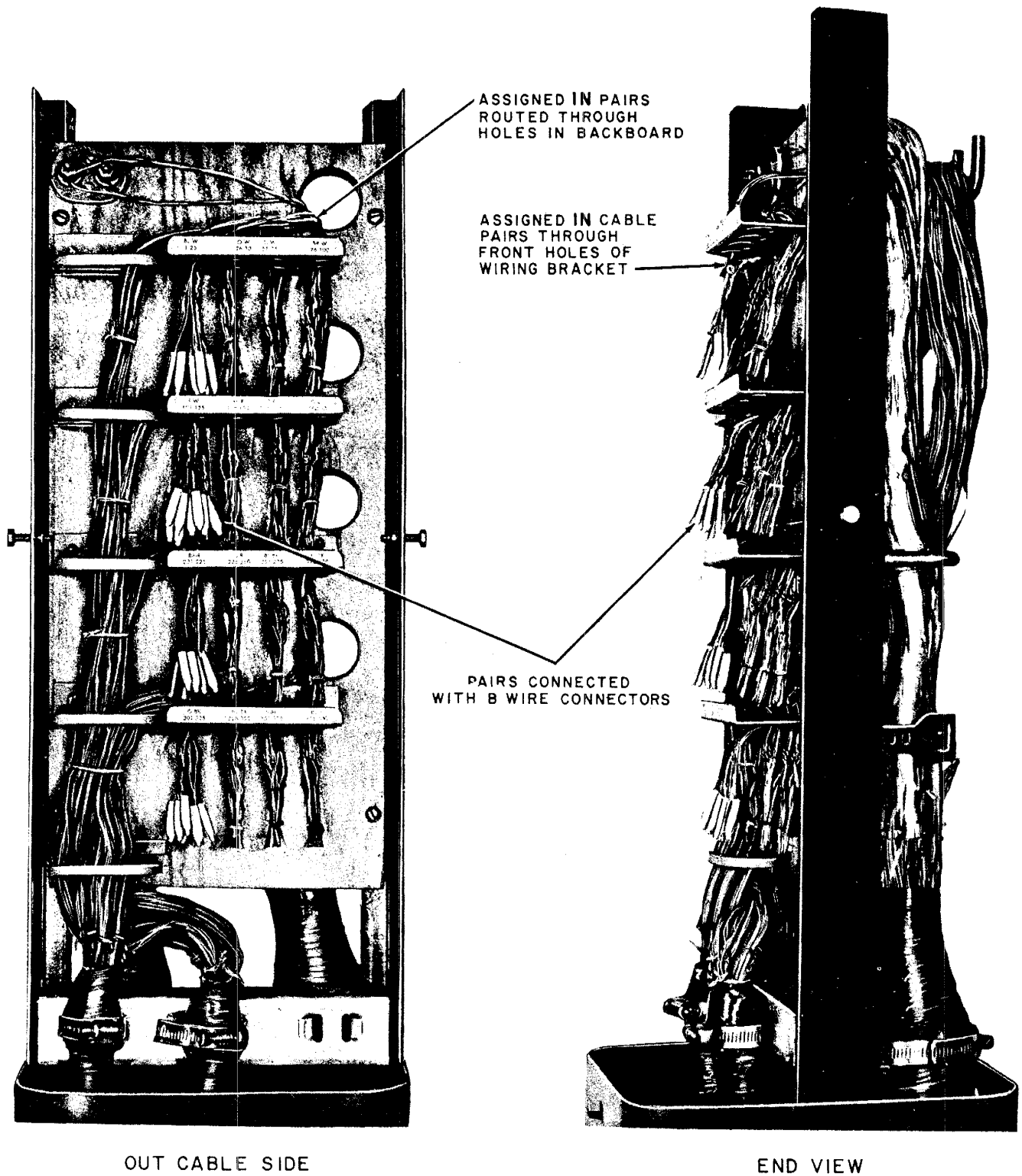


Fig. 6—E Backboard



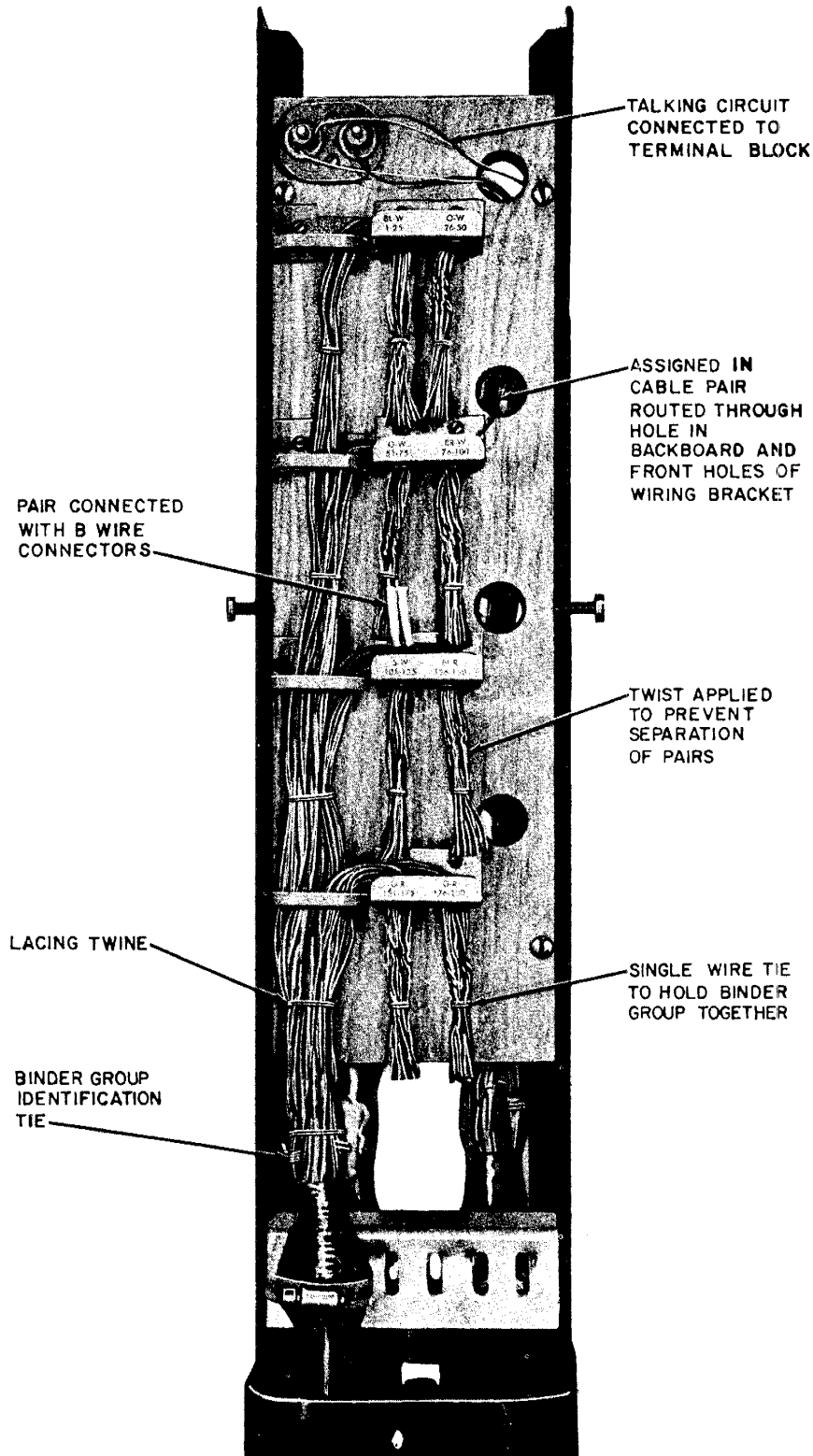


Fig. 7—F Backboard

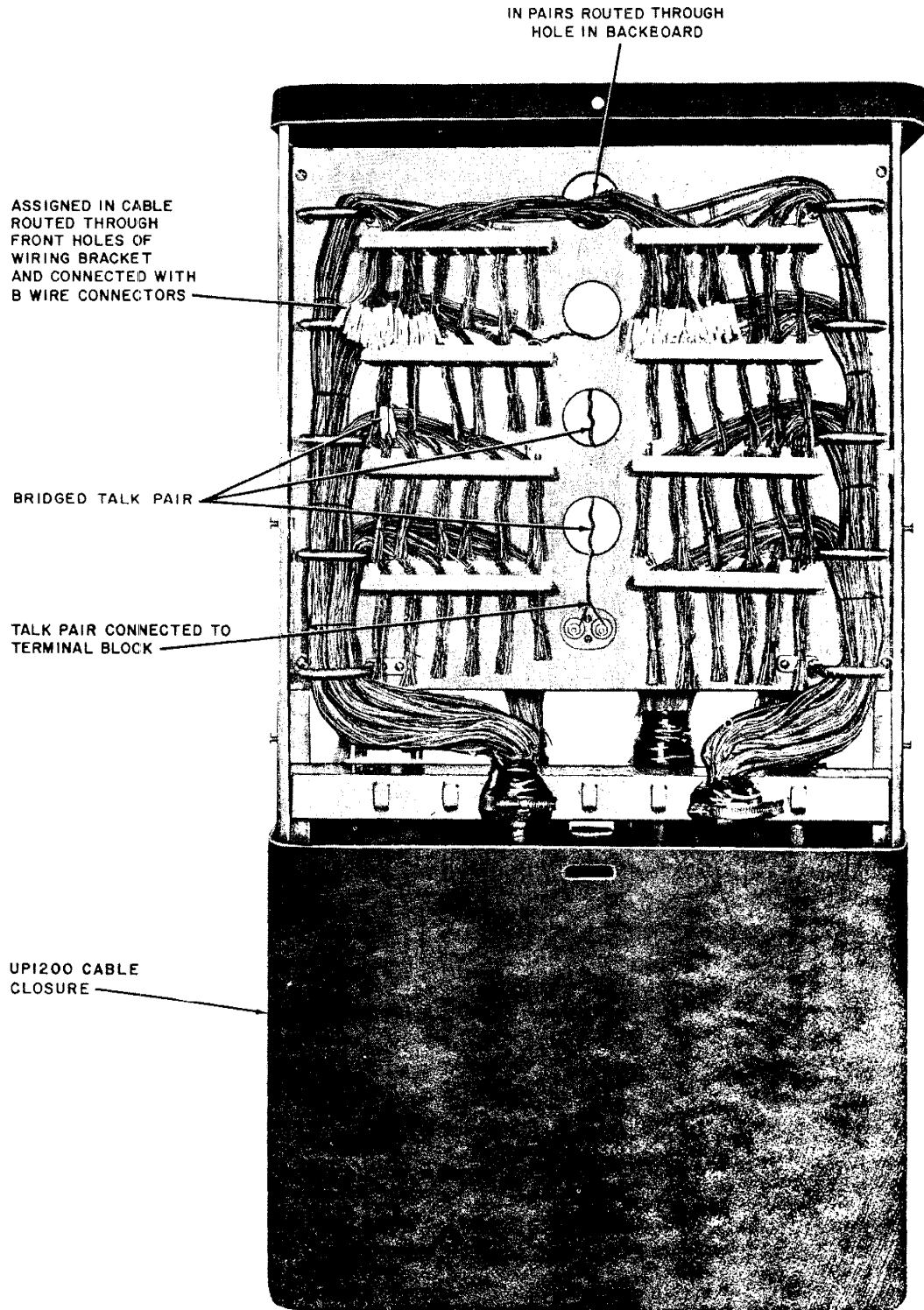


Fig. 8—D Backboard

in buried plant. Wiring arrangements for the B and C Backboards used in conjunction with the 38-Y-B and 38-Y-C Cable Closures are identical to the wiring arrangements for the E and F Backboards.♦

#### 4. IDENTIFYING SPECIAL CIRCUITS

**4.01** When cable pairs are used for special services, it will be necessary to identify the circuits at the time the pairs are connected by wrapping a red warning marker tape around each B Wire Connector as shown in Fig. 3.

**4.02** When disconnecting the special service pairs, remove the red warning marker tape from the B Wire Connectors.

#### 5. CONNECTING

**5.01** The procedures for connecting the *IN* and *OUT* cable pairs in an access point are the same in each type of closure and are designed to eliminate unnecessary handling of pairs once they are connected, promote good housekeeping, and provide easy identification; therefore it is important that the procedures outlined in this section be followed.

#### CABLE END LOCATION OR LOCATIONS FED BY STUB CABLE

**5.02** Loosen the B Cable Tie and select the assigned *IN* pair.

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5.03 Cut the assigned *IN* pair as close to the acetate container as possible as shown in Fig. 9.

*Note:* If the wrong pair is cut, insert each conductor in a B Wire Connector and press. Replace the pair within its binder group.

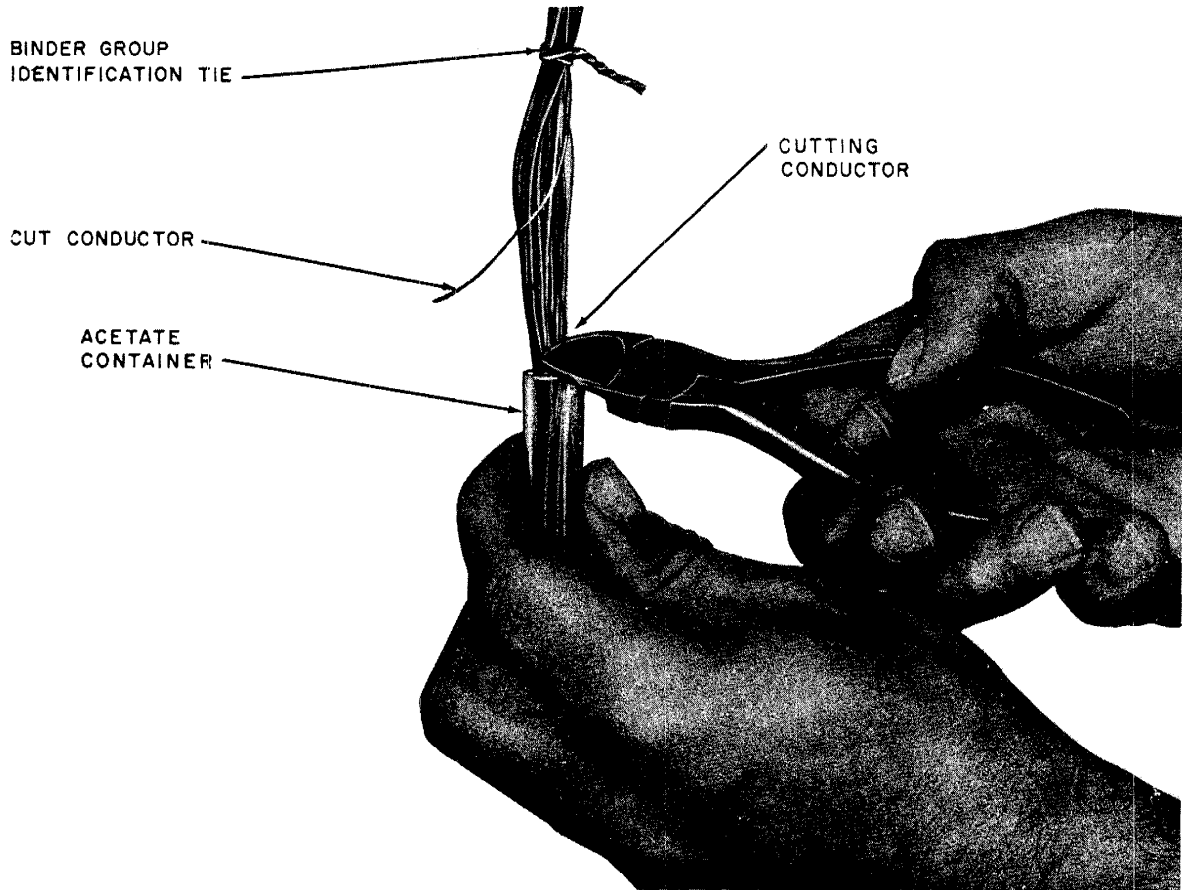
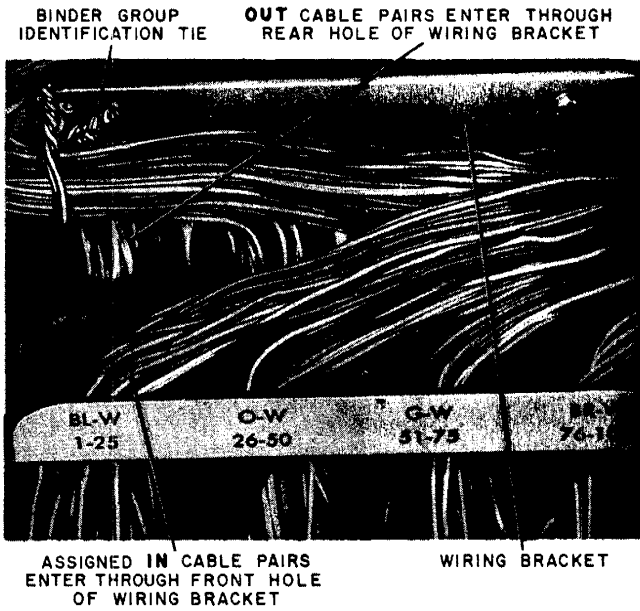


Fig. 9—Cutting Assigned Pair from Capped Binder Group



**Fig. 10—Assigned *IN* Cable Pair Routed Through Front Holes of Wiring Bracket**

**5.04** Pull the assigned *IN* pair from the binder group and place in the *front* wiring bracket hole (Fig. 10) corresponding to the assigned *OUT* cable pair to which it is to be connected. *Do not remove the OUT cable pair from the rear hole of the wiring bracket.*

**5.05** Remove the *OUT* cable pair from the single wire tie.

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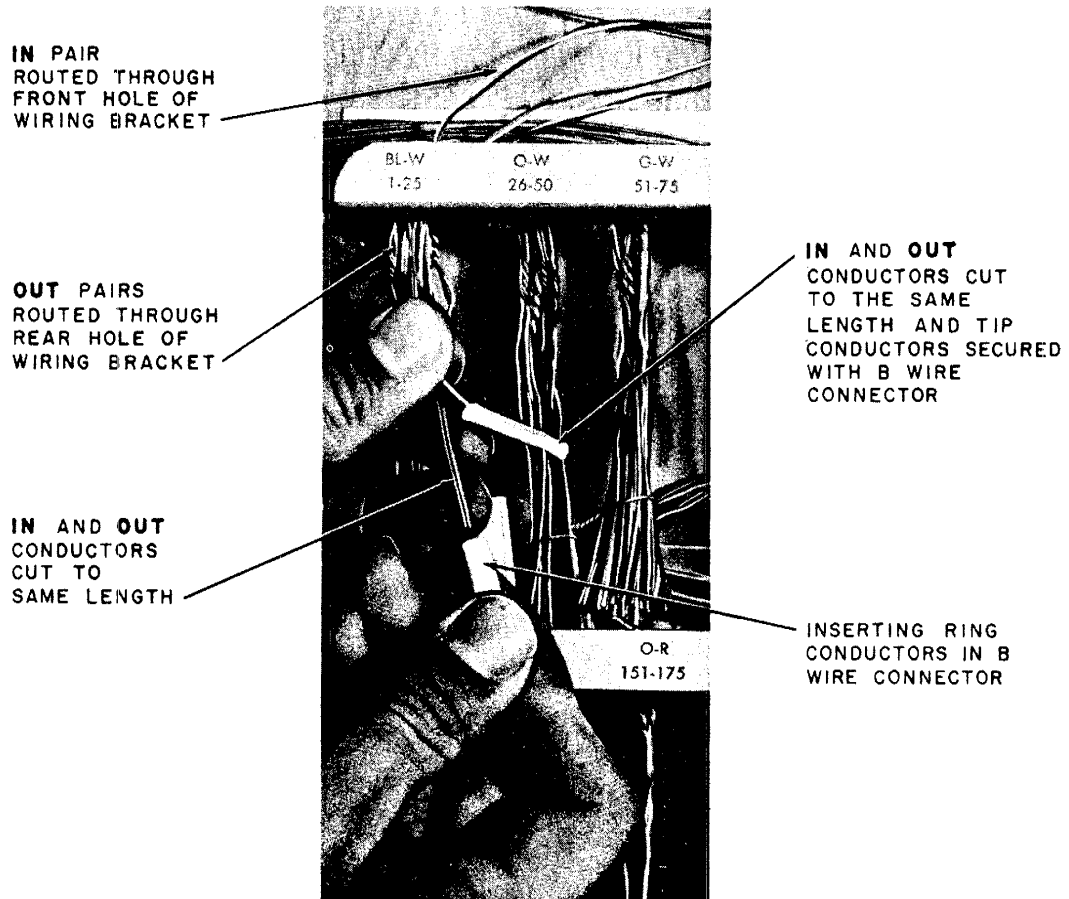
**5.06** Cut the assigned *IN* pair to the same length as the assigned *OUT* pair and connect with a B Wire Connector as shown in Fig. 11. If for any reason the *IN* pair is shorter than the *OUT* pair, piece out the *IN* pair (Part 6). Do not cut the *OUT* pair. Use only a B Connector Presser or Pneumatic Presser for crimping the B Wire Connectors.

**5.07** Tighten the single wire tie on the remaining unconnected pairs of the *OUT* binder groups.

**5.08** Secure the capped spare binder groups to the bottom of the closure by tightening the B cable Tie.

**LOOP-THROUGH LOCATIONS AND STRAND-MOUNTED CLOSURES**

**5.09** Select the *IN* cable pair from the preferred count and cut the pair at the butt of the cable *away* from the central office side of the closure.



**Fig. 11—Connecting *IN* and *OUT* Cable Pair**

5.10 Repeat 5.04 and 5.06 for placing and connecting the assigned *IN* cable pair.

**6. PIECING-OUT**

***OUT* CABLE PAIR**

6.01 If for any reason the *OUT* cable pair is too short to reach an assigned wiring bracket hole, piece-out the conductor as follows (Fig. 12). Use wire having the same colored insulation and gauge as the cable pair.

- (a) Cut the *OUT* cable pairs even.
- (b) Insert the tip conductor and the like-colored piecing-out wire in a B Wire Connector and press.

(c) Insert the ring conductor and the like-colored piecing-out wire in a B Wire Connector and press.

(d) Route the *OUT* cable pair through the assigned rear hole of the wiring bracket and apply from 4 to 6 tight twists as close to the bottom of the wiring bracket as possible. This prevents pair splitting.

(e) Cut the piecing-out wire to the same length as the other unconnected pairs of the binder group.

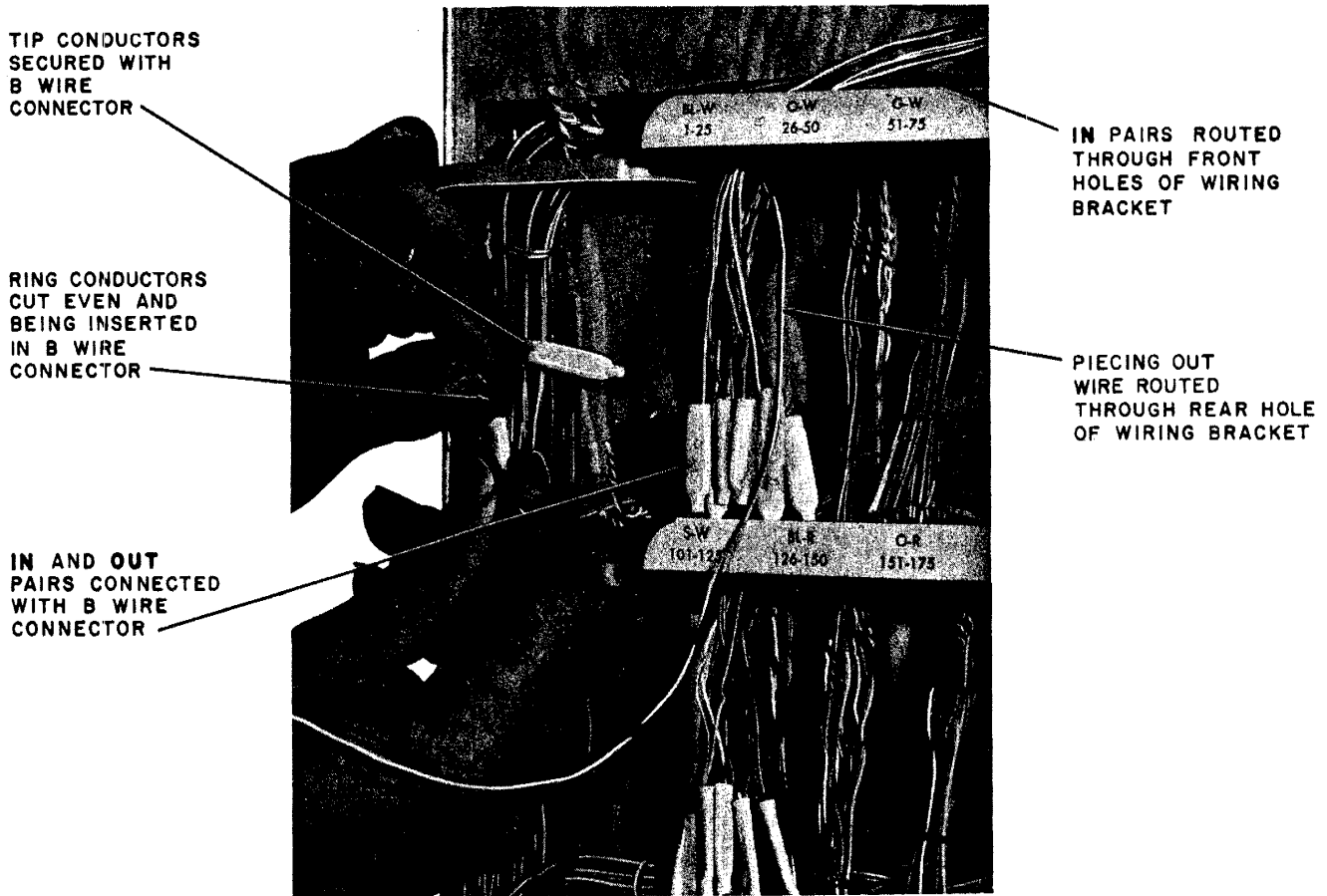


Fig. 12—Piecing-Out *OUT* Cable Pair

**IN CABLE PAIR**

**6.02** The procedures for piecing-out the *IN* cable pair (Fig. 13) are identical to the procedures outlined in 6.01, except cross-connecting wire may be used as the piecing-out wire if no wire having the same-colored insulation or gauge as the *IN* cable pair is available. *Never use an odd-colored wire.*

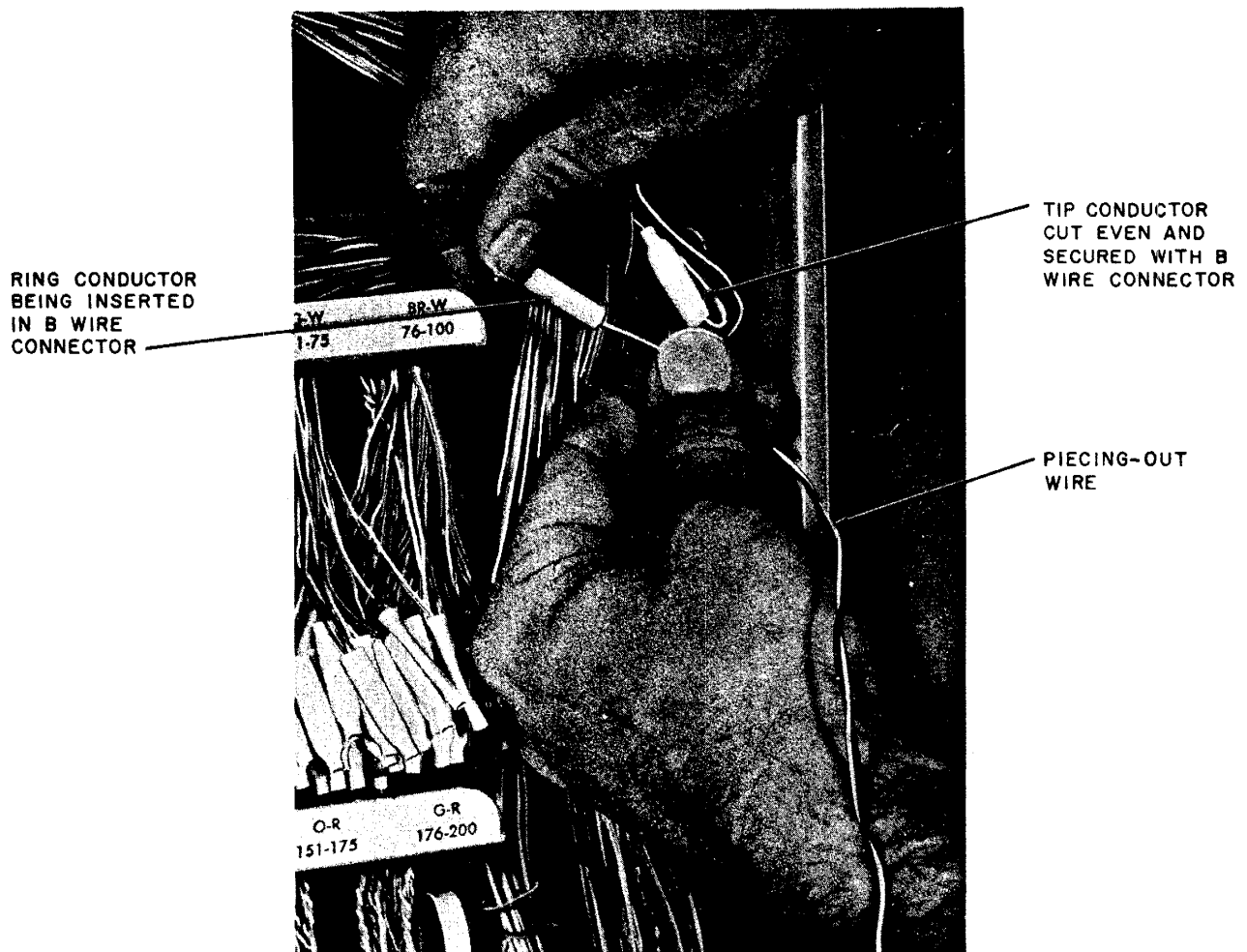
**6.03** Route the pieced-out wire through the distributing rings, binder group identification tie, and the front hole of the wiring bracket corresponding to the assigned *OUT* cable pair.

**6.04** Connect the assigned *IN* cable pair and the *OUT* cable pair using B Wire Connectors.

**7. TALKING CIRCUIT**

**7.01** The terminal block, installed at the time of construction, provides the workman with a talking circuit for calling the test desk, etc.

**7.02** Detailed instructions covering the use of specific types of handsets are covered in other sections.



**Fig. 13—Piecing-Out *IN* Cable Pair**



**DROP AND BLOCK WIRING**  
**LOWERING AND REPLACING DROP WIRE**  
**VOLTAGES LESS THAN 300 INVOLVED**

**1. GENERAL**

**1.01** This section covers the methods of lowering a drop wire, raising a lowered drop wire, and replacing a drop wire by pulling the new wire into the span as the old wire is pulled out of the span.

**1.02** This information was formerly covered in Section 625-800-311 (G32.415.1) which is canceled.

**1.03** The procedures outlined herein apply specifically to the conditions usually encountered where the drop wire does not cross over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 volts or more. The basic principles presented in this section should also be observed in those cases where conditions necessitate a departure from the usual procedures.

**1.04** The methods outlined herein are such that the drop wire is lowered, raised, or replaced by means of a handline while the employee remains on the ground where he can observe traffic, control the wire to prevent its striking persons or damaging property, and remove the wire from a street or highway quickly. An exception is made in certain cases where a wire, which does not cross a street or highway, may be dropped from a pole. The methods are intended also to avoid the possibility of accidents caused by releasing wire under tension from a building or strand attachment while working from a ladder or as the result of vehicles striking the wire as it is being lowered to the ground.

**1.05** Refer to Section 462-800-312 for the methods of lowering or replacing a drop wire which crosses over trolley or trolley-bus contact wires or over power wires or power cables operat-

ing at 300 volts or more. The methods of placing drop wires are covered in Sections 462-400-205 and 462-400-206.

**2. PRECAUTIONS**

**2.01** Obtain assistance before lowering a drop wire, raising a lowered drop wire, or replacing a drop wire over streets, highways, or elsewhere if traffic, tree, or other conditions are such that one man cannot do the work safely.

**2.02** Rubber gloves shall be worn by all employees when performing all operations in which the handline or the drop wire may come in contact with power wires or power cables.

**2.03** The handline used for lowering, raising, or replacing a drop wire under the conditions outlined in this section shall be free from metallic strands and shall preferably be dry. However, if weather conditions are such that it is impracticable to keep the handline dry, a wet handline may be used for lowering, raising, or replacing a drop wire over secondary electric service wires operating at less than 300 volts.

**2.04** In general, one 50-foot and one 100-foot 3/8-inch handline will be needed for the operations outlined in this section and Section 462-800-312. The handlines should be served at the ends to prevent unraveling.

**2.05** When it is necessary to carry a handline up a pole or ladder, double the end of the handline back on itself for a distance of approximately one foot and place this loop under the right or left side or back of the body belt or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

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**2.06** Never release the drop wire supports from a wire span while working inside the angle formed by the wire.

**2.07** Avoid working from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

**2.08** When a drop wire attached to a span clamp is to be lowered or replaced, place the foot of the extension ladder on the field side of the suspension strand and not in the street or highway. If there is no street or highway adjacent to the span clamp, place the ladder preferably against the opposite side of the strand from the drop wire run to the building.

**2.09** If conditions are such that the handline, or the drop wire to which it is attached, may become disengaged from a drive hook or crossarm or may slide along the strand or guard arm while doing the work outlined in this section, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or houseline placed over the handline or drop wire with the ends of the guide securely tied as follows:

- Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.
- Crossarm: Tie the ends to adjacent pins or insulators.
- Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.
- Strand: Tie the ends to the strand or the strand and lashed cable on each side of the handline or drop wire, or place the handline or drop wire through the hook of a span clamp.

### 3. LOWERING WIRE WHICH CROSSES A STREET OR HIGHWAY – WIRE ATTACHED TO POLE

*Caution: The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered*

*safely. These special precautions are covered in Part 6 of this section.*

#### Handline Lowering Method

**3.01** Lower the drop wire from its position on the pole (drive hook, guard arm, or cross-arm) in accordance with the following sequence of operations.

- (1) Lash a handline securely to the base of the pole at a point on the handline which will leave a sufficient length on the ground so that this end will be accessible from the ground until the wire has been lowered to the street.
- (2) Place the other end of the handline over the strand, guard arm, drive hook, or crossarm so that this end is toward the building and reaches the ground. If practicable, the handline may be formed into a coil at one end and thrown over the strand. If the drop wire passes through a tree in the immediate vicinity of the pole attachment, place the handline so that it follows the route of the wire through the tree. A wire raising tool may be used to facilitate this operation. After the handline has been placed, tie it to the base of the pole to avoid interference with pedestrians or vehicles.

*Caution: The handline shall not overhang the street unless it is properly guarded. If practicable, park the telephone company car so that it will shield the handline.*

- (3) Disconnect the drop wire from the terminal and remove the free end from the wiring rings on the pole.
- (4) Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.
- (5) Tie a loop of the handline to the tail of the temporary drop wire clamp so that the lashed end of the handline is sufficiently taut to remove tension from the original drop wire clamp.
- (6) Remove the original drop wire clamp from the wire span, thus leaving the wire supported by the temporary drop wire clamp and the lashed handline.

(7) Return to the ground. Untie the handline from the base of the pole and, when no vehicles or pedestrians are approaching, lower the drop wire to the ground by pulling that portion of the handline toward the building. The portion of the handline on the opposite side of the strand should pass through the employee's hand as shown in Fig. 1 in order that he may be able to pull the handline in either direction to work the drop wire among the branches of a tree or to raise the wire quickly if necessary.

(8) After the wire has been lowered to the street or highway, remove the temporary drop wire clamp from the wire, tie the handline to the base of the pole, and remove the wire from the street or highway.

#### 4. DROPPING WIRE WHICH DOES NOT CROSS A STREET OR HIGHWAY – WIRE ATTACHED TO POLE

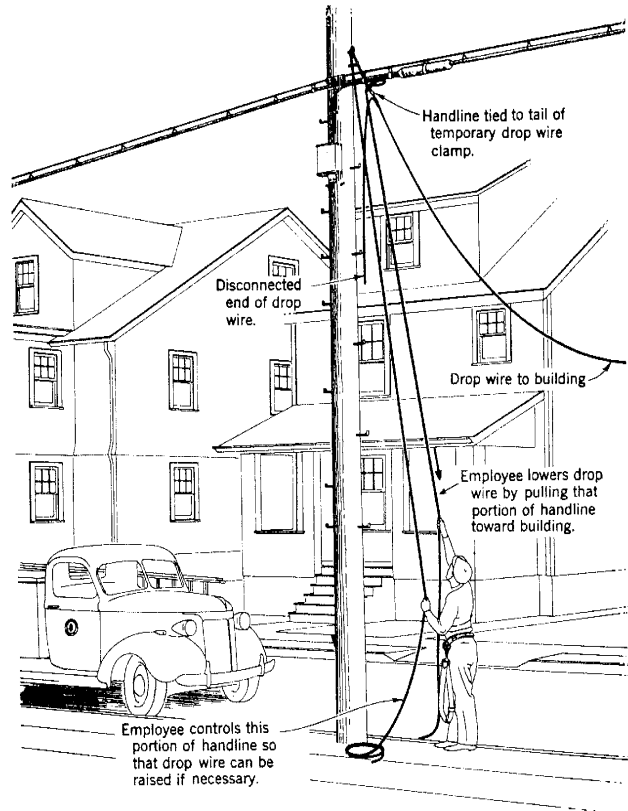
**Caution:** *The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered safely. These special precautions are covered in Part 6 of this section.*

**4.01** A wire span may be dropped from a pole provided conditions are such that: (a) the wire span does not cross a street or highway or over power wires or power cables, (b) a taut wire span is not involved, (c) the wire will not be struck by a passing vehicle, and (d) the wire will not fall on pedestrians or cause damage to property as a result of being dropped to the ground. If any of these conditions are present, the span shall be lowered by the handline method as covered in Part 3.

#### 5. LOWERING WIRE ATTACHED TO A SPAN CLAMP

**Caution:** *The lowering of a taut drop wire span requires that special precautions be taken to ensure that the wire is lowered safely. These special precautions are covered in Part 6 of this section.*

**5.01** The lowering method covered in this part applies to all drop wire spans attached to span clamps.



**Fig. 1 – Lowering Drop Wire**

#### Precautions

**5.02** The following precautions shall be observed when lowering a drop wire attached to a span clamp in order that the work may be done in a safe manner.

- (a) Place the extension ladder at the location of the span clamp as outlined in 2.08.
- (b) When climbing the extension ladder to work at a span clamp, the strand is forced out of line. The distance the strand is deflected depends on the tension in the strand, the weight of the cable, and the combined weight of the man and ladder. Therefore, while the employee is climbing the ladder, it is important that he observe the effect of the strand deflection on all drop wires attached to the section of strand in which he is working. The principal conditions to be observed are:

- (1) Where drop wire crosses a street or highway, avoid placing additional sag in a drop wire span which would create a

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traffic hazard, unless traffic is properly controlled.

(2) Where drop wire does not cross a street or highway, avoid placing excess tension in a drop wire span which may pull out the first building attachment, thereby causing property damage and sudden movement of the strand while the employee is climbing the ladder. See 6.04 for the method of releasing excess tension in a drop wire span.

**5.03** Lower the wire from the span clamp in accordance with the following sequence of operations:

- (1) Detach the drop wire first from the pole and lower this end of the wire run to the ground.
- (2) Coil the drop wire and place it on the ground near the ladder in order to avoid accidents resulting from vehicles striking it or pedestrians tripping on it.
- (3) Place a handline over the strand and lower the drop wire as outlined in Part 3, except that the handline shall be lashed to the lower rungs of the extension ladder if it cannot be fastened to a nearby pole or tree.

### 6. LOWERING TAUT WIRE

**6.01** The method outlined in this part covers the special precautions which shall be taken when lowering a taut drop wire span and it applies to the lowering of all taut wire spans whether or not they cross streets or highways.

#### Taut Span from Pole

**6.02** When it is necessary to lower a taut drop wire span from a pole, proceed as follows:

- (1) Place a handline over the strand, guard arm, drive hook, or crossarm so that the end of the handline toward the building just reaches the ground.
- (2) Disconnect the drop wire from the terminal and remove the free end from the wiring rings on the pole.

(3) Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

(4) Tie a loop of the handline securely to the tail of the temporary drop wire clamp.

(5) Return to the ground. Pull the long end of the handline sufficiently taut to remove tension from the original drop wire clamp and lash the handline securely to the base of the pole, thereby supporting the taut wire span by means of the temporary drop wire clamp and the lashed handline.

**Caution: Exercise care to avoid placing more tension in the drop wire span than is necessary to remove tension from the tail of the original drop wire clamp.**

(6) Climb the pole and check to ensure that the tension in the drop wire span has been removed from the tail of the original drop wire clamp.

(7) Cut the tail of the original drop wire clamp with pliers.

(8) Return to the ground. Untie the handline and slowly ease off the long end of the handline, thereby releasing excess tension in the taut drop wire span. When no vehicles or pedestrians are approaching, lower the wire span to the ground by pulling the short end of the handline. The long end of the handline should pass through the employee's hand in order that he can raise the wire quickly if necessary.

#### Taut Span from Span Clamp

**6.03** The procedure outlined in Part 5 also applies to the lowering of a taut drop wire attached to a span clamp, except that the excess tension in the drop wire span shall first be released.

**6.04** Release the excess tension in the drop wire from the building end of the span as follows:

- (1) Remove the C knob or the SC wire clip and the associated loop of drop wire from the first building attachment. Do not remove the drop wire clamp which supports the wire span.

- (2) Attach a temporary guide loop to the first building attachment, such as shown in Fig. 2, to prevent the handline used in releasing the excess tension from becoming accidentally disengaged from the building attachment.
- (3) Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.
- (4) Place a handline over the first building attachment and through the temporary guide loop. Tie the handline securely to the tail of the temporary drop wire clamp.
- (5) Return to the ground. Pull the handline sufficiently taut to remove tension from the original drop wire clamp and lash the handline to a substantial and secure support near the base of the building.

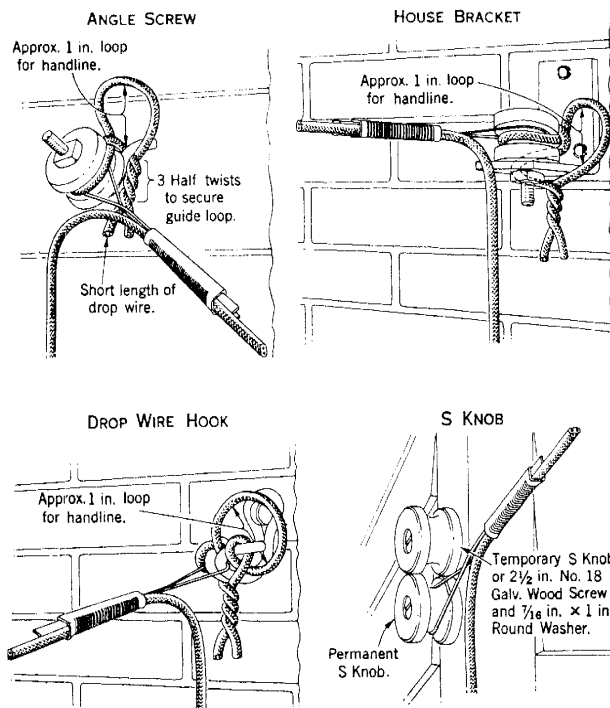


Fig. 2 – Temporary Guide Loop

**Caution:** Exercise care to avoid placing more tension in the drop wire span than is necessary to remove tension from the tail of the original drop wire clamp.

- (6) Check to ensure that the tension in the drop wire span has been removed from the tail of the original drop wire clamp.
- (7) Cut the tail of the original drop wire clamp with pliers.
- (8) Return to the ground. Untie the handline and slowly ease off the handline, thereby releasing excess tension in the taut drop wire span. Retie the handline to a substantial and secure support near the base of the building.
 

**Note:** If the amount of slack introduced into the drop wire span is not sufficient to release the excess tension, remove the wire from one or more of the building attachments beyond the first attachment and, if necessary, cut the wire in the building run.
- (9) Proceed as covered in Part 5 for lowering a normal wire span from a span clamp.

## 7. LOWERING WIRE ATTACHED TO TWO BUILDINGS

**7.01** The method described in this part shall be followed in lowering a drop wire span attached to two buildings.

- (1) Select the end of the drop wire span at which the following operations can be performed best.
- (2) Lower the drop wire run on the building up to the first attachment from which the wire span is to be lowered and remove the C knob or the SC wire clip and the associated loop of drop wire from this first attachment. Do not remove the drop wire clamp which supports the wire span.
- (3) Place a handline over the first building attachment so that the end of the handline toward the wire span just reaches the ground. Attach a temporary guide loop to the first building attachment around the handline as illustrated in 6.04 (2) to prevent the handline from becoming accidentally disengaged from the building attachment during the lowering operation.
- (4) Place a temporary drop wire clamp on the wire to be lowered, about one foot out in the span. Seat the clamp firmly on the wire.

- (5) Tie a loop of the handline securely to the tail of the temporary drop wire clamp.
- (6) Return to the ground. Pull the long end of the handline sufficiently taut to remove tension from the original drop wire clamp, lash the handline to a substantial, and secure support near the base of the building, thereby supporting the wire span by means of the temporary drop wire clamp and the lashed handline.
- (7) Remove the original drop wire clamp from the building attachment.
- (8) Return to the ground. Untie the long end of the handline and lower the wire span by pulling the short end of the handline.

**8. RAISING WIRE LOWERED BY HANDLINE METHOD**

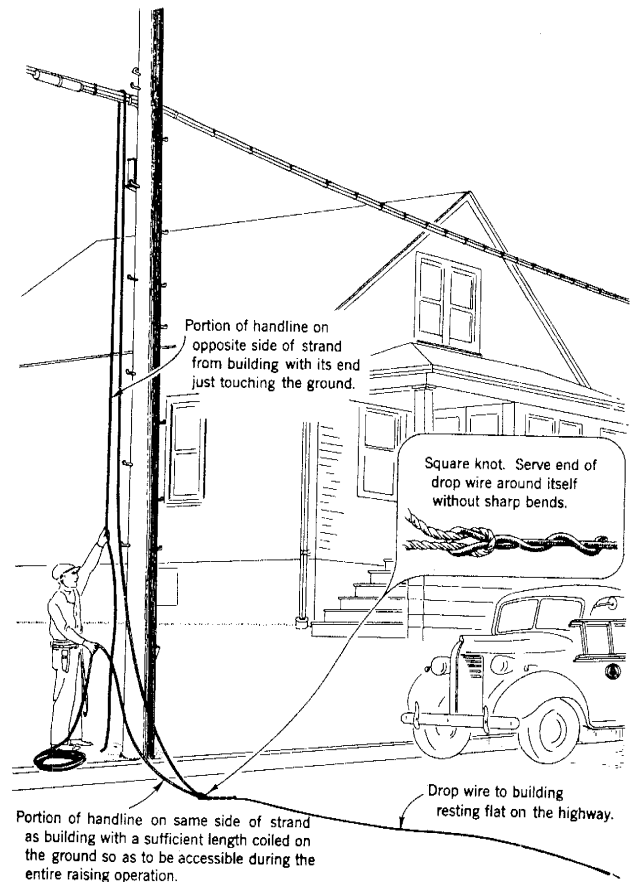
**8.01** When it is necessary to raise a drop wire that was lowered by the handline method, proceed as follows:

- (a) Where an intermediate portion of the original wire span is to be replaced or the entire original wire span is to be raised.

*Note:* The length of wire spliced in as an intermediate portion of the original wire span shall be approximately the same as that which it replaces in order that the drop wire clamp will be within reach of the employee after the wire span has been raised.

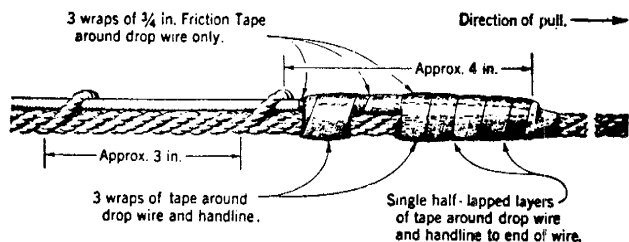
- (1) After the wire has been repaired, lay it along the ground between the building and the building side of the highway and coil the remaining length of wire.
- (2) When no traffic is approaching, carry the coil across the street or highway to the previously placed handline, paying out the wire so that it rests flat on the ground. If a metal or hard rubber-tired vehicle passes over the wire, pull the wire back to the building side of the highway. Inspect the wire for possible injury and replace any portions that are found to be damaged.
- (3) Tie the end of the drop wire to the handline as shown in Fig. 3 at a point in that

portion of the handline toward the building which will permit the employee to have access to both ends of the handline from his position on the ground during the entire raising operation.



**Fig. 3 — Raising the Drop Wire**

*Note:* If the handline has been placed over a drive hook or other support on which the square knot would snag, fasten the wire to the handline as shown in Fig. 4.



**Fig. 4 — Fastening Handline to Prevent Snagging**

(4) When no vehicles or pedestrians are approaching, raise the drop wire by pulling that portion of the handline on the opposite side of the strand from the building. The portion of the handline toward the building should pass through the employee's hand in order that he may be able to pull the wire to the ground quickly if necessary.

(5) After the drop wire has been raised to the approximate required height, tie the handline to the base of the pole or, if at a span clamp, to the lower rungs of the ladder.

(6) Climb the pole or, if at a span clamp, the ladder, and attach the drop wire to the pole or strand in a standard manner without removing the handline from the drop wire. When attaching the drop wire to a span clamp, bear in mind that the strand is forced out of line by the ladder resting against it and make any adjustments that are necessary to avoid excessive tension in the wire span when the employee is working from the ladder and also to ensure proper sag and clearance after removal of the ladder.

(7) Remove the handline from the drop wire and complete the connection in a standard manner.

(b) Where the entire original wire span or the end toward the pole or strand is to be replaced.

(1) On the building side of the street or highway, splice the end of the existing wire to the outer end of a coil of drop wire mounted on the drop wire reel.

**Caution:** *The inner end of the coil of drop wire shall be securely fastened to one of the springless spokes of the drop wire reel.*

(2) Coil up any excess length of wire on the drop wire reel.

(3) Proceed as in raising a new drop wire over a street or highway. See Section 462-400-205.

**8.02** When raising a drop wire between two buildings, provide as much sag as practicable in the wire span, and support the tension in the wire by means of a lashed handline before placing the second drop wire clamp.

## 9. RAISING WIRE LOWERED BY DROPPING METHOD

**9.01** When it is necessary to raise a drop wire that was lowered by the dropping method as outlined in Part 4, proceed as follows:

(a) Where an intermediate portion of the original wire span is to be replaced or the entire original wire span is to be raised.

**Note:** The length of wire spliced in as an intermediate portion of the original wire span shall be approximately the same as that which it replaces in order that the drop wire clamp will be within reach of the employee after the wire span has been raised.

(1) After the wire has been repaired, lay it along the ground between the building and the pole or span clamp location.

(2) Attach one end of the handline to the tail of the drop wire clamp. The length of the handline shall be greater than the distance from the ground to the drop wire attachment point.

(3) Loop the other end of the handline under the body belt as described in 2.05 and climb the pole or, if at a span clamp, the ladder.

(4) Place the handline over the strand, guard arm, drive hook, or crossarm from the side toward the building.

(5) Raise the drop wire to the approximate required height by pulling the handline over the strand or other support and then lash the handline to the pole or strand.

(6) Attach the drop wire to the pole or strand in a standard manner and then remove the handline. When attaching the drop wire to a span clamp, bear in mind that the strand is forced out of line by the ladder resting against it and make any adjustments that are necessary to avoid excessive tension in the wire span when the employee is working from the ladder and also to ensure proper sag and clearance after removal of the ladder.

(b) Where the entire original wire span or the end toward the pole or strand is to be replaced.

## SECTION 462-800-311

- (1) Splice the end of the existing wire to the outer end of a coil or drop wire mounted on the drop wire reel.

**Caution:** *Fasten the inner end of the coil of the drop wire securely to one of the springless spokes of the drop wire reel.*

- (2) Coil up any excess length of wire on the drop wire reel.
- (3) Proceed as in raising a new drop wire elsewhere than over a street or highway. See Section 462-400-205.

**Note:** If it is necessary to replace only a short length (not more than about 10 feet) at the free end of the drop wire, it may be found more convenient to splice in a length of wire of approximately the same length as that which it replaces and then place a drop wire clamp in the same relative position as that of the original clamp. Raise the repaired wire as outlined in 9.01 (a).

### 10. REPLACING WIRE NOT LOWERED FOR INSPECTION

**10.01** If it is obvious that an entire drop wire span requires replacement and conditions are such that it would be advantageous to pull the new wire into the span as the old wire is pulled out of the span, the method outlined in 10.02 may be followed, provided that:

- (a) The existing drop wire span has at least the minimum required clearance over streets or highways or over secondary electric service wires operating at less than 300 volts.
- (b) Specific approval to use this method has been obtained from the supervisor.
- (c) The operation of the drop wire reel can be observed from the handline location.
- (d) The drop wire reel can be located in a stable position so that when the tension in the wire span is transferred to the reel, it will not slide along the ground or fall over.
- (e) The existing drop wire span is not taut.
- (f) The existing wire does not cross over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 volts or more.

**Caution:** *If all of the above conditions are not met, the workman shall follow the standard method for lowering an existing drop wire span and raising a new drop wire span.*

**10.02** If conditions permit pulling the new drop wire into place as the old wire is pulled out, proceed as follows:

- (1) Remove the C knob or the SC wire clip and the associated loop of drop wire from the first building attachment. Do not remove the drop wire clamp which supports the wire span.
- (2) Attach a temporary guide loop to the first building attachment, as illustrated in 6.04 (2), to prevent the replacing drop wire from becoming accidentally disengaged from the building attachment.
- (3) Place the drop wire reel near the foot of the ladder on the side away from the wire span and in a stable position.

**Caution:** *Fasten the inner end of the coil of drop wire securely to one of the springless spokes of the drop wire reel.*

- (4) Set the brake of the reel so that it will hold the tension in the wire span after it is transferred to the reel.
  - (5) With the drop wire paying off from the bottom of the reel, pass the end of the wire over the first building attachment and through the temporary guide loop at this attachment.
  - (6) Place a temporary drop wire clamp on the wire to be replaced about one foot out in the span. Seat the clamp firmly on the wire. Tape the front end of the temporary clamp so that it will not foul on the strand, guard arm, or crossarm.
- Note:** If the drop wire is to be pulled over a drive hook or other support on which the temporary clamp would snag, fasten the end of the wire from the drop wire reel securely to the wire in the span in a manner such as illustrated in Fig. 4.
- (7) Tie the end of the wire from the drop wire reel securely to the tail of the temporary drop wire clamp.



- (8) Reel up all slack between the drop wire reel and the temporary drop wire clamp so that tension is removed from the original drop wire clamp.
- (9) Go to the other end of the drop wire span and lash one end of the handline to the base of the pole or, if at a span clamp, to the lower rungs of the ladder or to a nearby pole or tree.
- (10) Loop the other end of the handline under the body belt as described in 2.05 and climb the pole or ladder.
- (11) Disconnect the drop wire from the terminal and remove the free end from the wiring rings on the pole.
- (12) Place a temporary drop wire clamp on the free end of the drop wire (not in the span) to be replaced. This arrangement eliminates the necessity of pulling the temporary drop wire clamp over the strand, guard arm, drive hook, or crossarm on which it may become fouled.
- (13) Tie a loop of the handline to the tail of the temporary drop wire clamp so that the lashed end of the handline is sufficiently taut to remove tension from the original drop wire clamp.
- (14) Remove the original drop wire clamp from the drop wire at the pole or span clamp, thereby leaving the wire supported by means of the temporary drop wire clamp and the lashed handline.
- (15) Return to building, check to ensure that tension has been removed from the original drop wire clamp, and then cut the wire to be replaced behind the temporary drop wire clamp with pliers.
- (16) Return to the pole or span clamp location, untie the handline and, while standing on the ground, pull the new wire into the span, observing the drop wire as it feeds from the drop wire reel to make sure that the brake maintains sufficient tension to prevent the wire from sagging an excessive amount.
- (17) When a sufficient length of new wire has been pulled over the strand, guard arm, drive hook, or crossarm for terminating or splicing purposes, lash the old wire to the base of the pole, or to the lower rungs of the ladder. The wire in the crossing span shall be reasonably slack so that there will not be undue tension in the span when placing the drop wire clamp at the first building attachment.
- (18) Fasten the new wire span to the first building attachment with a drop wire clamp and then remove the temporary guide loop.
- (19) Fasten the new wire span to the pole or strand attachment in the standard manner without removing the old wire which was used as the pulling line. When attaching the drop wire to a span clamp, bear in mind that the strand is forced out of line by the ladder resting against it and make any adjustments that are necessary to avoid excessive tension in the wire span when the employee is working from the ladder and also to ensure proper sag and clearance after removal of the ladder.
- (20) Detach the old wire from the new wire and complete the connection in a standard manner.



## DROP AND BLOCK WIRING

### LOWERING AND REPLACING DROP WIRE

### VOLTAGES OF 300 TO 750 INVOLVED

#### 1. GENERAL

**1.01** This section covers the methods of lowering and replacing drop wire under the conditions usually encountered where the drop wire crosses over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 to 750 volts.

**1.02** This information was formerly covered in Section 625-800-312 (G32.415.2) which is cancelled.

**1.03** The basic principles presented in this section should also be observed in those cases where conditions necessitate a departure from the usual procedures.

*Note:* If, for any reason, it is necessary to lower or replace a drop wire crossing over any power wires or power cables operating at more than 750 volts, refer the case to your supervisor for specific instructions.

**1.04** The methods outlined herein are such that the drop wire is lowered by means of a handline while the employees remain on the ground and so perform the work that the drop wire does not come in contact with the trolley contact or power wires or power cables during the entire lowering operation. These methods are also intended to avoid the possibility of accidents caused by releasing tension from a building or strand attachment while working from a ladder or as the result of vehicles striking the wire or the handline as it is being lowered to the ground.

**1.05** Refer to Section 462-800-311 for the methods of lowering or replacing a drop wire where no trolley or trolley-bus contact wires, or power wires or power cables operating at 300 volts or more are involved. The methods of placing drop wire are covered in Sections 462-400-205 and 462-400-206.

#### 2. PRECAUTIONS

**2.01** In general, two men shall be employed when lowering or replacing a drop wire over trolley or trolley-bus contact wires, or over power wires or power cables operating at 300 to 750 volts. Obtain additional assistance before lowering or replacing a drop wire over streets, highways, or elsewhere if traffic, tree, or other conditions are such that two men cannot do the work safely.

**2.02** Rubber gloves shall be worn by all employees when lowering or replacing a drop wire over trolley or trolley-bus contact wires, or over power wires or power cables and until the crossing span has been completely removed or replaced in a standard manner.

**2.03** The handline used for lowering or replacing a drop wire under the conditions outlined in this section shall be free from metallic strands and shall be dry. A wet handline must not be used in the vicinity of power circuits operating at 300 volts or more, except as indicated below.

*Exception:* When it is necessary to maintain service or establish emergency service during rainstorms, a wet handline may be used over trolley or trolley-bus contact wires and other power circuits operating at 300 to 750 volts, provided that rubber gloves, rubber boots, and rubber raincoats are worn.

**2.04** When it is necessary to carry a handline up a pole or ladder, double the end of the handline back on itself for a distance of approximately 1 foot and place this loop under the right or left side or back of the body belt or in such other position that the handline will be released readily if it is placed under tension while the employee is climbing the pole or ladder.

## SECTION 462-800-312

**2.05** Never release the drop wire supports from a wire span while working inside the angle formed by the wire.

**2.06** Avoid working from a ladder placed against a building with the side rails crossing a wire run or in any other position where movement of the wire, due to loosening of the attachments, would cause an accident.

**2.07** When a drop wire attached to a span clamp is to be lowered or replaced, place the foot of the extension ladder on the field side of the suspension strand and not in the street or highway. If there is no street or highway adjacent to the span clamp, place the ladder against the opposite side of the strand from the drop wire run to the building.

**2.08** If conditions are such that the handline, or the drop wire to which it is attached, may become disengaged from a drive hook or crossarm or may slide along the strand or guard arm while doing the work outlined in this section, the handline or drop wire shall be enclosed with a temporary guide loop. This loop shall consist of a short length of wire or houseline placed over the handline or drop wire with the ends of the guide securely tied as follows.

- (a) Drive Hook: Tie one end to the vertical portion of the drive hook and lash the other end to the pole.
- (b) Crossarm: Tie the ends to adjacent pins or insulators.
- (c) Guard Arm: Tie the ends to the guard arm on each side of the handline or drop wire.
- (d) Strand: Tie the ends to the strand or the strand and lashed cable on each side of the handline or drop wire, or place the handline or drop wire through the hook of a D span clamp.

### **3. LOWERING WIRE OVER TROLLEY CONTACT OR POWER WIRES OR POWER CABLES**

**3.01** The procedure outlined below shall be followed when the drop wire span is to be permanently removed from plant, or lowered for inspection, repair, or replacement. Lower only one wire span at a time.

(1) Man No. 1: Loops one end of the handline under the body belt as described in 2.04 and climbs the pole or, if at a span clamp, the ladder. The handline shall be of a sufficient length to reach from the ground to the strand, guard arm, drive hook, or crossarm and then horizontally to about 25 feet beyond the trolley contact or power wires or power cables to ensure that the end of the drop wire can be pulled at least 10 feet beyond the power circuits.

*Caution: If a span clamp is involved, bear in mind that the strand is forced out of line by the ladder resting against it and take any steps that are necessary to prevent the drop wire from sagging onto the trolley contact or power wires or power cables while climbing and working on the ladder. Care should also be taken to ensure that there will be adequate clearance between the employee and power wires or cables when the strand is deflected by the weight of the employee on the ladder.*

(2) Man No. 1: Places a temporary drop wire clamp on the wire to be lowered, about 1 foot out in the span; seats the clamp firmly on the wire.

(3) Man No. 1: Places the handline over the strand, guard arm, drive hook, or crossarm and ties the end securely to the tail of the temporary drop wire clamp.

(4) Man No. 2, standing on the ground, grasps the free end of the handline and pulls it sufficiently taut to remove the tension from the original drop wire clamp and then lashes the handline securely to the base of the pole or, if at a span clamp, to the lower rungs of the ladder (see note). Man No. 1 on the pole or ladder then cuts the drop wire approximately 6 inches behind the temporary drop wire clamp, thereby leaving the drop wire span supported by means of the temporary clamp and the lashed handline.

*Note: If a taut drop wire span is involved, Man No. 2 on the ground grasps the free end of the handline and pulls it sufficiently taut to support the wire span, snubbing the handline if necessary. Man No. 1 cuts the tail of the original drop wire clamp with pliers. Man No. 2 slowly eases off the handline, thereby releasing excess tension in the taut*

wire span and then lashes the handline to the base of the pole or the lower rungs of the ladder.

(5) Man No. 1 and Man No. 2 both go to the opposite or building end of the drop wire span.

(6) Man No. 1 cuts the drop wire in the building run at a point where the end of the wire can be reached from the ground and then frees the wire from all intermediate attachments between the cut end of the wire and the first building attachment.

(7) Man No. 2 removes the C knob or the SC wire clip at the first building attachment and then places a temporary guide loop at the first building attachment, around the drop wire, such as shown in Fig. 1, to prevent the wire from becoming accidentally disengaged from the building attachment as it is being pulled over the power circuits.

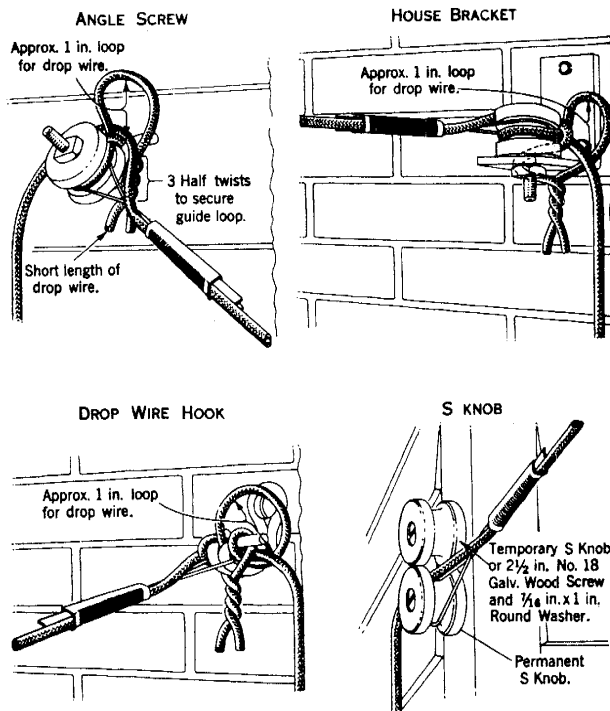


Fig. 1 — Temporary Guide Loop

(8) Man No. 1 on the ground holds tension in the drop wire while Man No. 2 removes the original drop wire clamp from the first building attachment. Man No. 1 continues to hold tension in the wire span to prevent it from coming in contact with the trolley contact or power wires or power cables.

(9) Man No. 2 returns to the other end of the wire span, unties the handline and keeps the drop wire taut while feeding it to Man No. 1 who pulls it over the power circuits and coils the drop wire as it is pulled out of the span.

(10) When the end of the drop wire has been pulled at least 10 feet beyond the trolley contact or power wires or power cables, and no traffic is approaching, Man No. 2 carefully releases the handline, allowing it to fall on the power circuits and then immediately goes into the street or highway to control traffic, assisted by the police if necessary.

(11) Man No. 1 pulls the remainder of the drop wire and the handline to the building end of the span and away from the street or highway.

#### 4. REPLACING WIRE OVER TROLLEY CONTACT OR POWER WIRES OR POWER CABLES

**4.01** When a drop wire crossing over trolley or trolley-bus contact wires or over power wires or power cables operating at 300 to 750 volts is lowered for inspection, repair, or replacement, it shall not be reused in the crossing span. Place new wire in the crossing span in accordance with the methods outlined in Section 462-400-206. If the wire that has been removed from the crossing span is in good condition, splice it to the end of the wire on the drop wire reel for reuse at a location where the wire will not cross over trolley or trolley-bus contact wires, or over power wires, or power cables.



**REPLACING PAGE ADDENDUM**  
*Filing Instructions:*

1. REMOVE FROM THE SECTION THE PAGES NUMBERED THE SAME AS THOSE ATTACHED TO THIS PINK SHEET.
2. INSERT THE ATTACHED PAGES INTO THE SECTION IN THEIR PLACE.
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## OBSERVATIONS AND TESTS TO BE MADE BEFORE CLIMBING OR WORKING AT JOINT USE POLES

### 1. GENERAL

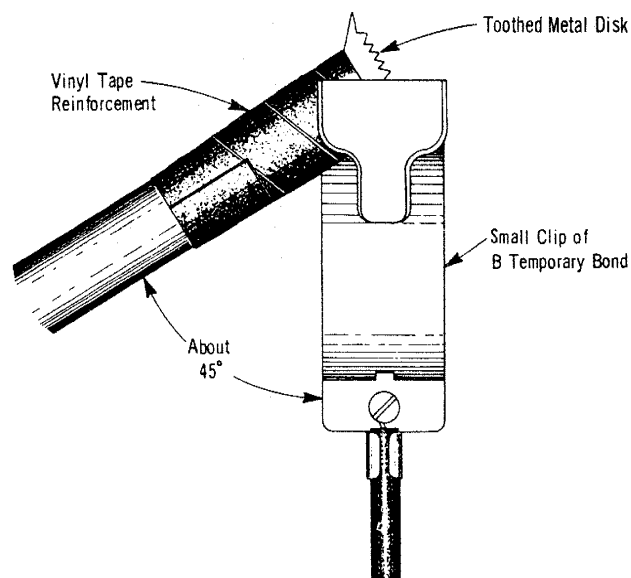
1.001 This addendum supplements Section 620-105-010, Issue 4.

1.002 This addendum is issued to provide an alternate method of using the B Shunting Capacitor with B Voltage Testers which have tape reinforced ferrules.

### 5. VOLTAGE TESTS AND SAFEGUARDS — POLES WITH STREETLIGHT FIXTURES

Add the following to Paragraph 5.02(h)(2)

If the metal cap or ferrule of the B Voltage Tester has been tape reinforced, attach the large clip of the temporary bond to the metal terminal of the capacitor; attach the small clip to the toothed metal disk of the B Voltage Tester as shown below.







**OBSERVATIONS AND TESTS TO BE  
MADE BEFORE CLIMBING OR  
WORKING AT JOINT USE POLES**

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**1. GENERAL**

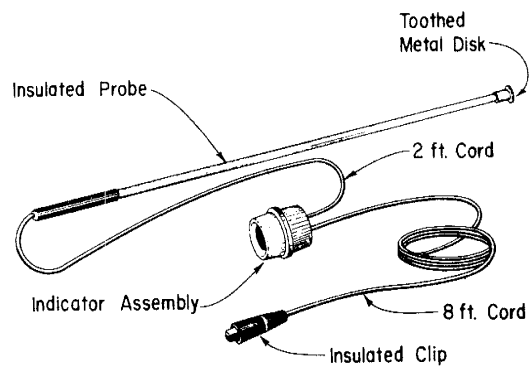
**1.01** This section covers observations and tests to be made before climbing or working at joint use poles to protect workmen against electrical shock from vertical power ground wires, metallic power conduit, or street light fixtures that may be energized. It has been reissued to cover modification of the B Voltage Tester Bag, specify recording the dates when the B Voltage Tester is tested, and add a requirement for temporary bonding of metal power conduit.

**1.02** These instructions supplement those given in the sections on "Safeguards To Be Taken Before Climbing Poles."

**2. DESCRIPTION OF B VOLTAGE TESTER AND VOLTAGE PLUG**

**2.01** The B Voltage Tester is designed to detect the presence of voltages from 60 volts to 7600 volts. It consists of an indicator assembly which contains a small neon glow unit and reflector, and a plastic insulated probe equipped

with a toothed metal disk on one end for making contact with the conductor, conduit or street light fixture to be tested. The probe is designed to limit the amount of current which can pass through the device. The probe, indicator assembly and an insulated clip are connected by insulated cord as illustrated.



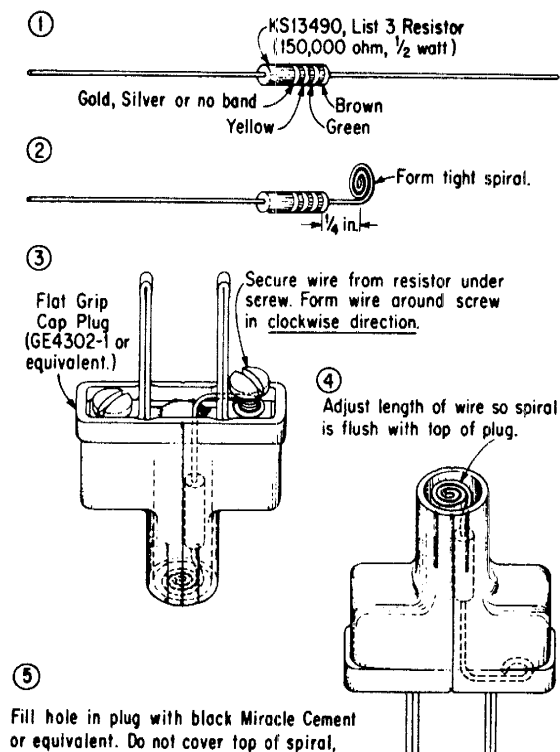
**B VOLTAGE TESTER**

**Fig. 1**

**2.02** At 60 to 70 volts the indicator of the B Voltage Tester glows dimly. Higher voltages will produce a brighter glow. Because the higher voltages can damage the tester if left connected (7200 volts will burn it out in approximately one minute) it should be touched to the facility being tested **ONLY LONG ENOUGH TO DETERMINE WHETHER OR NOT THE INDICATOR GLOWS.**

**2.03** A voltage plug, to be made up locally as illustrated, is designed to provide a safe and convenient means for checking the operation of the B Voltage Tester. When plugged into any standard 110- to 120-volt convenience outlet, it provides a source of voltage in series with a current limiting resistor. As illustrated, the resistor is connected to only one prong of the plug and this prong must be plugged into the "hot" side of the outlet. Normally the "hot" side may be identified as being the smaller of the two parallel slots in the outlet. (See Part 6 for use.)

**SECTION 620-105-010**



**Fig. 2**

**3. OBSERVATIONS TO BE MADE BEFORE CLIMBING**

→ **3.01** Examine the pole for potential hazards such as a vertical power ground wire, vertical metallic power conduit, or a street light fixture. Also observe the pole for such hazards as improper clearances from power conductors or equipment, dangling power wires, etc. If none of these is present, the pole may be climbed in accordance with safe climbing practices.

**3.02** If a vertical power ground wire is present, make a voltage test in accordance with Part 4 before climbing or working at the pole unless it meets one of the following conditions:

- (a) The ground wire is bonded to a telephone cable strand, or
- (b) The ground wire is covered with wood molding, or equivalent, up through telephone space, or
- (c) The ground wire is of the insulated type and the insulation is in good condition.

**3.03** If vertical metallic power conduit is present, make a voltage test in accordance with Part 4 before climbing or working at the

pole unless it can be clearly seen that the conduit is bonded to the telephone cable strand.

**3.04** If a street light fixture is present, make a voltage test in accordance with Part 5, → only if the pole also carries multiple line wire, telephone cable (including isolated cable), or a bare vertical power ground wire.

Γ **3.05** Poles carrying street light fixtures may be worked on without making a voltage test  
 ↳ under any of the following conditions:

- (a) The fixture is located in power space, or
- (b) The fixture is located ABOVE telephone attachments and it can be clearly seen that it is bonded to the telephone cable strand, or
- (c) The fixture is located BELOW telephone cable and it can be clearly seen that it is bonded to the telephone cable strand. However, in this case **INSULATING GLOVES SHALL BE WORN** in climbing the pole unless the wiring through and below telephone space is either 40 inches out from the pole surface or is otherwise made inaccessible.

→ **3.06** If a street light fixture is present in the telephone space on a pole not carrying a telephone cable or a bare vertical power ground wire, **WEAR INSULATING GLOVES AND AVOID CONTACT WITH IT OR ITS WIRING**, → even though a voltage test has been made, since it is not possible to place a temporary bond to an effective ground.

**4. VOLTAGE TESTS – VERTICAL POWER GROUND WIRES OR METALLIC POWER CONDUIT**

Γ **4.01** When a voltage test is required by Paragraph 3.02 or 3.03, proceed as follows  
 ↳ before climbing or working on the pole.

- (a) Attach the insulated clip of the voltage tester to one of the following:
  - (1) A guy rod or telephone anchor guy. (Do not attach to an anchor rod that carries an uninsulated guy which is bonded to the power vertical ground wire.)
  - (2) A fire hydrant, a projection on a man-hole cover, or a metallic curb box.

(3) A 5-inch screwdriver blade pushed into the earth about 5 feet from the pole.

(4) A substantial metal object such as a piece of lead sleeving, a metal crossarm brace, or a half-pound bar of D Seam Solder, etc, laid on the ground or pavement about 5 feet from the pole.

(b) Standing about 3 feet from the pole, grasp the insulated probe in one hand and the indicator assembly in the other. Push the toothed metal disk at the end of the probe firmly against the ground wire or metal conduit being tested, and promptly look into the open end of the indicator assembly.

(c) **IF THE INDICATOR GLOWS, THE GROUND WIRE OR METAL CONDUIT IS ENERGIZED.** Immediately remove the probe from contact with the ground wire or metal conduit and notify your supervisor. **DO NOT CLIMB OR CONTACT THE POLE IF THE INDICATOR GLOWS.**

(d) If the ground wire is broken, test the UPPER part as described above, unless the break occurs above the telephone space. Do *not* attempt to test a broken ground wire if the break is observed to be in the power space. Report the broken power wire to your supervisor.

(e) If the lower 8 feet or so of the ground wire is protected with wood molding, test above the molding.

**4.02** If the voltage tester DOES NOT GLOW in making the test described in Paragraph 4.01, poles carrying vertical power ground wires and telephone cable may be climbed in accordance with safe climbing practice. Care should be exercised to avoid simultaneous contact between power ground wires and telephone cable or guys as a small voltage (60 volts or less) may be present. This is recommended to avoid the possibility of surprise shock which might (under some circumstances) cause a fall from the pole.

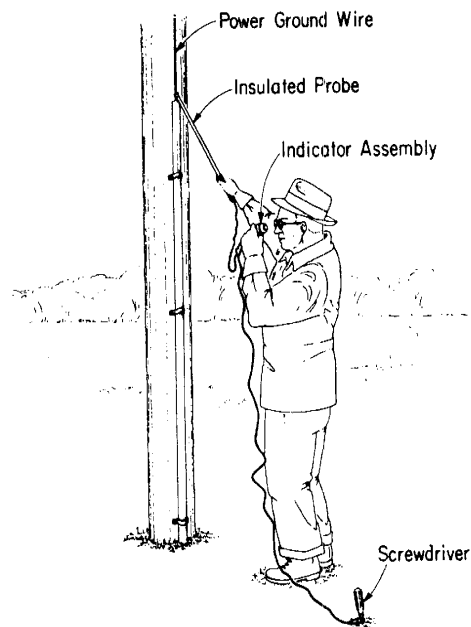
**4.03** After making the voltage test on a pole carrying vertical metallic power conduit and telephone cable, put on insulating gloves and place a B temporary bond as follows. **FIRST ATTACH THE SMALL CLIP TO THE TELEPHONE STRAND:** then attach the large clip to the conduit (or a conduit fastening if the conduit is too large). **LEAVE THE BOND IN PLACE,**

**UNTIL ALL WORK OPERATIONS AT THIS POLE HAVE BEEN COMPLETED FOR THE DAY.** If the bond starts to smoke, put on insulating gloves and descend the pole. Avoid contact with the bond or the conduit and notify your supervisor.

**4.04** On completion of work operations on the pole, remove the bond as follows:

- (a) Put on insulating gloves.
- (b) Remove the clip from the conduit. Remove this clip **FIRST**.
- (c) Remove the other clip from the strand.
- (d) If a spark is observed in removing the bond, notify your supervisor.

**4.05** If a shock is experienced as a result of simultaneous contact between the ground wire or conduit and grounded objects such as telephone cable, strand, guy, etc, descend the pole at once and report the matter to your supervisor immediately.



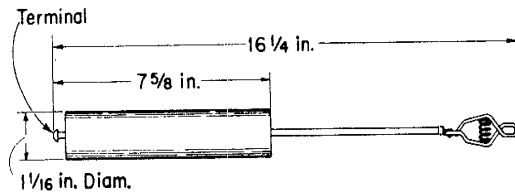
**Fig. 3**

## **5. VOLTAGE TESTS AND SAFEGUARDS — POLES WITH STREET LIGHT FIXTURES**

**5.01** The B shunting capacitor is required under certain conditions in testing street light fixtures. In general, areas where it will be re-

**SECTION 620-105-010**

quired will be known and workmen will be so equipped.

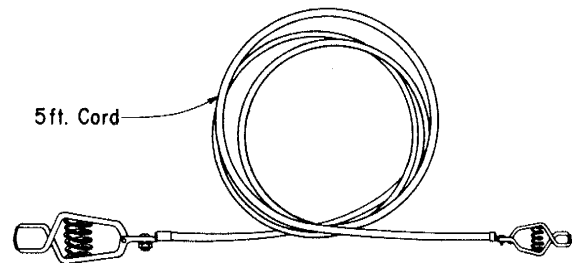


**B SHUNTING CAPACITOR**

**Fig. 4**

**5.02** Where a voltage test is required under conditions of Paragraph 3.04, proceed to test and safeguard the street light fixture as follows:

- (a) Attach B Voltage Tester bag containing test equipment to body belt.
- (b) Put on insulating gloves and climb to a convenient height to make the test. **AVOID CONTACTING THE LIGHT FIXTURE OR ITS WIRING.**
- (c) Attach the insulated clip of the voltage tester to the cable suspension strand, support bracket of multiple line wire or a bare vertical power ground wire. Push the toothed metal disk firmly against the street light fixture and promptly look into the open end of the indicator assembly.
- (d) If the indicator glows, immediately remove the probe from contact with the fixture, then remove the insulated clip from its attachment. If a B shunting capacitor is not available, descend the pole and notify your supervisor. **AVOID CONTACT WITH FIXTURE OR ITS WIRING.** If a B shunting capacitor is available, make a second test as described in subparagraphs (h), (i), and (j) following.
- (e) If the indicator does NOT glow, contact the fixture with the probe again to be sure that good contact has been made. If the indicator still does not glow, place a temporary bond as described in (f) below.
- (f) Attach the small clip of the B temporary bond to the cable suspension strand or the bare power vertical ground wire so as not to be in way of work operations. **DO THIS FIRST.** Then attach the other clip of the bond wire to the street light fixture. **DO NOT BOND** to the support bracket of multiple line wire or the suspension strand of **ISOLATED** cable.



**B TEMPORARY BOND**

**Fig. 5**

**DO NOT ATTACH TO THE STREET LIGHT WIRES OR TERMINALS TO WHICH THEY ARE ATTACHED. NEVER ATTACH THE CLIP TO A FIXTURE WHICH CAUSES THE INDICATOR TO GLOW.**

- (g) The insulating gloves may be removed **ONLY AFTER** the temporary bond is in place, and then only if other protection requirements permit. **LEAVE THE B TEMPORARY BOND IN PLACE UNTIL ALL WORK OPERATIONS HAVE BEEN COMPLETED AT THIS POLE FOR THE DAY.** If the bond starts smoking, put on insulating gloves and descend the pole immediately. Avoid contact with the bond, the fixture or its wiring. Notify your supervisor.
- (h) If a B shunting capacitor is available, under the circumstances described in Subparagraph (d) preceding, make a second test as follows:
  - (1) Attach the clip of the voltage tester and the clip of the shunting capacitor to the cable suspension strand or to the bare power vertical ground wire.
  - (2) Attach the small clip of the temporary bond to the metal terminal of the capacitor and the other clip to the metal cap behind the disk of the insulated probe.
  - (3) **MAKE ATTACHMENTS IN (1) AND (2) ABOVE SO THAT AT LEAST 1-FOOT SEPARATION IS MAINTAINED BETWEEN THE LEADS OF THE VOLTAGE TESTER AND THE TEMPORARY BOND OR SHUNTING CAPACITOR.**
  - (4) Touch the toothed metal disk to the street light fixture and promptly look into the open end of the indicator assembly. (See sketch.) **AVOID BODY CONTACT WITH TEMPORARY BOND OR CAPACITOR DURING TEST.**

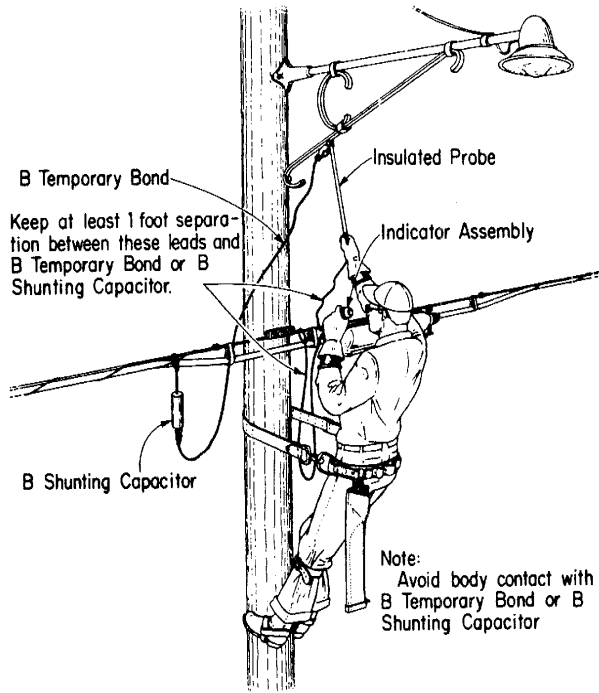


Fig. 6

- (i) **IF THE INDICATOR GLOWS, THE FIXTURE IS ENERGIZED.** Immediately remove the probe from contact with the fixture, replace testing equipment in the carrying case, descend the pole and notify your supervisor. **AVOID CONTACT WITH THE FIXTURE OR ITS WIRING.**
- (j) If the indicator does not glow, contact the fixture with the probe again to be sure that good contact has been made. If the indicator still does not glow, place a temporary bond as described in Subparagraphs (f) and (g) preceding.
- 5.03** On completion of work operations on a pole, remove the B temporary bond as follows:
- Put on insulating gloves.
  - Remove the clip attached to street light fixture. **REMOVE THIS CLIP FIRST.**
  - Remove the other clip from its attachment. If a spark is noticed on removing the bond, descend the pole immediately and notify your supervisor.

## 6. TESTING THE B VOLTAGE TESTER

**6.01** The B Voltage Tester should be tested weekly to ensure that it is operating satisfactorily. The dates on which it is tested shall be recorded on the test date card provided for the purpose. The test date card will be found in the external plastic pocket of the B Voltage Tester bag.

**6.02** The method of testing the B Voltage Tester is as follows:

- Locate a standard 110- to 120-volt convenience outlet which is energized. This may be checked with an extension cord and lamp.
- Insert the voltage plug, described in Paragraph 2.03, into the outlet; first choose the smaller of the two slots in the outlet to insert the prong connected to the resistor.
- Attach the insulated clip of the voltage tester to a ground such as a water pipe, radiator, metallic power conduit, etc. If none of these is available, lay the B temporary bond, uncoiled, on the floor and attach to one of its clips.
- Grasp the grip of the voltage tester in the palm of the hand so the end of the grip extends almost to the forefinger with the wire passing between the thumb and forefinger. (See sketch.) With the thumb and forefinger bent, pinch the wire firmly. Hold the grip as firmly as possible with three fingers, and while keeping the wire firmly pinched, straighten the thumb and forefinger—thus putting tension on the wire. **DO NOT USE BOTH HANDS AND PULL OR JERK ON THE WIRE SINCE EVEN A NORMAL CORD MAY BE DAMAGED OR BROKEN IF IT IS SUBJECTED TO VIOLENT PULLING.**
- Touch the toothed metal disk of the probe to the metal spiral of the voltage plug. The indicator should glow faintly. If the indicator does not glow, release the tension in the wire, but keep the probe in contact with the voltage plug. If the indicator glows after the tension has been released, the wire is broken under the insulation and the tester should be disposed of in accordance with the Company's established routine.

(f) If the indicator does not glow, reverse the voltage plug in the outlet by removing it, turning a half-turn and inserting again into the outlet, and repeat the test.

(g) If the indicator still does not glow, and it is known that the convenience outlet is not defective, then the voltage tester must be defective and shall be disposed of in accordance with the Company's established routine.

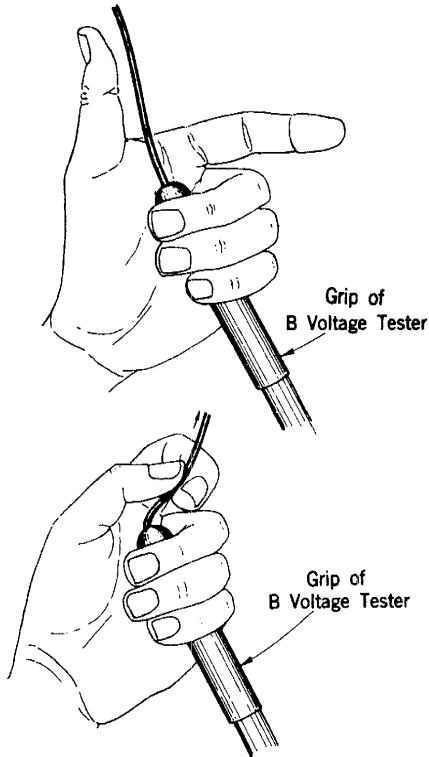
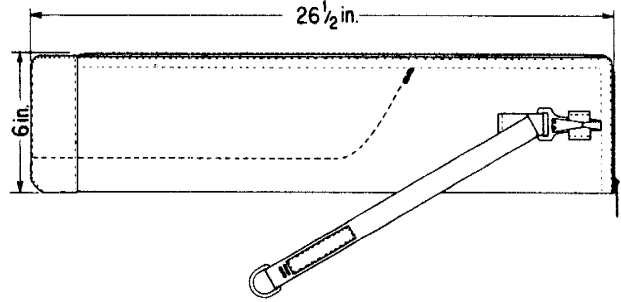


Fig. 7

**7. CARE AND STORAGE**

7.01 A canvas bag has been provided to carry and store the B Voltage Tester, B temporary bond, B shunting capacitor and test date

card when not in use. A web strap with dee ring and snap hook is provided to attach the bag to the body belt. In placing the tester in the bag, place the toothed metal disk first. The capacitor and bond should be carried in lower pocket of bag. The test date card is carried in the plastic pocket provided for the purpose.



B VOLTAGE TESTER BAG

Fig. 8

7.02 The B Voltage Tester should be handled and stored with reasonable care. Remove any dampness or dirt with a clean cloth before using or storing. Keep the instrument free of grease or oil to prevent deterioration of insulation.

7.03 Avoid exposing the instrument to excessive heat such as may be encountered near radiators, etc, as the plastic rod may deform under these temperatures.

7.04 The instrument should be CARRIED DOWN OR LOWERED from poles, NOT DROPPED, as the impact may short-circuit the elements in the neon glow unit of the indicator.

7.05 Certain minor field repairs to the B Voltage Tester are described in Section 620-105-300.

## FIELD REPAIR OF B VOLTAGE TESTER

### 1. GENERAL

**1.01** This section describes procedures to be used in making certain limited field repairs to the B Voltage Tester. It has been reissued to cover reinforcing the joint between the metal ferrule and the plastic probe.

**1.02** Testers which cannot be repaired by using the methods described in this section should be disposed of in accordance with local instructions.

### 2. WIRE INSULATION BREAKS NEAR THE PROBE

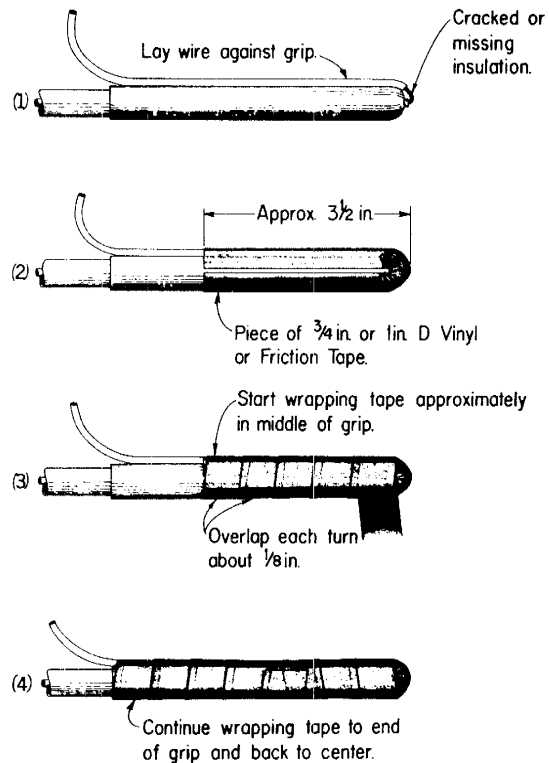
**2.01** Experience has shown that after extensive use under certain conditions, the insulation of the wire coming out of the probe handle or grip of the B Voltage Tester, may crack and expose the bare wire. This is not dangerous, but because the wire will tend to bend much more sharply at the point where the wire is exposed, it will eventually break at this point. The following procedure is designed to prevent wire breakage at this point.

**2.02** Clean the grip with a cloth (moistened if necessary with soap and water) to remove mud, grease and other foreign matter; dry it thoroughly before proceeding with repairs.

- (a) Lay the wire snugly against the grip as shown in (1).
- (b) Apply a 7-inch length of 3/4-inch (or 1-inch) D Vinyl Tape or friction tape along the grip and over the wire as shown in (2).
- (c) Starting at the middle of the grip, wrap tape around the wire and grip lapping each turn about 1/8 inch over the preceding turn. Continue the wrapping to the end of the grip and back to the other end of the grip, finally ending at the middle. This will result in a double layer of tape from one end of the grip to the other. The completed repair is shown in (4).

**2.03** The preceding repair should not be made, however, if the wire between the probe and

the indicator assembly has previously been field spliced, or is broken, as the wire will be too short.



**Note:** Testers issued after January 1960 are equipped with a piece of plastic tubing over the wire where it emerges from the grip which makes this type of repair unnecessary.

### 3. WIRE SPLICES

**3.01** The wire or cord of the B Voltage Tester may be spliced under the following conditions:

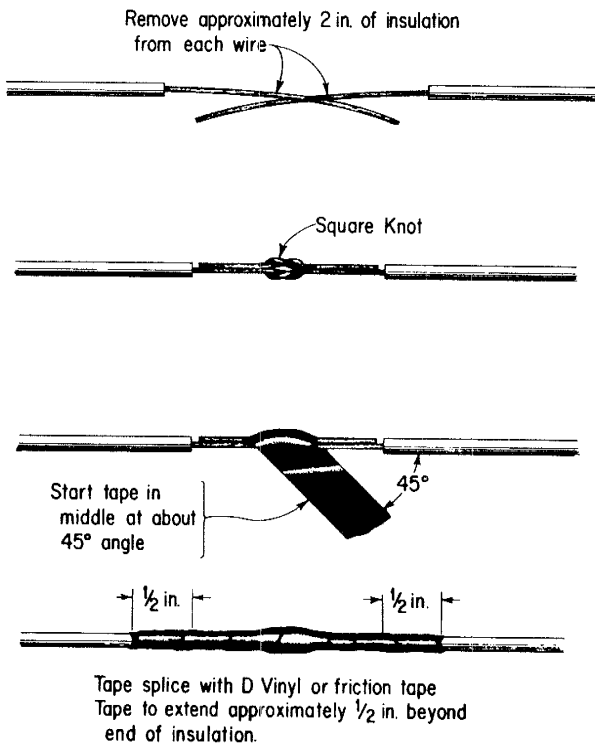
- (a) Between the probe and the indicator assembly, a maximum of two splices are permitted unless it is also necessary to tape the wire to the grip in which case no splices are permitted in this piece of cord. Do not attempt to splice wire if the break is within 4 inches of either the indicator assembly or the grip of the probe.
- (b) Between the indicator assembly and the grounding clip, a maximum of three

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splices are permitted except that no attempt should be made to splice wire breaks within 4 inches of the indicator assembly, and no attempt should be made to splice wire breaks if the over-all length of the cord between the clip and the indicator assembly will be less than 7 feet 6 inches. Each splice will reduce the length of the cord about 2 inches.

**3.02 Broken cords shall be spliced as follows:**

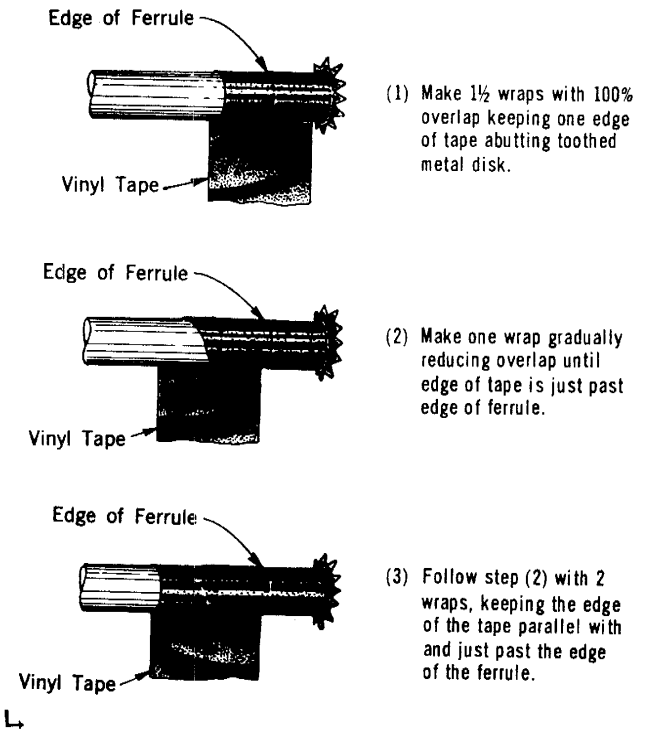
- (a) Strip 2 inches of insulation from the wire on each side of the break using the wire stripping hole of the standard 6-inch diagonal pliers.
- (b) Clean the insulation of the wire adjacent to the break for a distance of at least an inch to remove mud, grease, etc.
- (c) Tie a square knot in the middle of the exposed wire so that the ends will lie parallel and extend approximately to the beginning of the insulation.
- (d) Tape the joint with 3/4-inch D Vinyl or friction tape. Start the tape at about a 45-



degree angle beginning at the knot and continue until about 1/2 inch of the rubber insulation has been covered. Continue taping until the splice has two layers, ending the tape in the middle of the splice.

**4. REINFORCEMENT OF FERRULE JOINT**

**4.01** This procedure applies only to testers manufactured prior to October 1963. (The date is stamped in the plastic wand just above the red grip.) Testers manufactured prior to that date can also be readily identified by the lack of indentations on the brass ferrule at the end of the plastic probe. *Reinforcement of the ferrule joint is not necessary if the ferrule has three equally spaced indentations.* Testers which do not have these indentations shall be reinforced unless the ferrule has become loose. Testers with loose ferrules shall be disposed of in accordance with local instructions. The method of reinforcing is shown below.





SAFEGUARDS TO BE TAKEN  
BEFORE CLIMBING POLES  
GENERAL

1. GENERAL

- 1.001 This Addendum supplements Section 620-131-010.
- 1.002 This Addendum is reissued:
- (a) To emphasize that caution must be exercised by the workmen before climbing a pole marked with a "C".
  - (b) To cover precautionary measures to be observed before climbing or working on certain poles which were supplied during 1946 and 1947 and which have been found to be subject to early decay. These poles were treated as follows:
    - (1) Copper naphthenate
    - (2) Creosote-petroleum

2. IMPORTANT PRINCIPLES TO BE OBSERVED  
IN CONDUCT OF WORK

The following change applies to Part 2 of the Section:

- (a) 2.03 - revised

2.03 The condition of the pole can usually be determined before climbing, by examining and testing it by means of one or more of the methods described later. A pole marked with a "C" has been recommended for replacement. However, the strength of poles not so marked shall not be assumed to be adequate, and the precautions outlined in Paragraph 4 must be observed.

7. EARLY DECAY IN COPPER NAPHTHENATE  
AND CREOSOTE-PETROLEUM TREATED POLES

7.01 Copper naphthenate poles can be identified by the suppliers brand which appears on each pole 10 feet from the butt. The basic symbols which will appear in the brand, although not necessarily in this order, are as follows:

<u>Symbol</u>	<u>Meaning</u>
ACW	American Creosote Works
J	Jackson Tennessee Plant
SP	Southern Pine
N	Copper Naphthenate
	Treatment
46 or 47	Year of Treatment, 1946 or 1947
Digits	Class and Length

Note: Since these poles are subject to early decay, before climbing or performing any work operation, test the pole for soundness unless it has previously been inspected and marked. The pole shall be tested in accordance with Section 620-132-010.

7.02 In general a creosote-petroleum pole can be identified by an "X" included in the species-preservation brand. For example, a southern pine pole so treated would be marked "SPX". In some cases, however the "X" may not be associated with the species symbol, but may be located elsewhere in the pole brand.

(a) Before climbing or performing any work operation on a pole check the brand to see if it contains an "X". Then test the pole in accordance with 620-132-010.

7.03 Whenever one of these suspected copper naphthenate or creosote-petroleum treated poles has been checked by a pole inspector, the pole will be marked with the letter "C" or "Z".

(a) Any pole marked with the letter "C" will require that the precautions covered in Section 620-133-010 be taken.

(b) The letter "Z" indicates that the pole was sound at the time of inspection; however, the strength of such poles shall not be assumed to be adequate and the precautions outlined in paragraph 4 must be followed. The letter "Z" will be used by pole inspectors only on these suspected poles.

7.04 All unmarked suspected poles which are located during the daily work operations shall be reported to your Supervisor so that he may arrange to have such poles inspected and marked.

(a) Any such poles that are in the custody of the power company shall also be reported so that local arrangements may be made with the Power Company for inspection and marking.



**PRECAUTIONS TO BE TAKEN  
BEFORE CLIMBING POLES OR WORKING FROM  
STRAND- OR POLE-SUPPORTED EQUIPMENT**

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**1. GENERAL**

**1.01** This section, together with Sections 620-132-010 and 620-133-010, covers recommended procedures which will help prevent accidents associated with climbing and working on poles or strand-supported equipment. Observance of the principles and precautions in this section will help ensure the safe performance of work on poles.

**1.02** This section is reissued to include the visual examination and testing of the poles at each end of an aerial span before:

- (a) Placing a ladder against the strand
- (b) Hanging an aerial platform from the strand
- (c) Riding the strand.

**1.03** ♦*All poles must be visually examined* before climbing, placing a ladder against pole or strand, hanging an aerial platform, or riding the strand.♦

**1.04** *Test all poles prior to climbing* as described in Section 620-132-010 unless they satisfy the conditions listed in Part 5 of this section.

**1.05** *All unsafe poles or poles of doubtful condition should not be climbed or should be climbed only after suitable temporary supports have been applied.* Section 620-133-010 describes methods of temporarily supporting poles.

**1.06** This section emphasizes the necessity for visual inspection and testing of poles and the need for temporary support of poles which may be unsafe. *Assure that the pole is safe.*

**1.07** All men who will work on poles ♦or strand-supported equipment♦ must be familiar with the recommendations contained in the Bell System Practices covering the use of:

- (a) Body belts
- (b) Safety straps
- (c) Climbers
- (d) Insulating gloves and other protective equipment.

**1.08** Pole failures may occur as a result of various causes. While poles that have been given an approved preservative treatment will usually retain their strength for many years, a treated pole may occasionally be encountered which will have a relatively short life because of an inadequate preservative treatment or other unusual conditions. Therefore, it is necessary to exercise care in checking the conditions of all poles, including those which appear to be sound. The failure of a pole is usually due to one or more of the following causes:

- (a) Decay of the pole at or below groundline.
- (b) Storm damage.
- (c) Mechanical damage, such as might result from a vehicle collision.

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- (d) Termite, carpenter ant, or other insect attack.
- (e) Lightning damage or fire damage.
- (f) Woodpecker attack.
- (g) Application of excessive loads or creating unbalanced loads which are excessive under the existing conditions. These excessive loads may result from the use of improper or inadequate construction or maintenance methods.

### 2. PRELIMINARY VISUAL EXAMINATION

**2.01** Before climbing a pole or testing it for safe climbing conditions, make a visual check for the following conditions:

- (a) Excessive rake or unexplained leaning of a pole. This may be due to failure of the pole at or below groundline.
- (b) Insufficient depth of setting. This may be due to erosion of the earth around the pole as a result of heavy rainfall, flood water, road widening, etc, and would affect the stability of the pole. The depth of setting can frequently be checked by reference to the brand which is present on most poles at a distance of ten feet (measured to the bottom of the brand) from the butt of the pole. ♦Do not rely upon the brand mark to determine the depth of setting of non-Bell System poles.♦
- (c) Evidence of collision damage if the pole is at an exposed location along a highway.
- (d) Presence of fungus growth in checks or protruding from the pole surface ♦or on areas near groundline where the wood appears water-soaked in contrast to surrounding wood.♦ These symptoms usually indicate a condition of advanced decay in the interior of the pole.
- (e) Presence of termite or carpenter ant infestation, evidenced by mud channels or debris in the checks, wood dust at the base of the pole, or movement of ants when the pole is struck with a hammer or other tool.
- (f) Bent, loose, or missing pole steps.

- (g) Wide seasoning checks which could result in loosening of pole steps or a climbing hazard.
- (h) ♦Evidence of compression wood indicated by short horizontal cracks along one side of the surface of the pole, or by curling of short sections out away from the pole surface.♦
- (i) Presence and distribution of large knots, ♦excessive knot clusters,♦ climber gaff splinters, unauthorized signs, aerials, clotheslines, and nearby interfering tree growth.
- (j) Presence of large stones, ground irregularities, and debris at base of pole.
- (k) Presence of conduits or vertical runs on pole which might interfere with use of pole steps or climbing.
- (l) Broken wires in adjacent span.
- (m) Excessively tight or excessively slack drop or line wires on one side of pole.
- (n) Contact or insufficient separation between telephone and power wires or other plant on the pole, or in the span or spans adjacent to the pole.
- (o) Woodpecker holes.
- (p) Evidence of lightning or fire damage.
- (q) Presence of markings ♦or pole tags♦ placed by pole inspector to indicate an unsafe pole or pole to be replaced.
- (r) Presence of ice on the pole surface or pole steps which might result in hazardous climbing.
- (s) ♦Shell rot decay on cedar poles.♦

### 3. RESULTS OF VISUAL EXAMINATION

**3.01** If any conditions listed in Part 2 are found, they must be considered in connection with the results of the tests described in Section 620-132-010 and necessary precautions taken.

### 4. PRINCIPLES TO BE OBSERVED

**4.01** The most important principle to keep in mind is to *avoid placing an excessive*

**unbalanced load on a pole.** Take into account the condition of the pole and the nature of the work operation which is to be performed.

**4.02** In planning a work operation involving a pole which may be unsafe, it is important to include temporary or permanent supports which will be effective in preventing failure of the pole.

**4.03** Under certain conditions described in Part 5, for minor work operations not involving the application of heavy unbalanced loads (5.02), poles can be climbed without being tested or applying additional supports.

## 5. CONDITIONS WHICH REQUIRE NO TESTING OR SUPPLEMENTARY SUPPORT

**5.01** It is unnecessary to make tests or to apply a temporary support before climbing a pole if *any* of the following conditions will exist throughout the work operations:

- (a) The pole is storm guyed on four sides.
- (b) The pole carries two or more storm side guys and a load as described in 5.02(b).
- (c) The pole is part of an H fixture which is provided with head and back guys.
- (d) The pole is not in a straight section of a line, but is an adequately guyed corner pole and carries a load as described in 5.02(b).

**5.02** It is also unnecessary to make tests or to apply a temporary support before climbing a pole if *all* of the following conditions exist throughout the work operations and the proposed work operations do not involve placing a heavy unbalanced load (excess of 150 pounds) on the pole:

- (a) The pole is in a straight section of line, but is not a dead-end pole.
- (b) The pole is carrying a 6M or larger suspension strand which is securely clamped to it and to each adjacent pole and will remain so attached throughout the work operations.
- (c) There is no downward change in grade at the pole.

(d) Neither adjacent span length is in excess of 165 feet.

**5.03** ♦ It is also unnecessary to make tests or to provide supplementary supports before climbing a pole if the following conditions exist:

- (a) Instead of carrying a suspension strand, the pole carries ten or more copper, copper-steel, or steel line wires which will remain securely tied at the pole and at each adjacent pole throughout the work operation.
- (b) All the other conditions described in 5.02(a), (c), and (d) exist.♦

**5.04** ♦ It is unnecessary to make tests before placing any strand-supported equipment if the following conditions exist:

- (a) The poles supporting the span and the poles at the far end of the adjoining spans form a straight section.
- (b) The suspension strand in the span is 6M or larger and is securely clamped to the two adjacent poles on each side of the span, and will remain attached to these four poles throughout the work operation.
- (c) There is no downward change in grade at the poles at each end of the span.
- (d) The span length and the adjacent span lengths are not in excess of 165 feet each.♦

## 6. PRECAUTIONS

**6.01** An end pole in a line, even though head guyed, should always be examined and tested before climbing since the guy and the end spans do not contribute any stability to the pole in a direction across the line.

**6.02** *No work aloft should be started unless the workman is satisfied that the pole ♦line structure♦ has adequate strength to support the load resulting from working aloft and the load which will result from the proposed work operations. If the strength of the pole line structure is in doubt, temporary or permanent supports must be applied before starting work.*

**6.03** *◆Poles at each end of an aerial span in which a ladder is to be placed, an aerial platform hung, or a cable car ridden shall be visually examined as described in this section and tested as described in Section 620-132-010.◆*

**6.04** Temporary supports adequate to support the pole shall always be placed before removing any attachments from a pole that is to be removed or replaced because of deterioration.

**6.05** Swinging rapidly around a pole imposes an additional load on any pole and should be avoided.

**6.06** Where a work operation is planned which is likely to result in a shock load on a pole or on an adjacent pole, a workman should remain off the pole to avoid being shaken off by the shock load. If the shock load would be likely to break the pole, temporary guys should first be placed to take up the shock.

**6.07** *Heavy unbalanced loads, such as those caused by placing or removing conductors or strands under tension at unguyed poles or inadequately guyed corners or deadends, may*

*cause even a pole in good condition to fail.* Therefore it is important to plan the work operations so the poles will not be subjected to too heavy an unbalanced load. The use of guys or braces provides a means of preventing excessive unbalanced loads. Typical operations for which temporary or permanent supporting of poles may be required are as follows:

- (a) Removal of guys.
- (b) Untying wires.
- (c) Releasing wires or strand under tension.  
*Do not cut while under tension.*
- (d) Placing additional wires or strand.
- (e) Tensioning wires or strand.
- (f) Changing locations of wire or strand attachments.
- (g) Loosening suspension clamps or guy clamps.
- (h) Moving line because of road widening.

SAFEGUARDS TO BE TAKEN  
BEFORE CLIMBING POLES

1. GENERAL

- 1.001 This Addendum supplements Section 620-132-010.
- 1.002 This Addendum is reissued to revise instructions concerning the reporting of poles found to be unsafe for climbing.

7. REPORTING POLES FOUND TO BE UNSAFE FOR CLIMBING

The following change applies to Part 7 of the Section.

(a) 7.01 - revised

7.01 Poles found to be unsafe for climbing as a result of the tests described above should be reported promptly to your supervisor as being in an unsafe condition. If the pole is believed to be a "Hazardous Plant Condition" as a result of any of the above tests, the procedures outlined in paragraphs 3.03 and 3.04 of General Plant Practice Section 002-410-001NE shall be followed.

9. HAZARDOUS OR NON-STANDARD PLANT CONDITIONS

9.01 Report on Form 156 all Plant Conditions which appear to be unsafe or hazardous to workmen, the public, or which endanger the property of others. In this connection the procedures outlined in General Plant Practice Section 002-410-001NE shall be followed.

9.02 When the nature of a hazardous condition is such that immediate remedial action is necessary, notify your supervisor by telephone or other means immediately and take any steps necessary to protect life or property, pending the arrival of proper repair forces.

9.03 Plant which does not conform to the standards of construction and maintenance established by this Company but is not unsafe or hazardous should be reported for correction on other forms available for the purpose such as Form 694, "Plant Upkeep Order", Form 707F-O.P. Upkeep Memorandum.





**SAFEGUARDS TO BE TAKEN  
BEFORE CLIMBING POLES  
TESTING POLES**

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*there is any question about the pole being sufficiently strong to permit safe climbing and safe working, do not climb the pole.* Inform your supervisor about the condition and request the necessary assistance to enable the work to be done safely.

**1. GENERAL**

**1.01** This section covers methods of testing poles to determine whether or not they are capable of withstanding the loads to which they will be subjected in climbing and working on them.

**1.02** This section is reissued to add information on the use of B and C Pole Tags for marking defective poles, and to clarify the prod and sounding test.

**1.03** The following tests will provide important information in addition to that obtained in the visual examination described in 620-131-010. The necessary tests shall be made to determine whether the pole can be climbed safely.

**1.04** *In any case where suitable means for determining the condition of a pole and bracing it when necessary are not available and*

**2. METHODS OF TESTING POLES**

**2.01** Each of the methods of testing listed below has certain limitations and may not be applicable under the conditions existing at certain locations. It is important, therefore, to make a selection of the tests that are applicable and most suitable under the existing conditions. The tests are as follows:

(a) Pike Pole Test

(b) Prod and Sounding Test ←

(c) Boring Test

(d) Hand Line Test

**2.02** As pointed out in Section 620-131-010, the necessity for testing occurs principally under *any* of the following conditions.

(a) At dead-end poles.

(b) In longer span cable or open wire construction.

(c) Where there is a downward change in grade at a pole.

(d) Where the line is carrying a small number of telephone wires or both power and telephone wires.

(e) Where drop wires are attached, especially ←  
where the pull from them is unbalanced. ←

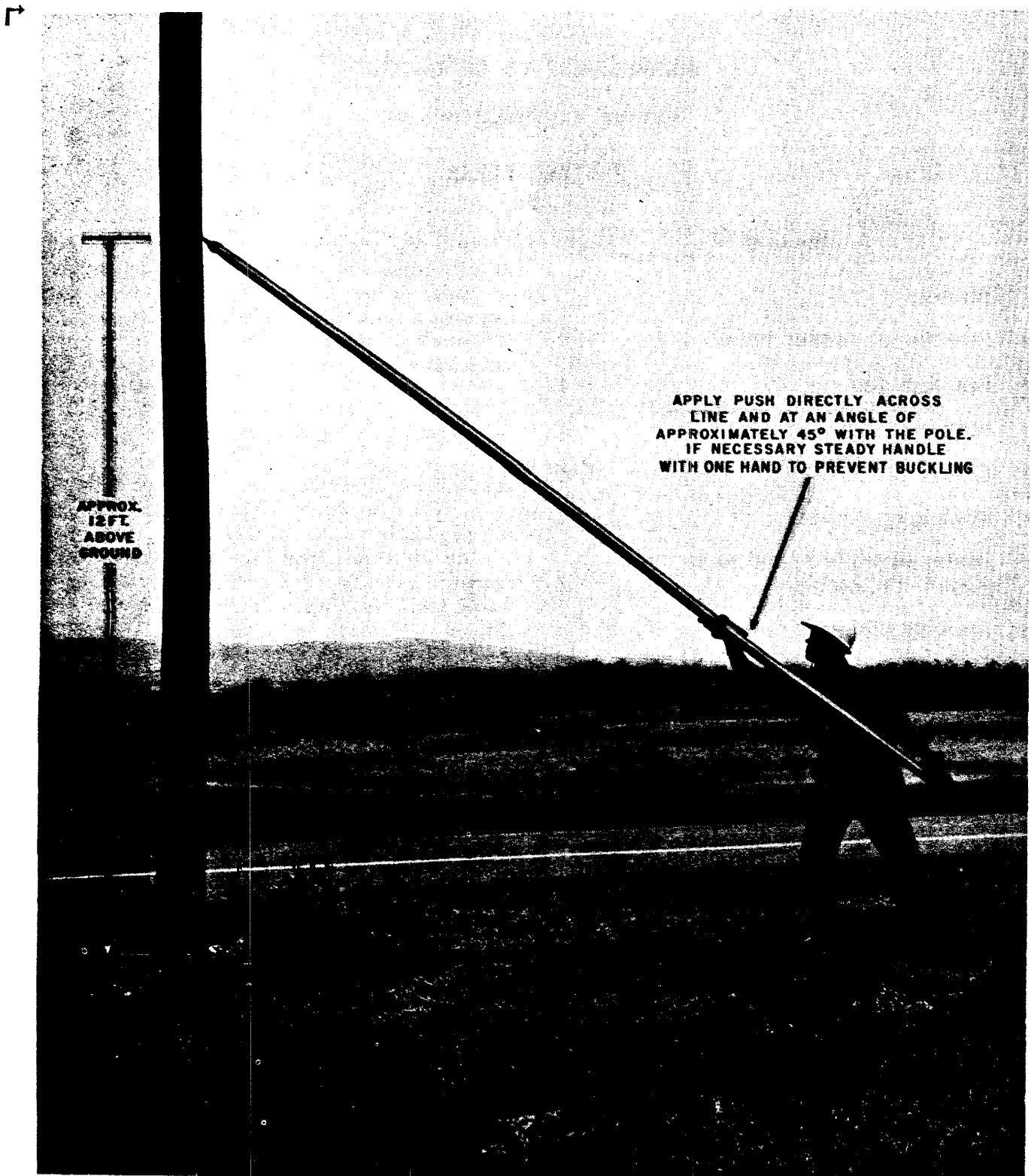


Fig. 1 — Pike Pole Test

### 3. PIKE POLE TEST

**3.01** The pike pole test is applied by making a vigorous effort to rock the pole back and forth in a direction at right angles to that of the line by pushing the pole with a 12-foot or longer pike pole. If practicable, the pike pole should be held at an angle of about  $45^\circ$  ( $\frac{\text{Lead}}{\text{Height}}=1$ ) with the pole, as shown in Fig. 1. If the pole cracks or breaks, the test should be discontinued immediately and the pole should be regarded as unsafe for climbing. The pole should not be rocked so hard as to cause the wires to swing together and thus introduce trouble in the circuits.

**3.02** If in certain cases (particularly in connection with the longer spans of telephone open wire and power wires) it is found impracticable to rock the pole without causing the wires to swing together, the pole should be given a steady push with the pike pole, applying as heavy a push as possible. If the pole withstands such a push, it should also be subjected to the prod and sounding test before being climbed.

**3.03** If a 16-foot pike pole is available, its use is preferred to that of a shorter size, inasmuch as it enables the push to be applied at a higher point on the pole and is therefore more effective. In those cases, however, where a 16-foot pike pole is not available, use may be made of a standard 14-foot or 12-foot pike pole or a standard 1-3/4 inch test-pike, fitted with two extension sections of the large tree pruner handle. As an alternative to the 1-3/4 inch test-pike, a standard 1-1/4 inch test-pike may be used, and it should be fitted with a tapered section and one extension section of a large tree pruner handle.

**3.04** The pike pole test cannot effectively be applied to poles that have attachments such as wires, guys, push braces, etc., arranged in such a manner as to take the thrust of the pike, rather than permitting the thrust to be transferred directly to the pole. Some locations at which such conditions are encountered are guyed corner poles, junction poles, side storm guyed poles, etc.

**3.05** Many of the small poles in suburban or rural leads, carrying eight wires or less have sufficient strength from a service standpoint, but can be broken by applying the pike pole test too vigorously. In applying the test to such poles, exercise reasonable care to prevent breaking those which are in serviceable condition and can be climbed safely. (See Paragraph 4.05.)

**3.06** Pavement or frozen ground surrounding poles sometimes tends to hold poles firmly, even though they may be badly deteriorated. Where such conditions exist, it is usually desirable to apply temporary supports to the pole, if there is any question as to the soundness of the pole.

**3.07** *The pike pole test should not be applied to poles which, if they were to break off, might cause damage to nearby property or result in contact between telephone plant and electric light or power wires, or introduce some other hazardous situation.*

### 4. PROD AND SOUNDING TEST

**4.01** The prod and sounding test can be used in some cases where it is impractical to apply the pike pole test. It consists of two parts:

- (1) exploring the condition of a pole at or below the groundline with a prod ↗
- (2) sounding the pole with a hammer from the groundline up to as high as can be reached.

#### BELOW GROUNDLINE

**4.02** The tool used for the prod portion of this test is a pole inspector's prod or screwdriver having a 5-inch or longer blade. It is undesirable to use a heavy, pointed tool, such as a digging bar, because of the damage which such a tool can cause to the treated sapwood of a sound pole, thus reducing the effectiveness of the preservative treatment and exposing the interior of the pole to decay attack. ↗

**4.03** Inasmuch as the section of maximum decay is normally encountered between the groundline and a point about 12 inches below the groundline, it is desirable, if conditions permit, to excavate sufficient earth from around the pole to permit a more satisfactory examination of the pole. If, however, the pole is set in pavement, or for other reasons, it is impracticable to remove any earth, the prod should be applied as close to the groundline as practicable, at any angle of approximately 45 degrees with the pole and completely around the pole. The presence of general sapwood decay or decay pockets will usually be evident from this test.

**4.04** If the prod test indicates the presence of extensive decay, it is desirable to apply temporary supports, regardless of the original circumference of the pole, unless in accordance with Section 620-131-010, no supports are required.

**4.05** If there is no indication of decay or other reduction of strength in the prod and sounding tests and the pole has been subjected to a moderate pike pole test where conditions permit its use, *25-foot or shorter poles* in straight sections of rural lines carrying eight or less 104 copper or stronger wires with no downward change in grade, and measuring 13 inches or more in circumference at the groundline, may be climbed without placing temporary supports.

**4.06** The prod test is not considered as satisfactory as the pike pole test and it should not be completely depended upon to furnish information as to the soundness of the pole.

#### ABOVE GROUNDLINE

**4.07** The sounding test consists of applying blows with a hammer, such as a drilling hammer, or the back of a hand axe, to the pole surface completely around the pole from points close to the groundline to as high as can conveniently be reached. The presence of a hollow heart condition or advanced internal decay can usually be recognized by the characteristic hollow or dull sound resulting from the blows on

the wood. A pole free from decay usually sounds clear and the hammer usually rebounds noticeably when the pole is struck sharply and squarely. Wet surfaces due to recent rains, wet interior near the groundline due to high soil moisture, wide checks, or shakes in the pole near the surface may change the sound of a solid pole. Care must be taken not to mistake the altered sound due to these causes for the sound associated with internal decay.

#### 5. BORING TEST

**5.01** The boring test consists of boring a hole in the pole at a point where internal decay is suspected by means of a 3/8 inch wood boring bit or by means of an increment borer. The condition of the wood can be determined by an examination of the chips or core brought out by the bit. The presence of a hollow heart condition is, of course, revealed by the bit breaking through the wood.

**5.02** If a hole is bored in a pole and it is concluded that the pole is in sound condition and the pole is to be left in plant, the hole should be filled by means of a wooden plug. (Ordering information is as follows: Plug, Wooden (length) inches. Plugs come in 2-, 3-, 4- or 6-inch lengths. Order the length desired.)

#### 6. HAND LINE METHOD

**6.01** The hand line method consists of applying a series of pulls to a pole with the object of rocking the pole back and forth. In applying this test, use should be made of a 3/8 inch or larger rope, attached to the pole at such a height that the pull can be applied at right angles to the direction of the line and at an angle of about 45 degrees with the pole. The same use limitations and precautions applying to the pike pole test, apply also to this method of testing. In attaching the rope to the pole, the pole should not be climbed, but the rope should be thrown over a fixed attachment, such as a pole step or a crossarm, or a loop should be made at the base of the pole and moved into position by means of a convenient tool, such as a wire raising tool.

## 7. REPORTING POLES FOUND TO BE UNSAFE FOR CLIMBING

**7.01** Poles found by the previously described tests to be unsafe for climbing should be marked immediately with a B or C Pole Tag, as described in Part 8. The unsafe condition should be reported promptly to your supervisor.

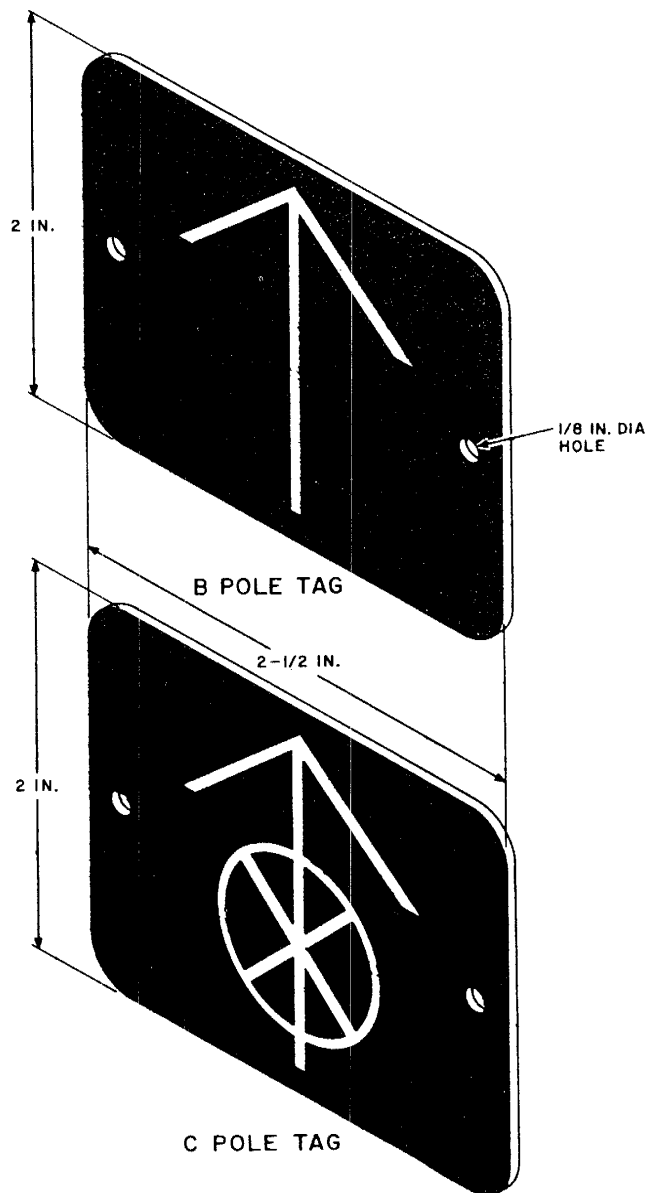
**7.02** If the pole has been broken, resulting in an unsafe condition and requiring immediate support, temporary supports should, if practicable, be applied immediately to prevent the pole from falling. If suitable bracing means are not available, steps should be taken to warn passers-by or traffic away from the location until a safe condition can be restored and a report of the condition should be made promptly to your supervisor.

## 8. MARKING DEFECTIVE POLES

**8.01** All poles which are recommended for replacement on account of deterioration or mechanical damage should be plainly marked to indicate that they are defective. Because of the transfer of personnel between Operating Companies during storm breaks or other restoration work, the method for marking poles should be uniform throughout the Bell System. Two aluminum tags, designated as B and C Pole Tags have been standardized for this purpose (see Fig. 2).

**8.02** The B Pole Tag has a white arrow on a red background. It is intended for marking defective poles which do not require immediate replacement, that is, defective poles which are not yet considered dangerous. It serves as a warning to workmen that the pole is defective and should not be climbed or worked on without following the recommendations of Section 620-131-011 "Safeguards To Be Taken Before Climbing Poles—General" and the appropriate tests, as described in this section have been made.

**8.03** The C Pole Tag is similar to the B Pole Tag except that an "X" inscribed in a circle is imposed on the shaft of the arrow. This tag is intended for marking poles which are in



**Fig. 2 — B and C Pole Tags**

a dangerous condition and require immediate replacement. It serves as a warning to workmen that the pole is in a dangerous condition and should not be climbed or worked on before being temporarily supported as described in Section 620-133-010 "Safeguards To Be Taken Before Climbing Poles—Temporary Supports."

**8.04** Place one tag on the road side of the pole just below the pole number, if the pole is numbered, or at approximately 6 feet above

**SECTION 620-132-010**

- ↗ groundline if the pole is not numbered. Place another tag at approximately the same height on the field side of the pole. If the pole is defective in the groundline section, place the tags so that the arrow points downward. If the pole is defective in the upper portion, place the tags so that ↗ the arrow points upward. If, however, the pole is defective in both the groundline section and in the upper portion place a double set of tags, one set with the arrow pointing downward and the other set with the arrow pointing upward.
- ↘ Attach the tags with Pole Tag Nails.

SAFEGUARDS TO BE TAKEN  
BEFORE CLIMBING POLES  
TEMPORARY SUPPORTS

1. GENERAL

1.001 This Addendum supplements Section 620-133-010.

1.002 This Addendum is issued to illustrate the use of wire lashing as a method of temporarily supporting poles.

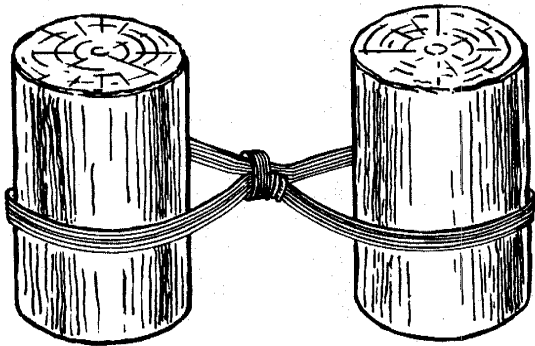
3. METHODS OF APPLYING TEMPORARY SUPPORTS

The following change applies to Part 3 of the section.

(a) 3.02 - Add illustration

Lashing Weakened Poles to New Poles

3.02 (Add following illustration)







## SAFEGUARDS TO BE TAKEN BEFORE CLIMBING POLES TEMPORARY SUPPORTS

Contents	Page
1. General .....	1
2. Precautions .....	1
3. Methods of Applying Temporary Supports.....	2

### 1. GENERAL

1.01 This section describes various methods of temporarily supporting poles.

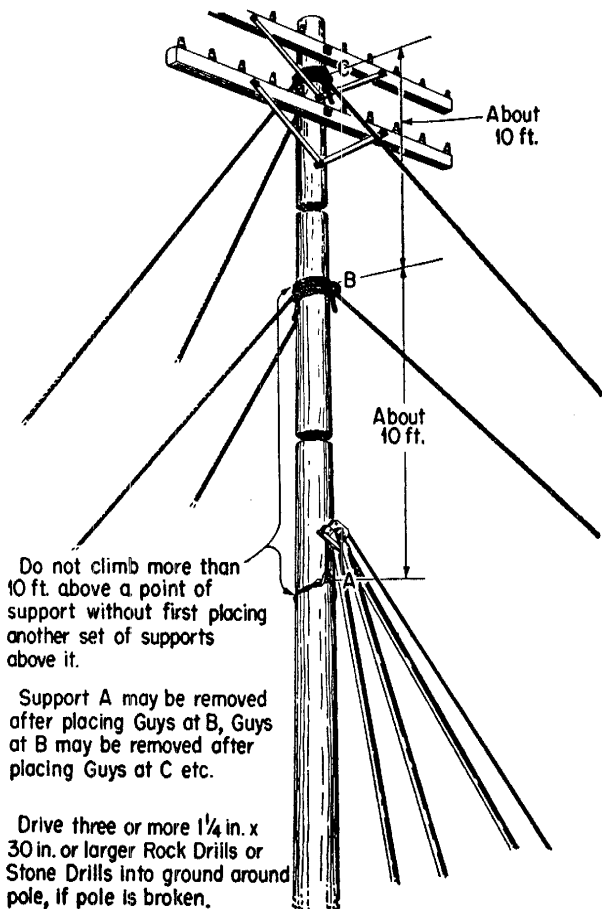
1.02 Poles which have been found to be unsafe or are suspected of being unsafe for climbing or working on, shall either not be climbed at all or shall be climbed only after suitable temporary supports have been applied which will ensure safe climbing and working conditions. If suitable supports can not be provided with the equipment at hand, refer the case to your supervisor.

1.03 The following methods of supporting poles temporarily may be used:

- (a) Lashing old or weakened pole to new pole.
- (b) Supporting pole by means of pole derrick.
- (c) Temporary guying.
- (d) Bracing pole by means of pike poles.
- (e) Using a combination of bracing and guying.

### 2. PRECAUTIONS

2.01 Where temporary supports are used to reinforce a pole, it is important that a workman should avoid climbing to a level more than 10 feet (measured to the workman's feet) above the point at which the temporary supports are attached. If necessary to work at a greater height above existing supports, place additional supports at a point approximately 10 feet above those supports as shown on Page 2.



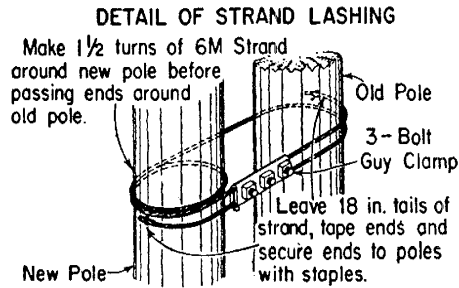
3. METHODS OF APPLYING TEMPORARY SUPPORTS

3.01 The various methods of supporting poles temporarily are described in detail in the following:

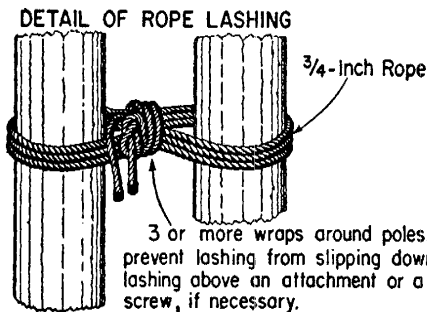
**Lashing Weakened Poles to New Poles**

3.02 A weakened or old pole should be supported by lashing it to a new pole, if the new pole is set within 3 feet of it, or if the new pole has been placed in the old pole hole. The two poles should be lashed together as shown in the following illustration.

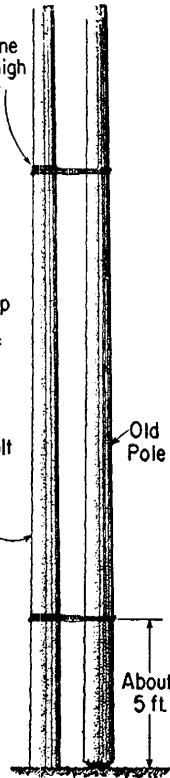
Place top lashing at least 4 ft. below nearest power conductor on jointly used pole. On telephone poles (no power attachments), place lashing as high as convenient, but not less than 3/4 of the height of old pole above ground.



Note: 2200 Pound Strand secured with One - Bolt Clamp may be used with 30-foot and shorter poles.



3.03 In order to place the upper lashing, climb the new pole. Do not, under any circumstances, work from the old pole until both upper and lower lashings have been completed. Rope lashings should be used only where the old pole is to be removed within a reasonable period of time (usually a few days) or where there might otherwise be an electrical hazard in passing the sling around the poles.



**Supporting Pole by Means of Pole Derrick**

3.04 A pole derrick can sometimes be used to advantage for temporarily supporting a pole. When using a derrick for this purpose, the winch line should be attached to the pole, working from the ground, and raised into position by means of a pike pole or wire raising tool. The winch line should be raised as high on the pole as practicable, but in no case should the eye of the winch line or its serving be permitted to enter the derrick sheave. See illustration in Part 2.

3.05 The point of attachment of the winch line should, if practicable, be several feet or more above the balance point of the pole. The location of the balance point of a pole will vary with the taper and general shape of the pole. In a pole, such as a southern pine, which ordinarily has a uniform but small amount of taper, the balance point will be close to the midpoint of the pole. In a pole with a greater amount of taper or a heavy butt, the balance point will be somewhat lower. For example, in a 35-foot southern pine, Douglas fir or western larch pole (all of which normally have a small taper), the balance point will usually be 1 to 2 feet below the midpoint that is, about 19 feet below the top of the pole. In a 35-foot western cedar pole having a somewhat greater amount of taper or a heavy butt, the balance point may be two to three feet below the midpoint. It should be noted, however, that the balance point of a pole broken off at the ground line is close to the midpoint of the portion of the pole projecting out of the ground and that if the pole carries any plant such as wires or cable, the balance point may be considerably higher, thus necessitating the use of supplementary rope guys as described in Paragraph 3.06.

3.06 If it is not practicable to attach the winch line sufficiently above the balance point to ensure stability of the pole with a workman in position on the pole, temporary rope guys should be attached to the pole either close to the ground line or far enough above the winch line attachment to ensure the required stability. The positioning of the temporary guys above the winch line should be done working from a point below the level of the winch line attachment, using a pike pole or a wire raising tool.

3.07 A PM Frame may be used in conjunction with a pole derrick instead of using temporary rope guys.

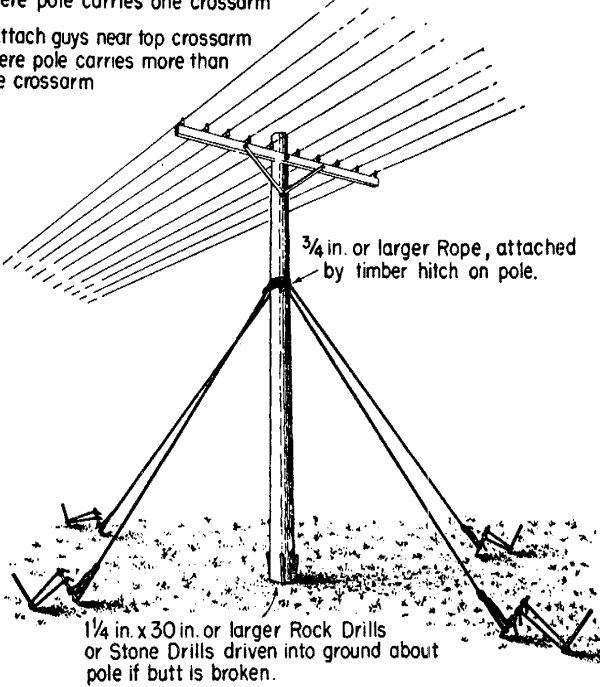
**Use of Temporary Guys**

3.08 Rope or strand guys may be used as shown in the following illustration. The temporary guys may be attached for anchorage purposes to other poles, trees or stumps that are in sound condition, sufficiently strong and in the desired position for the attachment of the guys. Where such anchorages are not available, use can sometimes be made of one or more bars driven into the ground as described below. The number of bars required depends upon the load and soil conditions. The use of two bars for each guy is generally recommended, although one will be sufficient if the load to be supported is very light and the ground into which the bar will be driven is firm.

3.09 To facilitate the operation of attaching the guys to the pole, it may be advantageous in some cases, to support the pole temporarily by three or four pike poles or a pole derrick. In other cases, the rope guys may be raised into position by means of a wire raising tool. Do not climb an unsupported questionable pole.

Attach guys about 6ft. below crossarm where pole carries one crossarm

Attach guys near top crossarm where pole carries more than one crossarm

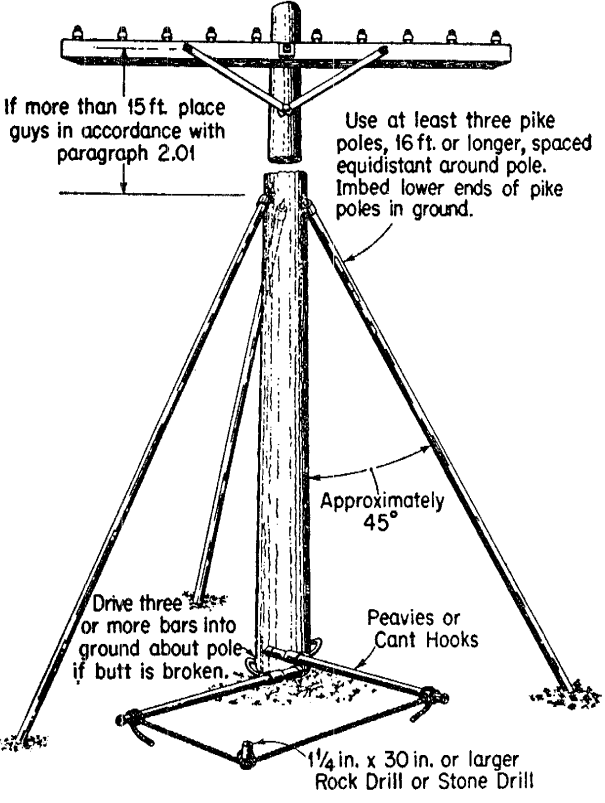


3/4 in. or larger Rope, attached by timber hitch on pole.

1/4 in. x 30 in. or larger Rock Drills or Stone Drills driven into ground about pole if butt is broken.

**Pike Pole Braces**

3.10 Pike poles placed as shown below can be used for bracing purposes. Either three or four pike poles should be used, and they should be evenly distributed around the pole. The pole should be prevented from rotating and thus disengaging the pike poles, by means of two cant hooks placed as indicated in the illustration.



If more than 15 ft. place guys in accordance with paragraph 2.01

Use at least three pike poles, 16 ft. or longer, spaced equidistant around pole. Imbed lower ends of pike poles in ground.

Approximately 45°

Drive three or more bars into ground about pole if butt is broken.

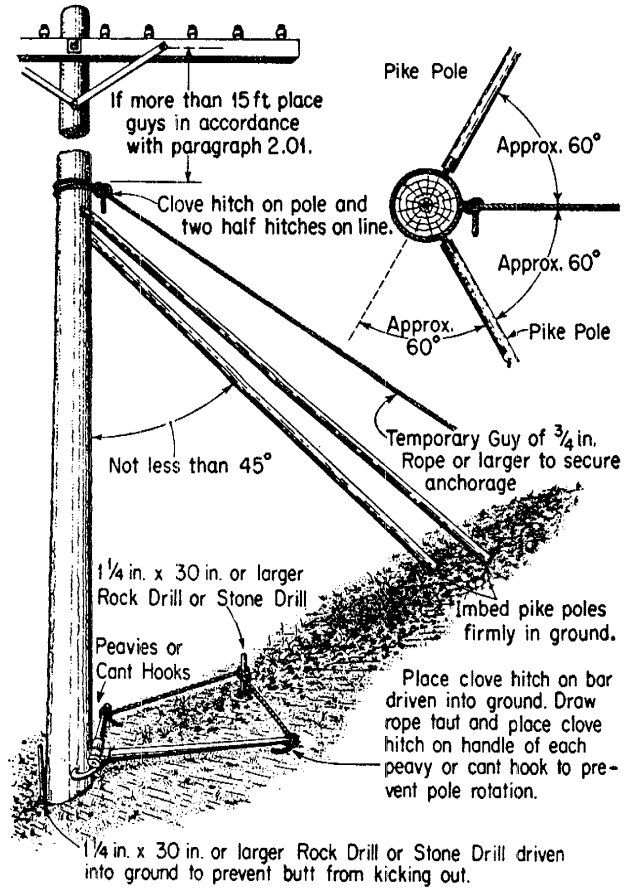
Peavies or Cant Hooks

1/4 in. x 30 in. or larger Rock Drill or Stone Drill

Place clove hitch on bar driven into ground. Draw rope taut and place clove hitch on handle of each peavy or cant hook.

**Combination of Bracing and Guying**

3.11 Where the slope of the ground or right-of-way or other conditions are such that three or four temporary guys or pike pole braces can not be placed, a combination of a rope guy and two pike pole braces placed as shown on Page 8 can sometimes be used to advantage. The pole should be prevented from rotating and thus disengaging the pike poles, by means of two cant hooks, placed as indicated in the illustration. The rope guy may be raised from the ground into position by means of a wire-raising tool. **Do not climb the pole to attach the guy.**



CLEARANCES ON JOINTLY USED POLES

1. GENERAL

- 1.001 This Addendum supplements Section 620-216-013.
- 1.002 This Addendum is being reissued to include the bonding and grounding of power company gang operated switch rods.
- 1.003 The power company switch rod is constituted to be a vertical run on the jointly used pole.
- 1.004 This Addendum is also being reissued to include the A. T. & T. Co. Addendum 620-216-013 Issue 2, April 1968 material concerning Part 4.

Part 13 in the A. T. & T. Co. Addendum will not be included in this Addendum because it is non-standard in the New England Company.

- 1.005 The A. T. & T. Co. Addendum Issue 2 to 620-216-013 is hereby cancelled. The following changes apply to Part 1 of the Section.

(a) 1.05 - 1.07 - added

1.05 Questions may arise as to when it is necessary to bring telephone plant which was placed according to the 5th Edition of the National Electrical Safety Code into conformance with the clearances specified in Section 620-216-013 which is based on the 6th Edition. Whenever existing plant which was placed in conformance with the 5th Edition clearances (see 1.06) is detached from the pole it shall be reattached in conformance with the clearances specified in Section 620-216-013. If the existing plant is not to be detached from the pole it shall remain in position unless directed otherwise.

1.06 The following are 5th Edition requirements. Separations for Street Light Brackets. (If street light is effectively grounded these separations do not apply.)

- (a) From open communication conductors on crossarms.
- Span wire or bracket above crossarm - 20 inches\*
- Span wire or bracket below crossarm - 24 inches
- (b) From communication cables - 12 inches
- (c) From terminal box of communication cables if practicable - 12 inches\*\*

- (d) From communication brackets, bridle wire rings, or drive hooks - 2 inches

\*This may be reduced to 12 inches for either span wires or metal parts of lamp brackets at points 40 inches or more from the pole.

\*\*Where it is not practicable to obtain a clearance of 12 inches from terminal boxes of communication cables, all metal parts of terminals shall have the greatest practicable separation from fixtures or span wires, including all supporting screws and bolts of both attachments.

1.07 There may be times when the power company cannot relocate street light fixtures right away to provide 6th edition clearances (20") due to their work load and the telephone company must place its cable due to service commitments. In this sort of situation the telephone cable may be placed according to the 5th edition requirement (12") on the basis that the power company will provide the proper clearance when their work load permits. The telephone work order shall state that negotiations are in progress with the power company to provide proper clearances.

2. STREETLIGHT FIXTURES AND THEIR ASSOCIATED WIRING

2.04 (Add after the last sentence) Telephone plant (cable, multiple line wire, terminals or through bolts) may be located not less than 4 inches above grounded streetlight fixtures having drip loops of grounded metal sheath cable. Telephone plant shall be at least 20 inches above such streetlight fixtures which are not grounded.

4. OPEN POWER WIRES, CROSSARMS, RACKS, ETC.

The following changes apply to Part 4 of the Section.

- (a) 4.03 - Added note  
(b) 4.03 - (c) through (h) - added  
(c) 4.03 - Fig. 9.1 and 9.2 - added

4.03 Added Note  
Caution: Power companies occasionally attach the neutral ABOVE the phase wire as shown in Fig. 9.1. Therefore, it is important to identify the neutral wire before determining separation requirements. The neutral can usually be identified by observing the presence of the following:

4.03 (Cont'd)

- (c) The neutral is usually bonded to a vertical ground wire at least every 1300 ft and more often when transformers are present.
- (d) The neutral is normally bonded to power guys which do not contain insulators.
- (e) Neutrals are sometimes carried on smaller insulators than those carrying phase wires.
- (f) The neutral is sometimes carried on a much lighter colored insulator than the phase wires.

(g) On transformer poles, the bushing for the neutral is usually smaller than the bushing for the phase connection. The neutral bushing is often located near the secondary bushings (Fig. 9.2).

(h) Where secondaries are dead ended, if the phase wire is carried through, the neutral will also be carried through.

If, after considering these factors, sufficient identification of the neutral wire has not been made, consult your supervisor or the electric utility company. However, if the neutral is attached above the phase wire, provide the clearance specified under paragraph 4.03 (a).

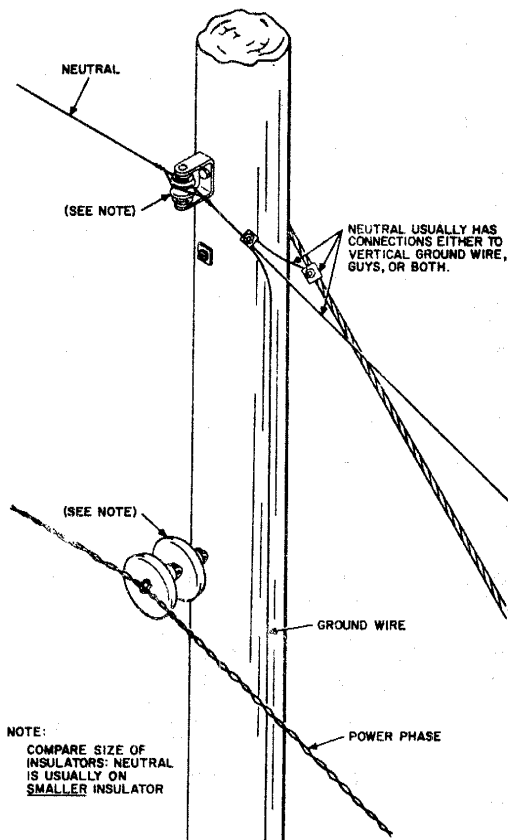
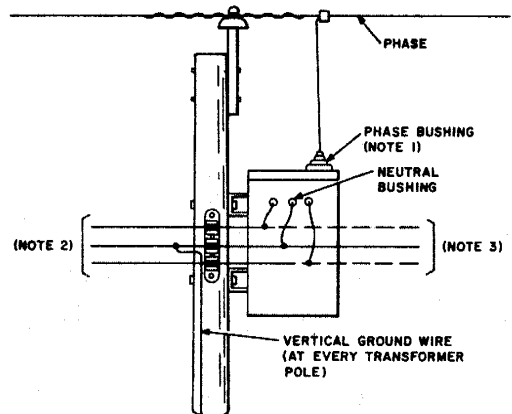


Fig. 9.1--Inverted Power Construction



- NOTES:
- 1. PHASE BUSHING USUALLY LARGER THAN NEUTRAL BUSHING.
  - 2. NEUTRAL CAN BE ANY ONE OF THESE. POSITION DEPENDS ON WIRING AT TRANSFORMER.
  - 3. NEUTRAL ALWAYS CARRIES THROUGH WHEN PHASE CARRIES THROUGH WHEN SECONDARIES ARE DEADENDED IN SOME CASES.

Fig. 9.2--Identification of Neutral at Transformer Location

8. POWER VERTICAL RUNS (BONDING AND GROUNDING)

The following changes apply to Part 8 of the Section.

(a) 8.03 - 8.11 - Added

8.03 In order to operate pole top mounted switches some power companies install a long handle in the form of a rod, which may extend, in some cases, from the top of the pole to a point on the pole near the ground. The power system involved would be the multi-grounded common neutral type.

8.04 Some Power Companies install all metal rods and some employ those with insulating material through the communication space. The rod of current carrying material and passing through communication space is of concern to the Telephone Company.

8.05 The metal rod which passes through communication space must be grounded for telephone compatibility on the pole. Generally the Power Companies ground the rod if of current carrying material.

8.06 In some cases the top part of the switch rod is grounded to the common neutral wire and the bottom part of the switch rod to a ground rod. In other cases the switch rod is grounded to the power vertical ground wire which runs from the common neutral wire at the top of the pole to a ground rod at the groundline. It should be determined whether or not the switch rod is grounded.

8.07 At this location the grounding of each company's plant is made to separate grounds. In order to attain common potential it is telephone policy to arrange for a bond to be placed between the telephone strand and the Power Company vertical ground wire.

8.08 The connection to the power vertical ground wire or the power ground wire which is attached to a ground rod and comes up the pole as far as the lower end of the switch rod may be done by the telephone workman. He should first test the switch rod and the power ground wire with the B Voltage Tester and use the B Temporary Bond. Of course, permission to make the connection to the ground wire must first be obtained from the Power Company. The agreement for this permission should be established between the companies by the Outside Plant Engineers. See Plant Series Section 627-230-203 and Section 620-105-010.

8.09 The Power Company may want to make the connection to their ground wire. The telephone workman would then connect the #6 copper bond wire to the telephone strand and leave a coil of wire for the power company to make their connection.

8.10 The procedure for making these connections should be included in an inter-company operating practice established by the outside plant engineers.

8.11 A recommended program for the placement of bonds from telephone strand to the power company ground wire at the switch rod locations is:

(a) In conjunction with other types of work necessitating a visit to the location.

(b) Where no visit is anticipated a planned program should be established to complete the work over a reasonable period of time.





## CLEARANCES ON JOINTLY USED POLES

### 1. GENERAL

1.001 This addendum supplements Section 620-216-013, Issue 2.

1.002 The addendum is reissued to cover variations in power construction involving location of the power system neutral and includes the information originally contained in Issue 1 of Addendum 620-216-013.

### 4. OPEN POWER WIRES, CROSSARMS, RACKS, ETC

The following changes apply to Part 4 and should be added to 4.03.

**Caution:** Power companies occasionally attach the neutral ABOVE the phase wire as shown in Fig. 9.1. Therefore, it is important to identify the neutral wire before determining separation requirements. The neutral can usually be identified by observing the presence of the following:

- (c) The neutral is usually bonded to a vertical ground wire at least every 1300 ft and more often when transformers are present.
- (d) The neutral is normally bonded to power guys which do not contain insulators.
- (e) Neutrals are sometimes carries on smaller insulators than those carrying phase wires.
- (f) The neutral is sometimes carried on a much lighter colored insulator than the phase wires.
- (g) On transformer poles, the bushing for the neutral is usually smaller than the bushing for the phase connection. The neutral bushing is often located near the secondary bushings (Fig. 9.2).

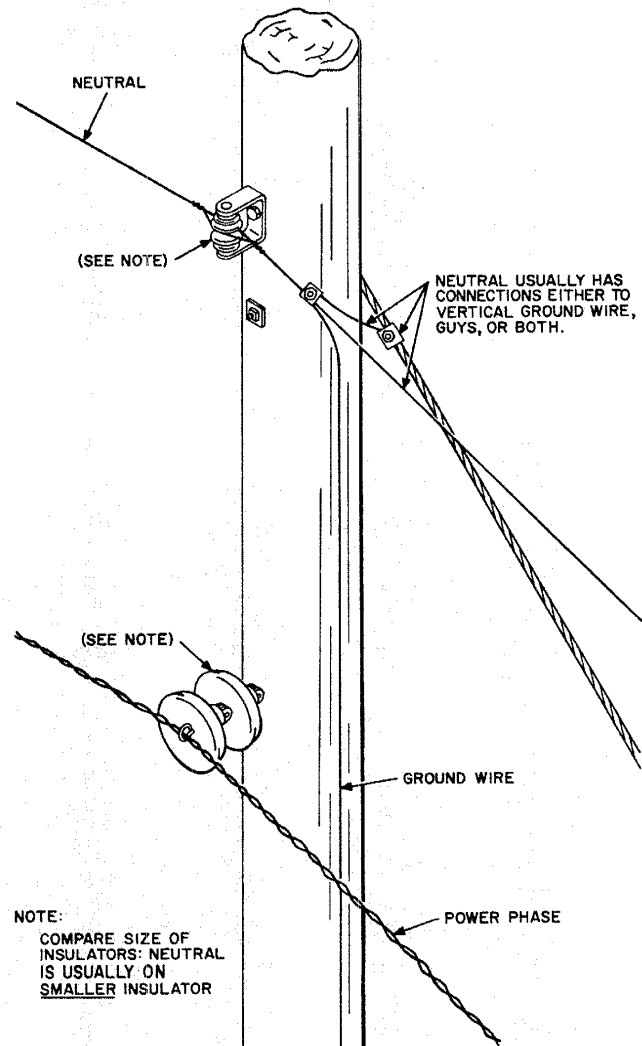
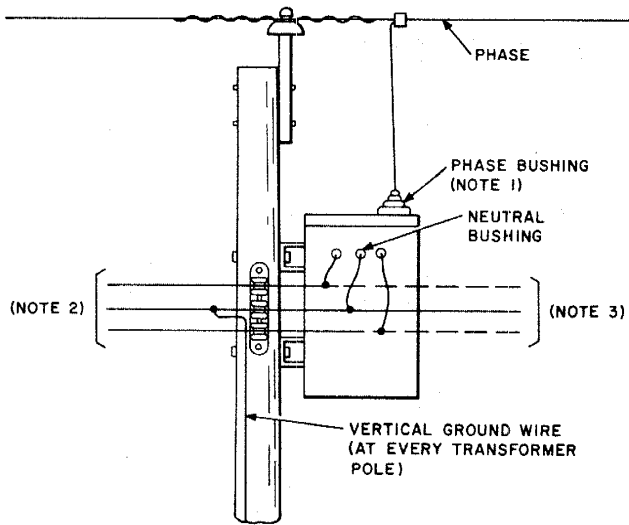


Fig. 9.1—Inverted Power Construction

- (h) Where secondaries are dead ended, if the phase wire is carried through, the neutral will also be carried through.

If, after considering these factors, sufficient identification of the neutral wire has not been made, consult your supervisor or the electric utility company. However, if the neutral is attached



NOTES:

1. PHASE BUSHING USUALLY LARGER THAN NEUTRAL BUSHING.
2. NEUTRAL CAN BE ANY ONE OF THESE. POSITION DEPENDS ON WIRING AT TRANSFORMER.
3. NEUTRAL ALWAYS CARRIES THROUGH WHEN PHASE CARRIES THROUGH. SECONDARIES ARE DEADENDED IN SOME CASES.

Fig. 9.2—Identification of Neutral at Transformer Location

above the phase wire, provide the clearance specified under paragraph 4.03 (a).

13. TELEVISION DISTRIBUTION SYSTEMS

The following changes apply to Part 13 and should be added to 13.01.

Where agreement with the power utility permits placing cable on both sides of the pole, the vertical clearance between foreign owned television cable and television cables may be less than 12 inches if the *diagonal* clearance will be 12 inches or more. Separation between suspension bolts shall be at least 4 inches. See Fig. 29.

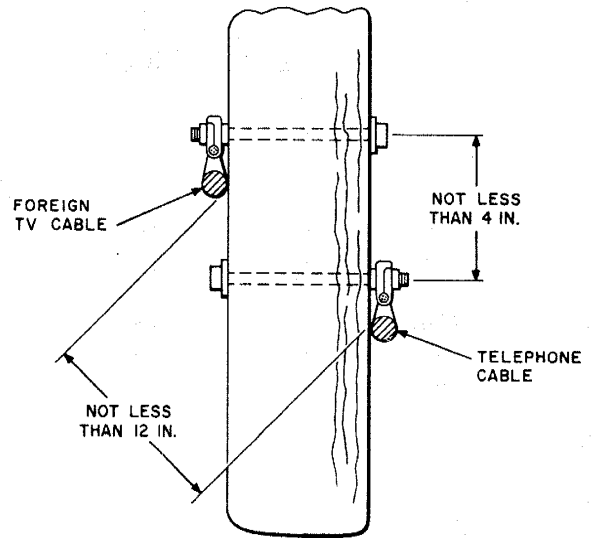


Fig. 29—Clearance Between Foreign Owned and Telephone Cables

CLEARANCES ON JOINTLY USED POLES

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1. GENERAL

1.01 This section deals with clearances on jointly used poles. It has been reissued primarily to add clearance requirements for traffic lights and their associated wiring. Several minor changes have been made elsewhere and are indicated in the usual manner. Requirements are largely based upon the Sixth Edition of the National Electrical Safety Code. Some, however, are based upon the E.E.I.-Bell System Joint Pole Practices, although a few are purely Bell System requirements. Clearances which are not based on the Code are appropriately identified. All values shown in this section apply to all three loading areas and should be used unless the detail plans indicate otherwise.

1.02 In the particular case of wire and cross-arm spacings, it should be noted that the values shown may have to be increased in some cases to meet the midspan clearance requirements shown in Section 620-216-012. In general, the

recommended spacings at the pole are adequate to meet midspan requirements for span lengths up to 150 feet and, in many cases, longer spans.

1.03 It will be noted that clearances from streetlights show one value for grounded fixtures and a larger value for nongrounded fixtures. Streetlight fixtures bonded to cable suspension strand or power multigrounded neutral conductors are considered to be sufficiently well grounded to use the smaller clearance. Fixtures which are merely grounded to a ground rod are *not* considered sufficiently well grounded to use the smaller clearance.

1.04 It will also be noted that clearances from grounded transformers, capacitors, etc, are smaller than for nongrounded transformers, etc. *Local instructions will designate areas where transformer and/or capacitor cases are grounded, since it is not generally possible to determine whether power equipment is grounded or not by looking at it.*

2. STREETLIGHT FIXTURES AND THEIR ASSOCIATED WIRING

2.01 Telephone attachments *should not*, in general, be placed *above* streetlight fixtures unless the fixtures are grounded.

2.02 Telephone cable or multiple line wire and terminals shall have at least 20 inches clearance from streetlight fixtures or span wires carrying streetlights which *are not grounded*, and at least 4 inches from fixtures and span wires which *are grounded*. (See Figs. 2, 3, 4, 6, and 7.)

2.03 Telephone crossarm through bolts shall be 20 inches from streetlight fixtures which are above them, or 24 inches if fixtures are below, regardless of whether the fixture is grounded or not. (See Figs. 1 and 5.)

2.04 Where streetlight fixtures are fed by means of drip loops entering the fixture from the surface of the pole, telephone cable or multiple line wire shall be at least 12 inches below the lowest part of the loop. (See Fig. 2.)

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2.05 Drivehooks, bridlewire rings and brackets shall have a clearance of at least 16 inches from streetlight fixtures or span wires which *are not grounded*, and at least 4 inches from fixtures and span wires which *are grounded* (See Fig. 3).

If carrying C rural wire, drivehooks which are *above* grounded fixtures or span wires shall have a clearance of 6 inches.

2.06 Obtain the following clearances from vertical feed wires of streetlight fixtures:

KIND OF VERTICAL RUN	ITEM OF TELEPHONE PLANT	HORIZONTAL CLEARANCE (INCHES)
(a) On surface of pole (Fig. 5)	Through bolts	2 min.—1/8 pole circumference in general
	Pole steps	3
(b) Streetlight feed run on pins and insulators (Fig. 6)	Pole steps	5
	Cable <sup>1</sup> , Wire <sup>1</sup> , Guys <sup>2</sup>	6
		3
(c) Streetlight feed from cross-arm run direct to fixture 40" from pole (Fig. 7)	Crossarms	12
	Cable	20
	Drop Wire, Guys <sup>1</sup>	6

1. EEI-Bell System requirement.
2. Bell System requirement.

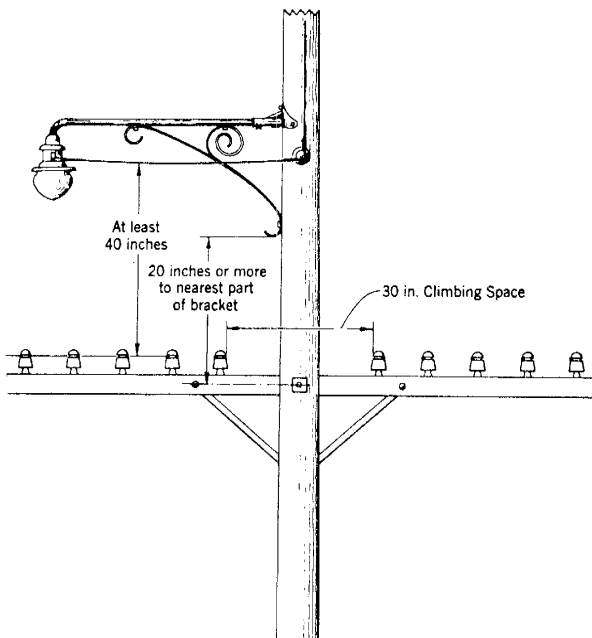


Fig. 1

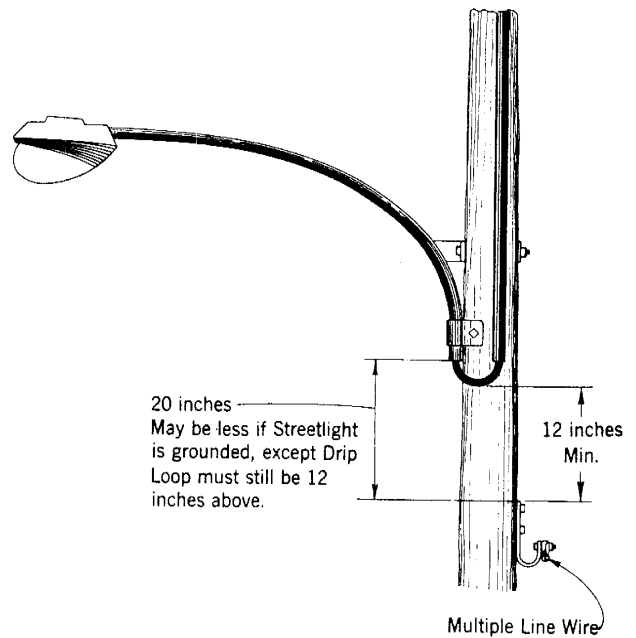


Fig. 2

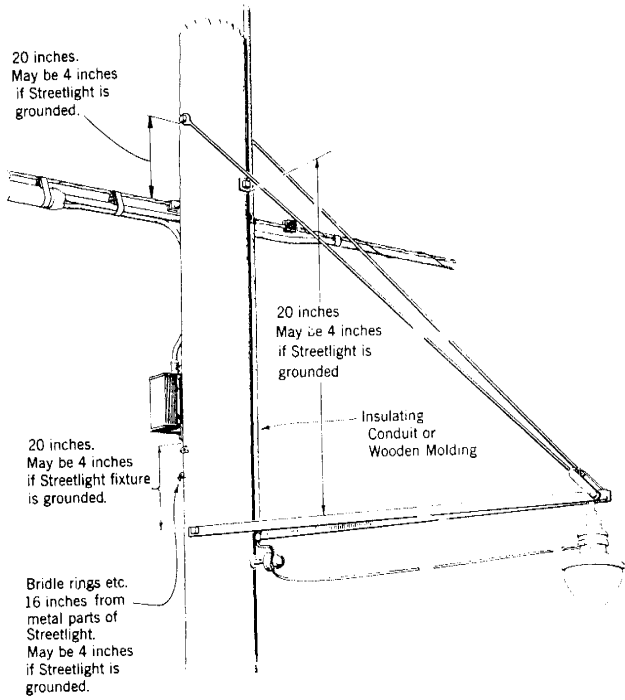


Fig. 3

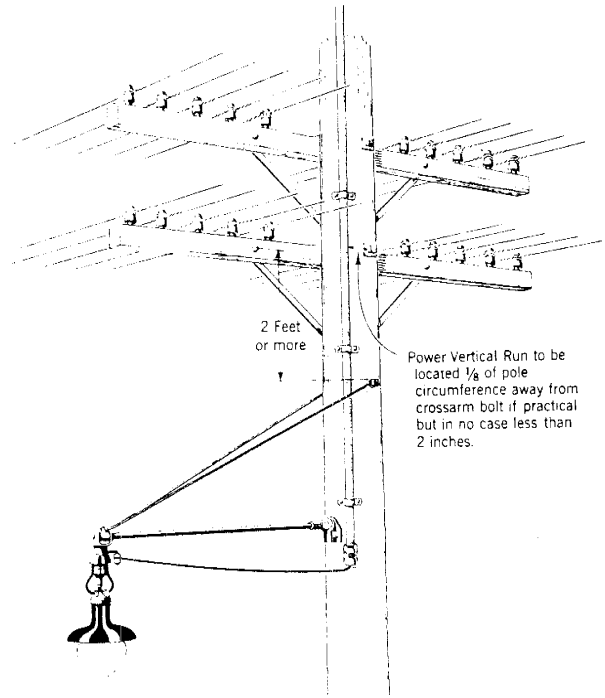


Fig. 5

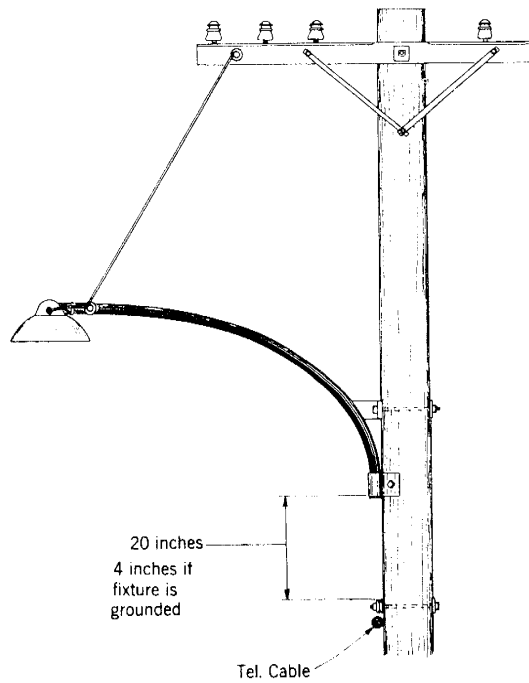


Fig. 4

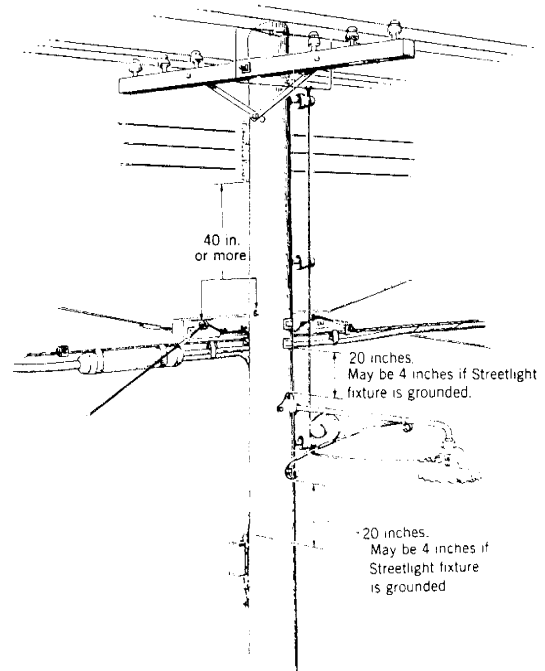


Fig. 6

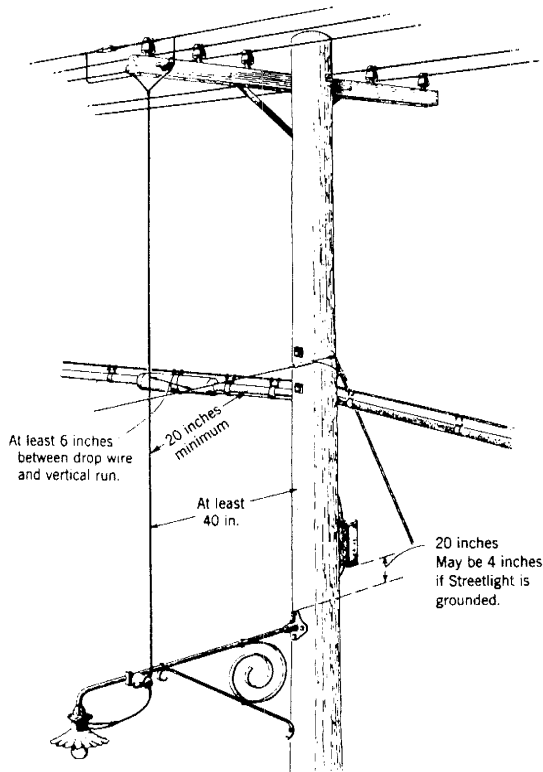


Fig. 7

3. TRAFFIC LIGHTS AND THEIR ASSOCIATED WIRING

3.01 Telephone cable, multiple line wire and their terminals shall have the following clearances from traffic light fixtures or their supporting span wires.

- If not grounded.....20 inches
- If grounded..... 4 inches

3.02 Telephone crossarms shall have the following clearances from traffic light fixtures or their supporting span wires regardless of whether the fixture is grounded or not. (Measured from crossarm bolt.)

- If above telephone crossarms...20 inches
- If below telephone crossarms...24 inches

3.03 Telephone bridle rings, drive hooks and brackets shall have the following clearances from traffic light fixtures or their supporting span wires.

- If not grounded.....16 inches
- If grounded ..... 4 inches

3.04 Telephone cable shall preferably be 24 inches below traffic light control cables. This may be reduced to 12 inches where necessary.

3.05 Vertical runs associated with traffic light fixtures and controls shall be given the same clearances as power vertical runs. See Part 8 of this section.

4. OPEN POWER WIRES, CROSSARMS, RACKS, ETC

4.01 Except in the case of trolley feeders, telephone attachments shall be placed *below* open power wires, crossarms, and racks. The clearances shown in 4.03 and 4.04 are *minimums* and may have to be increased for span lengths in excess of 150 feet. (See Section 620-216-012.) Greater clearances are desirable where they can be readily obtained.

4.02 *In order to determine the clearances required, it is necessary to know the voltage of the power wires and also whether they are, or are not, part of a grounded system. Clearances for grounded power systems are based upon their voltage to ground; for other systems, clearances depend upon the voltage between wires.* Most grounded power systems include a grounded conductor which has many connections to ground. Such conductors are called multigrounded neutrals and these are generally considered to be effectively grounded.

4.03 Telephone cables, wires, guys, loading coil cases, drivehooks, etc, shall have the following minimum vertical separations from *open* power wires:

- (a) Phase wires.

FOR GROUNDED POWER CIRCUITS		
VOLTAGE <sup>1</sup> TO GROUND	VOLTAGE BETWEEN WIRES	CLEARANCE <sup>2</sup> (INCHES)
8700 V - less	15,000 V - less	40 <sup>2</sup>
8701 V - 50,000 V	15,001 V - 86,500 V	60
FOR OTHER POWER CIRCUITS <sup>1</sup>		
—	8700 V - less	40 <sup>2</sup>
—	8701 V - 50,000 V	60

See footnotes on page 5.

(b) Multigrounded neutral wires.

SYSTEM VOLTAGE TO GROUND	SYSTEM VOLTAGE BETWEEN WIRES	CLEARANCE (INCHES)
22,000 — less	38,000 — less	40 <sup>5</sup>
22,001 — 50,000	38,001 — 86,500	60

**4.04** Telephone cables, wire terminals, load coil cases, drivehooks, etc shall have the following clearances from power crossarm braces, steel pins, and racks:

(a) Metal crossarm braces which are:

- (1) Attached to metal crossarms.
- (2) Within 1 inch of non-grounded transformer cases, capacitor cases or their supports.
- (3) Attached to wood crossarms at points *less than 1 inch* below the top of the arm.
- (4) Attached to wood crossarms at points *1 inch or more* below the top of the arm and more than 1 inch from non-grounded transformers, etc.

See Table A

See Table B

(b) Secondary racks (See Figs. 10, 11)  
 .....40 inches generally.

(c) Steel pins (A on Fig. 10, B on Fig. 11)  
 ..... See Table A

**TABLE A**

FOR GROUNDED POWER CIRCUITS		
VOLTAGE TO GROUND	VOLTAGE BETWEEN WIRES	CLEARANCE (INCHES)
8700 V - less	15,000 V - less	40
8701 V - 50,000 V	15,001 V - 86,500 V	60
FOR OTHER POWER CIRCUITS		
—	8700 V - less	40
—	8701 V - 50,000 V	60

**TABLE B**

FOR GROUNDED POWER CIRCUITS		
VOLTAGE TO GROUND	VOLTAGE BETWEEN WIRES	CLEARANCE (INCHES)
8700 V - less	15,000 V - less	12 <sup>6</sup>
8701 V - 50,000 V	15,001 V - 86,500 V	30 <sup>7</sup>
FOR OTHER POWER CIRCUITS		
—	8700 V - less	12 <sup>6</sup>
—	8701 V - 50,000 V	30 <sup>7</sup>

1. Voltage to ground will always be 58% of voltage between phase wires for three-phase power lines.
2. For open secondary service wires crossing over a telephone line on a pole top extension fixture or attached to the top of a pole carrying no other power attachments, the 40-inch requirement may be reduced to 24 inches above the *outer wires* of open wire on crossarms, provided 40 inches *clearance is maintained at the pole*. (See Fig. 8.) (EEI-Bell System requirement.)
3. See Par. 4.01.

4. These requirements also apply to neutrals *other* than multigrounded neutrals.
5. Telephone drop wires may be attached within less than 40 inches on common crossing poles (but not less than 4 inches), provided the requirements of (a) above are met. No reduction in clearance is permitted for longitudinal joint use, nor for common crossing poles where cable, open wire, or multiple line wire is involved. (See Fig. 9.)
6. EEI-Bell System requirement.
7. Bell System requirement.

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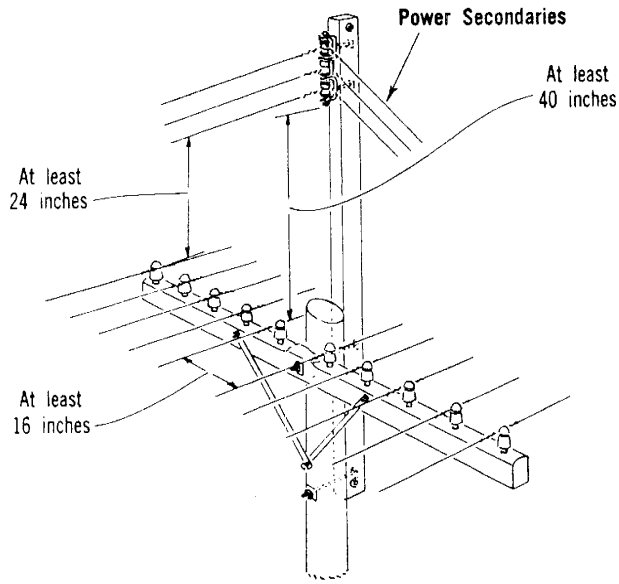


Fig. 8

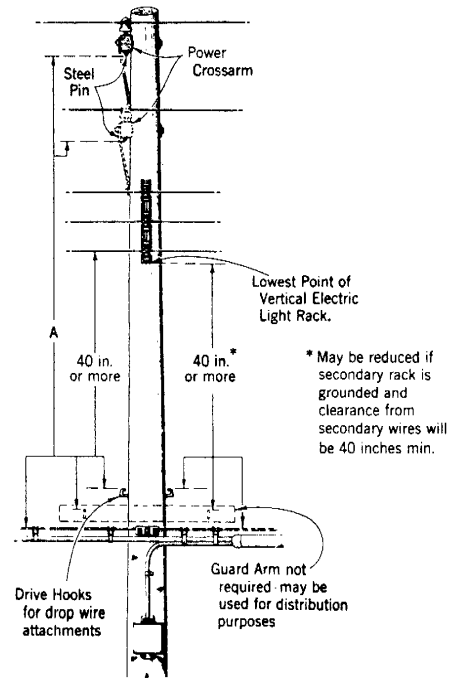
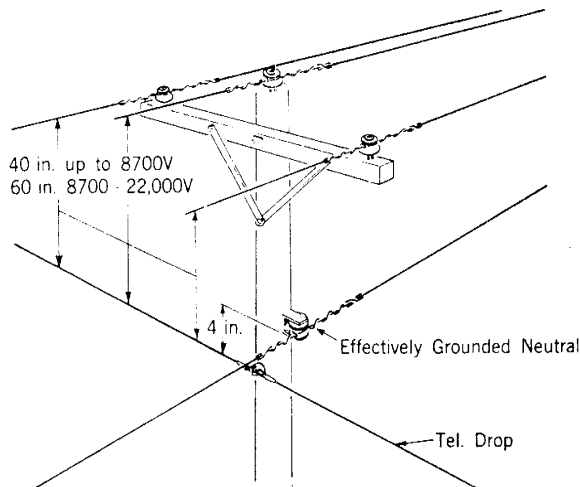


Fig. 10



1. For Drops Only Does not apply to cable, open wire multiple line wire
2. For crossing only not for longitudinal joint use.
3. Neutral must be effectively grounded

Fig. 9

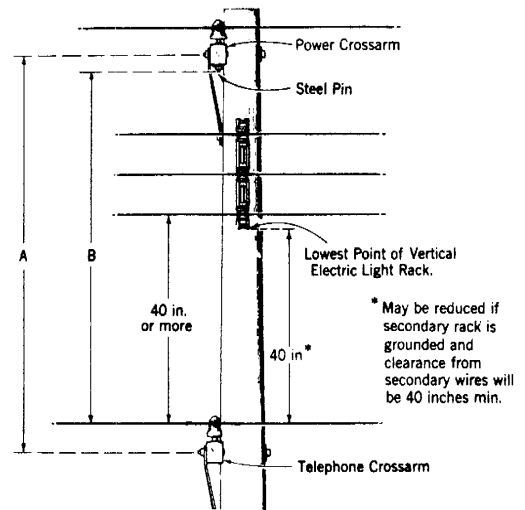


Fig. 11



4.05 Minimum vertical spacings between power and telephone crossarms shall be as follows: (Measured between crossarm centers.) ("A" on Fig. 11.)

FOR GROUNDED POWER CIRCUITS		
VOLTAGE TO GROUND	VOLTAGE BETWEEN WIRES	CLEARANCE* (INCHES)
8700 V - less	15,000 V - less	48
8701 V - 50,000 V	15,001 V - 86,500 V	72
FOR OTHER POWER CIRCUITS		
—	8700 V - less	48
—	8701 V - 50,000 V	72

\* See Par. 4.01.

5. POWER TRANSFORMERS, CAPACITORS, VOLTAGE REGULATORS, ETC

5.01 The minimum vertical clearance between power transformers, capacitors, or voltage regulators and telephone cables, wires, guys, terminals, loading coil cases, drivehooks, etc shall be as follows: ("A" on Figs. 12 and 13.)

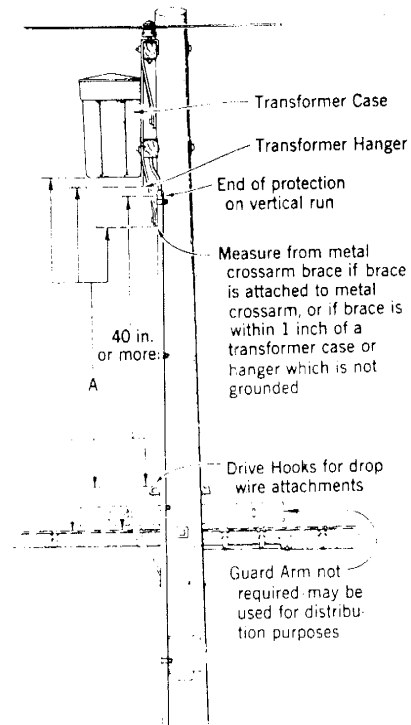


Fig. 12

FOR GROUNDED POWER CIRCUITS		
VOLTAGE TO GROUND	VOLTAGE BETWEEN WIRES	CLEARANCE (INCHES)
8700 V - less	15,000 V - less	40**
8701 V - 50,000 V	15,001 V - 86,500 V	60**
FOR OTHER POWER CIRCUITS		
—	8700 V - less	40
—	8701 V - 50,000 V	60

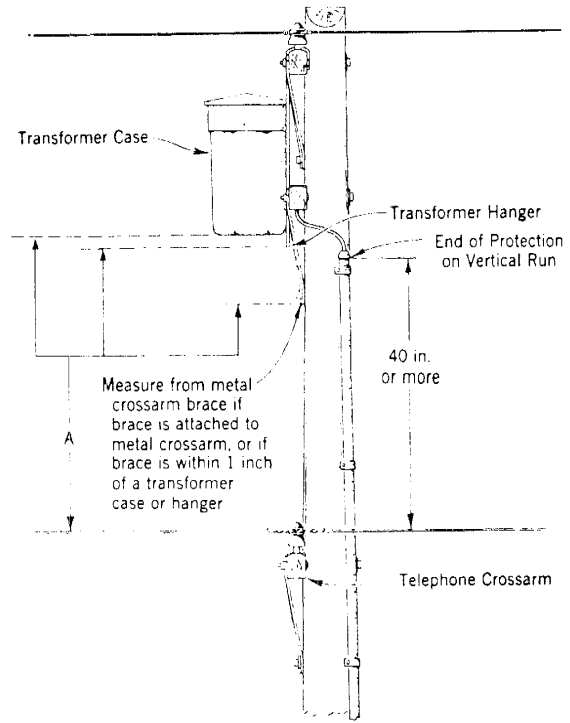


Fig. 13

\*\*May be 30 inches if case is effectively grounded as a uniform procedure over a well defined area. (See 1.04.)

6. POWER CABLES

6.01 Telephone cables, wires, terminals, guys, loading coil cases, drivehooks, etc, shall have the following minimum vertical clearances from power cables:

- (a) Grounded metallic sheath cables ..... 40 in.
- (b) Any cable lashed to a grounded messenger ..... 40 in.
- (c) Insulated conductors lashed to or spiraled around a grounded messenger ..... 40 in. } "A" on Fig. 14
- (d) Other power cables  
8700 V or less ..... 40 in.  
8701 V to 50,000 V ..... 60 in. }
- (e) Spacer type power cables (with grounded messenger)  
8700 V or less to ground ... 40 in. } "A" on Fig. 15  
8701 V to 50,000 to ground . 60 in. }

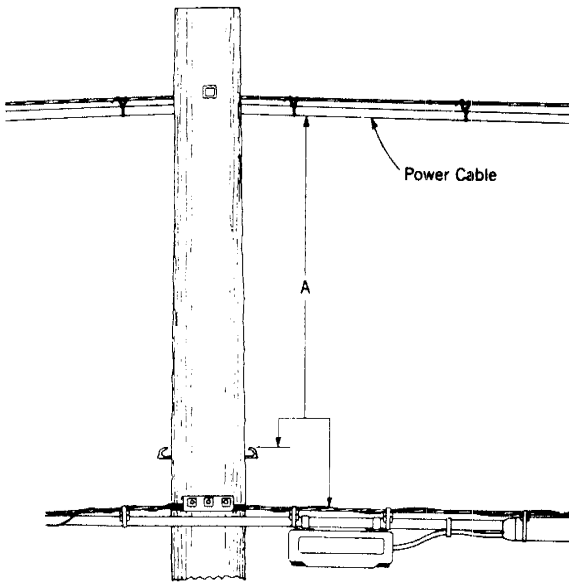


Fig. 14

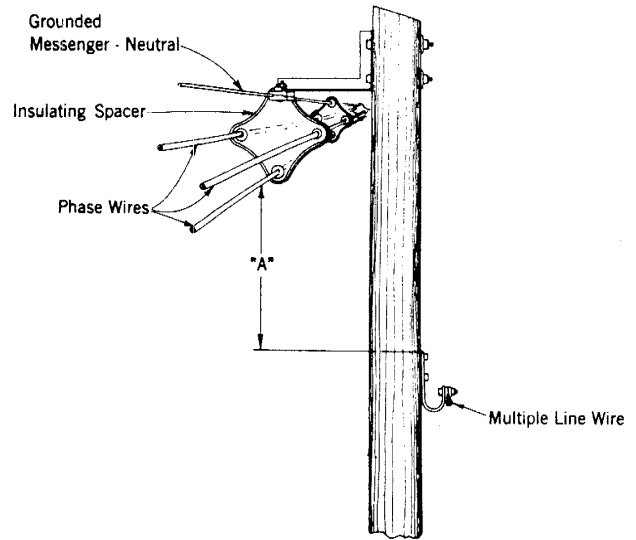


Fig. 15

7. TROLLEY SPAN WIRES AND BRACKETS

7.01 Minimum vertical spacings between span wires or brackets supporting trolley conductors and telephone crossarms shall be as follows: (Measured from center of crossarm to nearest edge of bracket, etc)

- Located *above* telephone crossarms ..... 20 in.
- Located below telephone crossarms ..... 24 in.

7.02 Minimum vertical spacings between span wires or brackets and telephone cables, multiple line wire, and terminals are as follows:

- If grounded ..... 4 in.
- If not grounded ..... 12 in.\*

7.03 Minimum vertical spacings between span wires or brackets and telephone drivehooks, bridle wire rings, and wire brackets are as follows:

- Grounded or not ..... 4 in.

7.04 General arrangements involving trolley construction are shown in Figs. 16 to 20.

\*For cable terminals, this may be reduced where 12 inches cannot be obtained, but should be kept as large as possible.

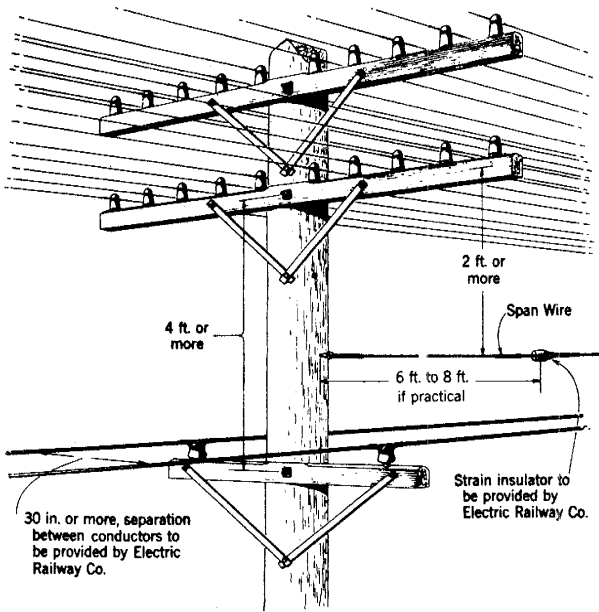


Fig. 16

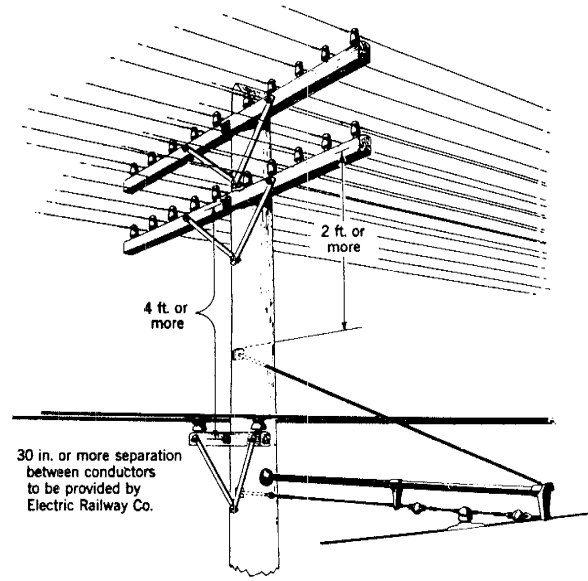


Fig. 18

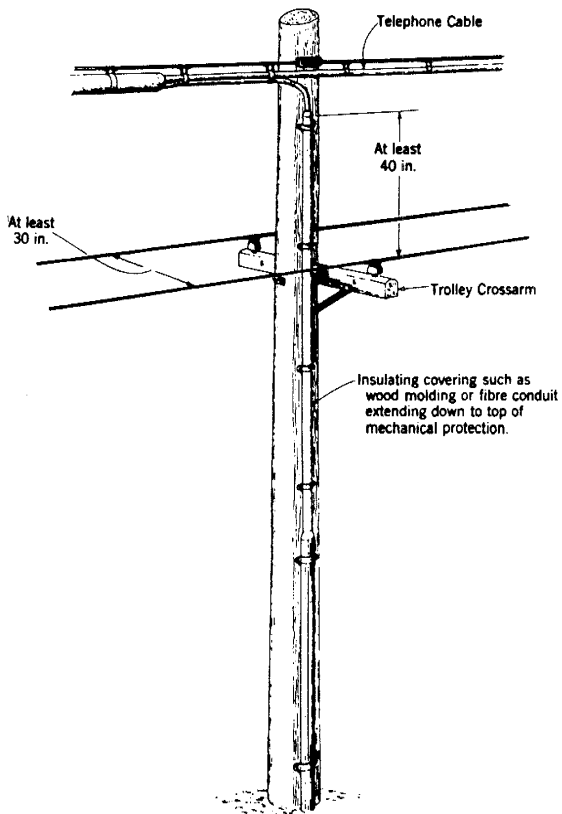


Fig. 17

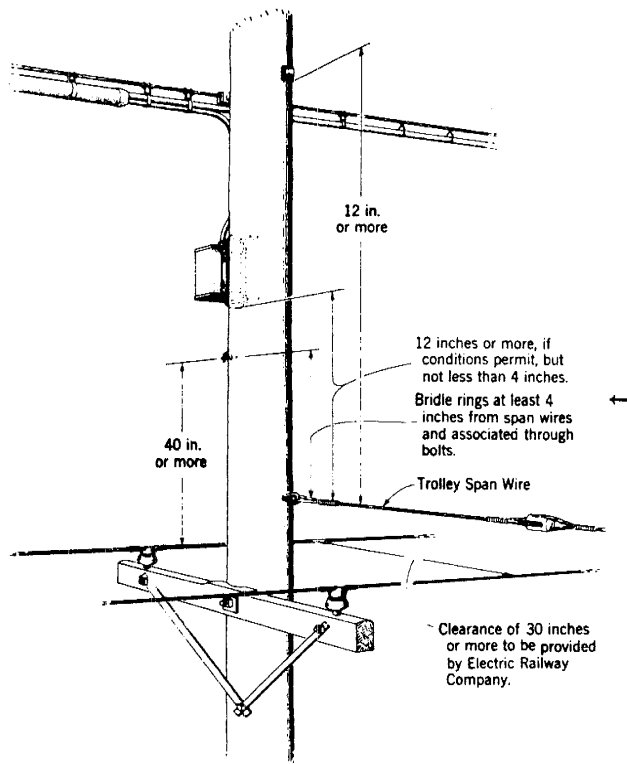


Fig. 19

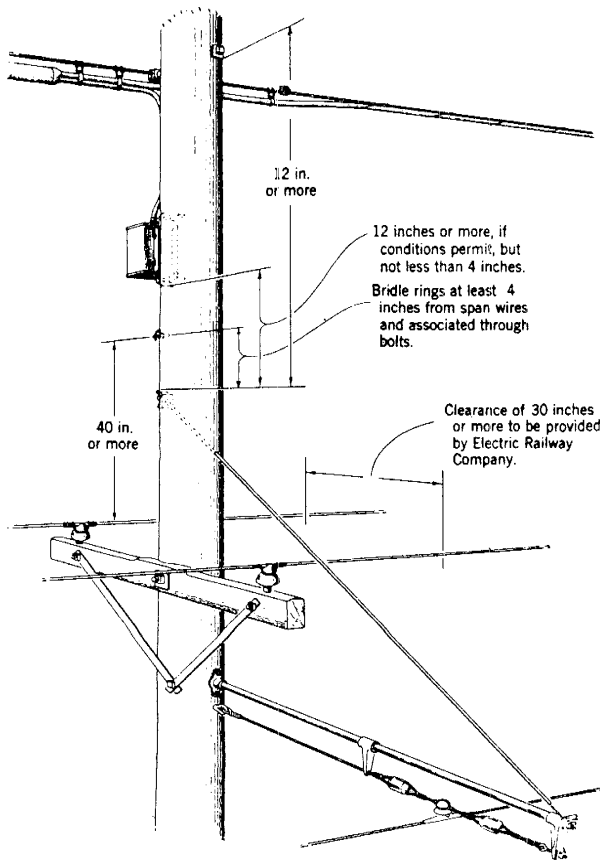


Fig. 20

8. POWER VERTICAL RUNS

8.01 Telephone through bolts, lag screws, and pole steps shall in general be located 1/8 pole circumference away from power vertical runs made on the surface of the pole. Through bolts and lag screws shall generally be 2 inches from such vertical runs. Bare vertical grounding conductors may be 1 inch from through bolts or lag screws, however. (See Fig. 21.)

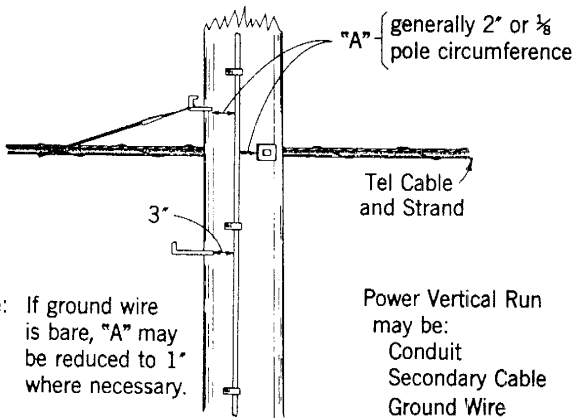


Fig. 21

8.02 Telephone facilities shall have the following clearances from power vertical runs not on the surface of the pole.

KIND OF POWER VERTICAL RUN	ITEM OF TELEPHONE PLANT	HORIZONTAL CLEARANCE (INCHES)
Power service under 750 V run on pins and insulators	Pole steps	5
	Cable <sup>1</sup> , Wire <sup>1</sup> , Guys <sup>2</sup>	3
Streetlight feed wires	See Part 2—this section	

9. POWER GUYS

9.01 If power side guys are attached above primary conductors, telephone wires or cables shall have at least 40 inches clearance from any part of such guys which lie between the nearest guy insulator and the pole.<sup>1</sup> (See Fig. 22.)

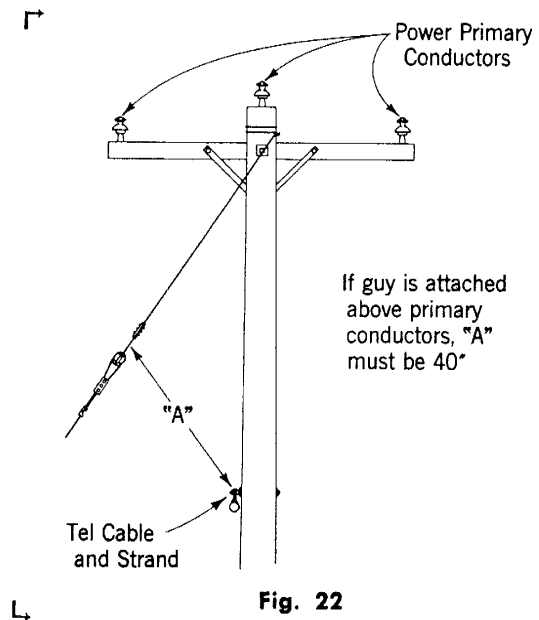


Fig. 22

9.02 If longitudinal (pole-to-pole) power guys are attached above primary conductors, telephone wires or cables shall have at least 30 inches clearance between any part of the upper end of the guy which lies between the pole and the guy insulator.<sup>1</sup>

1. EEI-Bell System requirement.
2. Bell System requirement.

**9.03** Telephone cables, wires, terminals, etc, shall have 2 feet clearance from power guys which are also attached to transmission line poles (15,000 V to ground and higher).<sup>1</sup> Obtain greater clearance where practical.

**9.04** Pole-to-pole power guys not attached above primaries but which pass within 12 inches of *bare* secondary conductors and also pass within 12 inches of telephone cable should either: be effectively grounded, covered with suitable insulation where they pass the power conductors, or contain an insulator located below the lowest power conductor and above the highest telephone cable. Provide at least 3 inches clearance between such guys and telephone wire or cable. If none of these conditions have been met, notify your supervisor before continuing work operations.

**10. TELEPHONE GUYS**

**10.01** Telephone guys shall clear telephone wires or cables by 6 inches where practical, but not less than 3 inches. This does not prohibit attaching guys and suspension strands to the same bolts or strain plates, however. (See 2.05 and 4.03 for clearance from power conductors on the same pole.)

**11. CLEARANCE OF OPEN WIRE FROM SURFACE OF POLES**

**11.01** Where practical, telephone open wire shall have a clearance of 5 inches from the surface of jointly used poles.

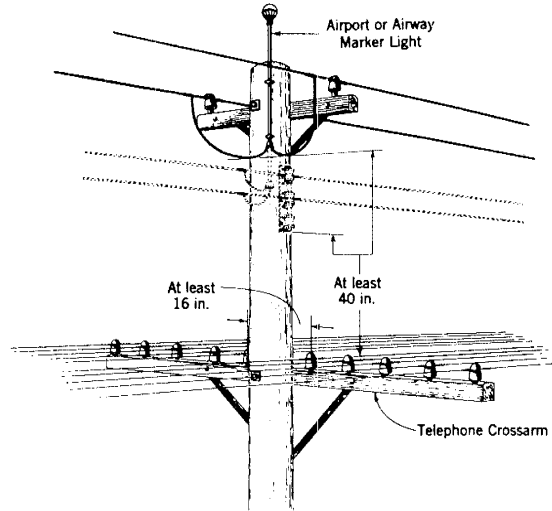
**12. AIRPORT MARKER LIGHTS**

**12.01** Clearances to be observed when airport marker lights are involved are shown in Fig. 23.

**13. TELEVISION DISTRIBUTION SYSTEMS**

**13.01** Television distribution systems which are not owned by the Telephone Company require the same clearances from power facilities as telephone facilities. Such TV facilities should preferably have 24 inches clearance<sup>2</sup> from telephone cables but not less than 12 inches clearance.<sup>2</sup> Figs. 24 through 28 illustrate the general requirements for foreign-owned television distribution systems.

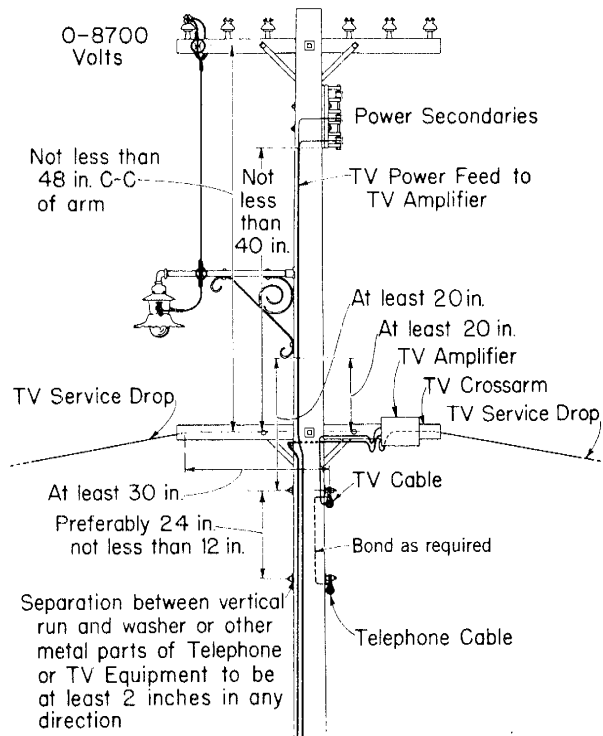
**13.02** Telephone Company-owned television cables shall have the same clearances as other telephone cables. When so specified on the work order, they may be lashed to the same messenger.



**Fig. 23**

**ATTACHMENTS OF TV DISTRIBUTION SYSTEM TO POLES**

- TV Cable Mounted on Pole
- TV Amplifier Mounted on Crossarm
- Electric Light Bracket on Pole



**Fig. 24**

1. EEI-Bell System requirement.

2. Bell System requirement.

ATTACHMENTS OF TV DISTRIBUTION SYSTEM TO POLES  
TV Cable, Amplifier and Meter Mounted on Pole

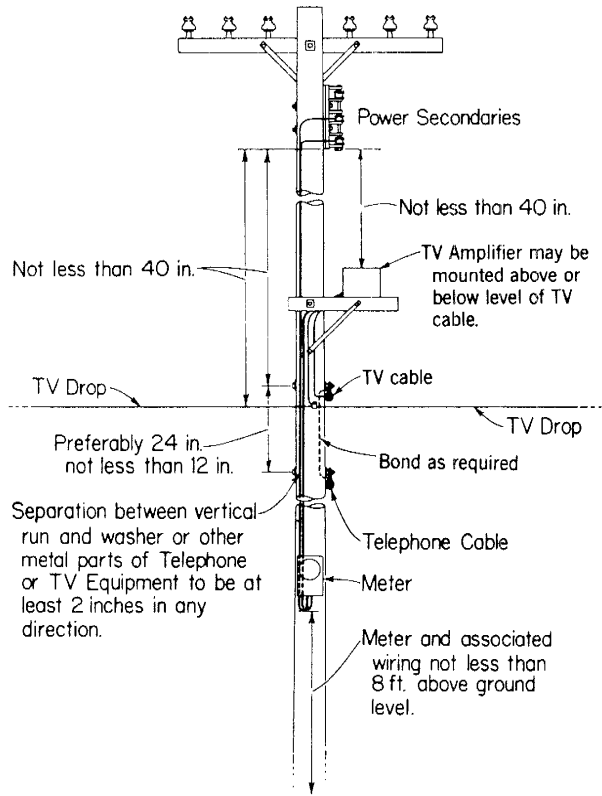


Fig. 25

ATTACHMENTS OF TV DISTRIBUTION SYSTEM TO POLES  
No Amplifier - No Meter

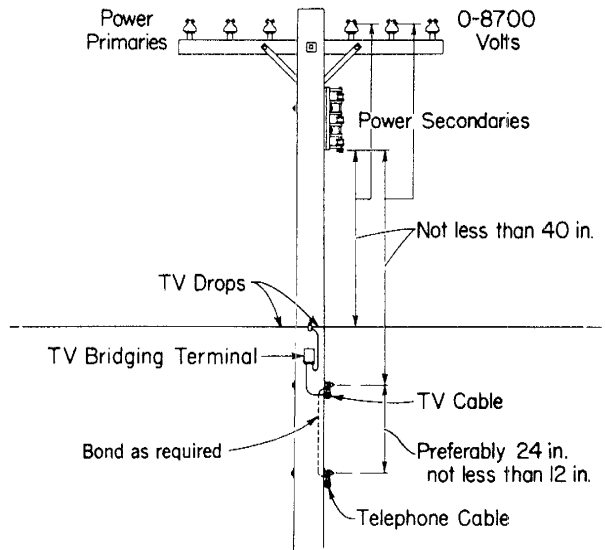


Fig. 26

ATTACHMENTS OF TV DISTRIBUTION SYSTEM TO POLES  
Telephone Pole Carrying Open Wire or Cable or Both,  
TV Cable, but no TV Amplifier

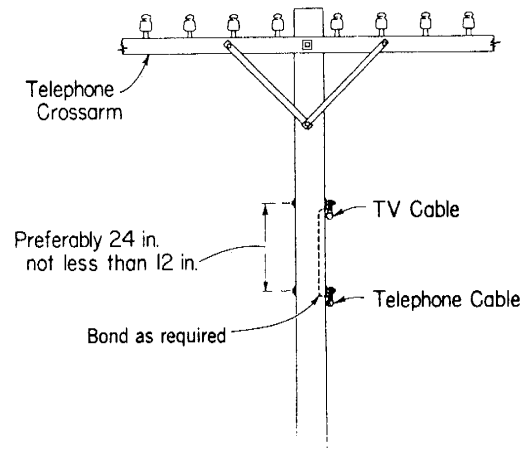


Fig. 27

ATTACHMENTS OF TV DISTRIBUTION SYSTEM TO POLES  
Telephone Pole Carrying Open Wire or Cable or Both  
TV Cable, Amplifier and Drop Wires with Power Lead for TV Amplifier

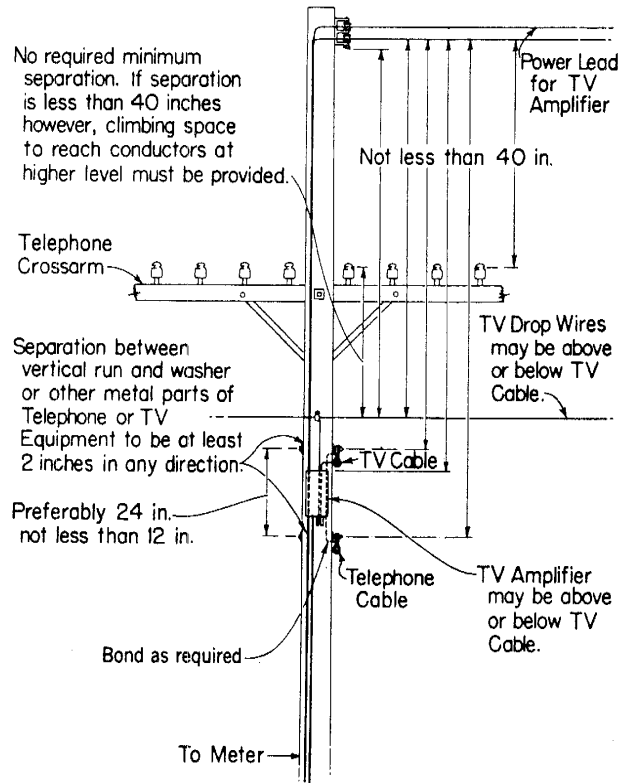


Fig. 28

## CLIMBING SPACE ON JOINTLY USED POLES

### 1. GENERAL

**1.01** This section deals with climbing space on poles jointly occupied with electric utilities. The requirements stated in this section are based upon the Sixth Edition of the National Electrical Safety Code. These requirements apply in all loading areas unless state rules, municipal requirements or local arrangements with other utilities call for greater values.

**1.02** Provision of climbing space is required by the National Electrical Safety Code and is generally specified as one of the conditions for joint use with the electric utility. Lack of adequate climbing space may endanger or hinder workmen in the performance of their duties, and increases the likelihood of plant damage.

**1.03** The dimensions of climbing space vary somewhat with the voltage of the power conductors. For *effectively grounded* power circuits, *voltage always means voltage to ground*. In the case of three phase power systems, voltage to ground is 58% of the voltage between conductors. For power circuits which are *not effectively grounded*, voltage must be taken as the full voltage between conductors.

**1.04** If climbing space is obstructed by attachments of community TV, municipal fire alarm, police call, traffic control facilities, etc., report the matter to your supervisor. Do not try to rearrange foreign attachments.

### 2. DEFINITION AND EXPLANATION

**2.01** Climbing space is an unobstructed vertical space along the side of a pole. In general, it consists of an imaginary box at least 30 inches on each side and extending at least 40 inches above the highest telephone cable, wire, crossarm, etc., and 40 inches below the lowest telephone cable, wire, crossarm, etc. See Fig. 1.

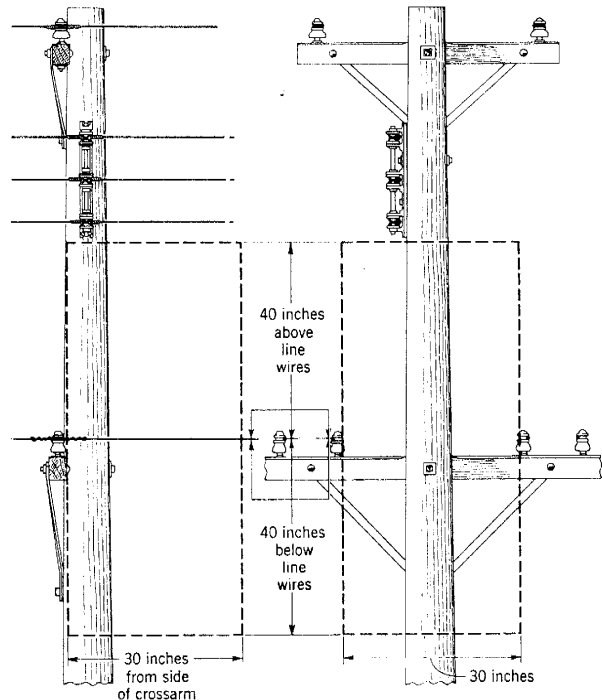


Fig. 1

**2.02** Climbing space serves not only to permit workmen to climb poles, but also serves to permit raising and lowering of the electric utility's equipment and material through telephone attachments. Because of this, it is generally preferable to maintain climbing space on the same side or quadrant of the pole all the way from the groundline up to a point 40 inches above the highest telephone attachment. This will minimize the chances that material raising operations of the electric utility may damage telephone plant or interrupt telephone service.

**2.03** As the definition points out, climbing space is to be provided along one side of the pole. NESC rules provide further that part of the pole itself may be included in the climbing space without being considered an obstruction. However,

**SECTION 620-216-014**

this should be kept to a minimum in order to leave as much room as possible for raising and lowering of the electric utility's equipment and material.

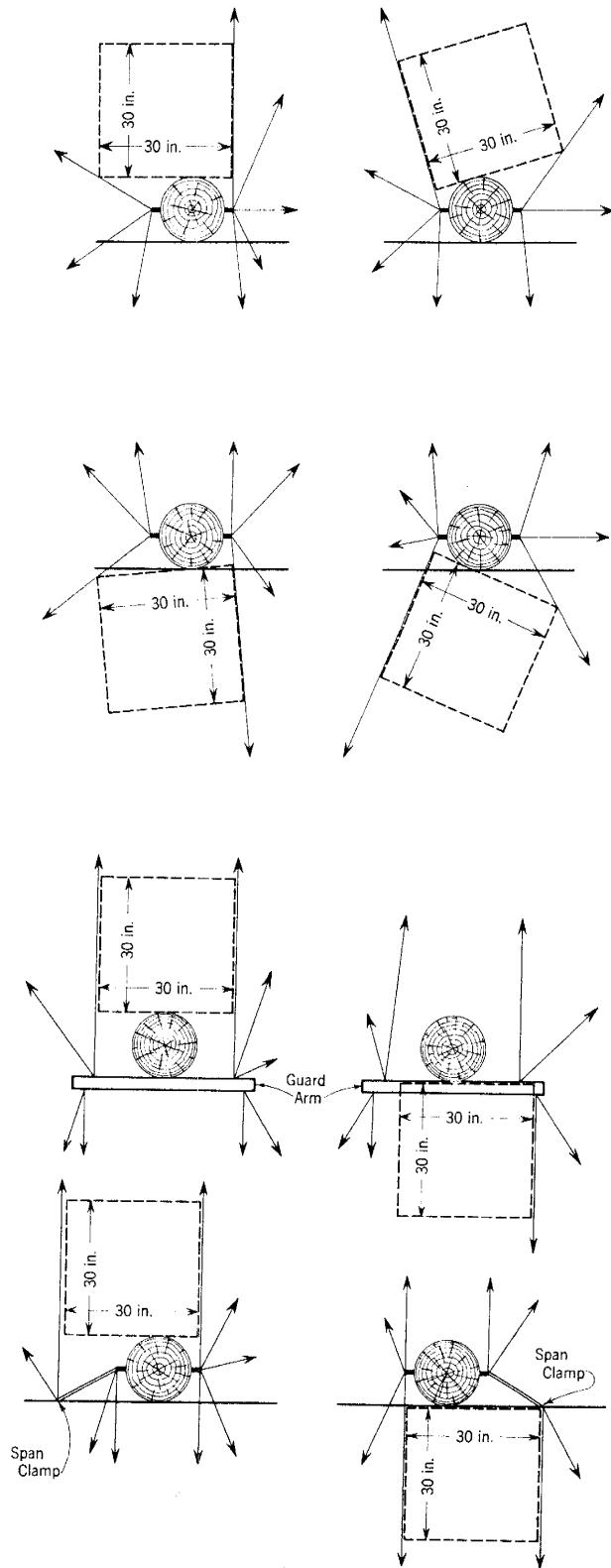
**2.04** Vertical runs securely fastened to the surface of the pole and covered with molding or in conduit are not considered to obstruct climbing space under NESC rules. Unprotected vertical runs fastened to the surface of the pole or made on pins and insulators *are* considered as obstructions and should *not* be included in the climbing space. Where practical, climbing space should be located so as to avoid *all* vertical runs. Pole steps should be located so as to be outside of climbing space.

**3. REQUIREMENTS AND METHODS OF PROVIDING CLIMBING SPACE**

**3.01** Full climbing space, as defined in 2.01, shall be provided and maintained on all joint poles carrying power conductors of over 750 volts. *Do not obstruct climbing space with drop wires.* Examples of how climbing space is obtained when drop wires are distributed directly from the pole are shown in Fig. 2. Drive-hooks should not be placed on the climbing side of the pole.

**3.02** Where climbing space cannot be obtained because of drop wire attachments, if longitudinal cable is present, place span clamps on the strand and distribute from it. If longitudinal cable is not present and climbing space cannot be otherwise obtained, place a guard arm and distribute from it. See Fig. 3.

**3.03** Full climbing space must be provided *past* longitudinal runs of cable, multiple line wire, drop wire, etc. Cable or multiple line wire, for example, may abut one or two *sides* of the 30-inch square, but may not run through the climbing space. Hence when telephone cable is *less* than 40 inches above or below telephone open wire on a joint pole, it will usually be necessary to shift pins, etc., to provide climbing space. See Fig. 4.



**Fig. 3**



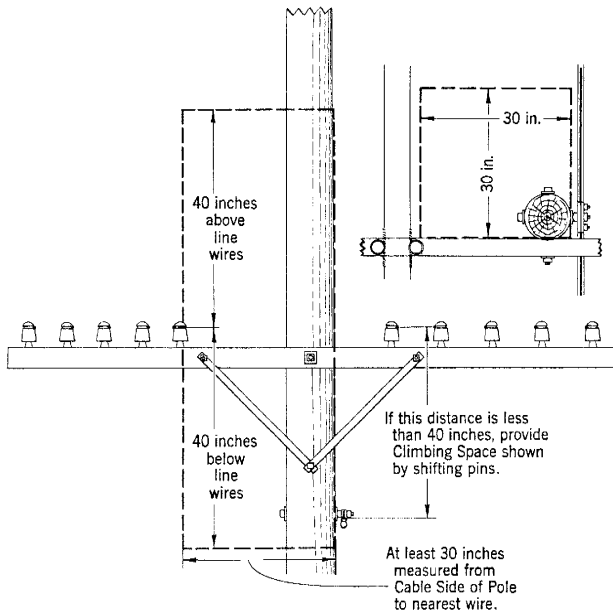


Fig. 4

**3.04** Open wire may be placed on wooden pole brackets attached to one side of the pole if the electric utility has no objection. Where wooden pole brackets are installed so there will be less than 40 inches between the wire on the crossarm and the wire on the brackets, respace the pins to provide 30 inches climbing space. See 3.03.

**3.05** On joint poles carrying only longitudinal power secondary conductors of 300 volts or less, the horizontal dimensions of climbing space may be reduced to 24 x 24 inches instead of the usual 30 x 30 inches. There is no reduction in the vertical requirement of 40 inches above and below telephone attachments, however.

**3.06** On joint poles carrying only longitudinal power conductors of 750 volts or less and used to supply airport or airway marker lights, the width of climbing space *across* the line may be reduced to 16 inches. The width of climbing space *along* the line must be maintained at 30 inches, however. See Fig. 5.

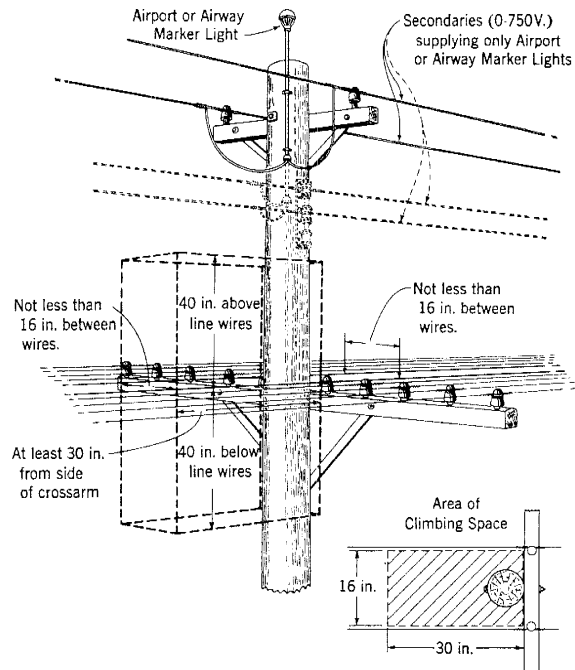


Fig. 5

**3.07** On *common crossing poles* carrying only secondary conductors of 750 volts or less, the width of climbing space may also be reduced to 16 inches across the line. The width of climbing space along the line must be maintained at 30 inches. This applies without regard to whether the electric attachment is made by means of a pole top extension or is made directly to the pole. See Fig. 6.

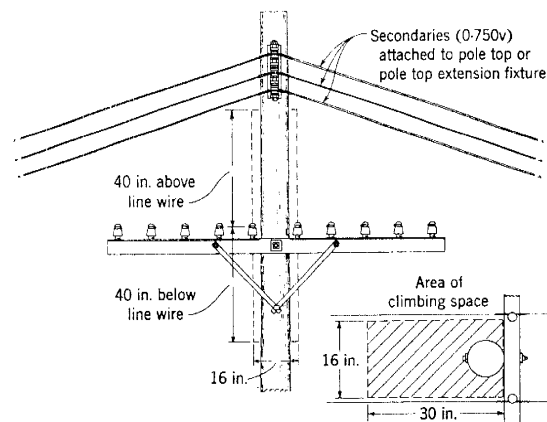


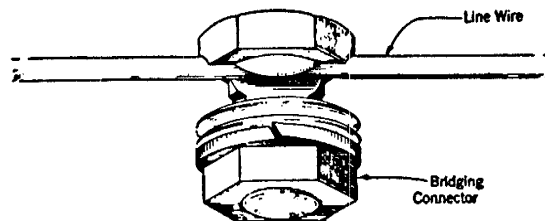
Fig. 6



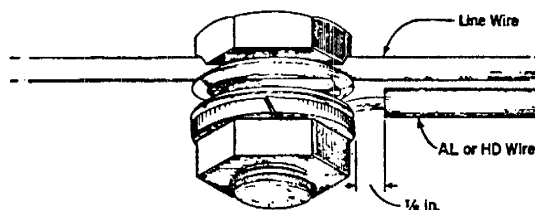
## OPEN WIRE BRIDLING TO LINE WIRE

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3. B Bridging Sleeves .....	2
4. Installing DB Copper Sleeves .....	2

(b) Loosen the nut and washers of the bridging connector to uncover the wire slot and place the connector on the line wire as illustrated.



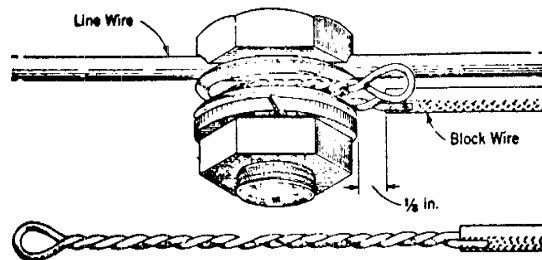
(c) Wrap the AL or HD Wire conductor around the binding post between the washers in the direction that the nut tightens. Using pliers and braid stripper, tighten bridging connector on line wire being careful not to bend the line wire.



(d) Bridge Block Wire on the line wire in a manner similar to the other wires after the Block Wire conductors are prepared for termination as follows:

- (1) Skin and clean conductor ends for a length of 4-1/2 inches.
- (2) Bend conductor back on itself with the wire and lapping over the insulation for 1/8 inch.
- (3) Grip wire insulation and conductor end with pliers and twist conductor loop with fingers until twists are close and there remains a small loop at the end as illustrated.

(e) Using pliers and braid strippers, tighten bridging connector on line wire being careful not to bend the line wire.



### 1. GENERAL

1.01 This section replaces Issue 1 and changes the method of bridging between wires using the B Dead-End Sleeve and the B Bridging Sleeve.

1.02 The types of connections to line wires depend upon the types of circuits and are as follows:

- (a) For toll circuits—Bridging Sleeve or DB Sleeve.
- (b) For excl age circuits—Bridging Sleeve or Bridging Connector.

1.03 The types and uses of the various connections are as follows:

- (a) **2B Bridging Connector:** For bridging AL, HD, or Block Wire to 080 Copper or Copper-Steel Line Wire.
- (b) **3B Bridging Connector:** For bridging AL, HD, or Block Wire to 104 and 128 Copper or Copper-Steel Line Wire.
- (c) **5006 Fargo Unit Connector:** For bridging AL or HD Wire to 165 Copper Line Wire.
- (d) **6C Bridging Connector:** For bridging AL, HD, or Block Wire to all sizes of steel line wire.
- (e) **104 by 064 B Copper Bridging Sleeve:** For bridging AL or HD Wire to 104 Copper or Copper-Steel Line Wire.
- (f) **104 by 104 B Copper Bridging Sleeve:** For bridging 104 Copper or Copper-Steel Line Wire to 104 Copper or Copper-Steel Line Wire. Also for bridging No. 10 AWG (0.102" diameter) protector lead wires to 104 Copper or Copper-Steel Line Wires.
- (g) **109 by 064 B Aluminum Bridging Sleeve:** For bridging AL or HD Wire to 109 Steel, High Strength Steel, and Extra High Strength Steel Line Wire.
- (h) **109 by 109 B Aluminum Bridging Sleeve:** For bridging 109 Steel Line Wire to 109 Steel, High Strength Steel, and Extra High Strength Steel Line Wire. Also for bridging No. 10 AWG (0.102" diameter) protector lead wires to 109 Steel, High Strength Steel, and Extra High Strength Steel Line Wires.
- (i) **104 DB Copper Sleeve:** For bridging AL or HD Wire to 104 Copper or Copper-Steel Line Wire.

Note: Manufacture of 104 H Dead-End Wire, with which the 104 DB Copper Sleeve is used, has been discontinued. Information on the 104 DB Copper Sleeve is retained to cover use with 104 H Dead-End Wire that may still be in Telephone Company stock.

### 2. INSTALLING BRIDLING CONNECTORS

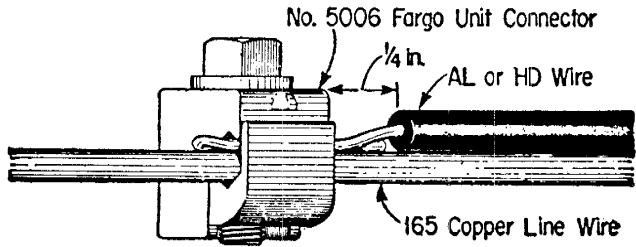
2.01 Install 2B, 3B, and 6C Bridging Connectors as follows:

- (a) Clean the line wire at the bridging point with abrasive cloth. Skin and clean the ends of AL, HD, or Block Wire conductors.

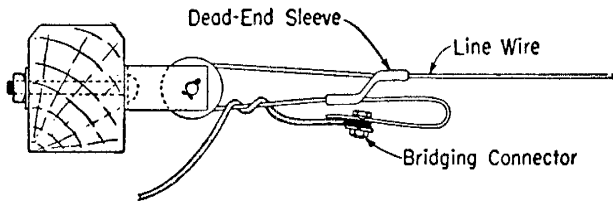
2.02 Install 5006 Fargo Unit Connector as follows:

- (a) Clean the line wire at the bridging point with abrasive cloth. Skin and clean about 2 inches of the AL or HD Wire conductor and bend back so that end of wire is about 1/8 inch from insulation.

- (b) Loosen the nut of the connector and position on line wire.
- (c) Insert AL or HD Wire as illustrated and tighten with pliers.

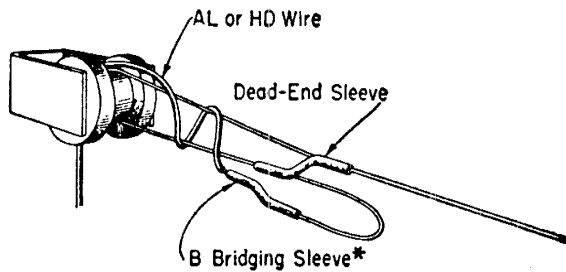
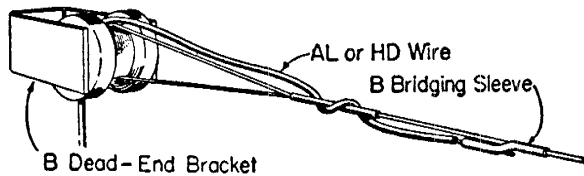


2.03 Where the line wire is dead-ended by the use of dead-end sleeves, and bridging connectors are to be used, they should be placed as shown in the following illustration:



**3. B BRIDGING SLEEVES**

3.01 The B Bridging Sleeve is placed as shown in the following illustrations. See the separate section on B Bridging Sleeves for detailed information on placing B Bridging Sleeve.

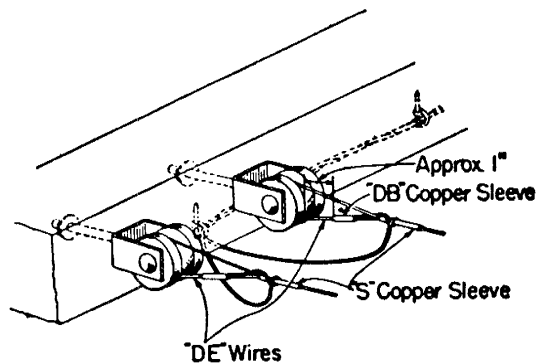


\* Use combination S Sleeve on 104 Copper or Copper-Steel Line Wire.

**4. INSTALLING DB COPPER SLEEVES**

4.01 DB Copper Sleeves at dead-ends shall be installed as follows:

- (a) After forming the dead-end loop as shown in the section on dead-ending and before inserting the ends in the S Sleeve, place a DB Sleeve on the lower side of the dead-end loop.
- (b) The wire for bridling should be placed in the usual manner and with sufficient excess length so that after it is placed in the DB Sleeve it will be loose between the last drive ring and the line wire.
- (c) After measuring the amount of bridling wire required, remove a sufficient length of insulation from the end of the bridling wire so that with the conductor extending through the DB Sleeve a clearance of about 1/4 inch is provided between the insulation and the end of the sleeve. With abrasive cloth, clean the portion of the wire from which the insulation has been removed.
- (d) In order to facilitate rolling the S Sleeve for the connection to the line wire, place the DB Sleeve so that the distance between the end of the DB Sleeve and the dead-end bracket is about one inch.
- (e) Insert the end of the bridling wire into the small hole of the DB Sleeve, entering it at the end away from the dead-end bracket. Make an indentation about 1/4 inch from one end of the sleeve with side cutting pliers to hold the wire in the sleeve and to hold the sleeve in place on the dead-end wire.
- (f) With the dead-end loop removed from the spool roll the DB Sleeve in the proper groove of the sleeve rolling tool. Roll from the end that will be nearer the dead-end bracket.
- (g) Place the loop in position on the dead-end bracket and place two wraps of bridling wire around both sides of the dead-end loop. With the two ends of the dead-end loop even insert them to the constriction in the S Sleeve. Make an indentation about 1/4 inch from the end of the sleeve to hold it in place.
- (h) Pull the line wires to the desired sag and cut it about 1/4 inch short of a point corresponding to the midpoint of the S Sleeve so that the sag will be maintained after the sleeve is rolled.
- (i) Insert the end of the line wire to the constriction of the S Sleeve and make an indentation to hold it in place. Roll the sleeve in the proper groove of the sleeve rolling tool. Slip the two turns of the bridling wire over the S Sleeve.
- (j) The following shows the completed installation.



**WIRE TERMINALS**  
**INSTALLATION OF 104-TYPE WIRE**  
**TERMINALS AND 116-TYPE PROTECTORS**

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4. LOCATING ON MULTIPLE LINE WIRE POLES . . . . .	3
5. LOCATING ON CABLE POLES . . . . .	4
6. LOCATING ON CABLE SUSPENSION STRAND . . . . .	6

**1. GENERAL**

**1.01** This section covers the installation of 6-pair wire terminals and protectors when specified for use with the various types of multiple line wire.

**1.02** This section is reissued to add information on the 104B2-6 Wire Terminal and the 116D2B-6 Protector. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted.

**1.03** The 104-type wire terminals are described in Section 624-300-100 and the 116-type protectors are described in Section 624-300-101. Any of these 6-pair wire terminals or protectors can be re-used if they are in satisfactory condition.

**1.04** Where a wire terminal or protector is installed on new wire, leave sufficient slack in the conductors at the time the new wire is being placed for proper installation of the terminal. Slack is provided by cutting out a section of the support wire and splicing the remaining ends of the support wire together. A wire terminal is installed on *existing* multiple line wire by splicing slack into the conductors. Be sure to maintain the color of conductors when providing slack. Cut only the conductors being terminated; the others can be placed in a B Cable Guard through the B Wire Bracket or behind the terminal.

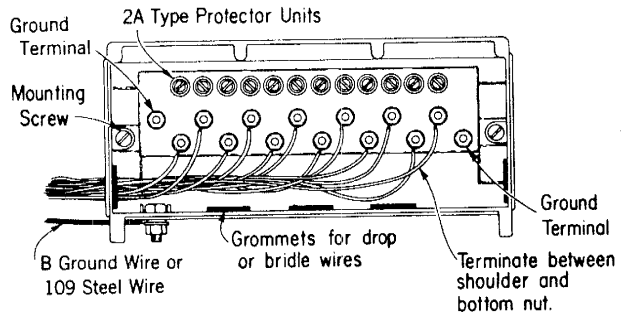
**1.05** A 116-type protector should be grounded as follows.

- (a) To a cable strand or power multigrounded neutral wire with B Ground Wire.
- (b) To the support wire of multiple line wire with a 109 Construction Wire or 109 Steel Line Wire.

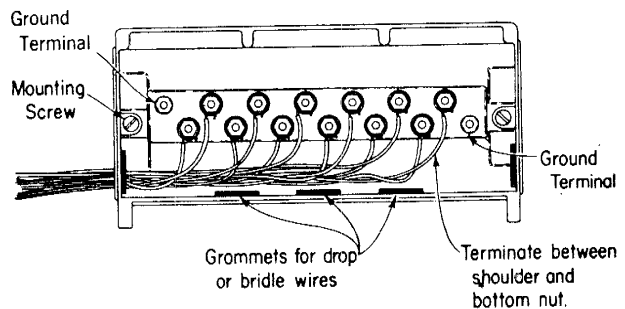
**2. INTERNAL WIRING**

**2.01** The insulation on the multiple line wire conductors must be removed before they are terminated on the binding posts.

**2.02** The internal wiring for a 116D Protector and a 104B Wire Terminal is shown in Figs. 1 and 2, respectively.



**Fig. 1 – 116D Protector (cover omitted for clarity)**



**Fig. 2 – 104B Wire Terminal (cover omitted for clarity)**

**2.03** The internal wiring for a 116B Protector and a 104A Wire Terminal is shown in Figs. 3 and 4, respectively.

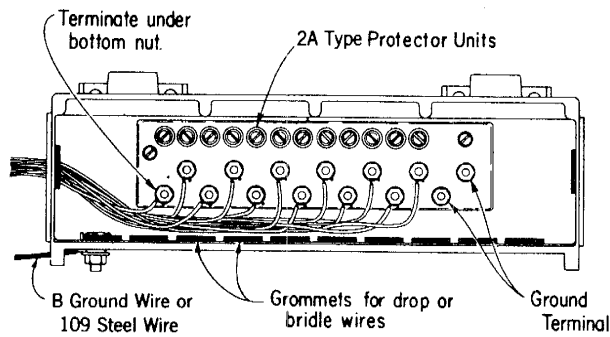


Fig. 3 - 116B Protector (cover omitted for clarity)

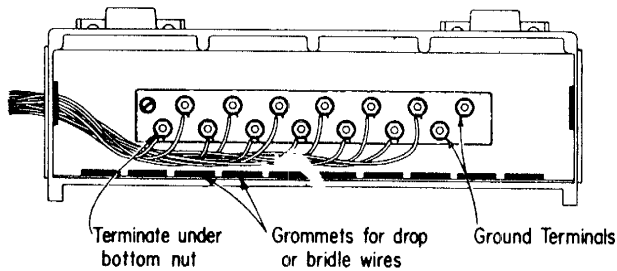


Fig. 4 - 104A Wire Terminal (cover omitted for clarity)

2.04 The internal wiring for a 116D2B-6 Protector and a 104B2-6 Wire Terminal is shown in Figs. 5 and 6, respectively.

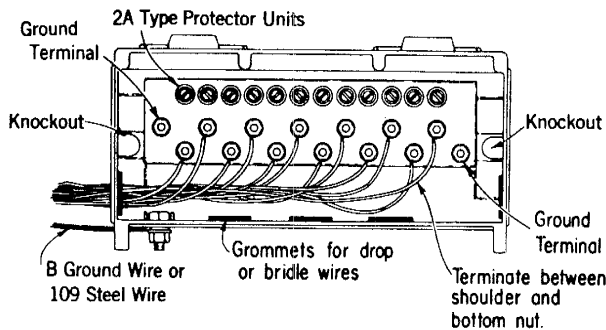


Fig. 5 - 116D2B-6 Protector (cover omitted for clarity)

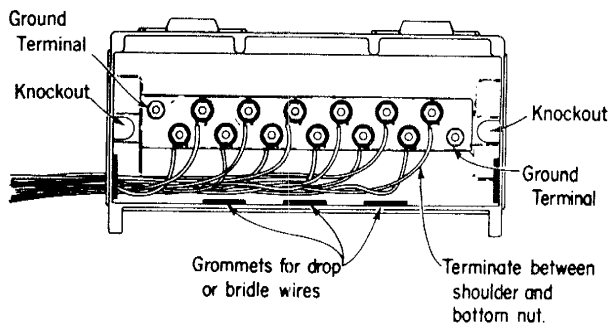


Fig. 6 - 104B2-6 Wire Terminal (cover omitted for clarity)

### 3. LOCATING ON SUPPORT WIRE OF MULTIPLE LINE WIRE

3.01 The 104B2-6 Wire Terminal or 116D2B-6 Protector can be placed on the insulated support wire. At deadend poles, this can be accomplished by using two B Wire Adapters and two lashed cable supports as shown in Fig. 7 and described in 3.03.

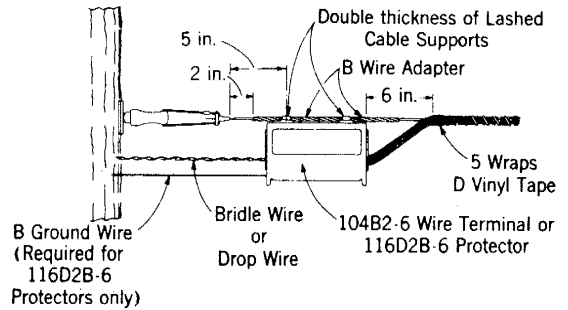


Fig. 7 - Multiple Line Wire Deadend

3.02 A 104B2-6 Wire Terminal or 116D2B-6 Protector can be located at a multiple line wire intermediate pole using two B Wire Adapters and two lashed cable supports as shown in Fig. 8 and described in 3.03.

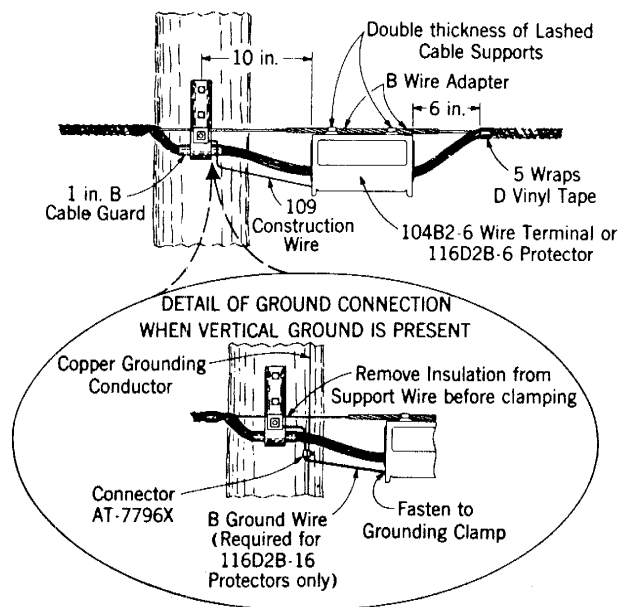
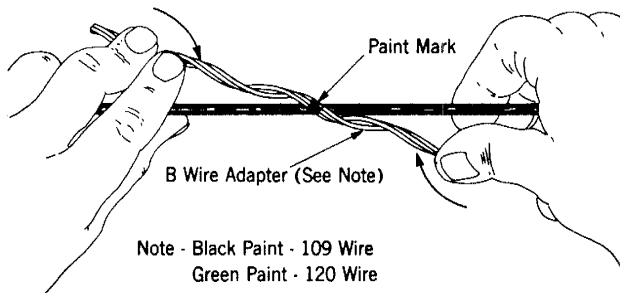


Fig. 8 - At Multiple Line Wire Intermediate Pole

**3.03 Installation of 104B2-6 Wire Terminal or 116D2B-6 Protector**

(a) Place a B Wire Adapter about 5 inches from the end of the wirewise or sleeve deadending the support wire. **Do not remove the insulation from the support wire** before placing the wire adapter. The wire adapter is installed as follows.

(1) Place the 3-wire set first, starting at the center which is marked by paint, as shown in Fig. 9. Place the 3-wire set (gauge by eye) on the support wire so that it is centered at the terminal clamp nearest the pole (see Fig. 7). Wrap the set so it is spiraled around the support wire from the center out to the ends in each direction at once using the thumb and forefinger of each hand. Be sure that the ends are snapped into place over the support wire.



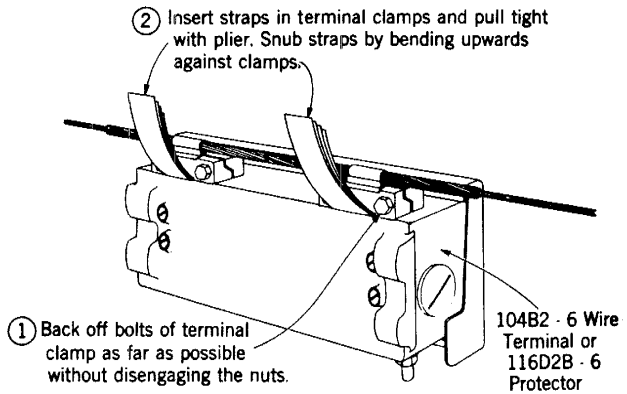
**Fig. 9 – Installation of B Wire Adapter**

(2) Place the second 3-wire set for 120 size or first 2-wire set for 109 size next to the first 3-wire set, being sure to match the paint marks at the center so the ends will be approximately even. It is installed in a similar manner to the 3-wire set.

(3) Place the last 2-wire set in the gap left between the other sets and match the paint marks so the ends will be about even. Install as described in (1).

(b) Start the second B Wire Adapter on the support wire with the paint mark about 3 inches from the end of the first B Wire Adapter so that it is centered at the far terminal clamp. (See Fig. 7.)

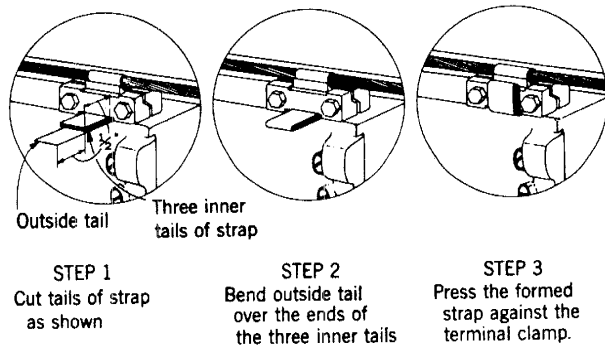
(c) Cut off the buckles from a pair of lashed cable supports and fold in half to obtain double thickness. Bend straps over the wire adapter on support wire with ends pointing down. (See Fig. 10.)



**Fig. 10 – Inserting Cable Supports In Terminal Clamps**

(d) Hold the terminal in proper alignment with support wire, and tighten the bolts of the terminal clamps with the C Socket Wrench or N Cable Terminal Wrench. Take up alternately on the two bolts of each clamp.

(e) Terminate straps as shown in Fig. 11.



**Fig. 11 – Terminating Cable Supports**

**4. LOCATING ON MULTIPLE LINE WIRE POLES**

**4.01** At wire deadend poles, 6-pair wire terminals or protectors can be located as shown in Fig. 12.

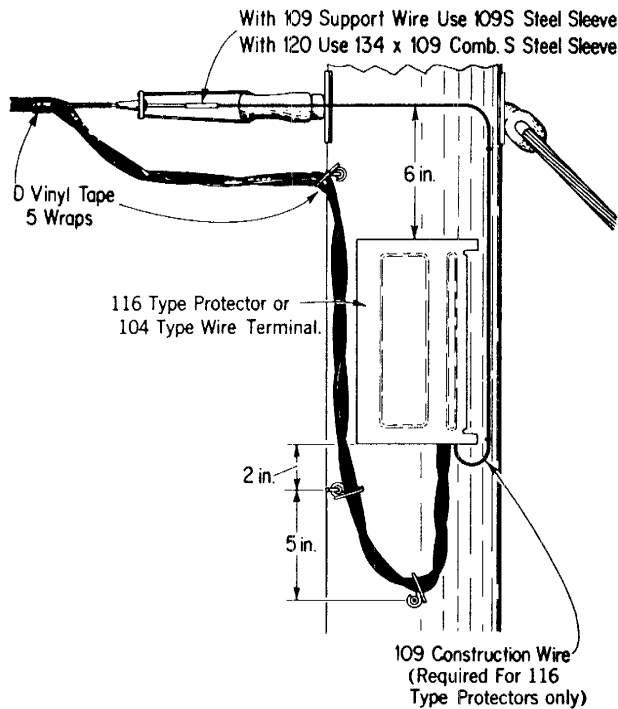


Fig. 12 — At Wire Deadend Pole

4.02 At intermediate poles, 6-pair wire terminals or protectors can be located as shown in Fig. 13.

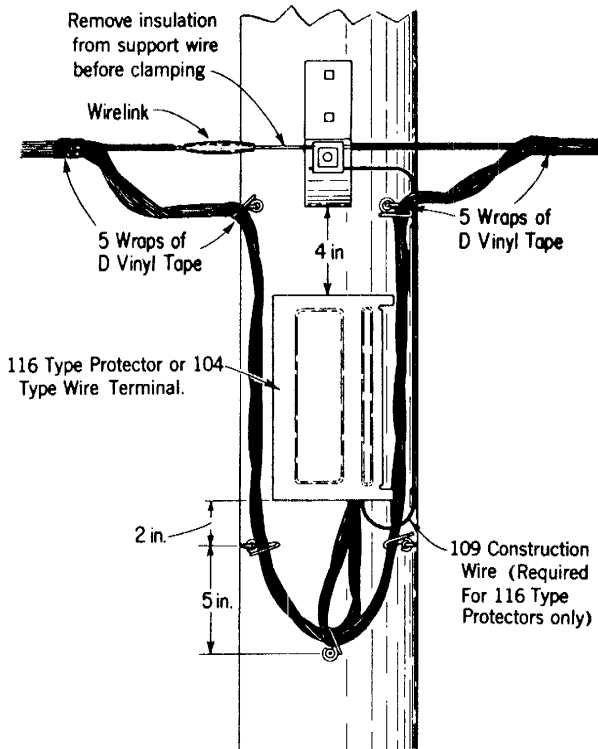


Fig. 13 — Intermediate Pole

4.03 At wire deadend poles involving cross-arms, the wire terminals or protectors can be located on the crossarm as shown in Fig. 14.

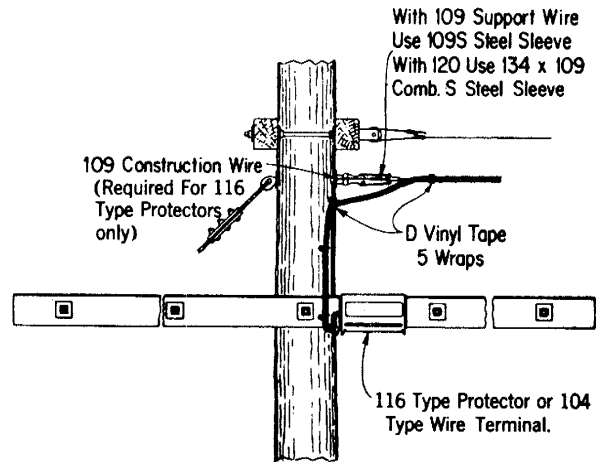


Fig. 14 — Crossarm or Wire Deadend Pole

5. LOCATING ON CABLE POLES

5.01 The various types of 6-pair wire terminals or protectors should be located on intermediate cable poles as shown in Figs. 15, 16, and 17.

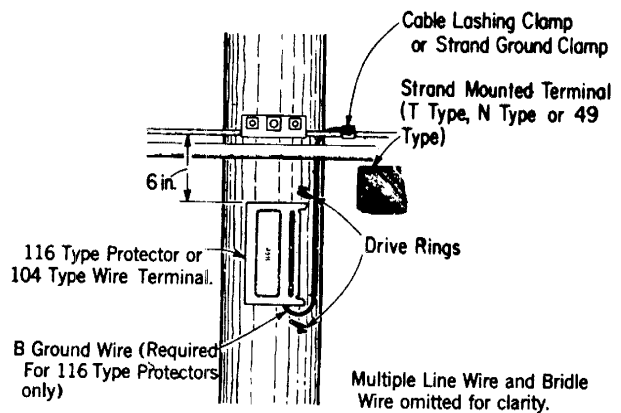
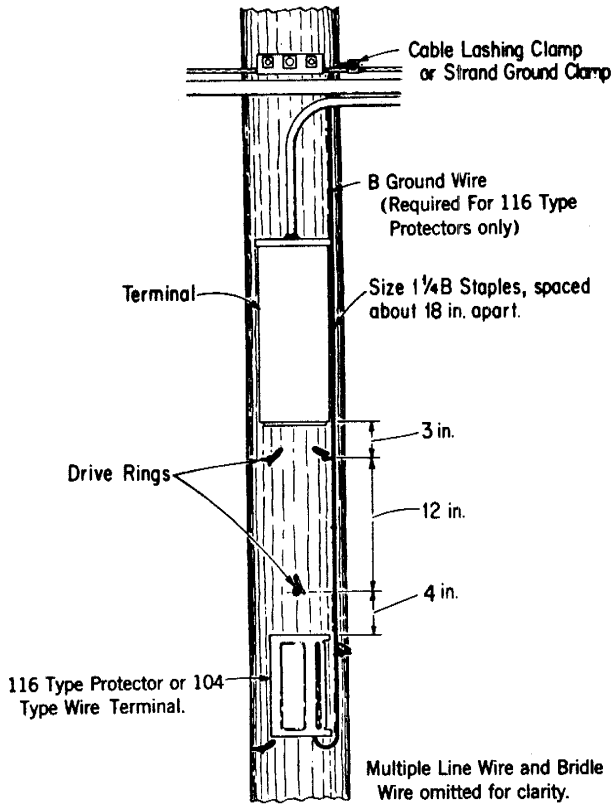
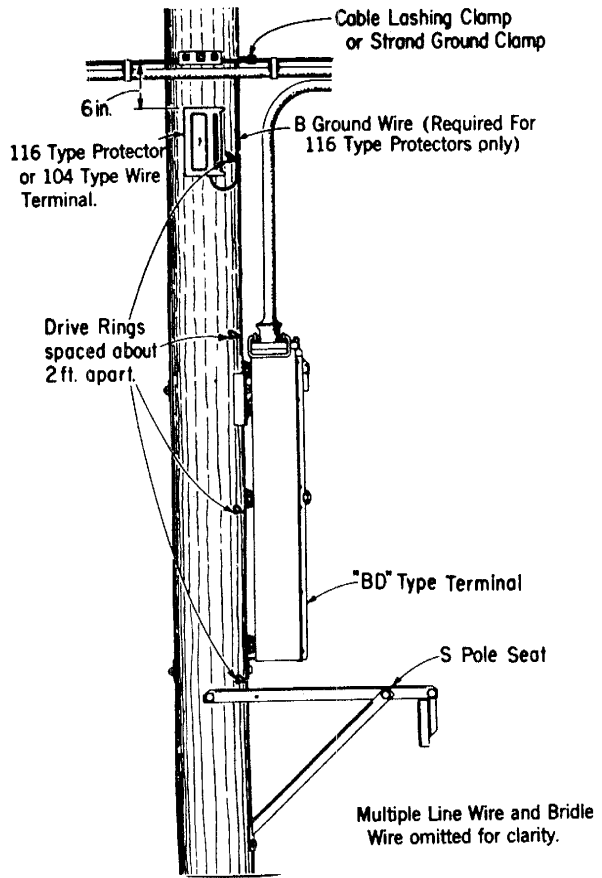


Fig. 15 — Pole With Strand-Mounted Cable Terminal (multiple line wire and bridle wire omitted for clarity)





**Fig. 16 – Pole With Pole-Mounted Cable Terminal (multiple line wire and bridle wire omitted for clarity)**



**Fig. 17 – Pole With Pole-Mounted Cross-Connecting Terminal (multiple line wire and bridle wire omitted for clarity)**

5.02 The various types of 6-pair wire terminals or protectors should be located at cable deadend poles as shown in Figs. 18 and 19.

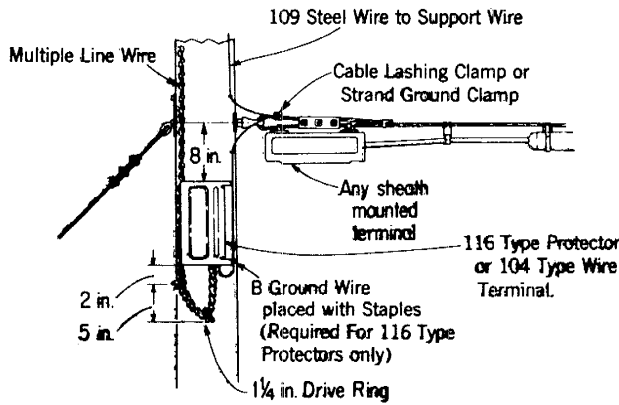


Fig. 18 — Deadend Pole With Strand-Mounted Cable Terminal

6. LOCATING ON CABLE SUSPENSION STRAND

6.01 The 104B2-6 Wire Terminal or 116D2B-6 Protector is installed on cable suspension

strand in a manner similar to the installation of cable terminals described in Section 631-210-201.

6.02 Wire terminals and protectors should be placed on the cable suspension strand in such a location that they do not interfere with climbing space, existing aerial splices, or terminals.

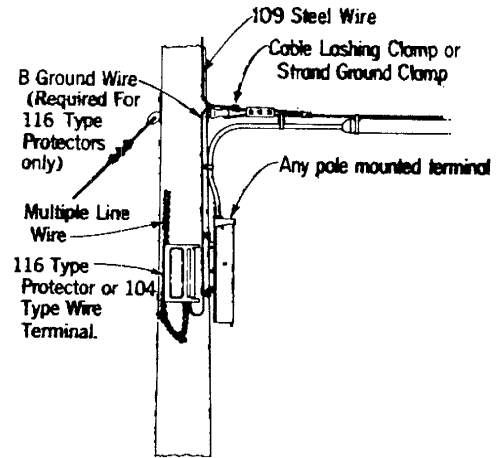


Fig. 19 — Deadend Pole With Pole-Mounted Cable Terminal

## WIRE TERMINALS INSTALLATION OF 105A

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4. Locating on Dead-end Poles .....	3

### 1. GENERAL

1.01 This section covers the description of the 105A Wire Terminal and its installation on all types of multiple line wire.

1.02 The 105A Wire Terminal can be reused if it is in satisfactory condition.

1.03 Local instructions should cover whether the 105A Wire Terminal is to be removed when subscriber service is disconnected, or whether it should be left intact. Where the terminal is removed, the insulation on the support wire should be repaired by two half-lapped layers of DR Tape and two half-lapped layers of D Vinyl Tape. The insulation of the conductors should be repaired by cutting the wire and joining them with the proper size splice sleeve as instructed in Section 624-220-200.

1.04 On all conductors except those of 24-gauge with a single PVC jacket, remove the insulation before placing on the binding posts. This is done by crushing the insulation with long nose pliers and cutting it away. With 24-gauge having a single PVC jacket, such as C Urban Wire, place the wire under the lower washer and tighten the nut with a 216B Tool. Be careful not to tighten so hard as to break the wire, but be sure that the insulation has crushed enough for a good contact to be made. At temperatures below + 10°F, it will be necessary to precrush the insulation with long nose pliers.

### 2. DESCRIPTION OF 105A WIRE TERMINAL

2.01 The 105A Wire Terminal consists of a circular molded phenolic block and a neoprene snap-on cover. One side of the block has two binding posts and the other side has a corrosion resistant clamp for mounting on the support wire.

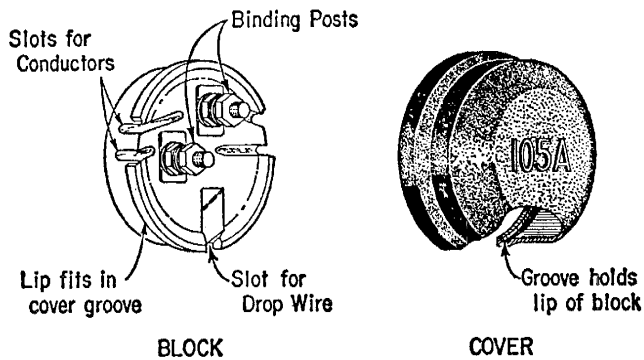


Fig. 1

2.02 The cover can be removed from the terminal as shown below.

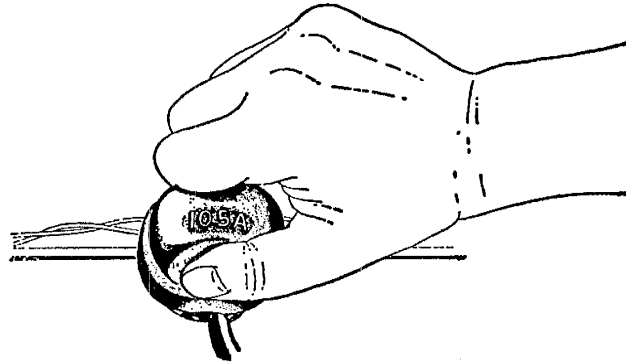


Fig. 2

### 3. LOCATING ON INTERMEDIATE POLES

3.01 The first 105A Wire Terminal at a pole can be installed in the following manner.

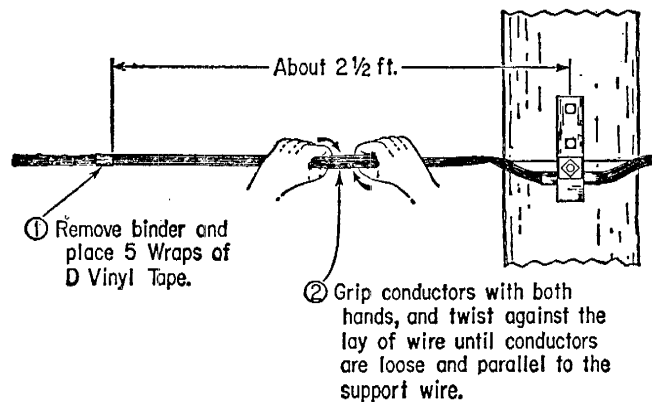


Fig. 3

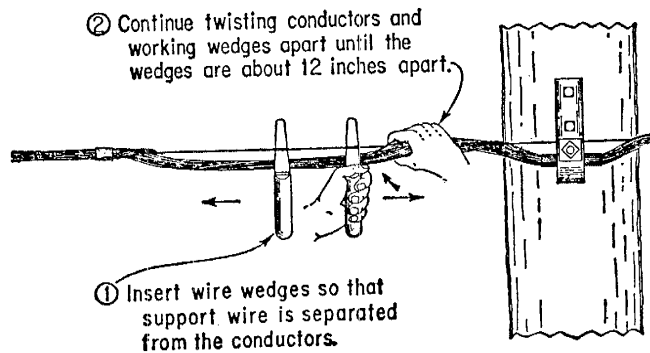


Fig. 4

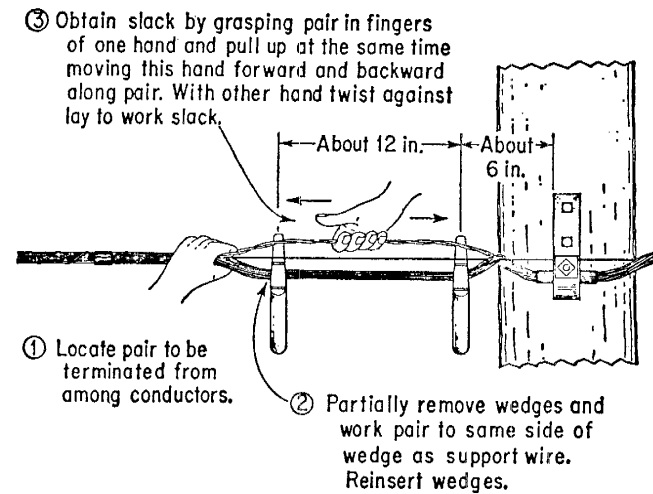


Fig. 5

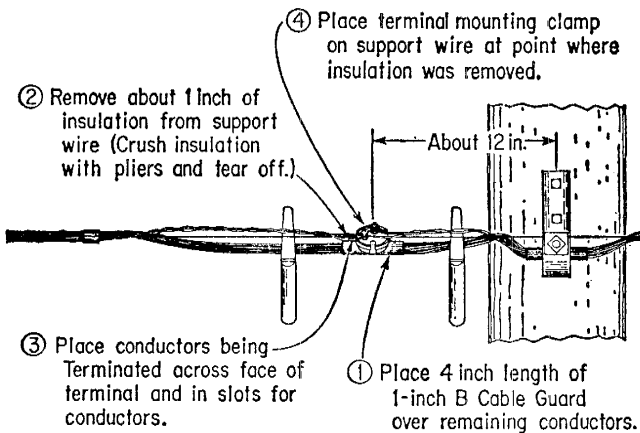


Fig. 6

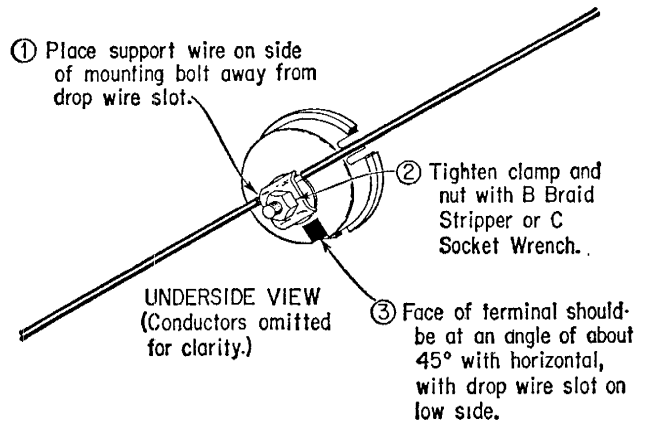
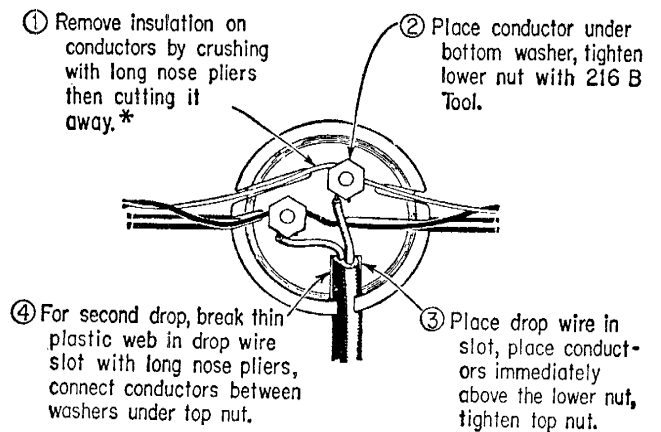
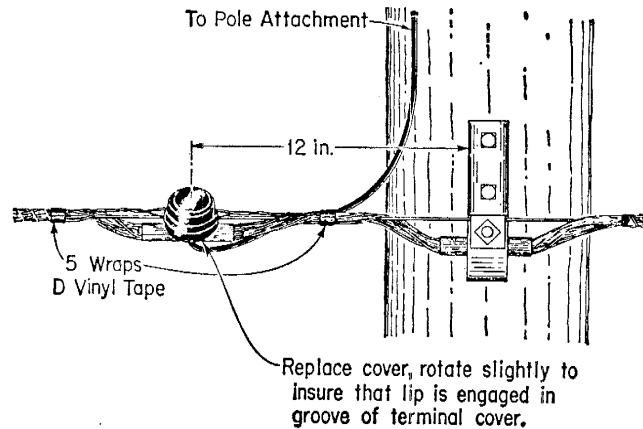


Fig. 7



\* Not required with 24 gauge, single PVC jacketed conductors such as C Urban Wire. (See Par 1.04)

Fig. 8



3.02 A maximum of three wire terminals can be mounted on each side of the wire bracket. The method of installation for each is similar to that in Paragraph 3.01. A complete installation is shown in Fig. 10, although individual terminals are added only as needed. The order of installation would depend on the direction of feed for the drop wires.

Fig. 9

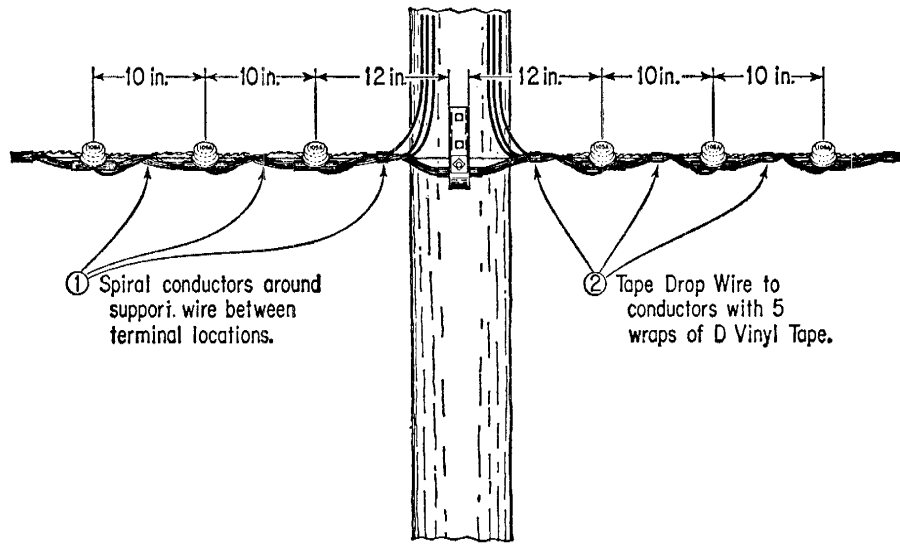


Fig. 10

4. LOCATING ON DEAD-END POLES

4.01 Multiple line wires, which are terminated as shown in Section 624-220-204, can have up to two wire terminals as shown below.

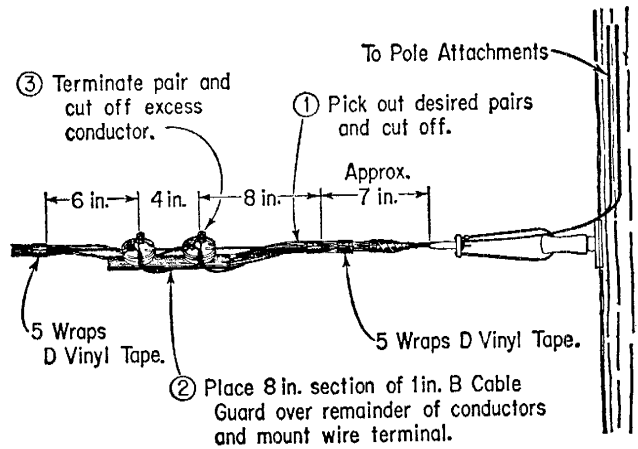


Fig. 11



## TESTING SUSPENSION STRAND

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### 1. GENERAL

1.01 This section covers the methods of testing the soundness of aerial cable suspension strand.

1.02 This section is reissued to include the visual inspection and testing of poles at each end of an aerial span in which a ladder is to be placed, an aerial platform hung, or a cable car ridden. Also added are procedures to be followed when work is to be performed in spans crossing electrified railroads.

1.03 Before placing a cable car, ladder, or splicing platform in a pole-to-pole span, a ladder in a pole-to-building span, or before performing any work operation which involves shifting the strand or varying the strand tension in the span, the entire span should be checked from the ground and the strand *given a mechanical test* to determine its soundness, except as indicated in

Part 4. Also, the poles at each end of the span shall be inspected and tested as described in Sections 620-131-010 and 620-132-010.

*Note:* In no case shall a platform or cable car be suspended from any size strand which is attached to a building.

### 2. PRECAUTIONS

2.01 Vehicles, tools, and equipment that might be damaged as a result of strand breakage should not be located under the strand when it is being tested. Only the individuals involved in making the test should be permitted in the work area.

2.02 On joint use lines or at power crossings, the rope used for testing shall not be thrown over the strand. Pass the rope over the strand with a tree pruner handle or place it over the strand at the pole and move the rope along the strand to the desired location.

2.03 Do not make a mechanical test of a span that crosses over electric light, power, fire alarm, or trolley wires. Follow procedures outlined in 4.01.

2.04 Do not make a mechanical test of a span that crosses over the main line of a railroad or any electrified railroad line. Procedures to be followed in testing spans that cross railroad tracks are outlined in 4.03, 4.05, and 5.01.

2.05 Do not make a mechanical test of a strand that has been in contact with an electric power wire. Follow procedures outlined in 4.05 and 6.04.

## SECTION 627-295-500

### 3. TESTING THE STRAND

**3.01** Before testing suspension strand or the strand of self-supporting cable, examine the span from the ground for:

- (a) The presence of power crossings, power clearances, etc, that may prevent testing the strand.
- (b) Strand abrasion or corrosion, particularly at points of tree interference, strand splices and dead ends, strand attachments, etc, and for any other irregularities of the strand, cable, lashing wire, or rings which may require attention. Observe self-supporting cable spans closely as the covering on this strand may hide possible defects.

#### TESTING STRAND PRIOR TO PLACING LADDER

**3.02** Before placing a ladder against suspension strand or the strand of self-supporting cable, the strength of the strand and its supports should be tested in the following manner:

- (1) ♦Inspect and test the poles at each end of the span (Sections 620-131-010 and 620-132-010).♦
- (2) Throw or place the handline (2.02) over the strand at the point where the ladder is to be placed.
- (3) The workman who will work from the ladder should grasp the two ends of the handline and gradually apply his full weight to the strand by lifting himself slowly off the ground (Fig. 1).

**3.03** Be alert for visual or audible signs of weakness. A strand and its supports which will support the workman without showing any signs of failure or slippage have ample strength to support the ladder and the workman.

#### TESTING STRAND PRIOR TO PLACING AERIAL PLATFORM OR CABLE CAR

**3.04** Before placing an aerial platform or a cable car on suspension strand, the strength of strand and its supports should be tested in the following manner:

(1) ♦Inspect and test the poles at each end of the span (Sections 620-131-010 and 620-132-010).♦

(2) Throw or place the handline (2.02) over the strand at midspan.

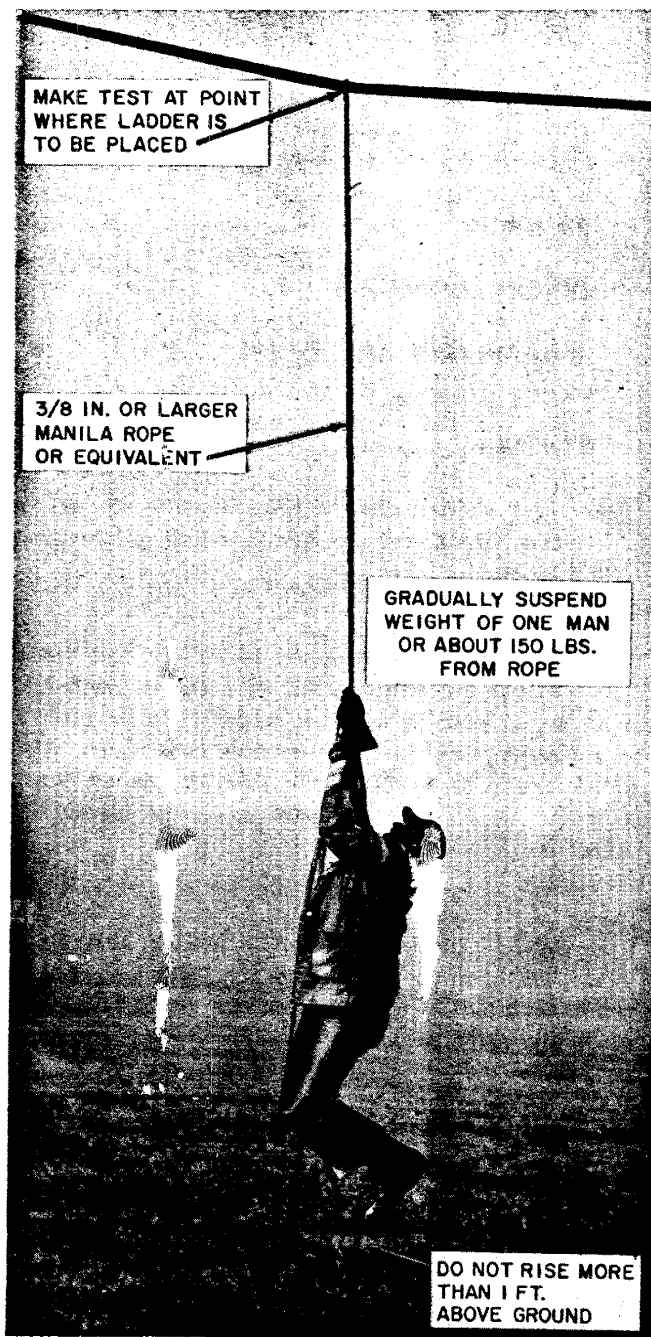


Fig. 1—Testing Strand Prior to Placing Ladder



(3) Two workmen should grasp the two ends of the handline and gradually apply their full weight to the strand and gradually apply their full weight to the strand by lifting themselves slowly off the ground (Fig. 2).

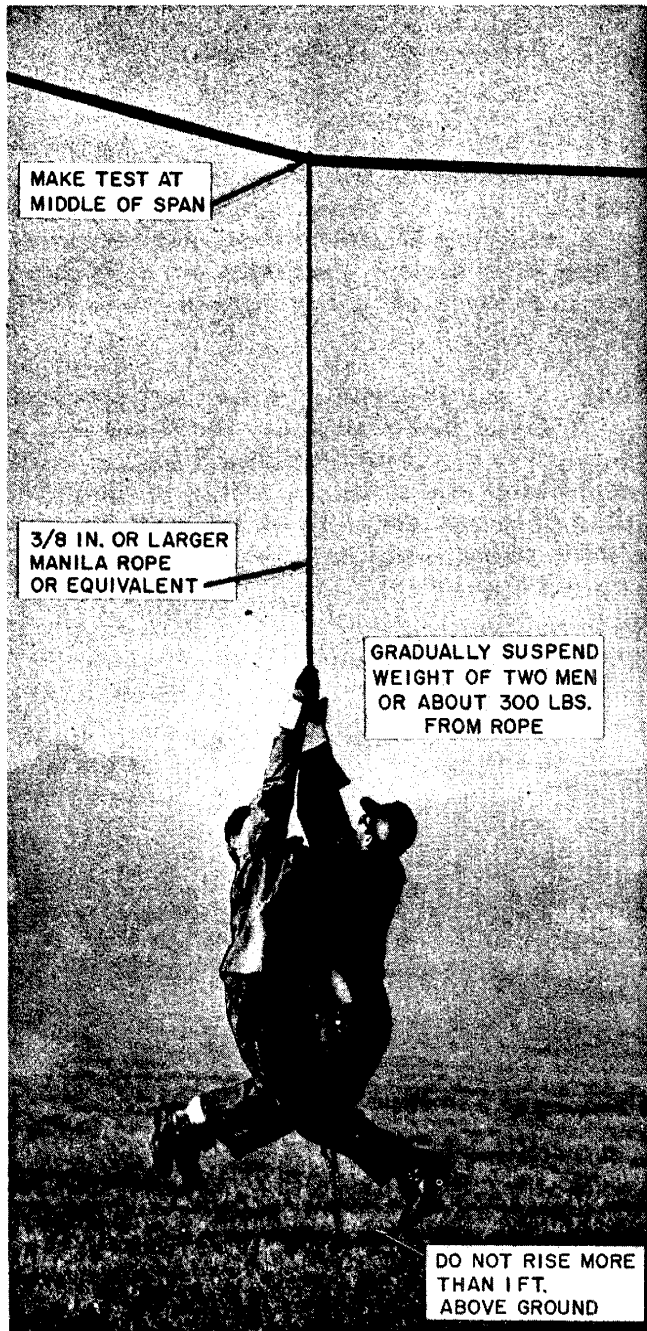


Fig. 2—Testing Strand Prior to Placing Aerial Platform or Cable Car

**3.05** The equivalent of the two-man test may be made by attaching one end of the handline to some suitable anchorage, such as a tree or the bumper of a truck, located under or nearly under the strand at midspan. Pass the free end of the handline over the strand and gradually support one man's weight on the handline.

**3.06** Be alert for visual or audible signs of weakness. A strand and its supports which will support the weight of two men without showing any signs of failure or slippage have ample strength to support a properly placed platform and two men or a cable car and one man.

#### 4. INSPECTION OF STRAND THAT CANNOT BE TESTED

**4.01** Do not make a mechanical test in spans that cross over electric light, power, fire alarm, or trolley wires. Make a careful visual inspection of the span from the ground. Then, from a working position on the poles, examine the strand adjacent to each of the supporting poles. If any of the following defects are found, the strand must be repaired before performing any work operation that will place an additional load on the strand.

- (a) *Corrosion of the strand* to the extent that no galvanizing remains.
- (b) *Strand wire breaks* in one or more of the strand wires.
- (c) *Excessive strand wear* caused by rings, tree interference, cable guards, etc.
- (d) *Any loose attachments* affecting the structure within reach of the workman.

**4.02** If any defects are found and work operations must be performed on the cable prior to making repairs on the strand, use a ladder platform or aerial lift truck or place an auxiliary strand to work from.

**4.03** Do not make a mechanical test of a span that crosses over a main line railroad track. If the strand has been in place less than one year or if it is known that no coal-burning locomotives have been in use under the strand since it was placed, examine the strand as prescribed in 4.01.

**SECTION 627-295-500**

*If the strand has been exposed to coal-burning locomotive smoke and is more than one year old, it shall not be ridden.* All work operations shall be performed from a ladder platform or aerial lift truck or from an auxiliary strand. A truck shall not be used within 10 feet of the railroad track.

**4.04** Do not make a mechanical test of a span that crosses an electrified railroad. All work operations shall be performed from a ladder platform or aerial lift truck or from an auxiliary strand. A truck shall not be used within 10 feet of the railroad track.

**4.05** Do not make a mechanical test of any strand that has been in contact with a power wire. Immediate replacement or repair of the strand is necessary.

**5. SPECIAL CONDITIONS**

**5.01** Spans over non-electrified spur railroad tracks may be given a mechanical test provided signalmen are posted along the tracks in both directions and at sufficient distance from the work location to give ample warning of approaching trains.

**5.02** Strand crossing streets and highways where no power crossings are involved may be given a mechanical test provided proper warning signs are posted and all traffic is stopped during the test. For those locations where the traffic cannot be stopped, do not make a mechanical test, but follow the procedures in 4.01.

**6. MAINTENANCE AND REPAIR**

**6.01** Conditions found during the inspection or test which necessitate repairs include:

- (a) Shifted protecting guards
- (b) Loosened suspension clamps, grade clamps, cable lashing clamps, ground clamps, etc

- (c) Shifted, worn, or corroded cable rings
- (d) Loose or broken lashing wire
- (e) Loose or shifted cable supports or broken wire ties
- (f) Broken wires in the strand

**6.02** Where the overall corrosion of the strand is not serious but one or more broken wires are found apply a B Strand Connector to the strand with the center of the connector over the break. If this is not possible, the broken section of strand can be removed and a new piece of strand placed at that point.

**6.03** If only one wire is broken and permanent repair cannot be made, the strand may be temporarily reinforced by placing a piece of strand of the same size across the broken portion. This piece of strand should be of sufficient length to permit placing 3-bolt guy clamps on each side of the break as follows:

SIZE OF STRAND	NUMBER OF 3-BOLT GUY CLAMPS ON EACH SIDE OF BREAK
6M	2
10M	3
16M	4
25M	5

**6.04** Strand that has been in contact with a power wire shall be repaired by replacing a minimum of 2-1/2 feet of strand on either side of the point of power contact. If a single point of power contact cannot readily be determined, the entire span should be replaced.

**BURIED PLANT**  
**TERMINATION OF BURIED SERVICE WIRES**  
**AT JUNCTIONS WITH AERIAL PLANT**

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5. JUNCTION WITH OPEN WIRE . . . . .	8

**1. GENERAL**

**1.01** This section describes methods of terminating buried service wires at junctions with aerial plant such as aerial cable, multiple wire, C Rural Wire, or open wire.

**1.02** This section has been reissued to:

- (a) Change title
- (b) Expand coverage of junctions with aerial plant
- (c) Delete material on junctions with buried plant.

Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.03** Section 629-720-205 covers the termination of buried service wire at junctions with other buried plant.

**1.04** *The armor wire of D Underground Wire or the aluminum tape of B Service Wire must always be grounded at the subscriber's protector* when fed from any type of aerial or buried plant. Methods for grounding in a fuseless station protector are shown in Section 629-720-205. This grounding at subscriber's premises is required to protect against lightning damage and to minimize shock or fire hazards, caused by sustained power contacts.

**1.05** In order to minimize fire or shock hazards at the subscriber's premises when fuseless station protectors are used, a short piece of fine gauge wire must be placed so it will fuse open at the pole in the event of a sustained power contact. This fine gauge wire is known as a *fusible link*, and it must be smaller in current carrying capacity than the conductors of the service wire in order to make certain that it will burn open instead of the conductors of the buried service wire. In general, the 24-gauge copper conductors used in a cable terminal stub or in a connecting block with a 49-type cable terminal are satisfactory fusible links for D Underground or B Service Wire conductors. Block wire is a satisfactory fusible link for D Underground Wire conductors, but is *not* satisfactory with B Service Wire conductors, because of an insufficient difference in fusing characteristics.

1.06 Underground or service wires should be identified at terminations by means of tags made from B Glass Tape. Cut about 5 inches of glass tape and wrap it around the wire, pressing the sticky side against itself to make the tag. It can be readily marked with pencil or pen to designate the subscriber or to identify the route of the wire. These tags are shown in Fig. 1.

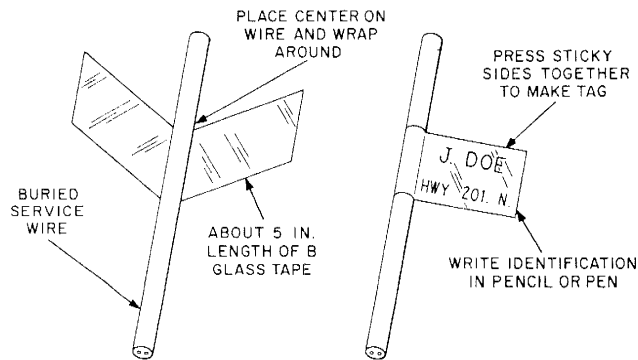


Fig. 1—Identifying Tags

1.07 The B Wire Connector should be used to join buried service wire with PIC cable conductors inside a cable closure as indicated in Section 632-205-201.

1.08 Unterminated pairs of buried service wire should be prepared as described in Section 629-720-205.

## 2. JUNCTION WITH AERIAL CABLE

2.01 At the cable terminal or closure where buried service wire feeds from aerial cable and where the length of the buried service wire is:

(a) **500 feet or less, do not bond** the armor wire or the aluminum tape to the strand or terminal housing. This will **protect the subscriber's location from possible fire** caused by excessive power fault, should the circuit come in sustained contact with power lines of any voltage.

(b) **More than 500 feet.** Use D Underground Wire and bond the armor wire to the strand or terminal housing. When the length of buried wire is greater than 500 feet, the resistance of the armor wire, because of its length, will limit the fault current to safe values. **The B Service Wire is not to be used for distances of more than 500 feet.**

2.02 No carbon block protection is required between the cable conductors and the buried service wire conductors unless severe lightning exposure exists. (See 2.08.)

2.03 Buried service wire can be brought up a pole and terminated directly in a pole- or strand-mounted cable terminal or cable closure if the cable conductor is 24- or 26-gauge. Where fuseless protectors are used at the station and the cable conductor is 22- or 19-gauge and exposed to power contact, a fusible link is required between the cable pair and the service wire. As stated in

1.05, the 24-gauge conductors in a cable stub or the connecting block of a 49-type cable terminal are satisfactory fusible links. At the groundline the wire should be protected with an 8-foot length of No. 0 U Cable Guard. A typical installation terminating in a 49-type cable terminal is shown in Fig. 2.

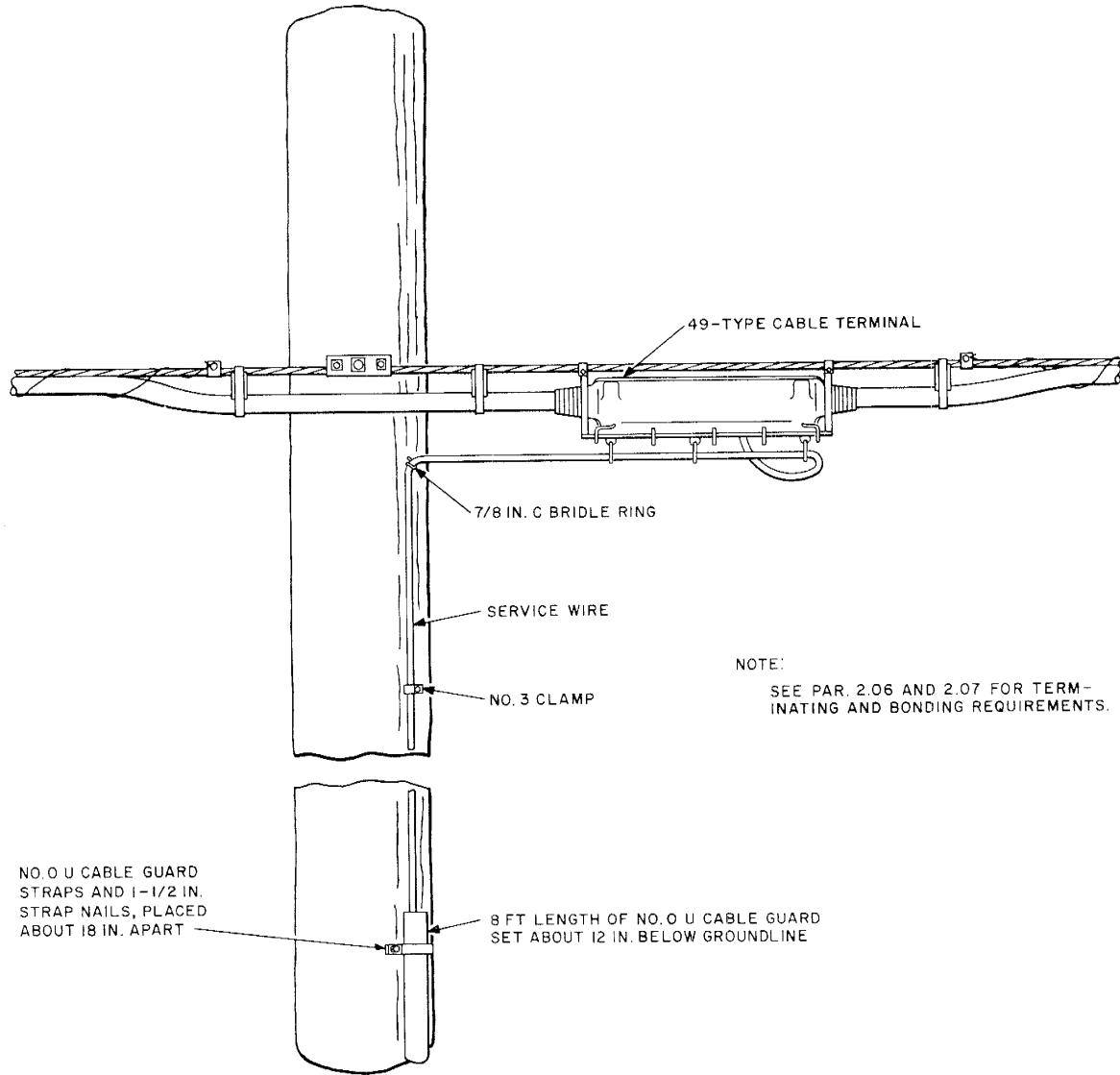
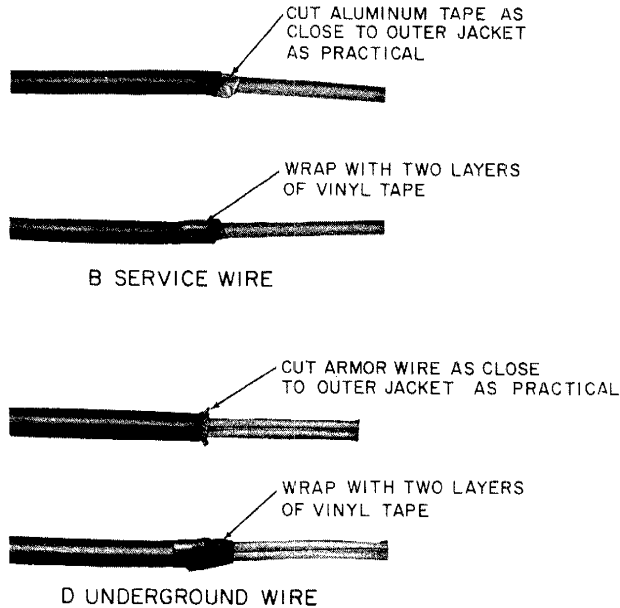


Fig. 2—Buried Plant Run up a Pole

*Inside a Cable Terminal*

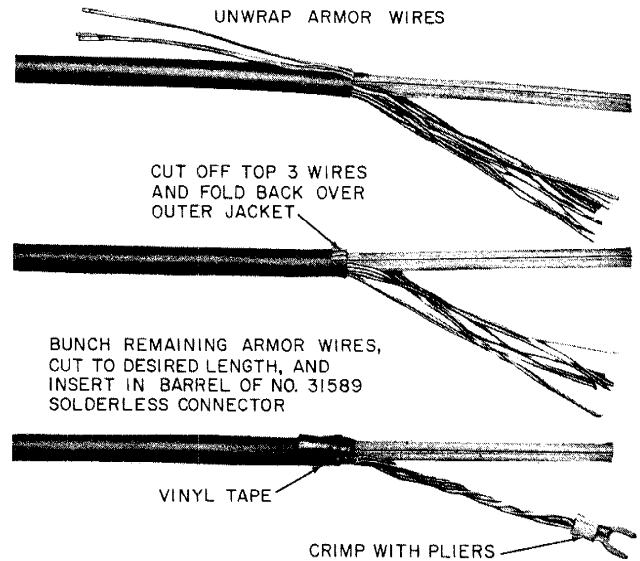
**2.04** Where the buried wire is 500 feet or less in length, grounding of the armor wire or aluminum tape at the cable terminal is omitted. Cut off the armor wire or aluminum tape and wrap with two turns of vinyl tape to protect against sharp edges (Fig. 3).



**Fig. 3—Removal of Aluminum Tape or Armor Wire**

**2.05** Where the buried wire is over 500 feet in length and the armor wire of the D Underground Wire is to be grounded to the cable terminal, terminate the armor wire in a solderless connector as shown in Fig. 4.

**2.06** Inside a cable terminal, the conductors of D Underground Wire or B Service Wire should be terminated on the binding post in the usual manner. The cable stub of the pole- or wall-mounted terminal provides the fusible link. In the case of a 49-type cable terminal, the 24-gauge conductors of the connecting block serve as the fusible links between the cable conductors and the buried plant conductors.

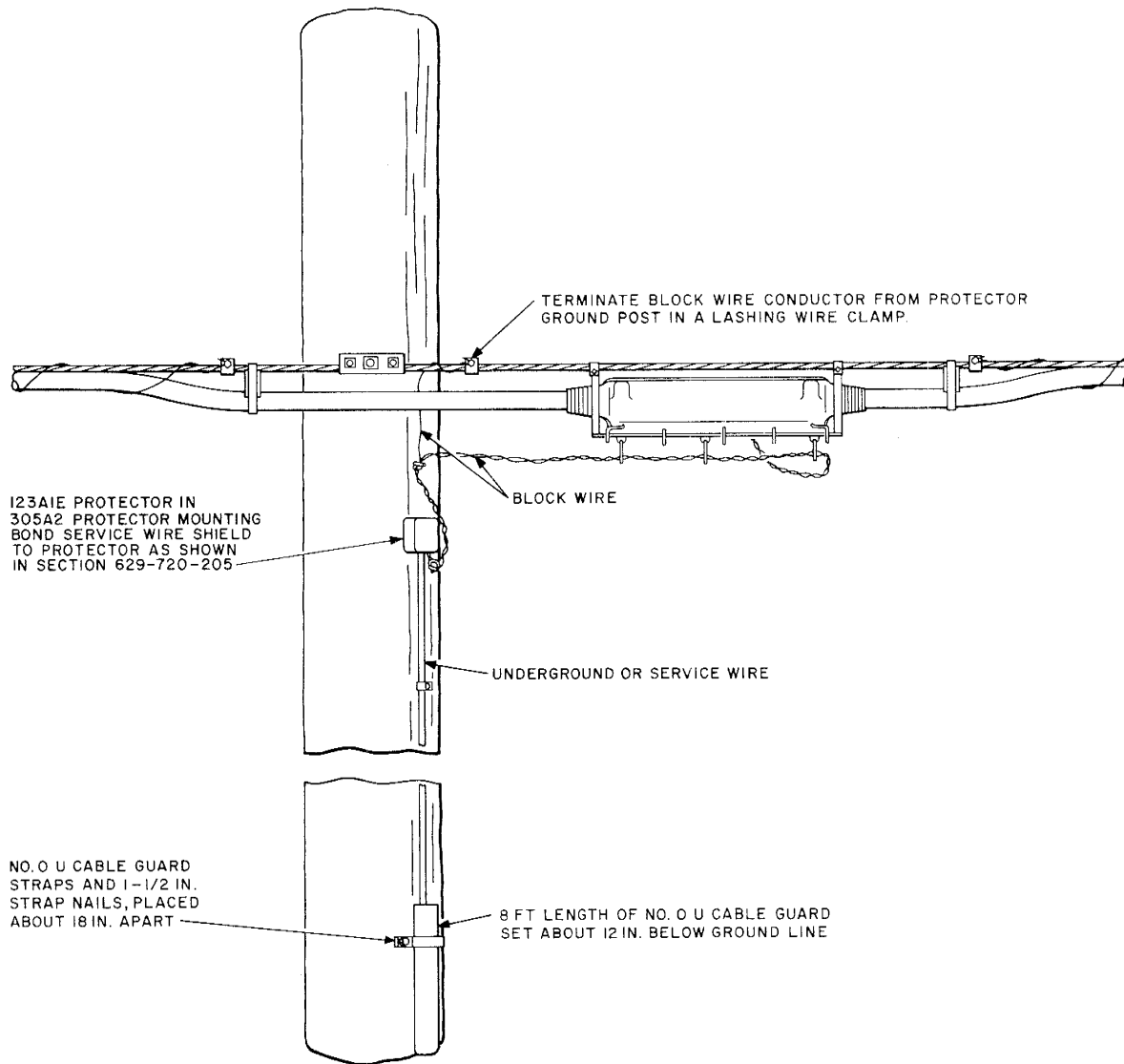


**Fig. 4—Armor Wire of D Underground Wire Terminated in No. 31589 Solderless Connector**

**2.07** Where the length of the buried wire is over 500 feet, grounding of the armor wire to the terminal housing with a solderless connector is required. In a 49-type cable terminal fasten the solderless connector under a convenient nut or screw in the base assembly.

*Special Lightning Protection*

**2.08** In heavy lightning areas where the subscriber's station is severely exposed to lightning, it may be desirable to furnish additional lightning protection to buried service wires which are 500 feet or less in length. Under these conditions detailed plans or other special instructions will authorize bonding the armor wire or aluminum tape at the aerial cable terminal. Such installations require the use of a 123- or 128-type protector (equipped with 2B1E Protector Units) and connection of the armor wire or aluminum tape to the ground post of the protector. A connection is also required between the protector ground post and the cable strand. For the latter purpose, block wire is required as a fusible link to prevent the common wire or aluminum tape from overheating. A typical installation is shown in Fig. 5.



**Fig. 5—Termination for Special Lightning Protection**

### 3. JUNCTION WITH MULTIPLE WIRE

**3.01** Where multiple wire is exposed to power contact and a fuseless protector is used at the station, B Service Wire should not be used with or fed from multiple wire, because of the relatively small size and low fusing level of the conductors or B Service Wire. A satisfactory fusible link is not available for use between multiple wire conductors and B Service Wire conductors.

**3.02** D Underground Wire can be used with or fed from multiple wire where the multiple wire is exposed to power contact and fuseless station protection is used. D Underground Wire should be brought up a pole and terminated in a 101B2 Wire Terminal. At the groundline the wire should be covered with an 8-foot length of No. 0 U Cable Guard. Cut off the armor wire as shown in Fig. 3. Connect the conductors of D Underground Wire to the conductors of the multiple wire with

block wire. Fig. 6 shows a typical example of D Underground Wire being connected to a 105-type wire terminal.

3.03 The block wire serving as a fusible link between the D Underground Wire conductors and the multiple wire conductors can be terminated

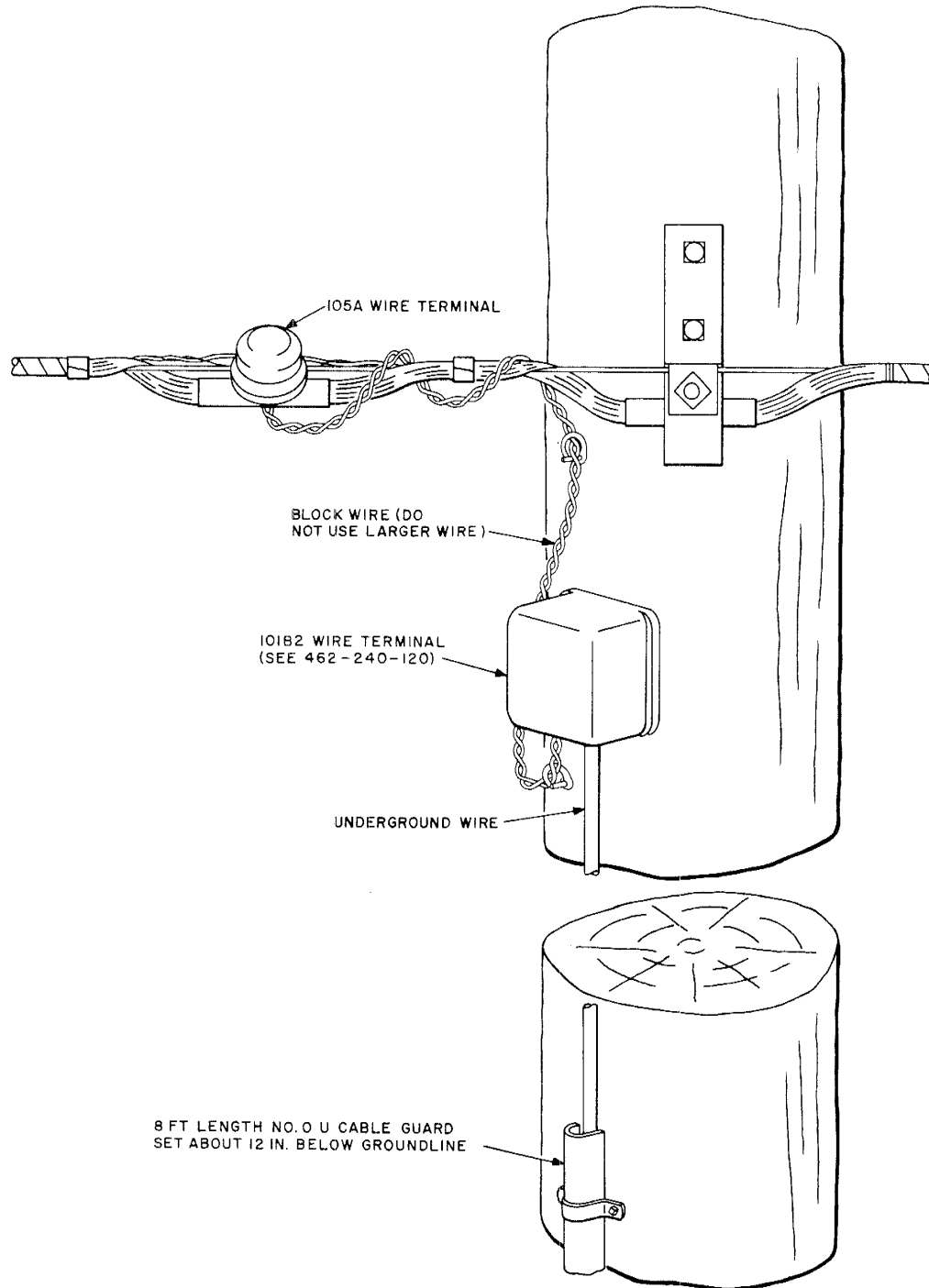


Fig. 6—Underground Wire Terminated to Multiple Wire



in a 105A Wire Terminal, a 104-type wire terminal, a 116-type protector, a 108-type wire terminal, or in similar wire terminals used with multiple wire.

#### 4. JUNCTION WITH C RURAL WIRE

**4.01** Do not connect B Service Wire to C Rural Wire because of the small size of the conductors of the service wire.

**4.02** At the junction with C Rural Wire, D Underground Wire can be brought up a pole and terminated in a 101B2 Wire Terminal. At the groundline the D Underground Wire should be covered with an 8-foot length of No. 0 U Cable Guard. The armor wire should be cut off as shown in Fig. 3. Block wire should be used to bridle between the 101B2 Wire Terminal and the 107-type wire terminal on the C Rural Wire. A typical installation is shown in Fig. 7.

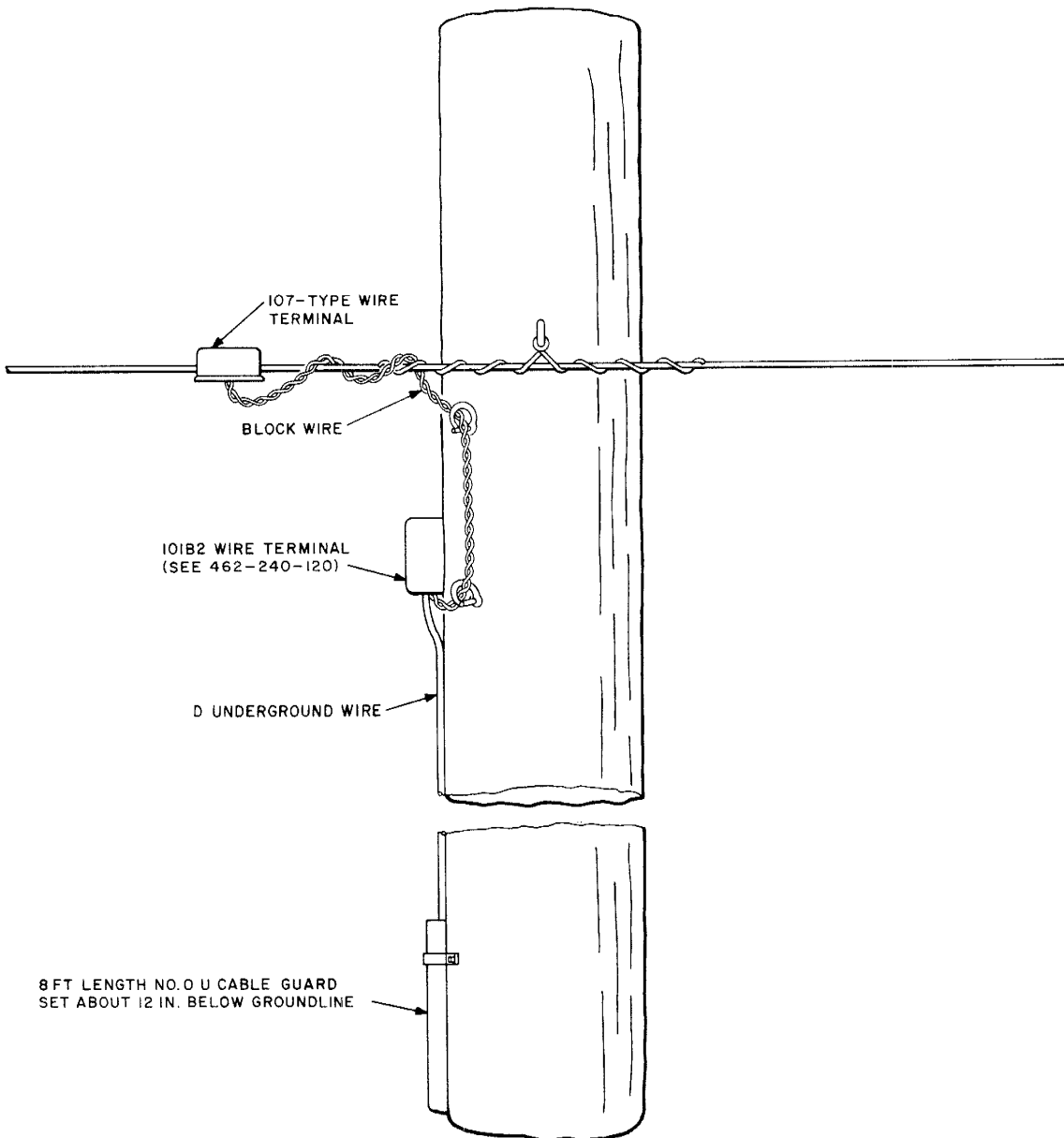


Fig. 7—Termination of Underground Wire and Rural Wire

5. JUNCTION WITH OPEN WIRE

5.01 B Service Wire should not be used with or fed from open wire because of the relatively small size and low fusing level of the conductors of the service wire.

5.02 At the junction with open wire, D Underground Wire can be brought up a pole and terminated in a 101B2 Wire Terminal. At the groundline the wire should be covered with an 8-foot length of No. 0 U Cable Guard. The armor wire should be cut off as shown in Fig. 3. Block wire must be used between the protector and the open wire. A typical installation is shown in Fig. 8.

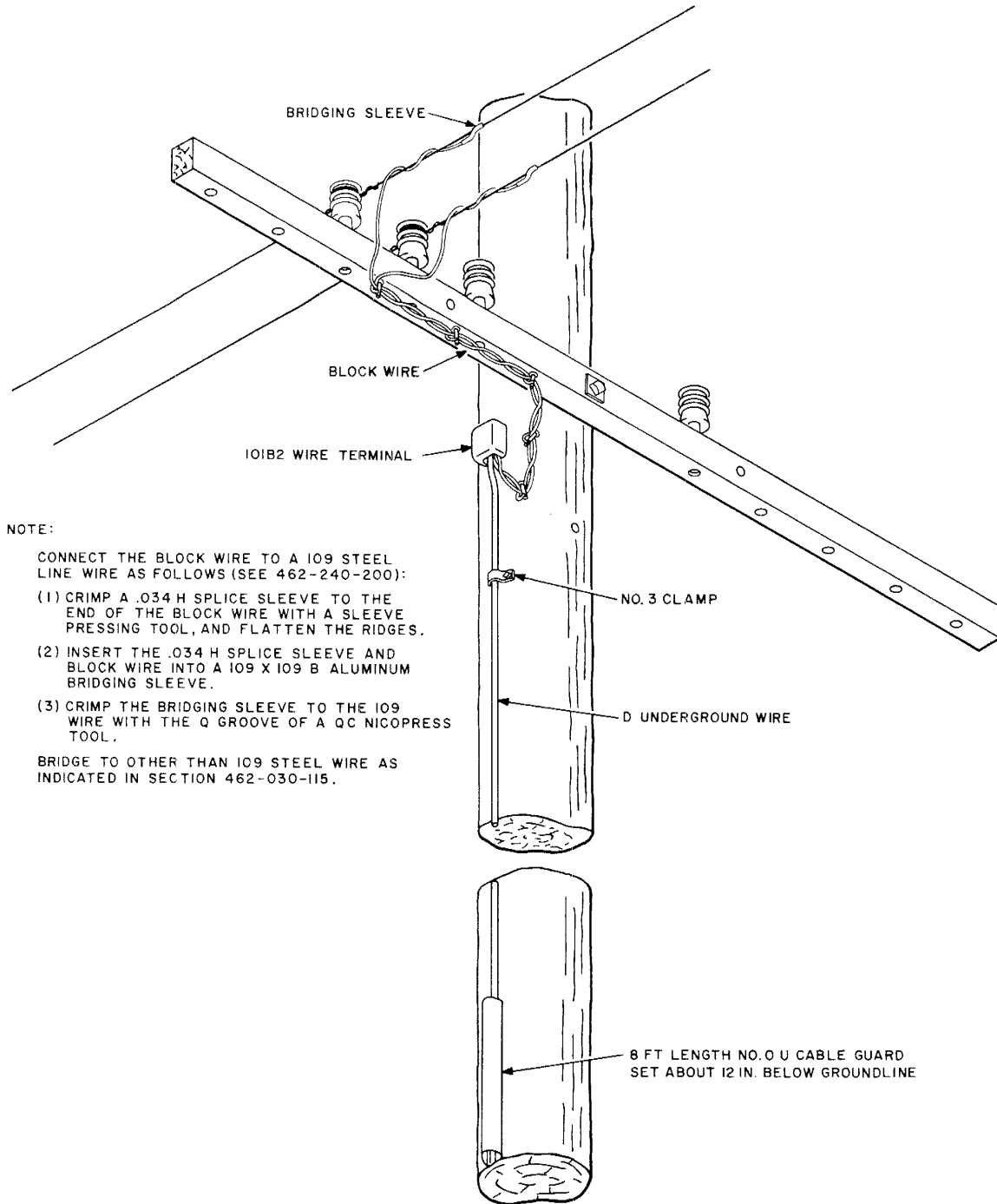


Fig. 8—Termination of Underground Wire and Open Wire

**BURIED PLANT**  
**TERMINATIONS OF BURIED WIRE**  
**AT JUNCTIONS WITH BURIED PLANT**

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**1. GENERAL**

**1.01** This section describes methods used for terminating service wire and underground wire at junctions with other types of buried plant and at subscriber locations.

**1.02** This section is reissued to delete detailed information on the B Wire Connector which is covered in other practices, and to include information on the F Connector presently being furnished which was formerly known as the Thomas and Betts Company Lug-It No. 264-30489-38. The F Connector is used to ground the aluminum shield of B Service Wire. This section also includes use of the 128A1A Protector and termination of service wire in an E Cable Closure.

**1.03** Section 629-720-200 covers the termination of buried wire at the junction with aerial plant.

**1.04** The armor wire of D Underground Wire or the aluminum tape of B Service Wire must *always* be grounded at the subscriber's protector when the protector is fed from buried plant. The grounding is needed at subscriber locations to protect against lightning damage and to minimize shock or fire hazards caused by sustained power contact. The aluminum tape of

B Service Wire or the armor wire of D Underground Wire should always be bonded to the terminal housing at the junction with buried cable.

**1.05** At the older buried wire installations where a shield wire was used, the shield wire can be terminated in the same manner as recommended for aluminum tape or armor wire.

**1.06** Those stations which use fuseless protectors, and which are served from buried distribution cable of 19- or 22-gauge, that is exposed to possible contact with power of over 300 volts, such as in random separation construction, require a fusible link in the circuit between the exposed cable and the station. This fusible link can be provided at junctions of buried cable and buried service wire by terminating the buried service wire on 3A3-6 (P-18A782) terminal block installed in a buried cable pedestal. The 24-gauge wire leads which are connected to the cable pair provide the fusible link. The 3A3-6 terminal blocks can be used only in B and E Cable Closures.

**1.07** The B Wire Connector should be used to join B Service Wire to PIC cable, as covered in Section 632-205-201.

**1.08** The 19-gauge conductors of D Underground Wire can be joined to PIC cable as covered in Section 632-205-201 if the conductors are split apart for about 2 inches.

**1.09** Buried wires can be identified at terminations by means of tags made from B Glass Tape. Cut about 5 inches of glass tape and wrap it around the wire, pressing the sticky side against itself to make the tag. It can be readily marked with pencil or pen to show the subscriber or to identify the route of the buried wire, as shown in Fig. 1.

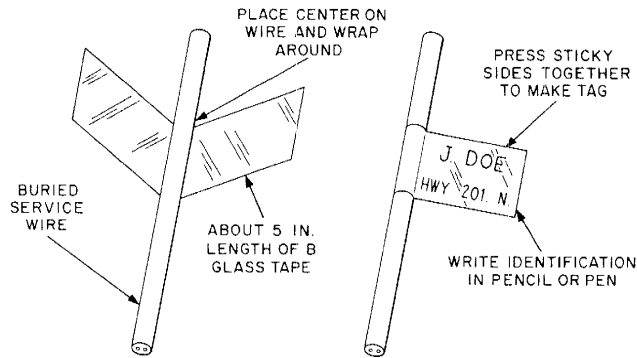


Fig. 1—Identifying Tags

## 2. DISPOSITION OF UNTERMINATED PAIRS

**2.01** Buried wire not in use may include new installations when some time may elapse before the buried wire is placed in service or where existing service is being disconnected. To avoid differences in potential between conductors and armor wire or aluminum tape, buried wire which is not in use should be protected as follows:

(a) **New installations** where the wire is not being terminated on a station protector at time of placing.

- (1) At station end, twist the bare conductors and armor wires together and wrap with vinyl tape.
- (2) At end toward central office, bridge armor wires and conductors to a common ground post, or if not available, follow instructions in (1).

(b) **Service disconnections** where the wire has been terminated and existing service is being disconnected.

- (1) At station end, leave all terminations as they are, but where the station protector is being removed, twist the armor wires and bare conductors together and wrap with vinyl tape.
- (2) At end toward central office, when the wire terminates on a protector, leave the terminations as they are. Under "Dedicated Plant" conditions, leave the terminations as

they are. Under all other conditions follow the instructions in (a)(2).

## 3. JUNCTIONS WITH BURIED CABLE

**3.01** The armor wire of D Underground Wire, the aluminum tape of B Service Wire, or the separate shield wire occasionally used with buried wire should be terminated on a common ground as outlined in the paragraphs which follow.

### B Cable Closure

**3.02** The termination of B Service Wire in a B Cable Closure is described in Section 631-600-201.

**3.03** To terminate D Underground Wire, pull slack from the wire and mark the outer jacket about 6 inches above the baseplate. Prepare the end as shown in Fig. 2.

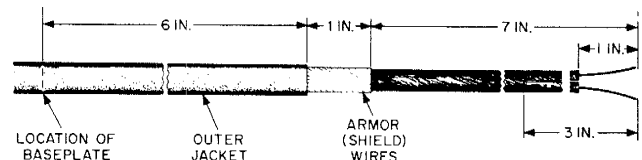


Fig. 2—Preparation of D Underground Wire for B Cable Closure

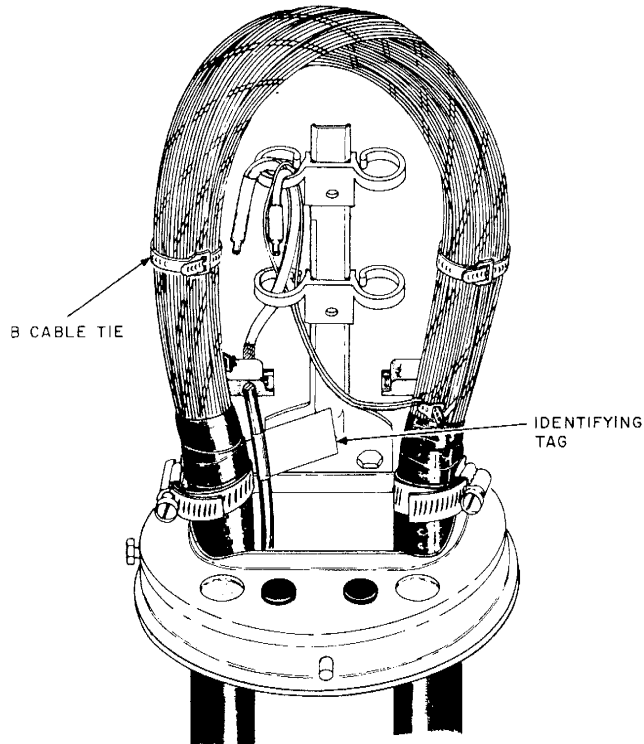
**3.04** Insert the armor wire in the ground connector of the closure and tighten securely. Do not crush the conductor insulation by too great a pressure.

**3.05** Push any slack in the underground wire down into the terminal post. Arrange the identifying tags so they are most easily read.

**3.06** Run the D Underground Wire through the plastic clamps and bend down over the top clamps. Run the cable pair through the same route as the D Underground Wire. Bend the cable pair over the top plastic clamp and cut off wires about 1-1/2 inches below the bend.

**3.07** Skin the insulation from the D Underground Wire and connect the cable pair to the wire by using B Wire Connectors as covered in Section 632-205-201. Where these 19-gauge conductors are

to be joined to 26-gauge cable conductors, place a short length (about 8 inches) of 24-gauge PIC wire between the 19- and 26-gauge conductors, thus allowing the use of the B Wire Connector. A completed installation is shown in Fig. 3.



NOTE:  
WHEN BURIED WIRE IS EXPOSED AND A FUSELESS PROTECTOR IS USED AT THE SUBSCRIBERS STATION AND IF CABLE IS 19-OR 22-GAUGE, PLACE A 3A3-6 TERMINAL BLOCK AND TERMINATE THE BURIED SERVICE WIRE.

Fig. 3—D Underground Wire in B Cable Closure

**3.08** Where the binding posts on a connecting block installed for loading are not all used for loading, they should be used for any terminations required. Insert the armor wire into the ground connector and terminate the conductors of the D Underground Wire on the binding posts of the blocks in the usual manner. The installation should be similar to that shown in Section 631-600-201.

**D Cable Closure**

**3.09** The termination of B Service Wire in a D Cable Closure is described in Section 631-600-203.

**3.10** To join D Underground Wire directly to a cable conductor in a D Cable Closure, prepare the wire as shown in Fig. 4.

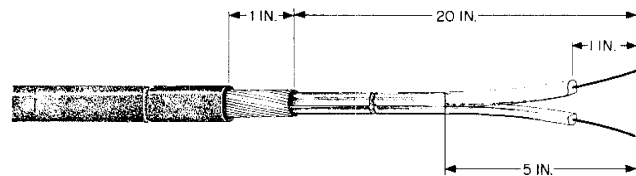


Fig. 4—Preparation of D Underground Wire for D Cable Closure

**3.11** Insert the armor wire of the D Underground Wire in the ground connector and tighten securely. Run the underground wire and the cable pair to be connected through the plastic eyebolt and bend down over it.

3.12 Skin the insulation from the D Underground Wire and connect to the cable pair by using B Wire Connectors as covered in Section 632-205-201. Where these 19-gauge conductors are to be joined to 26-gauge cable conductors, place a short length (about 8 inches) of 24-gauge PIC wire between the 19- and 26-gauge connectors, thus allowing the use of the B Wire Connector. After the splice is made, the end of the connector and the wire should be wrapped with a short piece of vinyl tape to insulate the bare conductor. A completed installation is shown in Fig. 5.

3.13 The termination of B Service Wire in an E Cable Closure is covered in Section 631-600-205. Fig. 6 illustrates the service wire terminated in the E Cable Closure.

3.14 Terminate D Underground Wire in the E Cable Closure as covered in 3.11 and 3.12.

3.15 The 38-Y-D and 38-Y-DB Cable Closures have been replaced by the E Cable Closure.

4. JUNCTIONS WITH BURIED WIRE

4.01 At junctions of buried wire with buried wire, place a D or E Buried Wire Terminal as described in Section 629-720-215. Bridge the branch buried wires in the terminal as required. Each wire can be identified with a suitable designation by placing a tag made from glass tape as covered in 1.09. The armor wire or aluminum tape of buried wire should be connected to the ground post of each terminal.

5. TERMINATIONS AT SUBSCRIBER LOCATIONS

5.01 An F Connector is used to bond the aluminum tape of B Service Wire to a 123A1A or 128A1A protector. (Do not attempt to bond aluminum tape otherwise.) The F Connector has a tongue which can be placed under the washer of the protector ground post without removing the nut.

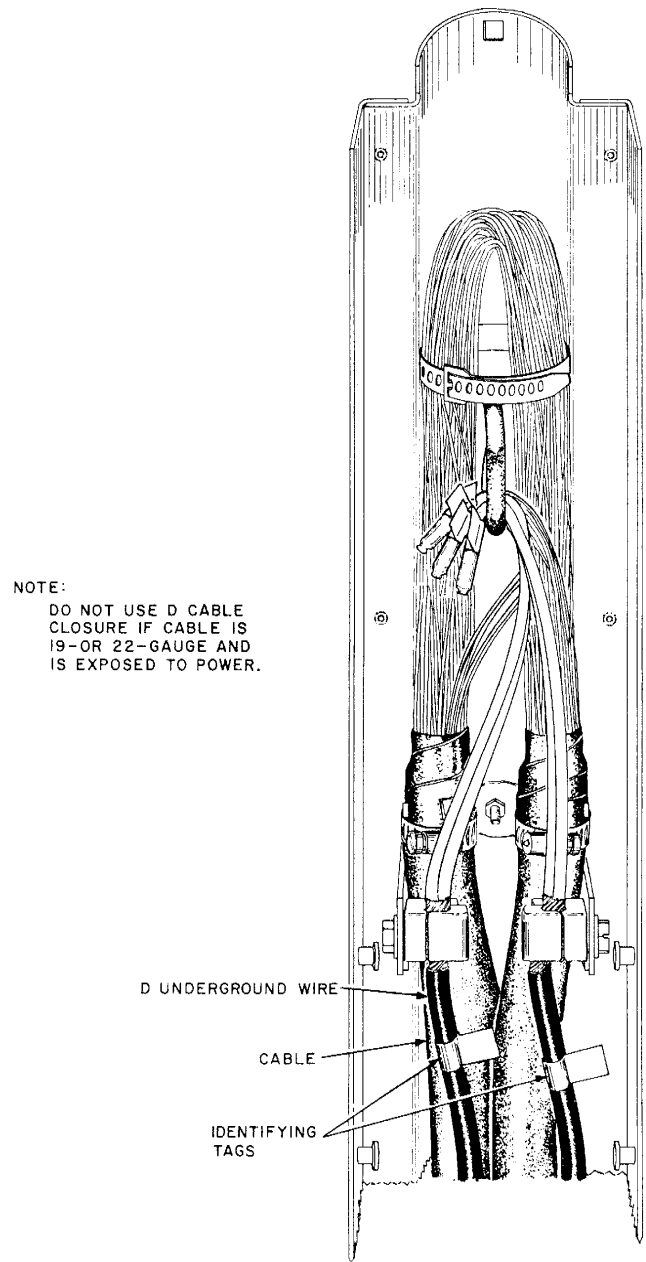
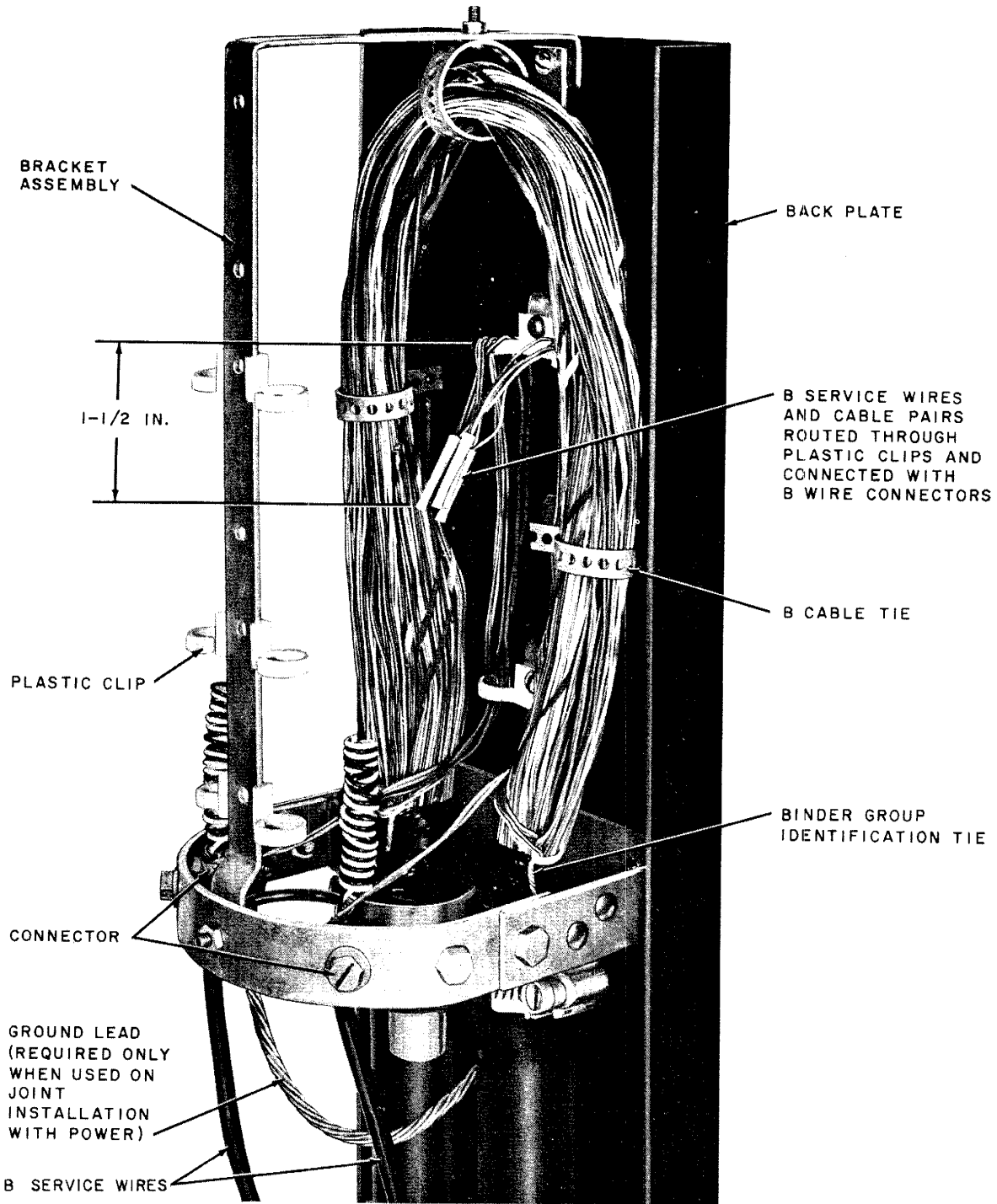


Fig. 5—D Underground Wire in D Cable Closure



**NOTE:**

IF CABLE IS 22-OR 19-GAUGE AND EXPOSED TO POWER, AND BURIED SERVICE WIRE IS TERMINATED ON A FUSELESS STATION PROTECTOR, PLACE A 3A3-6 TERMINAL BLOCK AND TERMINATE THE SERVICE WIRE ON IT.

**Fig. 6—B Service Wire Terminated in E Cable Closure**

5.02 Mount the 123- or 128-type protector on the wall and mark the location of the F Connector on the service wire. Cut off the wire about 5 inches beyond this point. Remove the outer jacket.

5.03 Remove the aluminum as shown in Fig. 7.

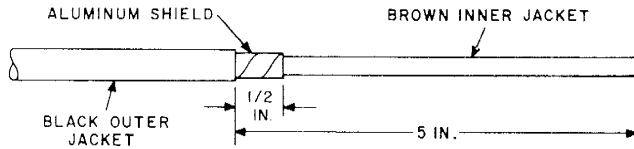


Fig. 7—Strip Outer Jacket and Aluminum Tape

5.04 Remove the inner jacket up to the aluminum tape. Position the F Connector on the wire

as shown in Fig. 8, and tighten firmly with a C, D, or 4-inch E screwdriver.

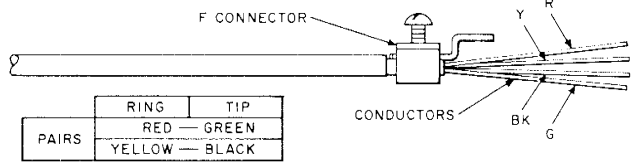
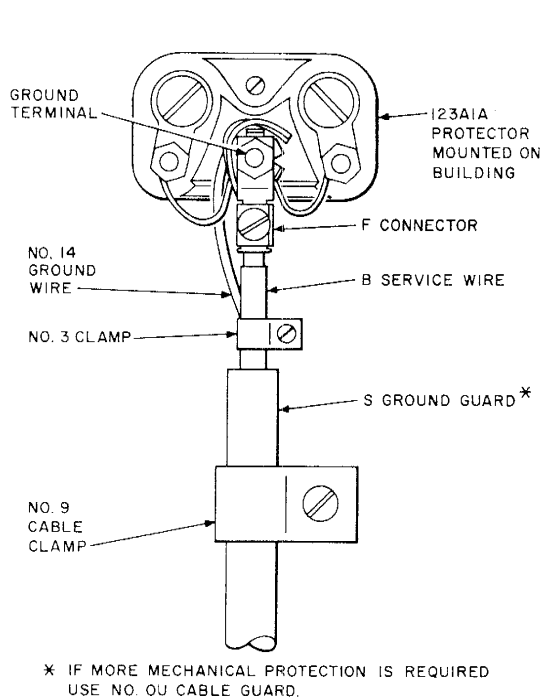


Fig. 8—F Connector on Service Wire

5.05 Terminate service wire on a protector as illustrated in Fig. 9. Place the tongue of the F Connector under the prong washer. Place the ground wire between the prong washer and brass washer. Tighten the nut securely.



\* IF MORE MECHANICAL PROTECTION IS REQUIRED USE NO. 0U CABLE GUARD.

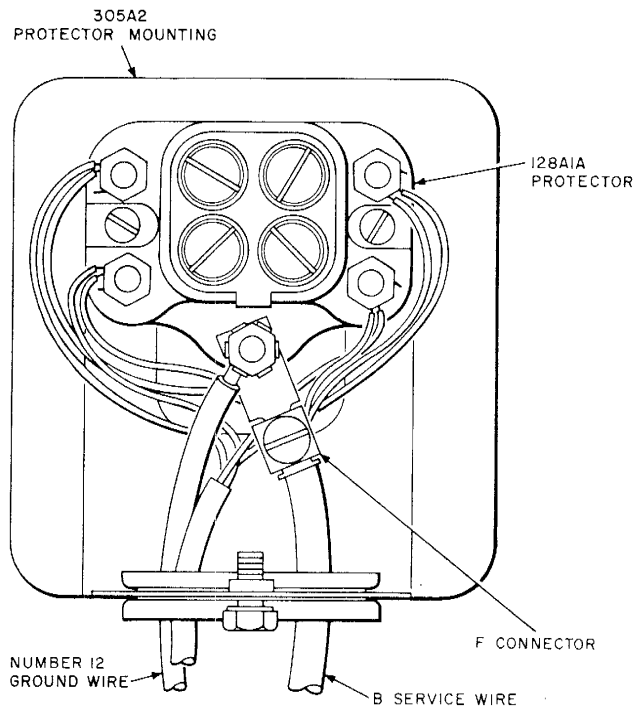


Fig. 9—Service Wire on Protector



5.06 Cover the protector with a 150A Cover as illustrated in Fig. 10.

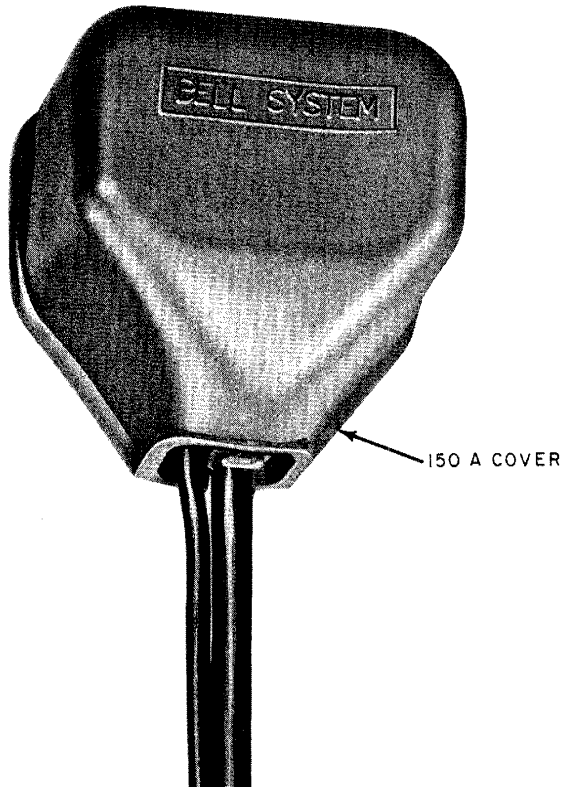
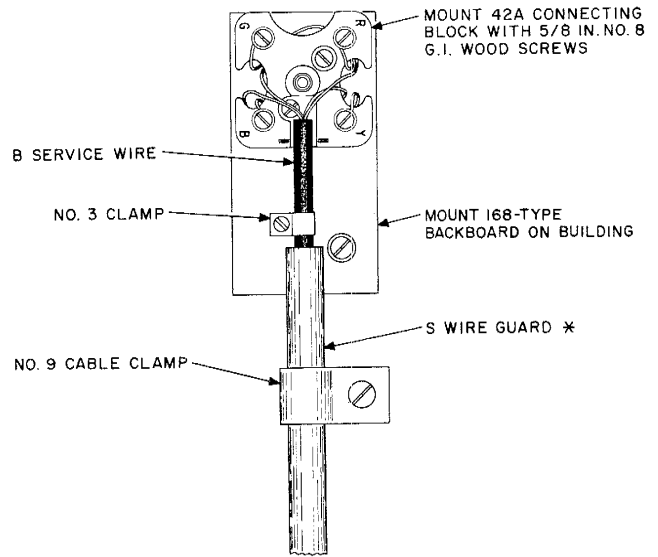


Fig. 10—Protector With Cover in Place

5.07 Where a protector is not required, a service wire can be terminated on a 42A Connecting Block on a 168-type backboard as shown in Fig. 11.

5.08 D Underground Wire can be terminated in a protector by preparing the end as shown in Fig. 12. The solderless connector can be placed on the ground post in a manner similar to placing the F Connector (on service wire) on the ground post as described in 5.05.



\* IF MORE PROTECTION IS REQUIRED, USE A NO. 0 U CABLE GUARD.

Fig. 11—Service Wire on 42A Connecting Block

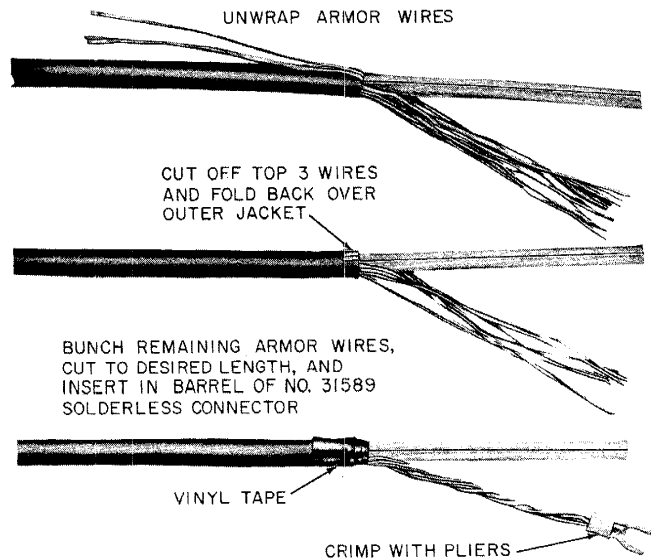


Fig. 12—Preparation of D Underground Wire for Protected Terminal



## BURIED WIRE

### D AND E BURIED WIRE TERMINALS

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#### 1. GENERAL

1.01 The D and E Buried Wire Terminals are used to terminate, splice and load buried wire. This section includes a description of these terminals, and the methods used to install them.

1.02 This section is reissued to cover minor modifications to the D and E Buried Wire Terminal. The covers are fastened by a captive bolt arrangement to eliminate lost bolts or nuts and the decals have been deleted from the closure. These decals must be ordered separately. ↗ ↘

1.03 The D Buried Wire Terminal mounts directly in the ground on its steel post.

The E Buried Wire Terminal has brackets for wall or pole mounting. Both terminals are made from bonderized steel with a dark green baked enamel finish.

1.04 The connecting block which is furnished with both terminals provides air gap lightning protection. The large washers on each binding post are spaced to provide an air gap between themselves and between the heads of the screws mounting the block to the terminal plate. This equalizes any discharge between the conductors and the armor wire or terminal housing at connecting blocks. If the large washers, the binding posts, or the connecting blocks become damaged through a discharge, a new connecting block should be used to replace the entire block containing the damaged part or parts.

#### 2. D BURIED WIRE TERMINAL

2.01 The D Buried Wire Terminal is illustrated in Fig. 1.

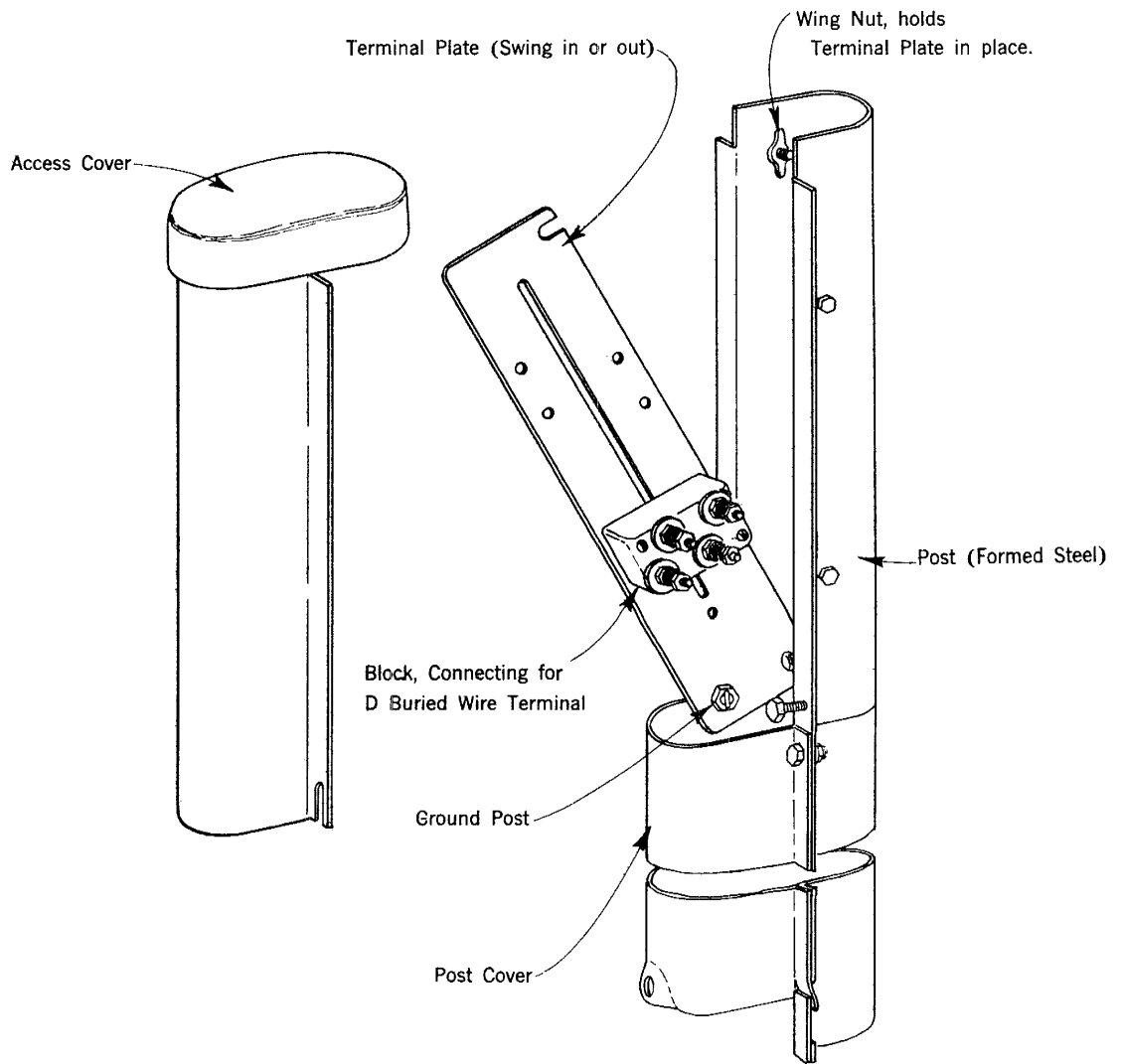


Fig. 1 – D Buried Wire Terminal

2.02 The access cover is removed as shown in Fig. 2.

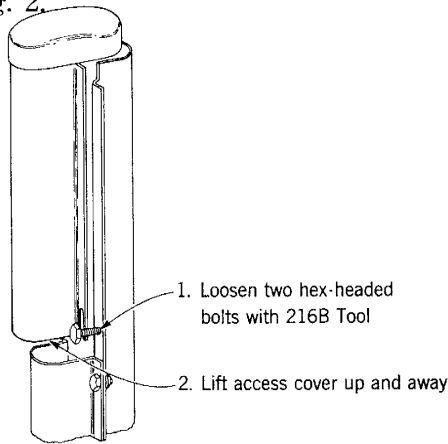


Fig. 2 — Remove Access Cover

2.03 *D or E Warning Decals* are to be placed on the cover of the terminal as a protective warning device. The decal should be positioned to provide maximum warning as to the location of the buried plant. *The D Decal has white letters on a green background* and is for use in areas or locations where a decal that blends into the landscape is desirable. *The E Decal has black letters and yellow background* and is intended primarily for use in areas where higher visibility is required. Fig. 3 illustrates the decal design.



Fig. 3 — Warning Decal

2.04 The terminal plate has one two-pair connecting block mounted on it. There is space for mounting a second block. The second block must be ordered separately as a *Block, Connecting, for (D or E) Buried Wire Terminal*. It is mounted by means of the small bolts furnished with it. There is also space for mounting two 179 Type Coil Cases. They are located on the terminal plate as shown in Fig. 4.

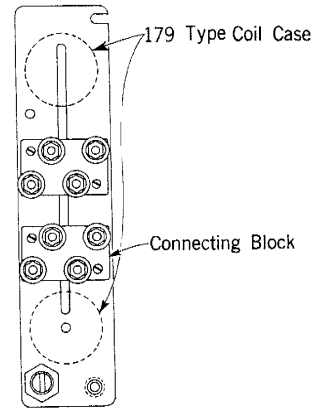


Fig. 4 — Mount Equipment on Terminal Plate

2.05 The post cover can be removed after the access cover has been removed as shown in Fig. 5.

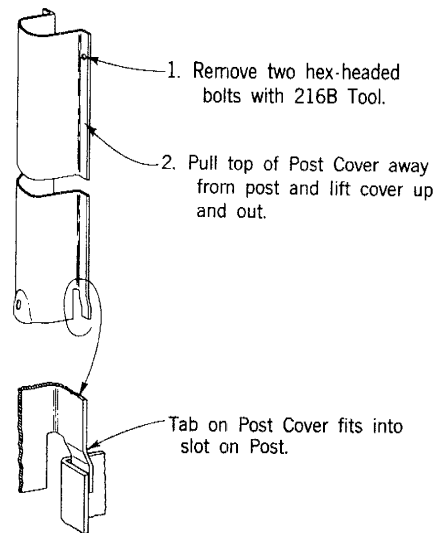


Fig. 5 — Remove Post Cover

2.06 Install the terminal post in the following manner:

- (a) Remove the access cover and post cover from the terminal before placing.
- (b) Where possible, place the terminals in advance of the wire plowing operation. This provides the workman with an exact reference point for measuring the proper amount of slack to be left at each location. Fig. 6 indicates some methods for accomplishing this.

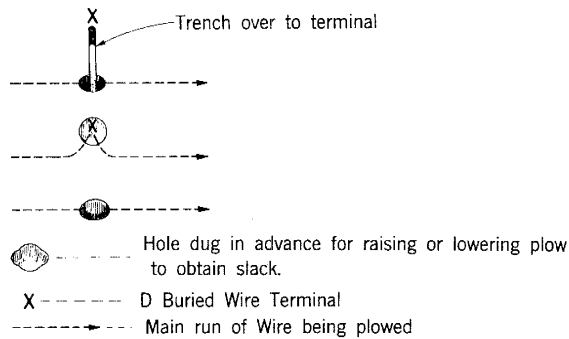


Fig. 6 — Measure Amount of Slack at Terminal

- (c) Drive the terminal post into the ground until approximately 36 inches remains above the estimated finished grade. Use a post driver when available. If a post driver is not used, place a block of wood over the end of the post to protect it from damage by the hammer blows.
- (d) Replace the post cover and the access cover to keep them from being misplaced.
- (e) When the buried wire is plowed in, stop at terminal location. Pull enough slack over to the terminal to permit wiring it. Tie the slack to the terminal post.

2.07 The D Buried Wire Terminal should be wired as shown below.

- (a) Remove the access cover and post cover and place incoming wires in the post. Replace the post cover.
- (b) Pull the slack from the first two D Underground Wires and mark the outer jacket about 6 inches above the ground post. Prepare the ends of the wires as illustrated in Fig. 7.

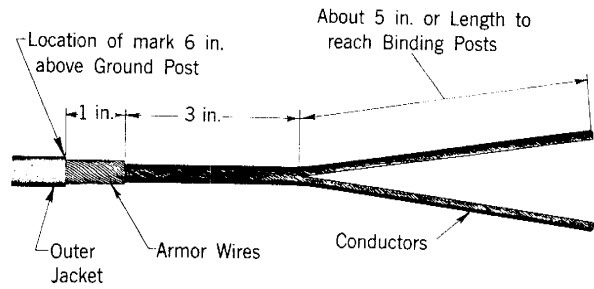


Fig. 7 — Prepare Ends of First Two Wires

- (c) Where there are more than two underground wires, pull the slack from them and mark the outer jacket about 6 inches above the ground post. Prepare the ends of the third and fourth wires as shown in Fig. 8.

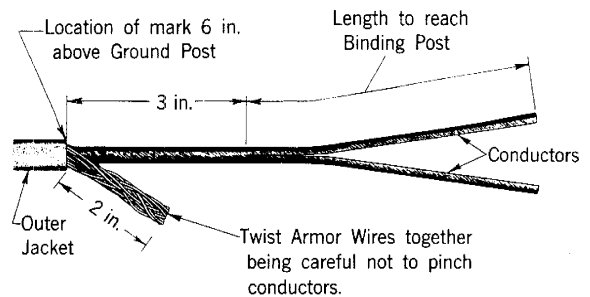


Fig. 8 — Prepare Ends for More than Two Wires

- (d) Connect the conductors to the proper binding posts of the connecting blocks as shown in Figs. 9 and 10.

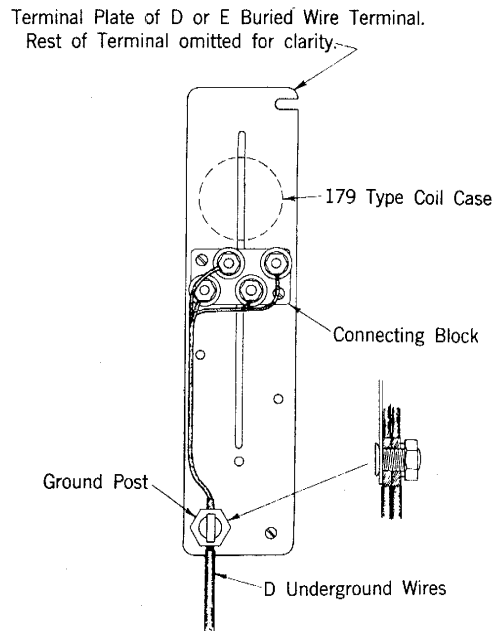


Fig. 9 — Wiring with One Connecting Block

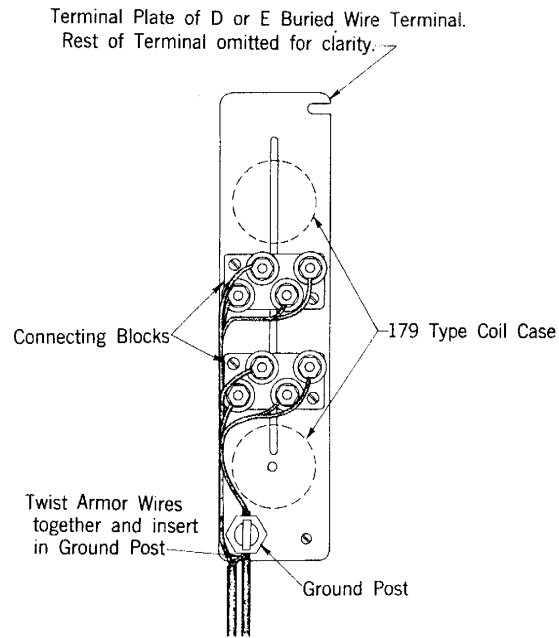


Fig. 10 – Wiring with Two Connecting Blocks

3. E BURIED WIRE TERMINAL

3.01 The E Buried Wire Terminal is illustrated in Fig. 11.

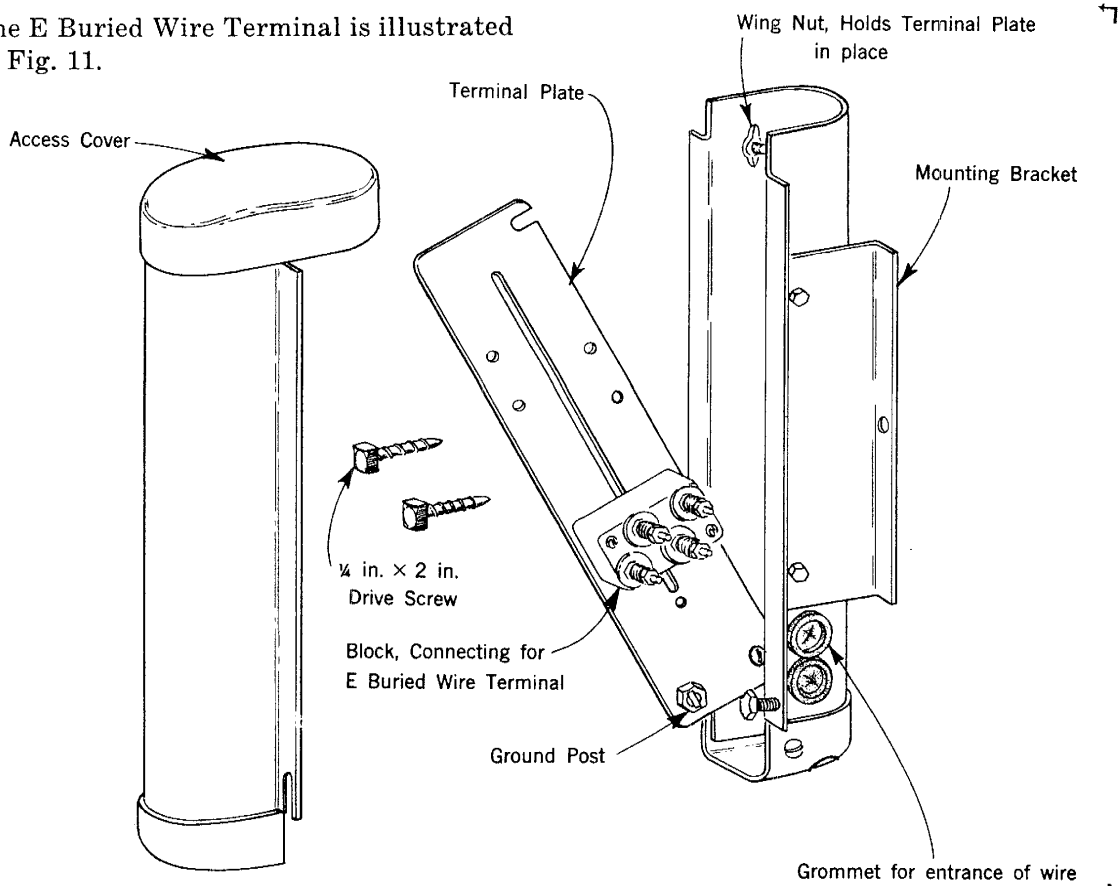


Fig. 11 – E Buried Wire Terminal

**SECTION 629-720-215**

**3.02** The access cover is removed in the same way as shown for the D Buried Wire Terminal in Paragraph 2.02 and Fig. 2.

**3.03** The terminal plate is the same as that in the D Buried Wire Terminal and has the same capacity for mounting connecting blocks or coil cases as in Paragraph 2.04.

**3.04** Where the buried wire running up to an

E Buried Wire Terminal is exposed to mechanical damage, place it in an S Wire Guard held in place with No. 9 Cable Clamps. Where more protection is required, use a No. O—U Cable Guard.

**3.05** The internal wiring within an E Buried Wire Terminal is similar to that for the D Buried Wire Terminal shown in Paragraph 2.07 (b) through (d).



**BURIED WIRE**  
**SPLICING ONE-PAIR**  
**B UNDERGROUND WIRE**

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**1. GENERAL**

1.01 This section describes the methods and materials used in splicing one-pair B Underground Wire. It includes the restoration of the armor at splices which, to be fully effective as lightning protection, must be made electrically continuous across splices.

1.02 This section replaces G36.141.1 which covered armoring splices in the superseded UG Distribution Wire. Splicing other types and sizes of buried wire is covered in sections relating to the particular wire.

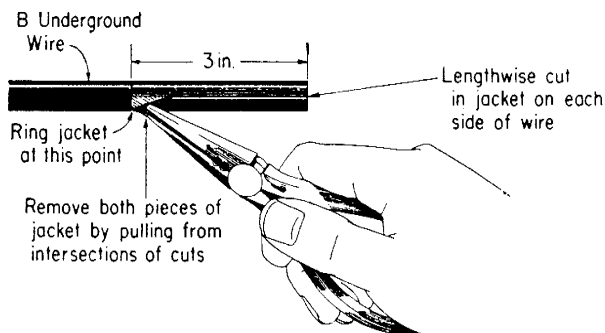
1.03 In wet weather, splicing should be done under a shelter, such as a splicer's tent, to keep the surfaces of the wires dry, as satisfactory splices cannot be made otherwise.

1.04 Splicing should follow as soon as practicable after placing, but not before the wire has been tested and reported free of faults. The splice locations will be found marked by stakes placed upright to one side of the wire and indicating the distance in feet to the splice. On completion of the splice, the excavation made in uncovering the wire should be cleaned out and the splice buried at the depth of the original plowing.

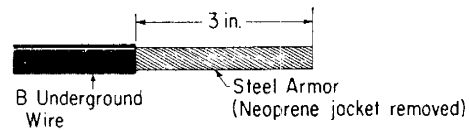
**2. PREPARING WIRE ENDS**

2.01 In preparation for splicing the conductors, remove the neoprene jacket as follows:

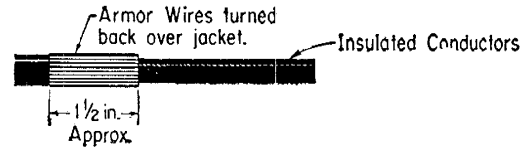
- (1) Measure 3 inches from the end of one wire and at that point ring the jacket with diagonal pliers. The jacket should be cut through to the armor, but care should be taken not to nick or cut the armor itself.
- (2) Using the large groove of the braid stripper, make two lengthwise cuts from the ring to the end of the wire, one on each side.



(3) Remove both pieces of jacket, as shown.



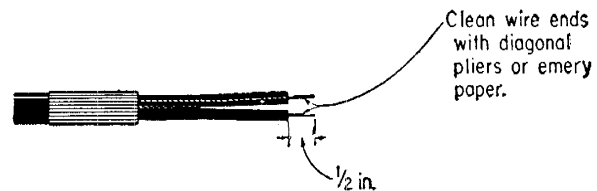
2.02 Free the armor wires from the insulation. With diagonal pliers or scissors cut all armor wires to leave ends about 1-1/2 inches long. Turn these ends back over the jacket.



2.03 Using diagonal pliers split the insulation between the conductors to separate them, as shown.



2.04 Remove the insulation from the ends of both wires to expose 1/2 inch of conductor. Be careful not to nick the conductors. The insulation can be removed more readily if the bond between the rubber and the conductor is broken by crushing the insulation in the crotch of the pliers handles.

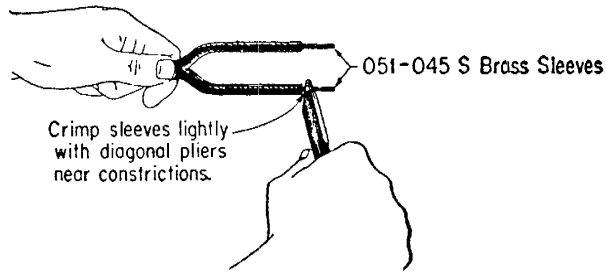


2.05 Repeat the above operations with the end of the other wire to be spliced.

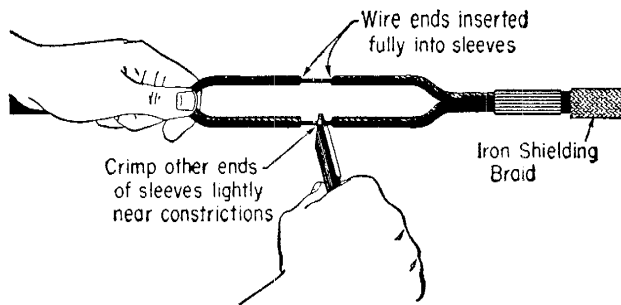
2.06 Before joining the conductors shape a 10-inch length of Iron Shielding Braid into a tube and slip it over one of the wires.

**3. SPLICING CONDUCTORS**

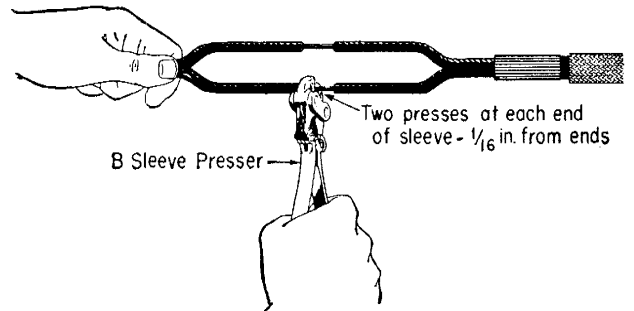
3.01 Place 051-045 S Brass Sleeves on the bared ends of each conductor of one wire. Make certain that each sleeve is pushed fully onto its conductor, then crimp the sleeve lightly to hold it in place.



3.02 Insert the conductors of the other wire end in the sleeves and join the two ends temporarily, as shown.

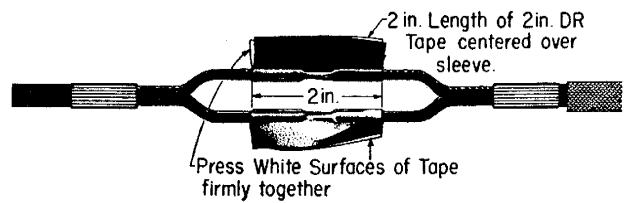


3.03 Complete the wire joints by pressing the sleeves in the larger groove of the B Sleeve Presser. Using a wire carding brush, scour the insulation between the jacket ends to remove dirt and roughen the rubber.

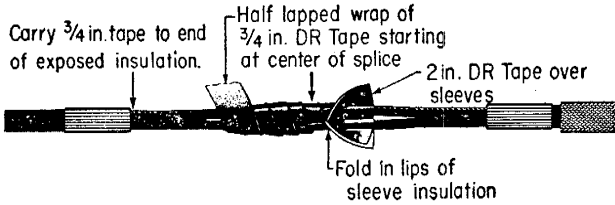


**4. INSULATING CONDUCTORS**

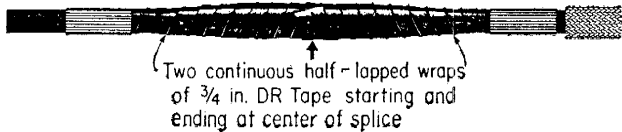
4.01 Over each pressed sleeve fold a 2-inch length of 2-inch DR Tape as shown.



4.02 Fold in the surplus tape to reduce bulkiness and start a half-lapped wrapping of 3/4-inch DR Tape at the midpoint of the splice to include both conductors.



4.03 Continue the wrapping of 3/4-inch tape to cover the exposed insulation at one end of the splice. Reverse the wrapping direction and wrap to the other end of the splice. Complete the wrapping as shown.

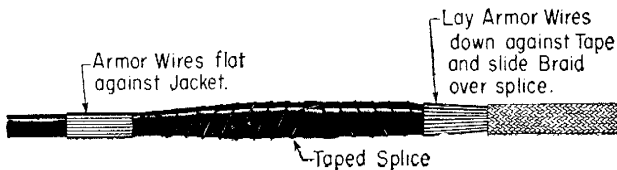


**5. RESTORING ARMOR**

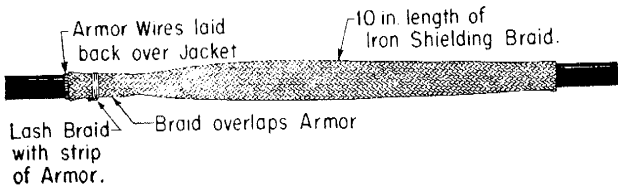
5.01 The covering placed over the insulated splice is intended to serve a double purpose; (1) the braid makes the armor electrically continuous over the splice, and (2) the completed covering provides mechanical protection against cuts and punctures comparable with that of the wire itself.

5.02 Apply the splice covering as follows:

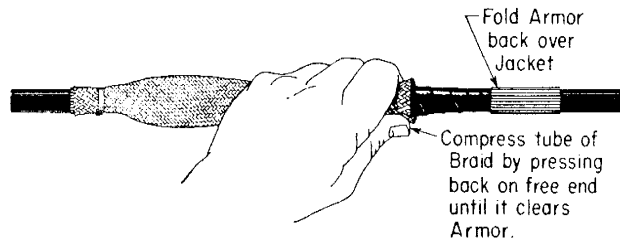
(1) Straighten out the armor wires at the end over which the braid was placed and lay them over the taped splice.



(2) Slip the braid over the splice so that the braid overlaps the armor at the other end of the splice. Lash the braid to the armor with a strip of armor wire to hold it in place and improve the electrical contact.



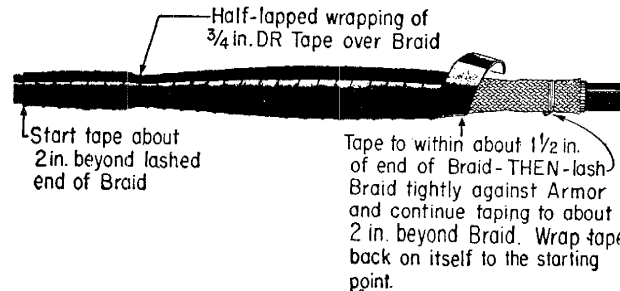
(3) Shorten the tube of braid by pressing against the free end until it clears the ends of the armor lying against the tape. Lay these ends back over the jacket.



(4) Release the braid and pull it down snugly over the length of the splice until it overlaps the turned back armor ends.



5.03 Using the carding brush, lightly scour the jacket for about 2 inches beyond the armor at each end of the splice. Then, starting about 2 inches beyond the lashed end of the braid, apply two half-lapped wrappings of 3/4-inch DR Tape over the jacket and braid. As the first wrapping progresses, the braid will elongate under the tape. When this wrapping has been carried to about 1-1/2 inches from the free end of the braid, lash the braid as in 5.02 (2). Complete the tape wrapping, as shown.



**6. SPLICING 154A LOADING COIL CASE**

6.01 The 154A Loading Coil Case is furnished with one-pair B Underground Wire leads of a length suitable for splicing to the line wire. The splices required to insert a 154A Case in a one-pair B Underground Wire line are made in the same manner as described in the foregoing. It is not necessary to distinguish between the leads of the case—either lead may be spliced to either end of the line wire.



## BURIED WIRE SPlicing D UNDERGROUND WIRE

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### 1. GENERAL

1.01 This section describes the methods and materials used in splicing D Underground Wire. It includes the restoration of the armor at splices which, to be fully effective as lightning protection, must be made electrically continuous across the splice.

1.02 In wet weather, splicing should be done under a shelter, such as a tent or tarpaulin, to keep the surfaces of the wires dry. Satisfactory splices cannot be made otherwise.

1.03 Splicing should follow as soon as practical after placing, but not before the wire has been tested and reported free of faults. Locations will be found marked by stakes placed upright to one side of the wire and indicating the distance in feet to the wire ends. On completion of the work, the wire should be buried at the depth of the original plowing.

### 2. PREPARING WIRE ENDS

2.01 In preparation for splicing the conductors, remove the PVC jacket as shown in Fig. 1.

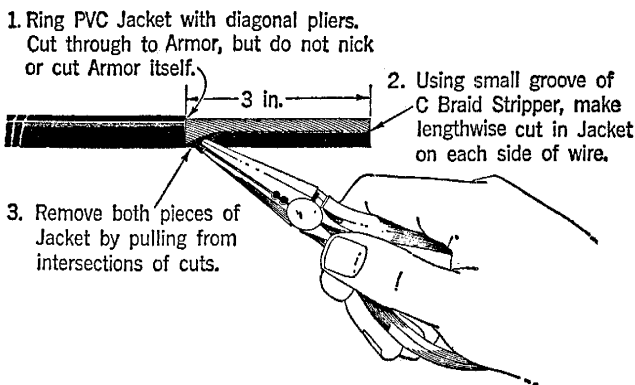


Fig. 1

2.02 Free the armor wires from the insulation as shown in Fig. 2.

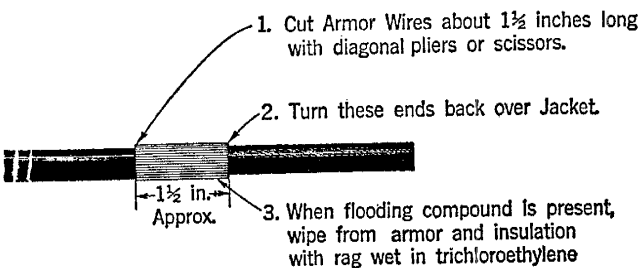


Fig. 2

2.03 Split the insulation between conductors to separate them as shown in Fig. 3.

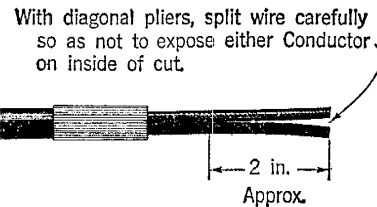


Fig. 3

2.04 Remove the insulation from the ends of both wires as shown in Fig. 4.

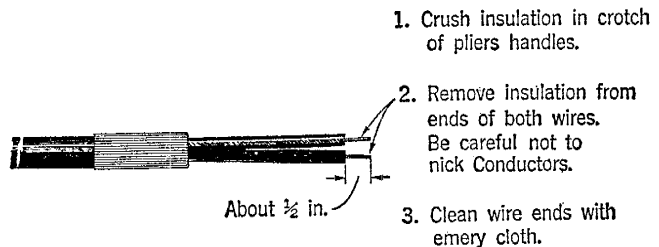


Fig. 4

2.05 Repeat the operations shown in Fig. 1 through Fig. 4 with the end of the other wire to be spliced.

2.06 BEFORE SPLICING THE CONDUCTORS shape a 10-inch length of Iron Shielding Braid into a tube and slip it over one of the wires.

### 3. SPLICING CONDUCTORS

3.01 Place 032-025 S Brass Sleeves on the bared ends of each conductor as shown in Fig. 5.

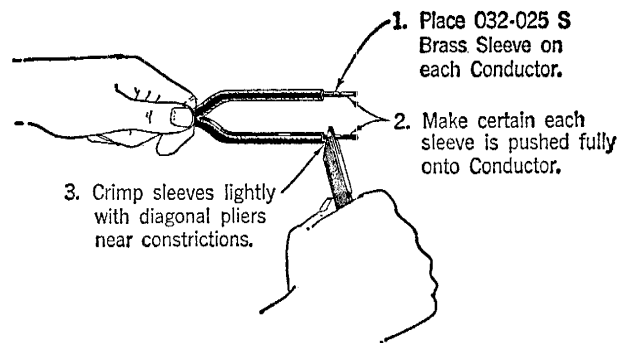


Fig. 5

3.02 Insert the conductors of the other wire end into the sleeves as shown in Fig. 6.

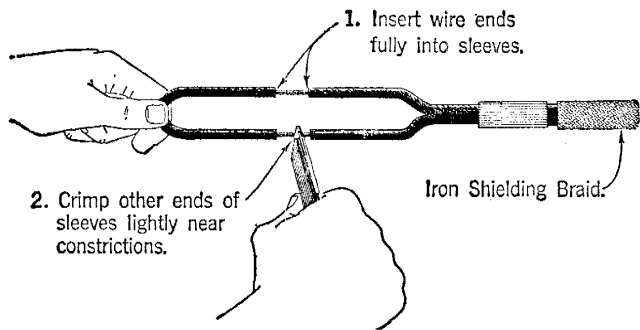


Fig. 6

3.03 Complete the splice by pressing the sleeves as shown in Fig. 7.

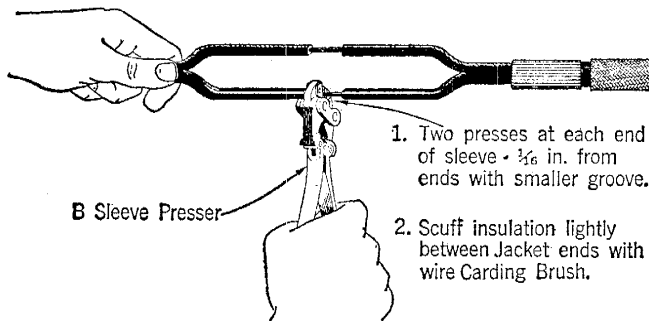


Fig. 7

4. INSULATING CONDUCTORS

4.01 Over each pressed sleeve fold a 1-1/4 inch length of 2-inch DR Tape as shown in Fig. 8.

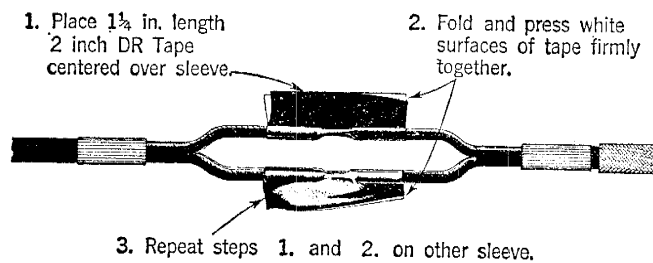


Fig. 8

4.02 Provide a length of D Underground Wire to act as a splint to stiffen the splice as shown in Figs. 9 and 10.

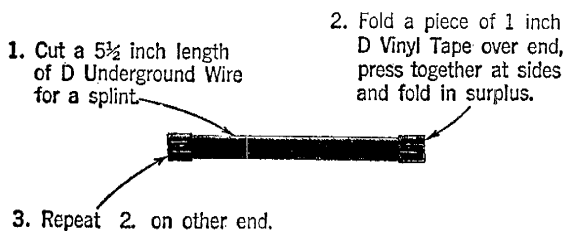


Fig. 9

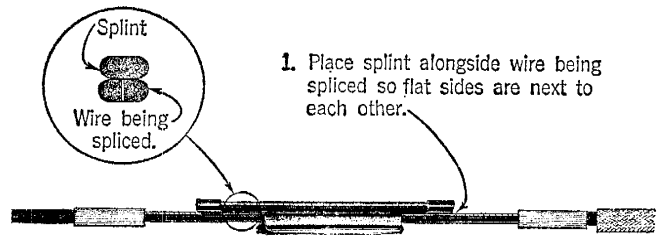
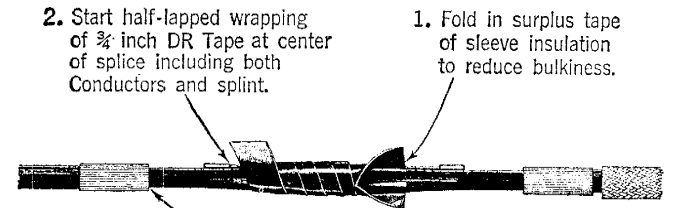


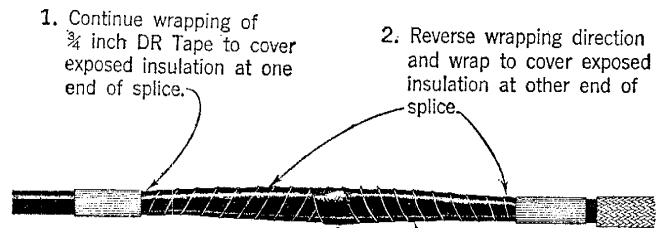
Fig. 10

4.03 Wrap splice in two continuous, half-lapped layers of DR Tape as shown in Figs. 11 and 12.



3. Carry  $\frac{3}{4}$  inch tape to end of exposed insulation.

Fig. 11



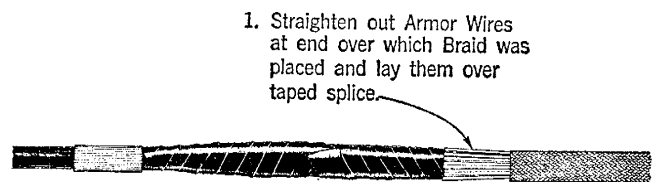
3. Reverse wrapping direction a second time and end at center of splice.

Fig. 12

5. RESTORING ARMOR

5.01 The length of Iron Shielding Braid (see Paragraph 2.06) placed over the insulated splice is intended to serve a double purpose; (1) the braid makes the armor electrically continuous over the splice, and (2) the completed covering provides mechanical protection against cuts, punctures, or insect damage comparable with that of the wire itself.

5.02 Apply the splice covering as shown in Fig. 13 through Fig. 16.



10 in. length of Iron shielding Braid.

Fig. 13

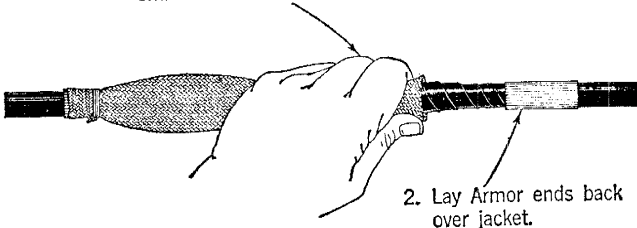
1. Slip Braid over splice so that the Braid overlaps the Armor at the other end of the splice.



2. Lash Braid to Armor with 049 Construction Wire. Fold flat against braid to prevent wire from puncturing tape covering.

Fig. 14

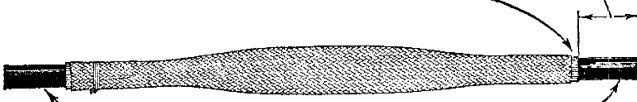
1. Compress tube of Braid by pressing back on free end until it clears Armor.



2. Lay Armor ends back over jacket.

Fig. 15

1. Release Braid and pull it down snugly over the length of splice to overlap the turned back Armor ends.

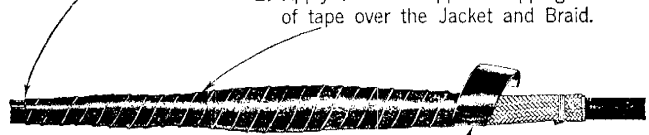


2. With Carding Brush, lightly scuff Jacket for about 2 inches beyond Armor at each end.

Fig. 16

- 5.03 Apply tape covering to completed splice as shown in Fig. 17.

1. Start  $\frac{3}{4}$  inch DR Tape about 2 inches beyond lashed end of Braid.



2. Apply two half-lapped wrappings of tape over the Jacket and Braid.

3. Tape to within about  $1\frac{1}{2}$  in. of end of Braid - THEN - lash Braid tightly against Armor with 049 Construction Wire. Fold flat against braid to prevent wire from puncturing tape covering.

4. Continue taping to about 2 in. beyond Braid.
5. Wrap tape back on itself to the starting point.

Fig. 17

- 5.04 Apply outer tape covering of 1-inch D Vinyl Tape to provide tougher shell and to hold DR Tape tight.

1. Apply single half-lapped wrapping over DR Tape of 1 inch D Vinyl Tape extending  $\frac{1}{2}$  inch beyond at each end.



Fig. 18





BURIED PLANT  
SPLICING B SERVICE WIRE  
"SCOTCHCAST UNIPAK METHOD"

1. GENERAL

- 1.001 This Addendum supplements Section 629-760-211.
- 1.002 This Addendum is issued to describe the encapsulated butt splicing method for the joining of B Service Wire at buried locations.
- 1.003 The splicing methods described herein supplement the method outlined in Section 629-762-211 and are primarily for use where the splice is to be buried below ground.

2. MATERIALS

The following changes apply to Part 2 of the Section

- (a) Materials - Added materials under this subheading

<u>Materials</u>	<u>Use</u>
Resin, Communications, No. 17 Scotchcast, Size F	For encapsulating butt splice connections
Connector, Split-Bolt, #6	For clamping and bonding shields

3. PREPARING WIRE ENDS

The following change applies to Part 3 of the Section

- (a) 3.05 - Added

Butt Splicing

- 3.05 Prepare each B Service Wire as described in Paragraphs 3.01 to 3.04 except the length of exposed conductors should be reduced to  $1\frac{1}{2}$  inches as shown in Figure 13.

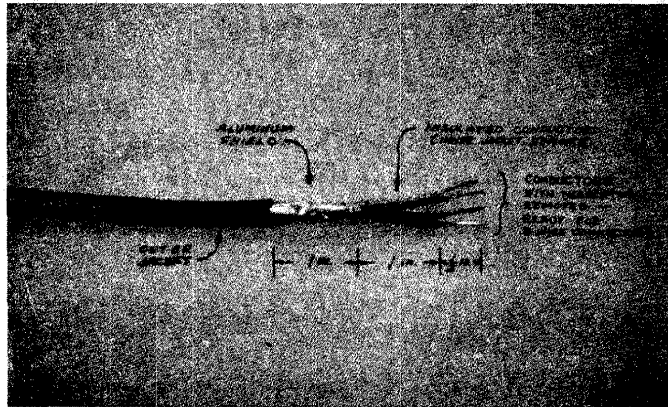


Figure 13

4. SPLICING CONDUCTORS

The following changes apply to Part 4 of the Section.

(a) 4.09, 4.10, 4.11 - Added

Butt Splicing

4.09 Place the two prepared wire ends together as shown in Figure 14.

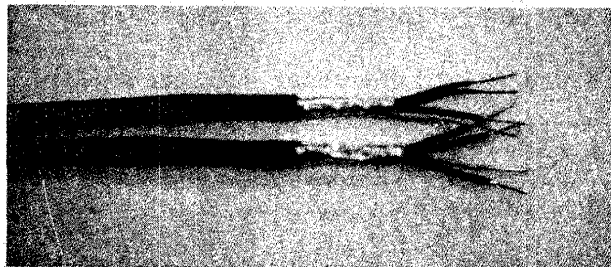


Figure 14

4.10 Clamp or bond the two aluminum shields together using a #6 Split-Bolt Connector as shown in Figure 15.

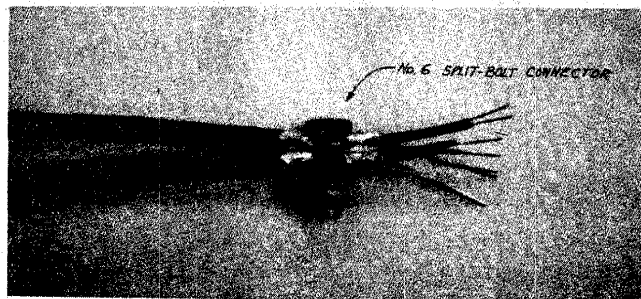


Figure 15

Note: If #6 Split-Bolt Connectors are not readily available an AT-7796X Connector may be substituted.

4.11 Join the respective service wire conductors using B Wire Connectors and the B Connector Pressor as shown in Figure 16.

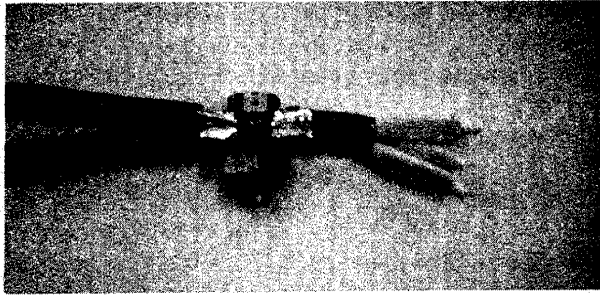


Figure 16

5. ENCAPSULATING BUTT SPLICE

5.01 Butt spliced B Service Wires are encapsulated in a "Scotchcast Resin Unipak" preparatory to its burial and to waterproof the B Wire Connectors.

5.02 The Scotchcast resin (See Figure 17) is packaged in dual compartment plastic bag called a "Unipak". This "Unipak" is furnished in a sealed vapor proofed aluminum lined envelope to insure reasonable shelf life for the material.



Figure 17

**CAUTION:** DO NOT use previously opened or punched foil containers. Also DO NOT use a "Unipak" after the expiration date as printed on both the box and foil container. Further DO NOT use any "Unipak" which upon removal from its envelope shows any evidence of crystallization.

5.03 Mix the resin as follows:

- (a) Remove the "Unipak" from the foil container.
- (b) At the "white" end of the "Unipak" container, grasp the sides of the bag and roll the end seal down and in between the sides until it touches the center barrier, see Figure 18. Then by continuing the rolling action push and pull the sides of barrier apart. Break barrier all the way across to side seals.



Figure 18

- (c) Mix the two compounds together by alternately squeezing ends of "Unipak" forcing compounds back and forth. Strip the compounds from the corners. Mix vigorously until the color (green) is completely uniform. (The resin will get quite warm during this mixing process.)
- 5.04 Force all of the mixed resin into one end of the "Unipak". Then cut the upper end open.

**PRECAUTION:** Observe the same precautions regarding bodily protection, ventilation, good personal hygiene and good housekeeping as required with System Standard Plugging Compounds and as noted on the back of the box in which this resin compound is supplied.

5.05 Place the butt spliced B Service Wires, as prepared under paragraphs 3.05 and 4.09 to 4.11 inclusive, into the open resin filled plastic bag. Slide the splice up and down slowly in the resin to insure complete penetration and removal of all air pockets. Force the wires and resin completely to one side of the bag and fold the emptied side over as shown in Figure 19 and 20. Visually inspect the encapsulation (the resin is transparent) for air pockets and also to ascertain the location of the B Wire Connectors. In general, the B Wire Connectors should be completely enveloped in resin and at least 1/2 inch from the end of the plastic bag.



Figure 19

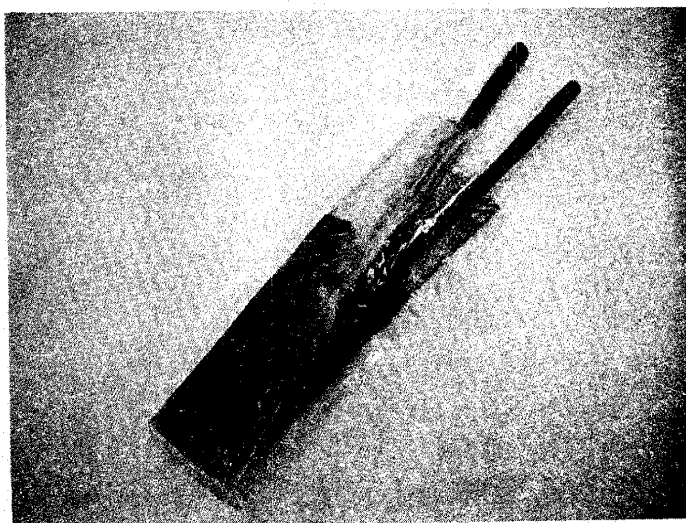


Figure 20

5.06 Bind open end of "Unipak" bag to B Service Wires using vinyl tape. Exercise care to prevent forcing any compound out of the "Unipak" bag to impair the taping operation and/or where it may get onto the hands etc. (See Figure 21).

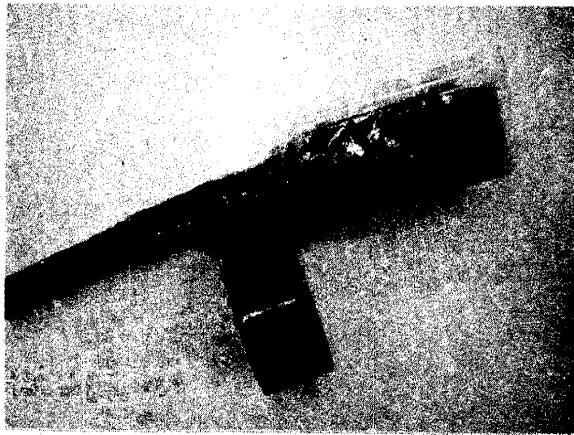


Figure 21

5.07 Wrap the entire "Unipak" bag with two layers of vinyl tape as shown in Figure 22.

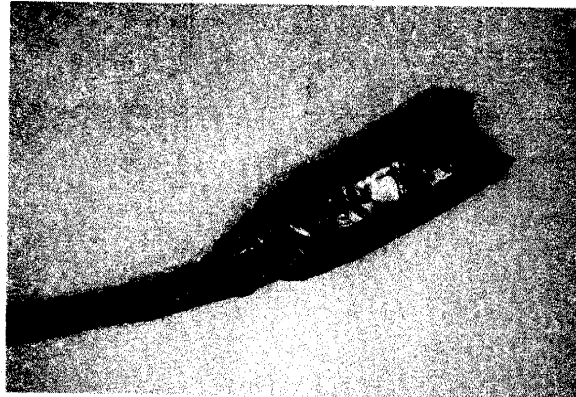


Figure 22

5.08 Bury the completed splice immediately if desired. The initial dirt cover should be free of stone or other possible injurious material.

**BURIED PLANT**  
**SPLICING B SERVICE WIRE**

<b>CONTENTS</b>	<b>PAGE</b>
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3. PREPARING WIRE ENDS . . . . .	1
4. SPLICING CONDUCTORS . . . . .	3

**1. GENERAL**

**1.01** This section describes the method of splicing B Service Wire.

**1.02** This section is reissued to include B Service Wire provided with inner and outer jacket slitting cords. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.03** B Service Wire is a 2-pair, quadded, polyethylene insulated wire used for underground service connections. B Service Wire is now furnished with inner and outer jacket slitting cords. Earlier type B Service Wire does not have the slitting cords. B Service Wire with slitting cords usually can be distinguished from the earlier wire by a slight ridge made in the outer jacket by the slitting cord.

**1.04** The conductors are made from 20 A.W.G. copper-steel wire. The insulation of the conductors is colored for purposes of identification. The opposite wires of the quad, red-green and yellow-black, are the pairs. The red wire and the yellow wire are the ring conductors of the two pairs.

**1.05** B Service Wire has a spiral wrapping of aluminum tape over the inner jacket. At splices, this tape is rewound over the spliced and insulated conductors to provide the tape with electrical continuity across the splice.

**2. LIST OF TOOLS AND MATERIALS**

**Tools**

**Use**

Diagonal Pliers	For cutting jackets and conductors and for skinning insulation from conductors
Long Nose Pliers	For grasping slitting cords
B Sleeve Presser	For compressing 032-025 S Brass Sleeves
C Sheath Slitter	For removing jackets from conductors (where slitting cords are not provided)

**Materials**

**Use**

032-025 S Brass Sleeves	For splicing conductors
3/4-Inch DR Tape	For insulating conductors and wrapping completed splice
1-Inch Vinyl Tape	For protecting completed splice from mechanical damage

**3. PREPARING WIRE ENDS**

**Jackets With Slitting Cords**

**3.01** Remove the outer (black) and inner (brown) jackets as follows:

- (1) Using diagonal pliers, make approximately a 1/2-inch slit in the end of the outer jacket along the ridge of the jacket, to expose the outer jacket slitting cord.

(2) Grasp the slitting cord firmly between the flat jaw portions of the long nose pliers. Pull the cord with the long nose pliers and slit the outer jacket back approximately 5 inches from the end of wire, as shown in Fig. 1. Remove the slit portion of the jacket, using the diagonal pliers.

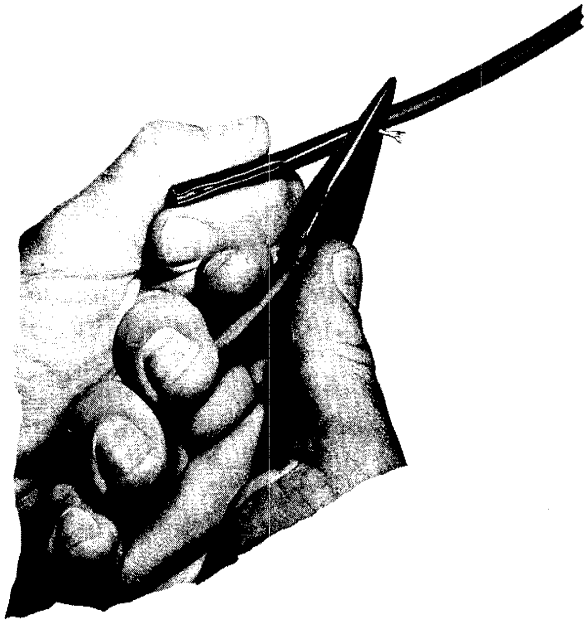


Fig. 1 — Slitting Outer Jacket, Using Slitting Cord

(3) Unwind the aluminum tape to the end of the outer jacket. If the free end of the tape lies under the preceding wrap, it can be released by twisting the entire wire opposite to the lay of the tape near the free end. This will cause the tape to bulge so that it can be grasped with long nose pliers.

(4) Slit and remove the inner jacket for a distance of 4 inches from the end of the wire, as shown in Fig. 2, using the procedures in (1) and (2).



Fig. 2 — Slitting Inner Jacket, Using Slitting Cord

(5) Measure 2 inches from the end of the inner jacket and cut off the excess portion of the conductors, as shown in Fig. 3.

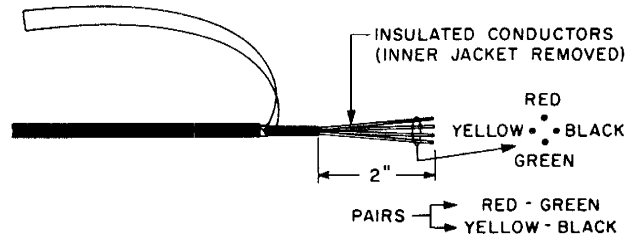


Fig. 3 — B Service Wire With Inner and Outer Jackets Removed

(6) Using the skinning hole of diagonal pliers, remove 1/2 inch of insulation from the end of each conductor, as shown in Fig. 4.

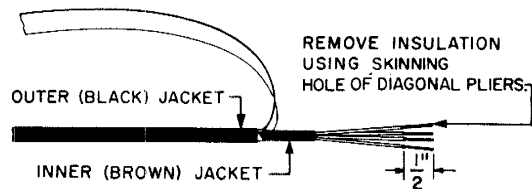


Fig. 4 — Wire Ready for Splicing

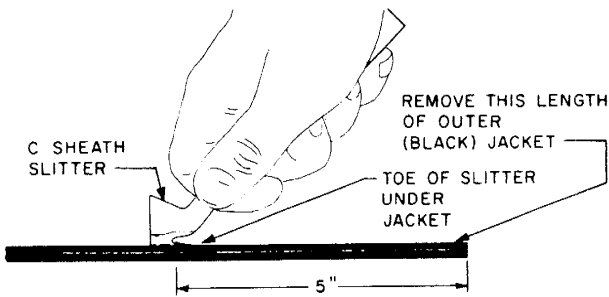
3.02 Repeat the procedures described in 3.01 with the end of the other wire to be spliced.



**Jackets Without Slitting Cords**

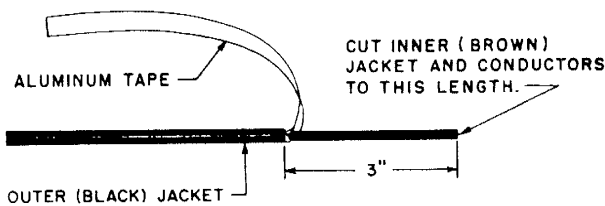
**3.03** Remove the outer (black) and inner (brown) jackets as follows:

- (1) Measure about 5 inches from the end of the wire and at that point puncture the outer jacket with diagonal pliers or C Scissors. Cut only deep enough to pierce the jacket without cutting the aluminum tape.
- (2) Place the wire on a flat surface and insert the toe of the C Sheath Slitter into the cut in the outer jacket with the toe toward the end of the wire, as shown in Fig. 5.



**Fig. 5 — Slitting Outer Jacket, Using C Sheath Slitter**

- (3) Hold the slitter so the toe is slightly raised, to avoid catching the aluminum tape. Slit the outer jacket to the end of the wire and remove the jacket.
- (4) Unwind the aluminum tape to the end of the outer jacket. If the free end of the tape lies under the preceding wrap, it can be released by twisting the entire wire opposite to the lay of the tape near the free end. This will cause the tape to bulge so that it can be grasped with long nose pliers.
- (5) Measure 3 inches from the end of the outer jacket and cut off the excess portion of the inner (brown) jacket and conductors, as shown in Fig. 6.



**Fig. 6 — Inner Jacket Cut to Proper Length**

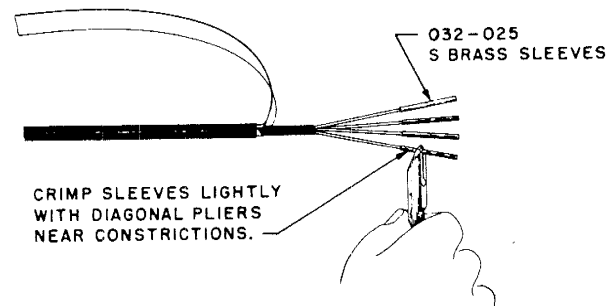
- (6) Remove the inner jacket for a distance of about 2 inches from the end of the wire. This can be done by using the sheath slitter as before or by cutting the jacket with diagonal pliers, starting at the open end of the jacket. Exercise care not to damage the conductor insulation.
- (7) Using the skinning hole of diagonal pliers, remove 1/2 inch of insulation from the end of each conductor, as shown in Fig. 4.

**3.04** Repeat the procedures described in 3.03 with the end of the other wire to be spliced.

**4. SPLICING CONDUCTORS**

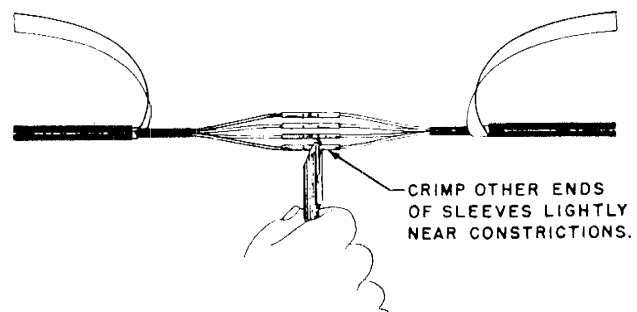
**Joining Conductors**

**4.01** Place 032-025 S Brass Sleeves on the bared end of each conductor. Make certain that each sleeve is pushed fully onto its conductor, then crimp the sleeve lightly with diagonal pliers to hold the sleeve in place, as shown in Fig. 7.



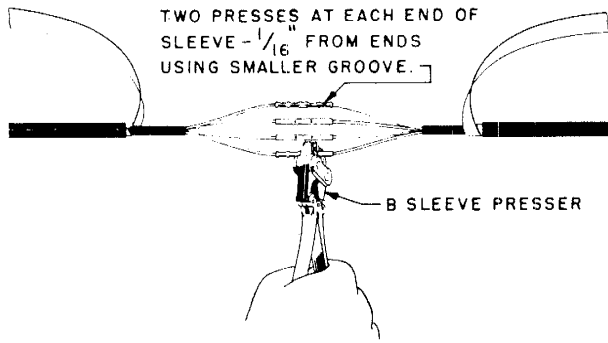
**Fig. 7 — Placing Sleeves on Conductors**

**4.02** Insert the prepared conductor ends of the other wire into the sleeves, matching the wires, color to color. Again crimp the sleeves lightly with the diagonal pliers to hold the conductors, as shown in Fig. 8.



**Fig. 8 — Wires Joined and Ready to be Pressed**

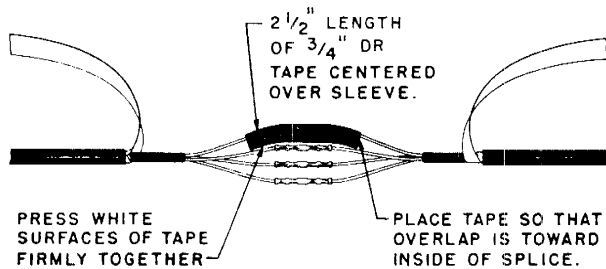
**4.03** Complete the wire joints by pressing the sleeves in the smaller groove of the B Sleeve Presser, as shown in Fig. 9.



**Fig. 9 – Pressing Wire Joints**

**Insulating Conductors**

**4.04** Spread the joined conductors, as shown, to provide adequate clearance for applying the insulation. Over each pressed sleeve fold a 2-1/2 inch length of 3/4-inch DR Tape, as shown in Fig. 10.

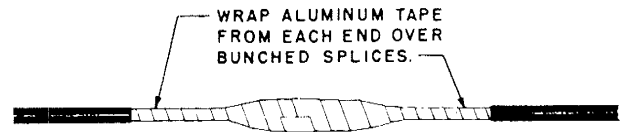


**Fig. 10 – Insulating Conductors**

**4.05** Bunch the insulated sleeves closely together.

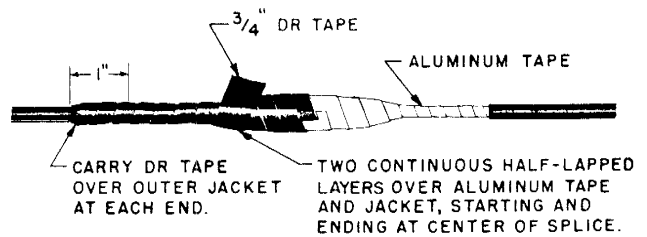
**Rewinding Aluminum Shield**

**4.06** Rewind the aluminum tape from each end of the splice back over the wires and insulated sleeves. Make certain that the tapes from each end overlap at the center of the splice for a full turn, as shown in Fig. 11.



**Fig. 11 – Aluminum Tape Wrapped and Overlapped**

**4.07** Starting at the center of the splice, cover the splice with two half-lapped layers of 3/4-inch DR Tape, as shown in Fig. 12.



**Fig. 12 – Taping Splice**

**4.08** To provide protection for the splice against damage and deterioration of the DR Tape wrappings, it is recommended that the DR Tape be covered with a half-lapped layer of 1-inch vinyl tape over the entire length of the splice.

## BURIED WIRE

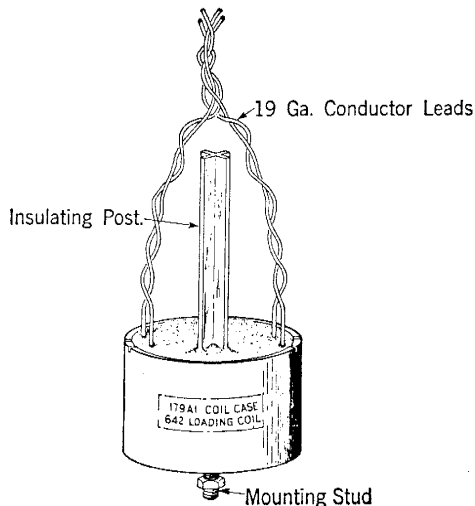
### INSTALLATION OF 179A1 COIL CASE

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3. INSTALLATION AT D OR E BURIED WIRE TERMINALS . . . . .	4

#### 1. GENERAL

**1.01** This section covers the installation of the 179A1 Coil Case with D Underground Wire at buried locations and at D or E Buried Wire Terminal locations.

**1.02** The 179A1 Coil Case consists of one 642 Loading Coil in a plastic container filled with an epoxy resin. The terminals of the coil are 19 gauge copper conductors which provide electrical connection to the D Underground Wire conductors only. The mechanical mounting is provided by means of the mounting stud and nut in the bottom of the case. The case is illustrated in Fig. 1.



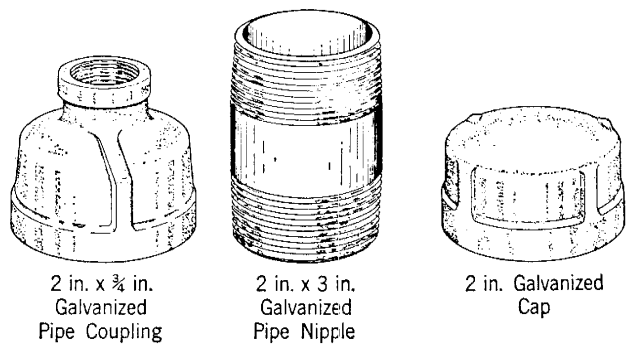
**Fig. 1**

#### 2. INSTALLATION AT BURIED LOCATIONS

**2.01** Loading coils should be installed at buried locations as soon as practical after the wire is placed, but not before the wire has been tested and reported free of trouble. The coil location should be marked temporarily by stakes, by an open trench suitably protected, or by other similar methods.

**2.02** In wet weather, load coils should be installed under a shelter such as a tent or tarpaulin. Satisfactory installation requires that the surfaces of the wire be dry and clean at the time of assembly.

**2.03** The items other than coil case and wire which are required for installing the load coil are shown in Fig. 2. The pipe nipple, pipe coupling, and pipe cap may be purchased locally.



**Fig. 2**

2.04 The ends of the D Underground Wire are prepared as shown below:

(a) Remove PVC jacket as shown in Fig. 3.

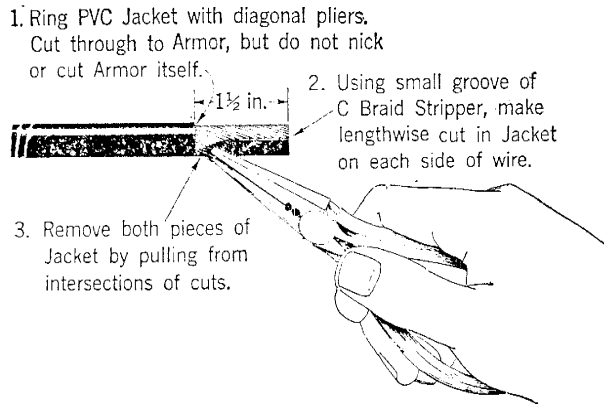


Fig. 3

(b) Twist armor wires together as in Fig. 4.

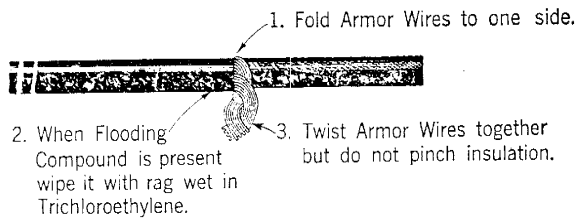


Fig. 4

(c) Split conductor ends as shown in Fig. 5.

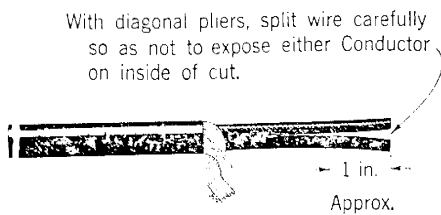


Fig. 5

(d) Remove insulation from both conductors as shown in Fig. 6.

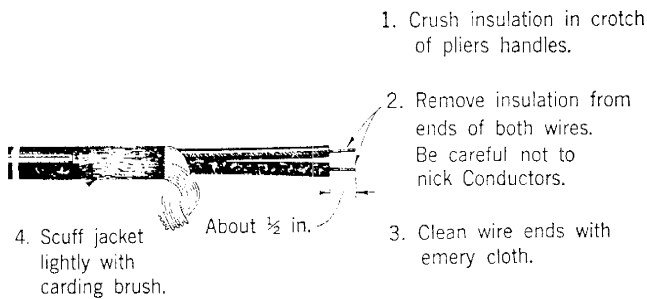


Fig. 6

(e) Prepare both buried wires being installed in coil case as in (a) through (d) above. Twist armor wires together and insert through pipe coupling as shown in Fig. 7.

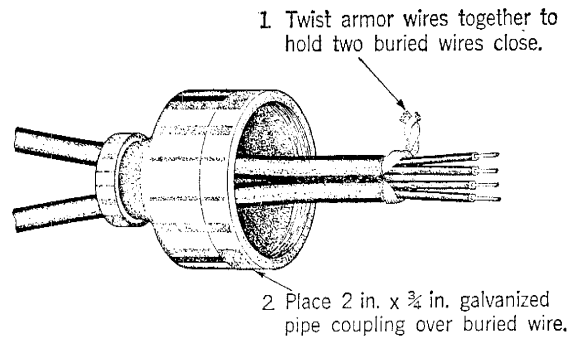


Fig. 7

2.05 Prepare the ends of the conductors from the coil case as shown in Fig. 8.

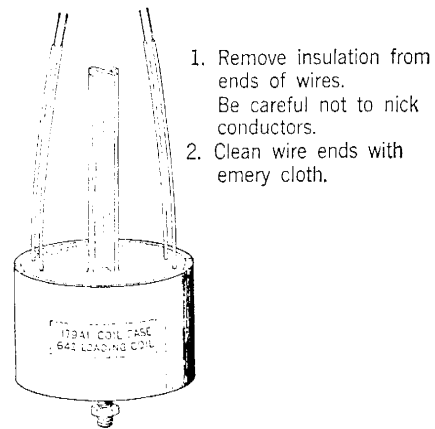


Fig. 8

2.06 Splice the buried wire to the coil case as shown in Figs. 9 and 10.

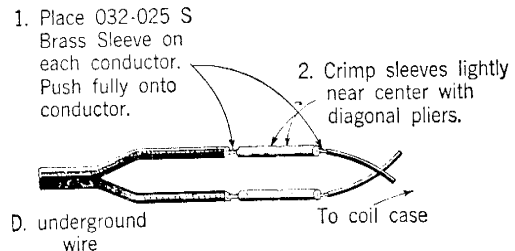
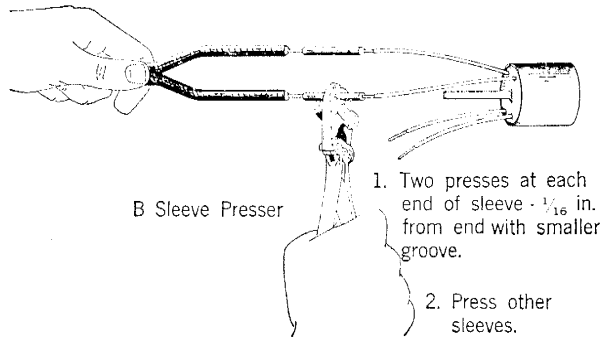


Fig. 9

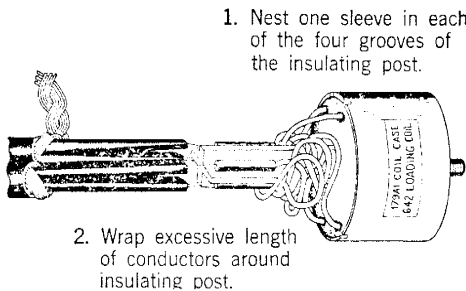


B Sleeve Presser

1. Two presses at each end of sleeve  $\cdot \frac{1}{16}$  in. from end with smaller groove.
2. Press other sleeves.

Fig. 10

2.07 Arrange sleeves on insulating post as shown in Fig. 11.

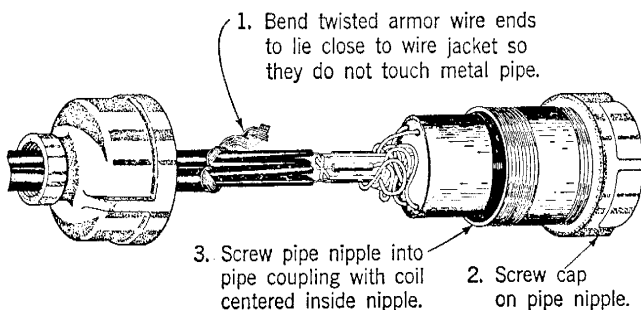


1. Nest one sleeve in each of the four grooves of the insulating post.

2. Wrap excessive length of conductors around insulating post.

Fig. 11

2.08 Assemble the coil case and other components as shown in Fig. 12. Make sure that the twisted armor wires do not touch the metal pipe nipple or coupling. This separation from ground is necessary for using the ground potential method in fault locating.



1. Bend twisted armor wire ends to lie close to wire jacket so they do not touch metal pipe.
2. Screw cap on pipe nipple.
3. Screw pipe nipple into pipe coupling with coil centered inside nipple.

Fig. 12

2.09 Fill the assembled coil case with B Plug Compound as follows: (More completely covered in Sections 637-241-011 and 637-242-011).

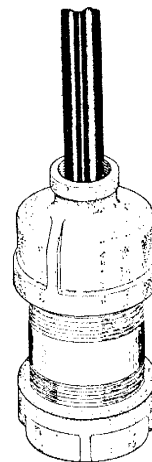
(a) The compound starts to set up in about 15 minutes at 70°F. Faster setup occurs at higher temperatures, and slower setup at lower temperatures. Therefore, the mixing should be done immediately before using. The coil case should preferably be filled at temperatures above 45°F. Where the plug compound must be used at lower temperatures, keep it warm before mixing, such as mixing inside a truck with a heater operating.

(b) **OPENING CAN (Part I):** Place the can on a flat surface and remove the friction cap carefully to avoid spilling. Use a 4-inch regular screwdriver or its equivalent as a pry. Form a pouring lip on the can by crushing the top rim against the side with the jaws of side cutting pliers. Do this before emptying Part II into the can.

(c) **HANDLING TUBE (Part II):** Hold the tube vertically and break off the tip with scissors or a pair of pliers. Invert the tube and squeeze the contents into the opened can; start at the folded end of the tube and press progressively toward the tip.

(d) Mix (do not whip) the two parts in the can thoroughly with the wooden blade for at least two minutes. See Section 637-241-011 for more complete instructions.

(e) Pour into opening of pipe coupling as shown in Fig. 13.



1. Place Assembly in Upright Position.
2. Be Sure Coil Case is Centered Inside Assembly.
3. Fill with 300 Grams of B Plug Compound.

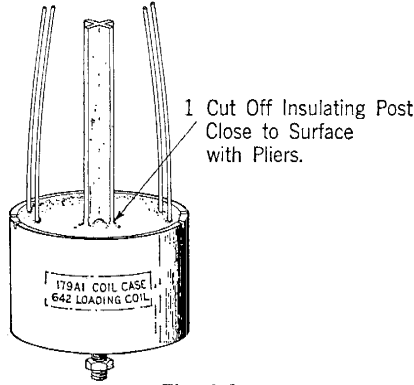
Fig. 13

2.10 Close the filling hole in the pipe coupling with B Sealing, DR or D Vinyl Tape, sufficiently to keep out dirt during backfilling of hole. Place the wire and coil case at the original plowing depth and backfill.

**3. INSTALLATION AT D OR E BURIED WIRE TERMINALS**

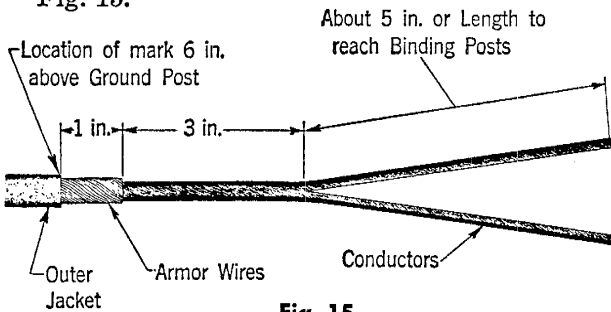
**3.01** At D or E Buried Wire Terminals the 179A1 Coil Case can be installed in the following manner:

(a) Cut off the insulating post close to the surface of the potting compound as shown in Fig. 14.



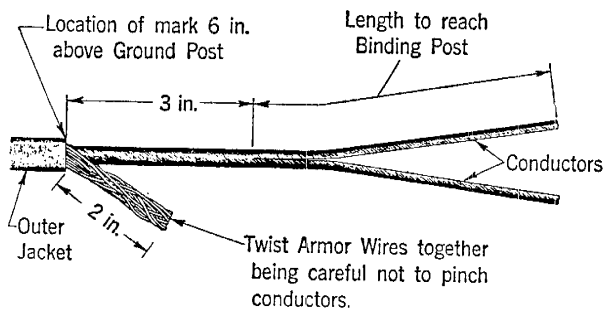
**Fig. 14**

(b) Terminate the armor wire on the first two D Underground Wires by pulling the slack from the wires and mark the outer jacket about 6 inches above the ground post. Then prepare the ends of the wire as illustrated in Fig. 15.



**Fig. 15**

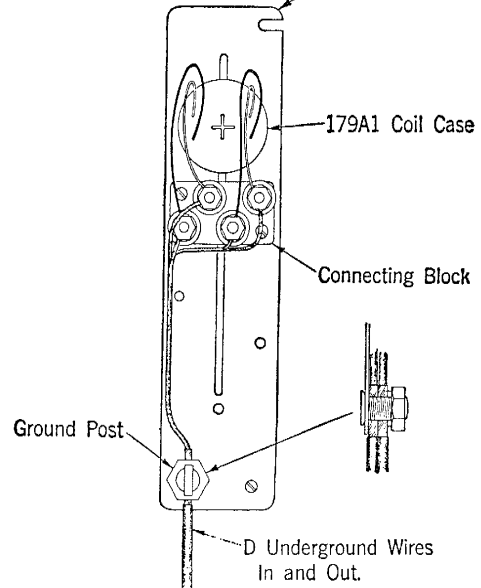
(c) Where there are more than two underground wires, terminate the third and fourth wires by pulling the slack from them and mark the outer jacket about 6 inches above the ground post. Prepare the ends as illustrated in Fig. 16.



**Fig. 16**

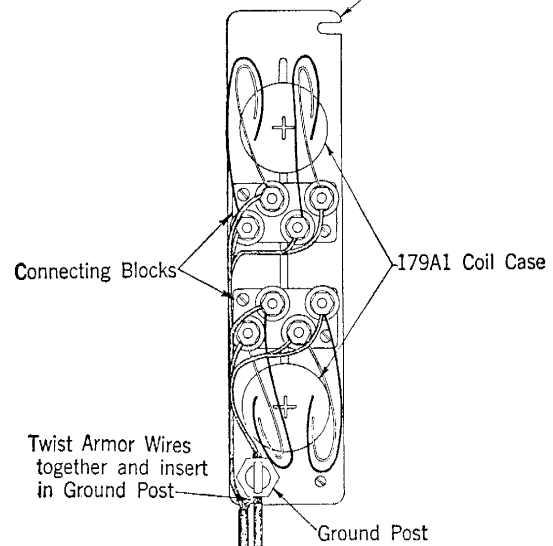
(d) Install the additional connecting block, when needed, with the screws furnished with the block. The 179A1 Coil Cases are mounted on the terminal plate with the mounting stud located on the bottom of the case. Connect the conductors and coil case leads to the proper binding posts of the connecting blocks as shown in Figs. 17 and 18.

Terminal Plate of D or E Buried Wire Terminal.  
Rest of Terminal omitted for clarity.



**Fig. 17**

Terminal Plate of D or E Buried Wire Terminal.  
Rest of Terminal omitted for clarity.



**Fig. 18**

**BURIED WIRE**  
**SPlicing 16-GAUGE COPPER**  
**CONDUCTORS TO D UNDERGROUND WIRE**

CONTENTS	PAGE
1. GENERAL . . . . .	1
2. PREPARING WIRE ENDS . . . . .	1
3. SPlicing CONDUCTORS . . . . .	2
4. INSULATING CONDUCTORS . . . . .	3
5. RESTORING ARMOR . . . . .	3

**1. GENERAL**

**1.01** This section describes the method, materials, and tools used to splice B or C Underground Wire or the 154A Coil Case to D Underground Wire. It includes the restoration of the armor at splices which, to be fully effective as lightning protection, must be made electrically continuous across the splice.

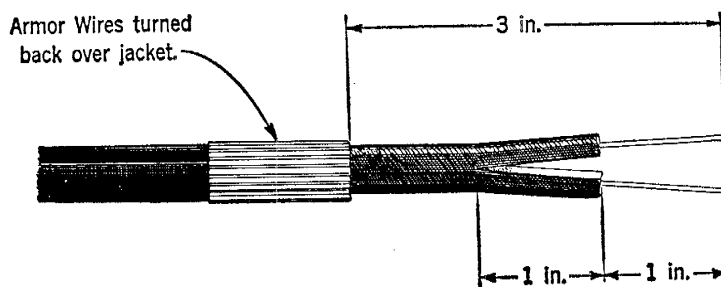
**1.02** In wet weather, splicing should be done under a shelter, such as a tent or tarpaulin, to keep the surfaces of the wires dry. Satisfactory splices cannot be made otherwise.

**1.03** Splicing should follow as soon as practical after placing, but not before the wire has been tested and reported free of faults. Locations will be found marked by stakes placed upright to one side of the wire and indicating the distance in feet to the wire ends. On completion of the work, the wire should be buried at the depth of the original plowing.

**2. PREPARING WIRE ENDS**

**2.01** The conductors being spliced should be prepared as shown in the following sections except that one inch of insulation shall be removed from each conductor (see Fig. 1) rather than the one-half inch shown in these sections.

<u>TYPE WIRE</u>	<u>SECTION</u>	<u>PART</u>
D Underground Wire	629-760-206	2
C Underground Wire	629-760-205	2
B Underground Wire	629-760-200	2
154A Coil Case (B Underground Wire)	629-760-200	2



**Fig. 1**

**2.02** Before joining the conductors shape a 10-inch length of Iron Shielding Braid into a tube and slip it over one of the wires. Place the braid with all types of wires even though C Underground Wire has no armor wire. Braid gives mechanical protection to splice.

**3. SPLICING CONDUCTORS**

**3.01** Place the 064 end of an 064 × 045 — 040 Combination S Brass Sleeve on the 16-gauge copper conductors of B or C Underground Wire or the 154A Coil Case as shown in Fig. 2.

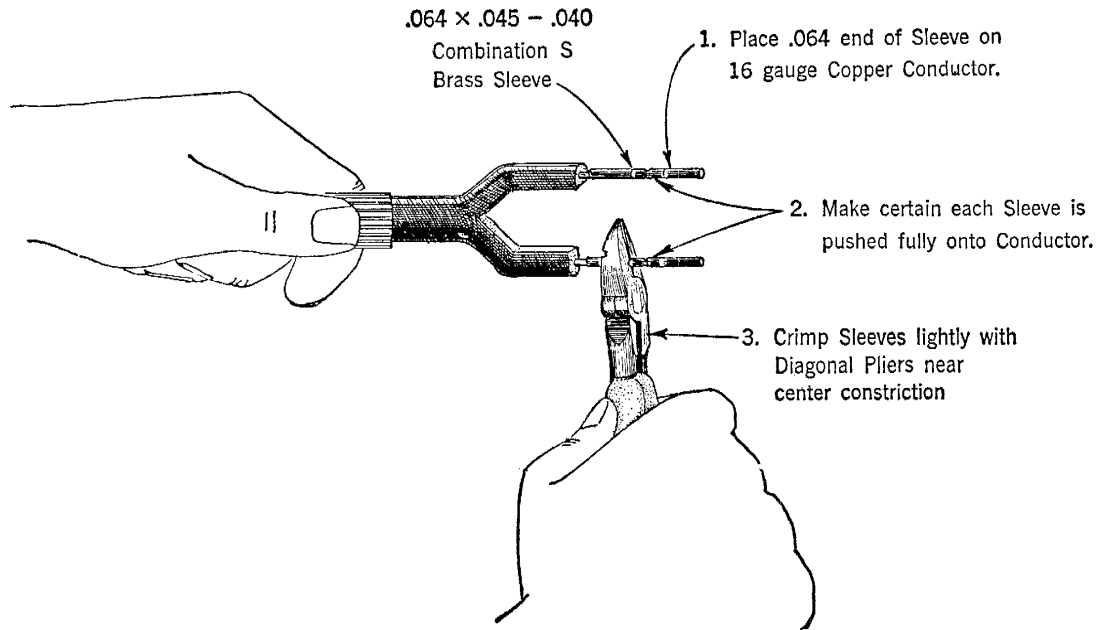


Fig. 2

**3.02** Insert the 19-gauge conductors of D Underground Wire into the 045 — 040 end of

the 064 × 045 — 040 Combination S Brass Sleeve as shown in Fig. 3.

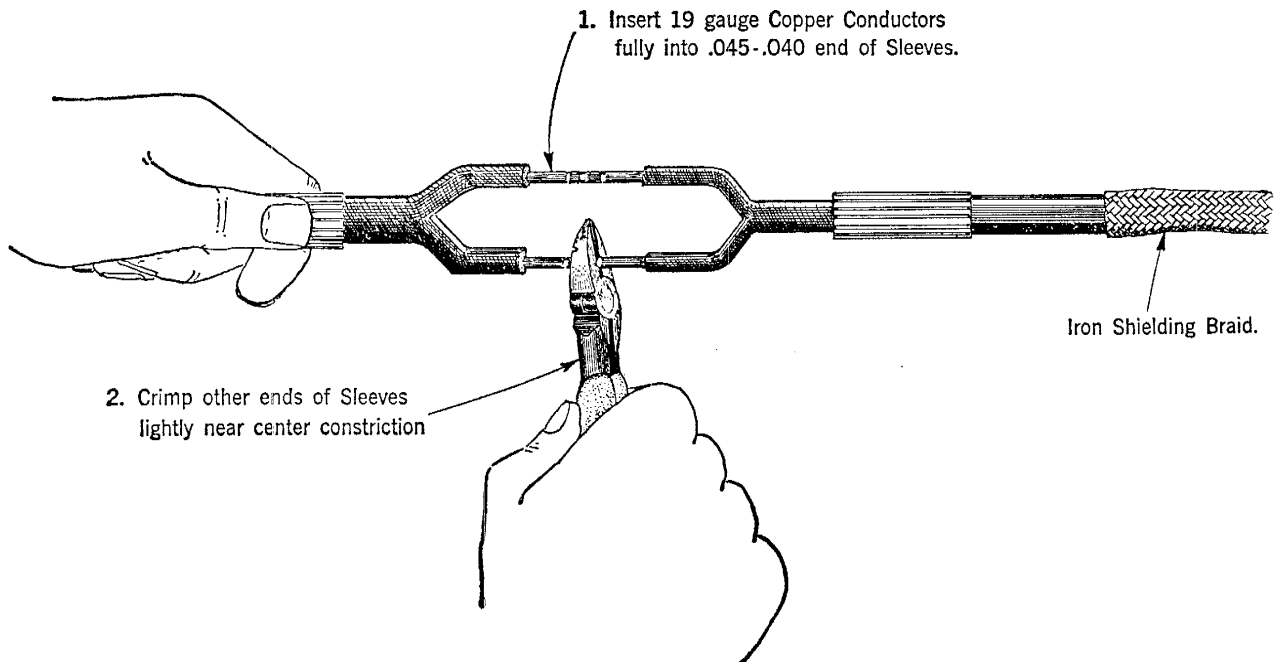
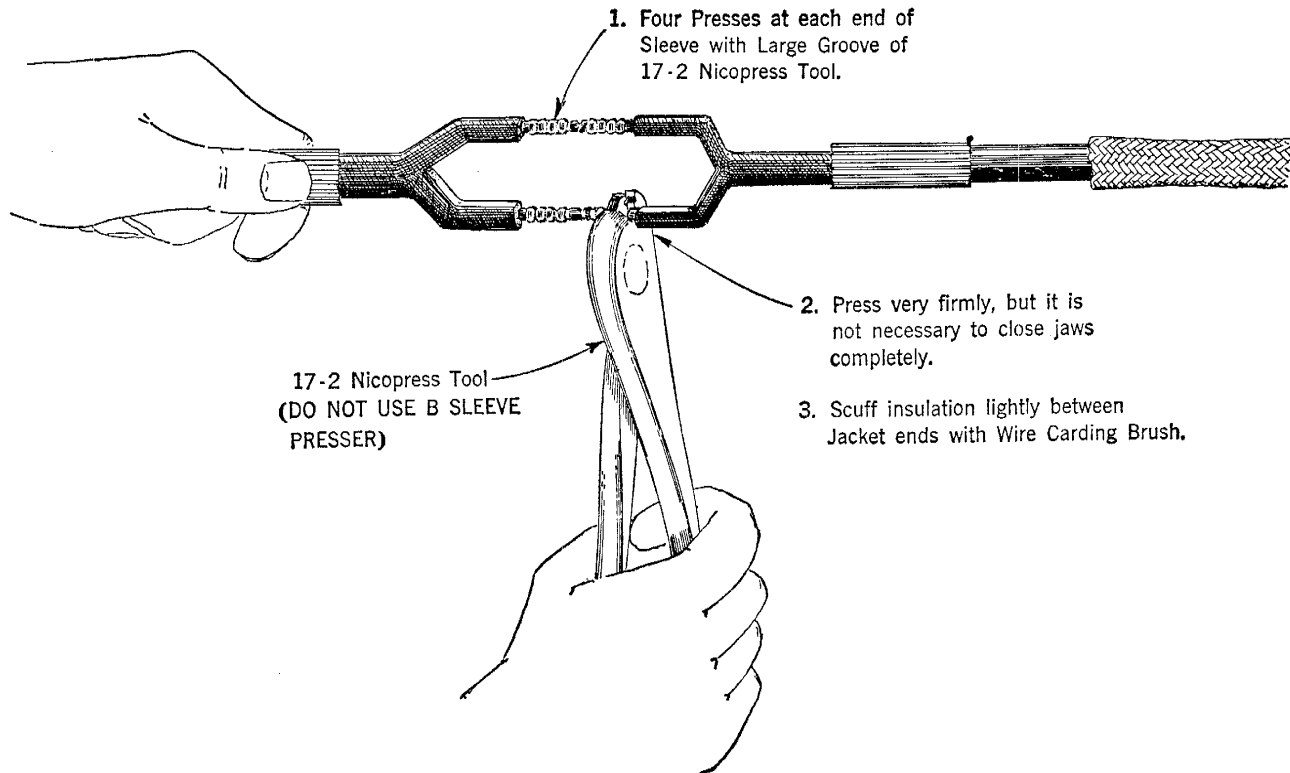


Fig. 3



**3.03** Complete the splice by pressing the sleeves as shown in Fig. 4.



**Fig. 4**

#### **4. INSULATING CONDUCTORS**

**4.01** Insulate the conductors just spliced as shown for D Underground Wire in Section 629-760-206, Part 4. Be sure to add the length of D Underground Wire to act as a splint to stiffen the splice as shown in Paragraph 4.02 of Section 629-760-206.

#### **5. RESTORING ARMOR**

**5.01** The length of Iron Shielding Braid placed over the insulated splice is intended to

serve a double purpose: (1) the braid makes the armor electrically continuous over the splice, and (2) the completed covering provides mechanical protection against cuts, punctures, or insect damage comparable with that of the wire itself.

**5.02** Restore the armor and replace the jacket with tape wrappings as shown for D Underground Wire in Section 629-760-206, Part 5. When splicing C Underground Wire, which has no armor wire, pull the braid over jacket and fasten with 049 Construction Wire.



## BURIED WIRE TESTING

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10. Running Down Faults .....	2
11. Identifying Faulty Wire .....	2
12. "Cut and Try" Method .....	2

### 1. GENERAL

- 1.01 This section describes methods of locating faults in buried wire.
- 1.02 The general procedure for locating a fault involves one or more of the following steps, depending upon circumstances.
- (a) Determining the nature and magnitude of the fault.
  - (b) Localizing the fault to a particular branch or section of the buried wire system.
  - (c) Making Wheatstone bridge measurements when this is possible.
  - (d) Tracing the path of the wire to the vicinity of the fault by the exploring coil method.
  - (e) Running down the fault by the exploring coil method by further Wheatstone bridge measurements or by a "cut and try" method.

### 2. APPARATUS

- 2.01 The following apparatus may be required.
- Amplifier:** 4-B AMPLIFIER. (For amplifying tone pick-up in the receivers).
- Bridge:** PORTABLE WHEATSTONE BRIDGE. (For fault locating measurements).
- Coil:** BICYCLE WHEEL EXPLORING COIL. (For use in tracing the path of a wire and running down faults).
- Condenser:** 1 MF CONDENSER. (For use with the Wheatstone bridge when locating opens).
- Megger:** 400 VOLT MEGGER. (For insulation resistance tests and for use as a source of potential when measuring high resistance faults).
- Rods:** GROUND RODS. (For use in making electrical tests).
- Receivers:** PAIR OF 528 RECEIVERS. (For use with the bicycle wheel exploring coil and 19-C test set).
- Test Sets:** 17-TYPE TEST SET. (For talking purposes and continuity tests).  
20-C TEST SET. (For supplying current in tracing the path of a wire and in running down faults).  
19-C TEST SET. (For running down faults).  
43-A OR 45-A TEST SET. (For supplying tone when locating opens with the Wheatstone bridge).
- Voltmeter:** HIGH RESISTANCE VOLTMETER. (For use in testing for grounded circuits).

### 3. PRECAUTION

- 3.01 Test clips shall not be used to penetrate the insulation in making tests on U-distribution wire as the resulting puncture will cause permanent injury to the insulation.

### 4. TESTS DURING INSTALLATION

- 4.01 In laying wire, the conductors at the outer end of each section or reel of wire should be short-circuited and wrapped with rubber tape to facilitate testing the wire at the reel during installation. The inner end of the wire may be exposed by removing the metal plate on the side of one of the flanges of the reel in case it is desired to have access to it for testing purposes. When anything occurs in the plowing operation which would indicate that the wire may have been broken or the insulation injured, the plow should be stopped and the conductors tested for an open circuit or a ground. Immediately after a length of wire has been placed and before it is spliced, a continuity test should be made and the insulation resistance of both conductors to ground should be measured simultaneously. The insulation resistance should be not less than 100 megohm miles.

### 5. COMPLETION TESTS

- 5.01 After the splices in a section of wire or branch have been made the wire should be tested for an open circuit and the insulation resistance between conductors and between conductors and ground should be measured to determine whether the conductors are in good electrical condition. The insulation resistance should be not less than 100 megohm miles.

### 6. LOCATING FAULTS—PRELIMINARY TESTS

- 6.01 Preliminary tests should be made by the test deskman or by the repairman with the 17-type test set, megger, or with a receiver and battery to determine the nature and magnitude of the fault, if possible.

### 7. SECTIONALIZING THE FAULT

- 7.01 In general, the methods for testing and localizing faults in drop and block wiring described in Division 625 are applicable to buried wire.
- 7.02 At the first buried wire terminal out from the central office, the repairman should test the line both ways and also any branch connected to the main line. The battery and receiver method (using 17-type test set) should be used to determine whether a wire contains a short-circuit or open. A megger or voltmeter should be used to determine whether the wire is grounded. If the fault is not found in the line toward the central office or in the branch line, the conductors should be reconnected to the terminal. These tests should be repeated at the next and succeeding terminals until the particular section containing the fault is found. If, preparatory to starting the sectionalizing tests, the fault is suspected to exist in a certain part of the wire, a test should be made first at the terminal nearest to and on the central office side of the section suspected of being in trouble.
- 7.03 After the fault has been sectionalized, an inspection should be made between the two terminals to see if there is any evidence of the cause of the trouble, such as road work, soil erosion, pole setting, etc.
- 7.04 If the trouble cannot be located by inspection, the faulty pair should be opened at the terminals on both sides of the fault so that Wheatstone bridge measurements or other tests can be made.

**8. WHEATSTONE BRIDGE MEASUREMENTS**

8.01 Methods of locating faults with a Wheatstone bridge are described in the field trial instructions on cable fault locating.

8.02 **Grounds and Shorts:** A single conductor ground can be located by the Varley method. If both conductors are grounded or if the fault is a short-circuit, it will be necessary to run an auxiliary wire on the ground between the two terminals in order to provide a "good" conductor for the Varley measurement. If it is necessary to lay an auxiliary wire on the ground and the section in trouble is long, say more than one-half mile in length, it may be advisable to sectionalize the trouble by the "cut and try" method to a shorter section. In the event that there is available a second buried wire, having terminals conveniently located with respect to the faulty pair, a conductor of the second pair can be used as the "good" wire.

8.03 The resistance of buried wire is 53.5 ohms per loop mile at 68° F. The resistance applying at the time fault locating measurements are made should be determined by a loop resistance measurement made in connection with the Varley measurements.

8.04 The battery in the Wheatstone bridge can be used in making bridge measurements to locate grounds and short-circuits having resistances of not more than a few thousand ohms. For faults of higher resistance, the 54-volt battery of a 45-A test set or the "earth" and "guard" terminals of a megger should be used as the source of potential for the bridge. With these external sources of potential, faults up to 50,000 ohms can be located in favorable conditions. In measuring high resistance faults, measurements should be made at both ends of the section.

8.05 **Opens** can be located by the Murray method, using a 1 MF condenser, and tone from a 43-A or 45-A test set. If both conductors are open, the equivalent capacitance of a "good" conductor can be calculated by taking the sum of the

bridge balancing resistances obtained by measurements on the faulty conductor taken from the two ends of the faulty section.

8.06 After the readings have been made, the resistance or capacitance should be translated into feet. Account must be taken of any loops left at terminals, in subscriber premises or anywhere in the line and of any loading coils that may be located in the section. The resistance of each coil winding is 2.1 ohms or 4.2 ohms for the loop resistance. Locations determined from each end should check closely and if they do not agree errors in measurements, calculations or double faults are indicated. The length of the section and the distance to the fault can be determined by measuring with a tape, by pacing or by other means.

8.07 **Combined Faults:** It may be necessary to locate complicated faults such as a combined ground and open by a "cut and try" method.

8.08 If it is necessary to trace the path of the wire, this can best be done by the bicycle wheel exploring coil method.

**9. TRACING THE PATH OF A WIRE**

9.01 The methods of tracing the path of a buried conductor described in Division 634 are applicable to buried wire. The 20-C test set should be connected between the wires and ground at one end of the section. The other end should be clear.

**10. RUNNING DOWN FAULTS**

10.01 After Wheatstone bridge readings have been made and the wire has been traced to the calculated location, the wire should be exposed by excavation. If there are two pairs of wire in the same trench, the faulty pair can be identified as outlined in Part 11. The faulty wire should be cut and then tested in both directions from the point to determine which section contains the fault. If the fault is not at the indicated point, further bridge readings should be made.

10.02 **Grounds** having resistances up to 10,000 ohms can generally be localized by the bicycle wheel exploring coil method, provided the length of wire beyond the fault is very short, say not over 50 feet. At the terminal or far end of the section containing the fault, a 20-C test set should be connected between the faulty wire and ground, using terminals 3 and 5. The cut end should be clear. Intermittent tone should be used.

Beginning at a point between the 20-C test set and the excavation where the tone can be heard, walk along the path of the wire toward the excavation with the bicycle wheel held in a vertical position and its plane in line with the direction of the wire. This position of the coil will give maximum tone pickup. The tone will be heard in the receivers at its full intensity between the 20-C test set and the fault. Beyond the fault the volume of tone will diminish. If the fault resistance is high, the decrease in tone will be slight. If the tone picked up by the exploring coil and receiver is not sufficiently loud, a 4-B amplifier should be connected between the coil and the receivers.

10.03 At the point where a decided decrease in tone occurs, the wire should be exposed but not disturbed. Listening to the tone by running the 19-C exploring coil along the exposed wire may be helpful in determining whether the fault is on either side of this excavation. If no change in tone intensity is evident, it may be assumed that the fault has either cleared or that it is not at this point and further tests should be made before cutting the wire. It should be borne in mind that in the case of high resistance faults there may be some carry-over of the tone, in which case accurate locations may not be practicable. Also, there is some possibility of clearing the fault by exposing the wire. When it seems probable that the point of fault has been found or where some positive indication of damage is visible, the supposedly damaged piece of wire should be removed. Tests should then be made in both directions with the Wheatstone bridge or megger to determine if the trouble has been cleared.

10.04 **Open:** If both conductors are open at the same point, the fault may be located with the bicycle wheel exploring coil and 20-C test set. The test set should be connected between both wires and ground using terminals 3 and 4. Intermittent tone should be used. The coil should be held as described in paragraph 10.02. The tone will diminish in volume from the test set to the open and very little, if any, tone should be heard beyond the open.

**11. IDENTIFYING FAULTY WIRE**

11.01 Where there are two buried wires in the same trench, they can be identified after exposure by the use of the 19-C and 20-C test sets. Terminals 3 and 5 and intermittent tone should be used. If the fault is an open on one conductor, the test set should be connected between the good conductor and ground. If both conductors are open, the set should be connected between either or both of the conductors and ground. If one of the conductors is grounded, the set should be connected between the faulty conductor and ground. If both conductors are grounded, or in the case of a short-circuit, the 20-C test set should be connected between one or both conductors and ground.

11.02 At the excavation the two pairs should be separated about one foot and the 19-C test set held against each pair in turn. The greater volume of tone will be heard in the receivers when the test set is held against the pair to which tone is connected.

**12. "CUT AND TRY" METHOD**

12.01 A fault which cannot be located by the above methods must be located by the "cut and try" method. The wire should be exposed and cut at the approximate center of the section in which the fault has been isolated. After the wire has been cut, tests should be made in each direction from the cut to determine which section contains the fault. The section containing the fault should be exposed at the approximate center, the wire cut and tested in both directions. These operations should be repeated until the section containing the fault has been shortened sufficiently to allow it to be readily replaced.

## 49-TYPE CABLE TERMINAL TERMINATING CONDUCTORS

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4. SELECTION OF CABLE PAIR . . . . .	4
5. PREPARING AND TERMINATING CONDUCTORS . . . . .	4
6. REARRANGEMENT . . . . .	11

### 1. GENERAL

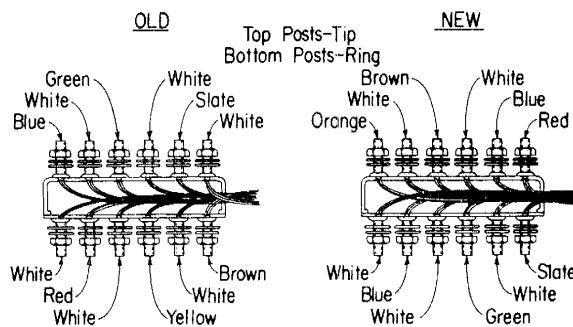
**1.01** This section describes a new method of arranging plastic-insulated conductors for terminating in 49-type cable terminals. This method will:

- (a) Promote better housekeeping.
- (b) Facilitate the selection of assigned cable pairs.
- (c) Simplify making conductor joints.

**1.02** This section is reissued to revise the figures.

### 2. TERMINAL BLOCKS

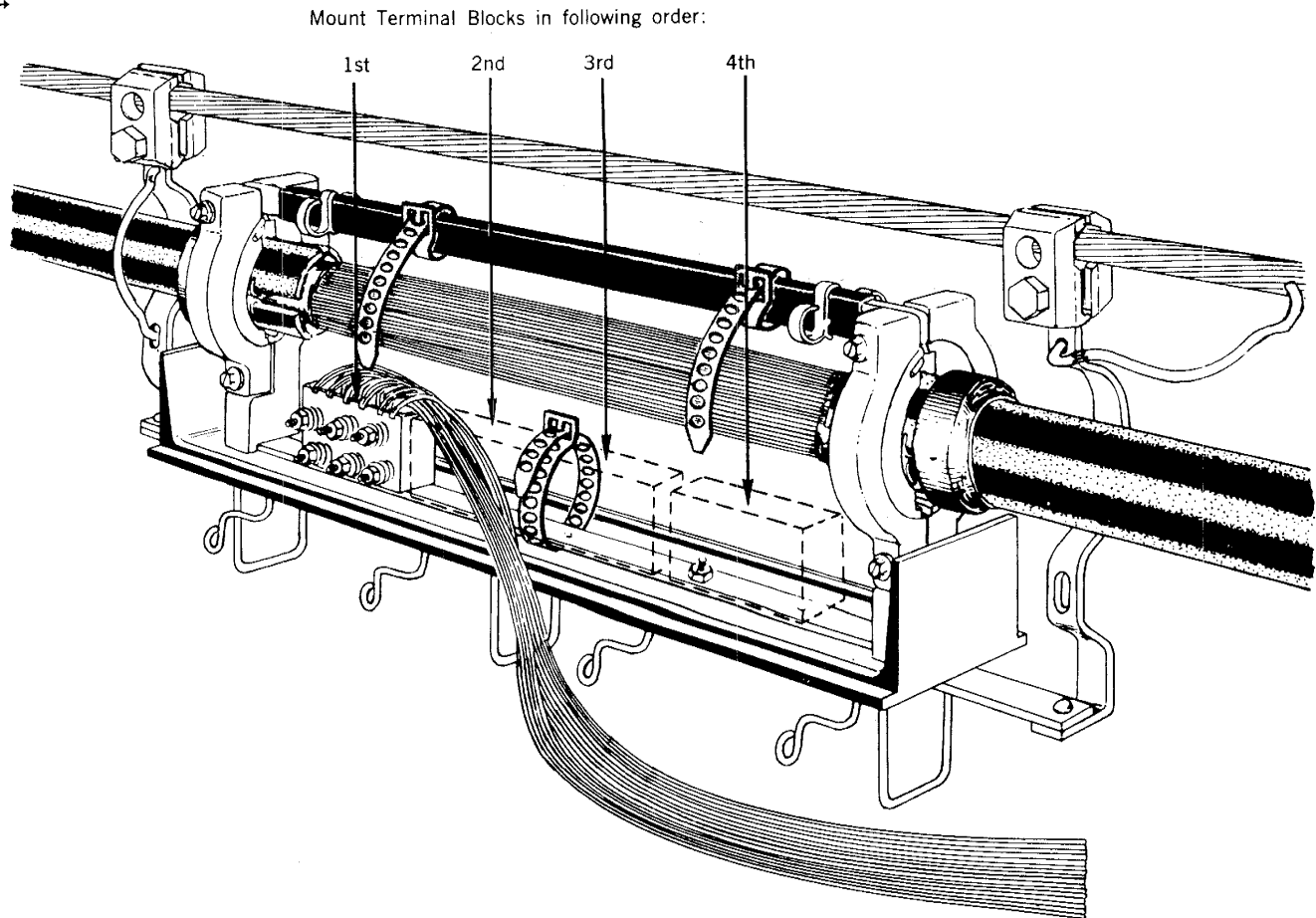
**2.01** The 49-type terminals are furnished with one P-18A782 Terminal Block (6 pair). See Fig. 1 and 2.



**Fig. 1 — Color Codes of P-18A782 Terminal Block ←**

**2.02** The P-18A782 Terminal Block is mounted in the first position. When additional blocks are required, mount them in the order shown in Fig. 2.

↗



Mount Terminal Blocks in following order:

↙

**Fig. 2 – Terminal Block Mounting Positions**

**2.03** At seacoast or other locations where corrosion due to salt atmosphere can be expected, remove the P-18A782 Terminal Block and replace it with a 3A1-6 Terminal Block. These blocks are similar except that the mounting studs of the 3A1-6 Terminal Block are made of zinc-plated steel.

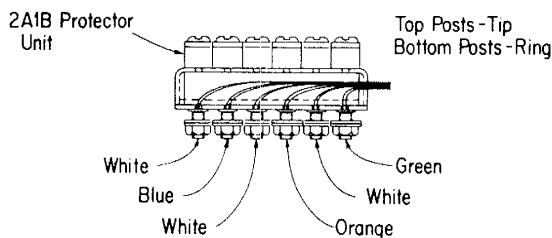
**2.04** If cable protection is required, remove the P-18A782 Terminal Block and substitute a 3A2B-3 Terminal Block (3 pair). The 3A2B-3 Terminal Block replaces the F-53458 Terminal Block. See Fig. 3.

**2.05** When mounting a terminal block, pierce the neoprene base visible in the mounting holes of the terminal and then work the studs of the block into the holes. Fasten securely with the nuts provided.

**2.06** The terminal blocks are equipped with two leads internally connected to each binding post. The two leads are designated as either tip or ring by colored plastic (PVC) insulation.

**3. IDENTIFYING AND MARKING BINDER GROUPS**

**3.01** Remove the core wrapper from the sheath opening. On color-coded cable having more than one binder group, it is necessary to identify the group or groups containing the assigned terminations. Each of these groups must be marked before removing its unit binders, so that the color code of the groups can be determined at later visits to the terminal. Binder groups are marked with color-coded plastic-insulated wire or with



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**Fig. 3 – Color Code of 3A2B-3 (F-53458) Terminal Block**

→

colored plastic markers. The method is illustrated in Section 632-410-200. It is recommended that insulated wire binder group markers be placed at

the center of the opening, which will facilitate selecting the binder group for the assigned cable pair. See Fig. 4 and 5.

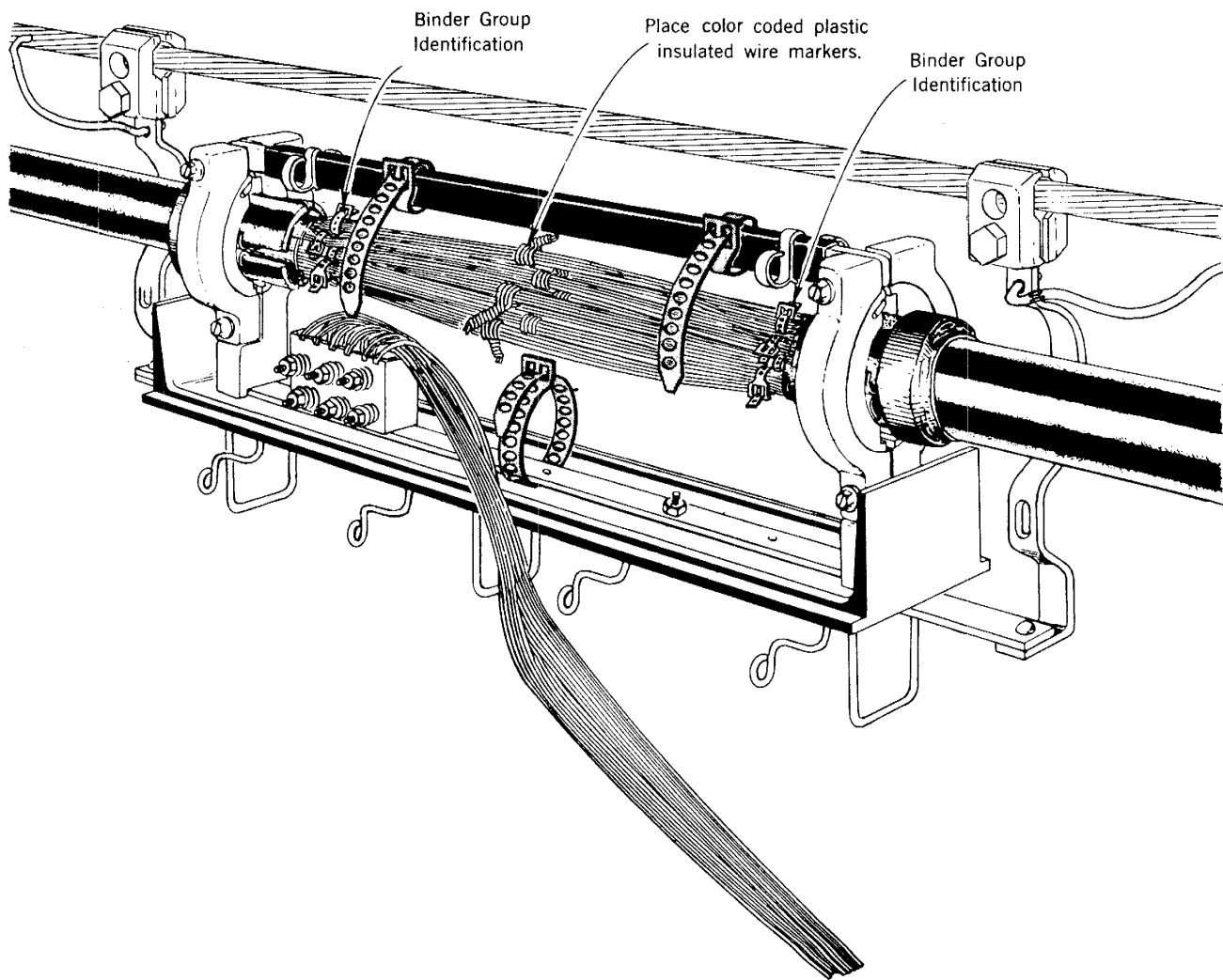


Fig. 4 – Placing Binder Group Identification in Cable

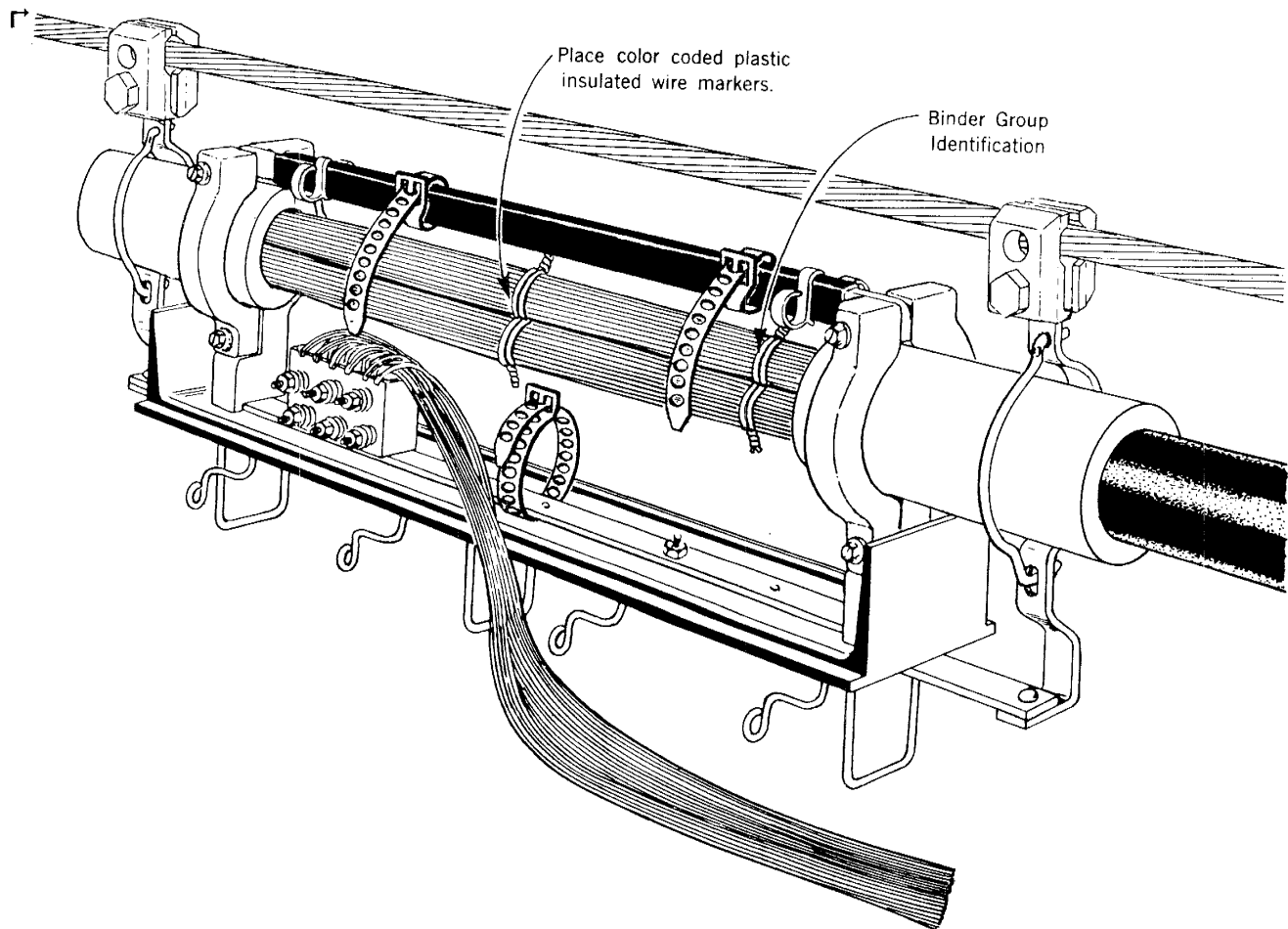


Fig. 5 – Placing Binder Group Identification in Stub

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#### 4. SELECTION OF CABLE PAIR

**4.01** The selection of the cable pair or pairs to be terminated should be done as called for on the work authorization, which should specify the method of identifying the pair, that is by color code or tone.

**4.02** When selecting cable pairs by color code, use the *center* binder group markers for identifying the required group. Slide the marker to one side and then select the required cable pair within the group.

#### 5. PREPARING AND TERMINATING CONDUCTORS

##### At Loop Through Locations

##### 5.01 Cable Pair

- (1) Cut the selected cable pair at the center of the sheath opening.

- (2) Restore the binder group marker to the center. See 3.01 and 4.02.

- (3) Separate the cut cable pair ends from the remaining pairs and from the center binder group marker.

##### 5.02 Terminal Block Leads

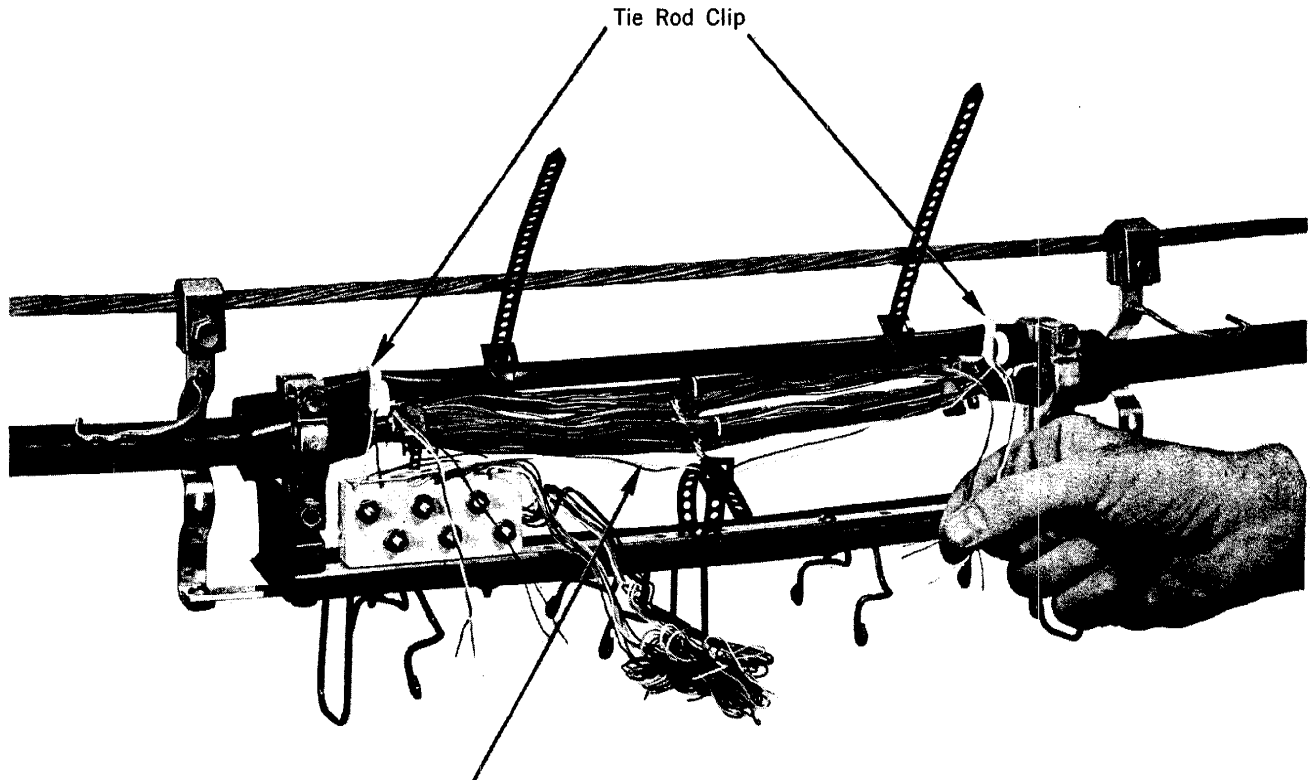
- (1) Pair the leads for the assigned binding post.
- (2) Twist each pair separately for the in and out connection.
- (3) Loop the binding post pairs through the tie rod clips.
- (4) Cut the binding post pairs so they are of lengths equal to the cut cable pair ends. See Fig. 6.

##### 5.03 Terminate conductors as outlined in Sections 632-205-204 and 632-205-205.



5.04 The terminated pairs are then twisted together. See Fig. 7.

5.05 Fig. 8 illustrates in and out connections for one cable pair completed and held in place with B Cable Ties.



Note: One Binding Post Pair is threaded through the B Cable Tie fastened to the base.

Fig. 6 – Cutting Binding Post Pairs

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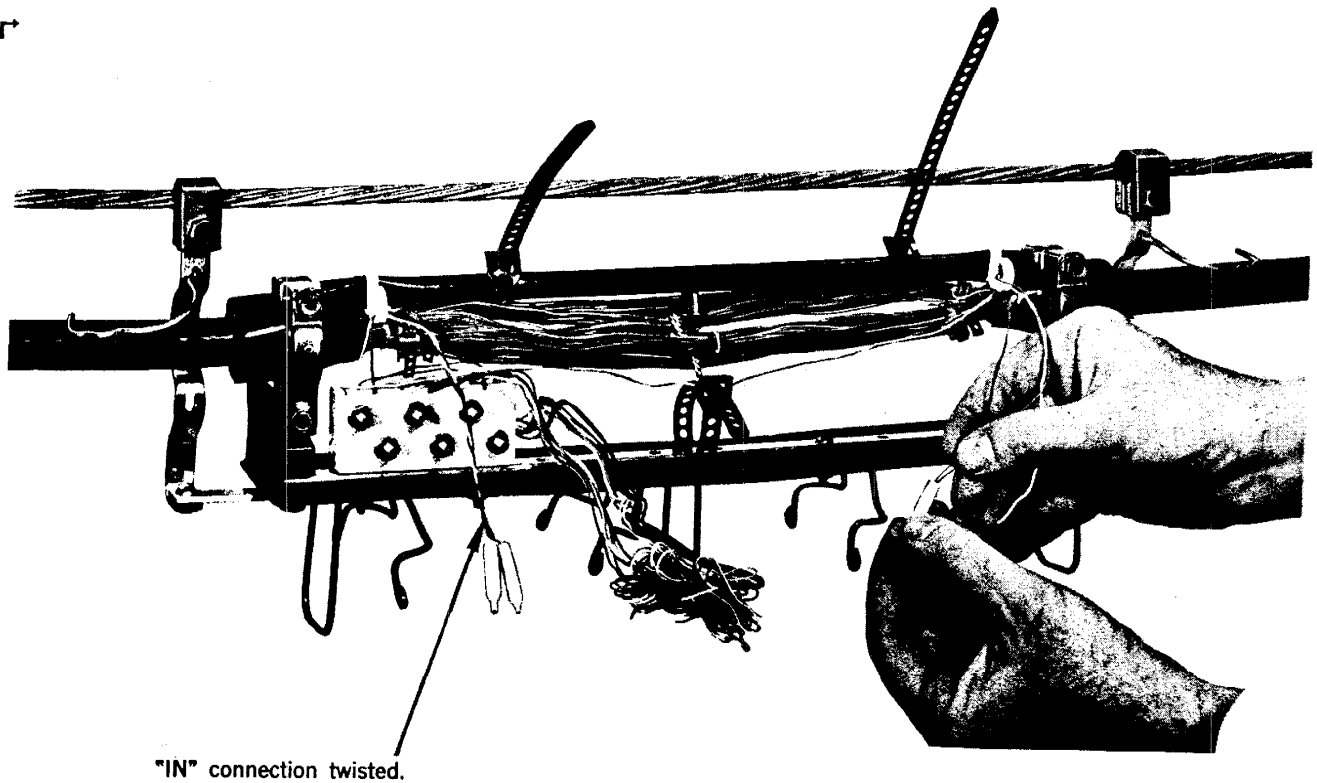


Fig. 7 — Terminated Pairs Twisted Together

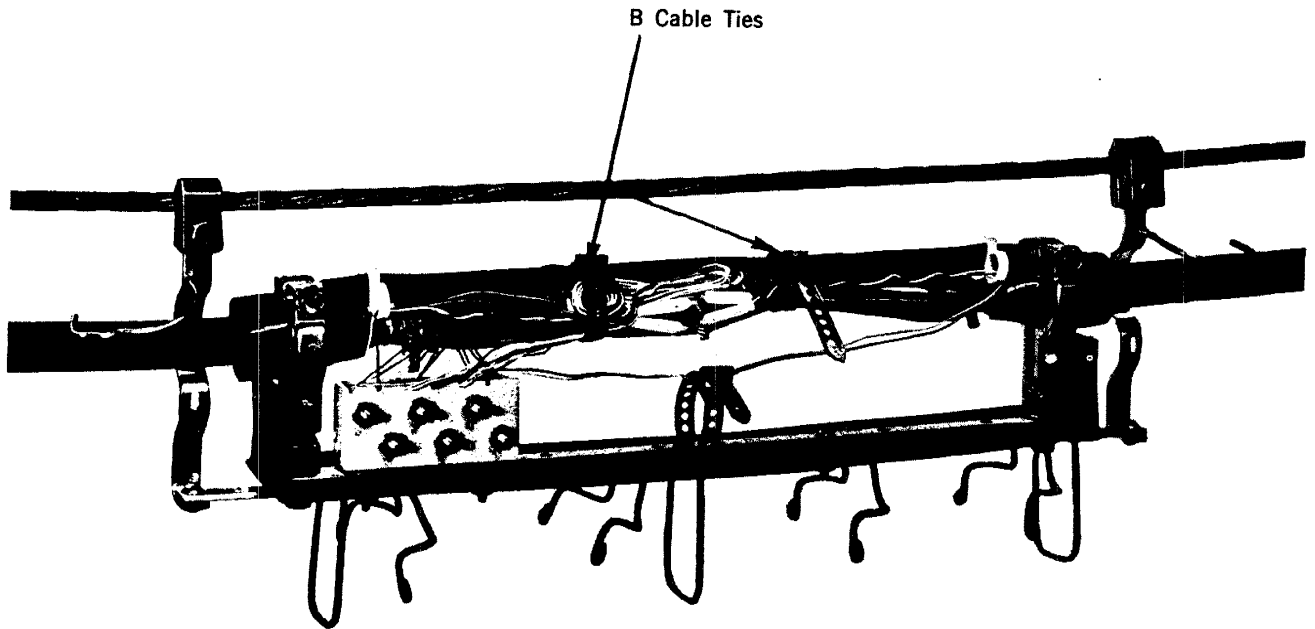


Fig. 8 — Completed Termination

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5.06 Fig. 9 illustrates *eight* cable pairs terminated. Note the ease of gaining access to the unterminated cable pairs.

5.07 Fig. 10 and 11 illustrate *four* terminal blocks placed with all terminal block leads joined to the assigned cable pairs. Note the orderly housekeeping that can be achieved.

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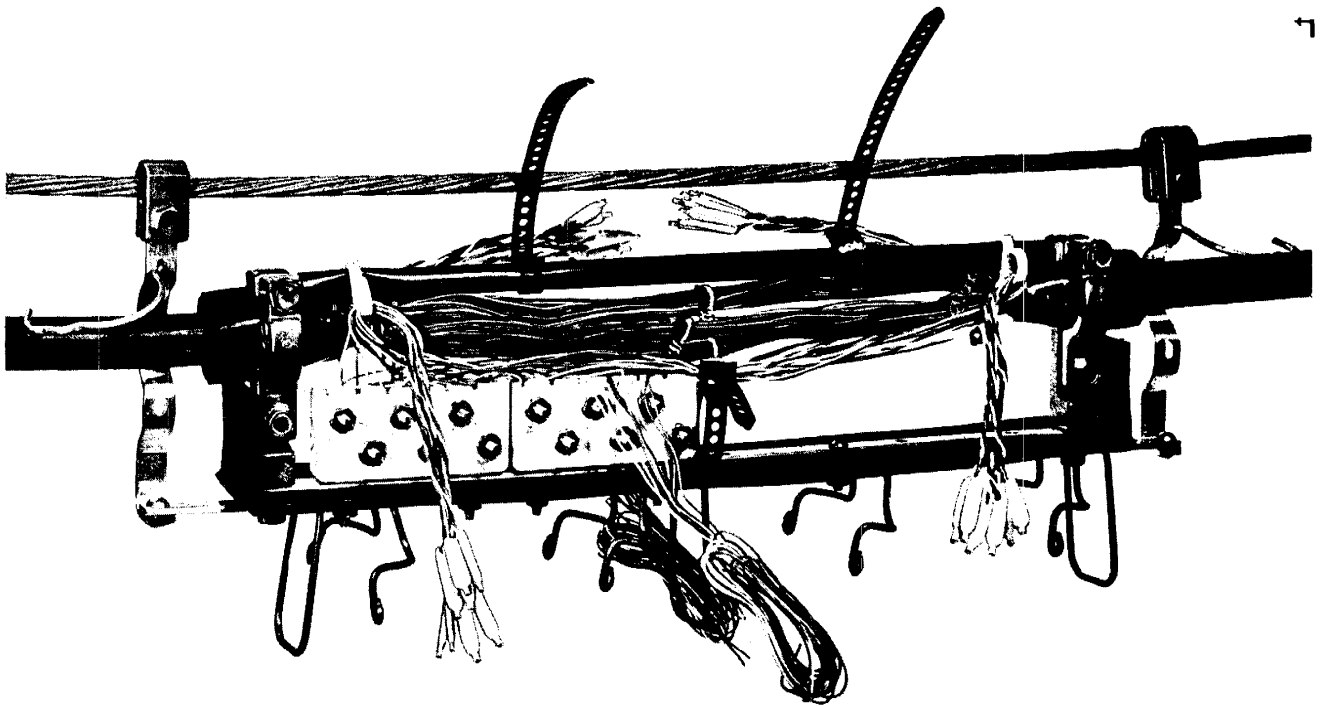


Fig. 9 – Eight Cable Pairs Terminated

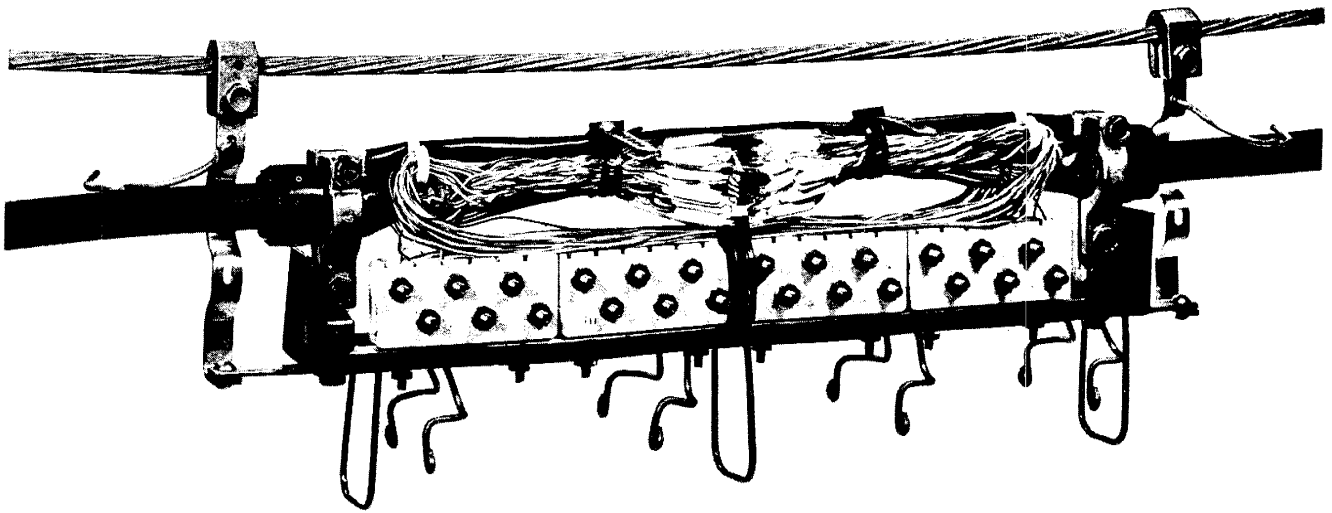
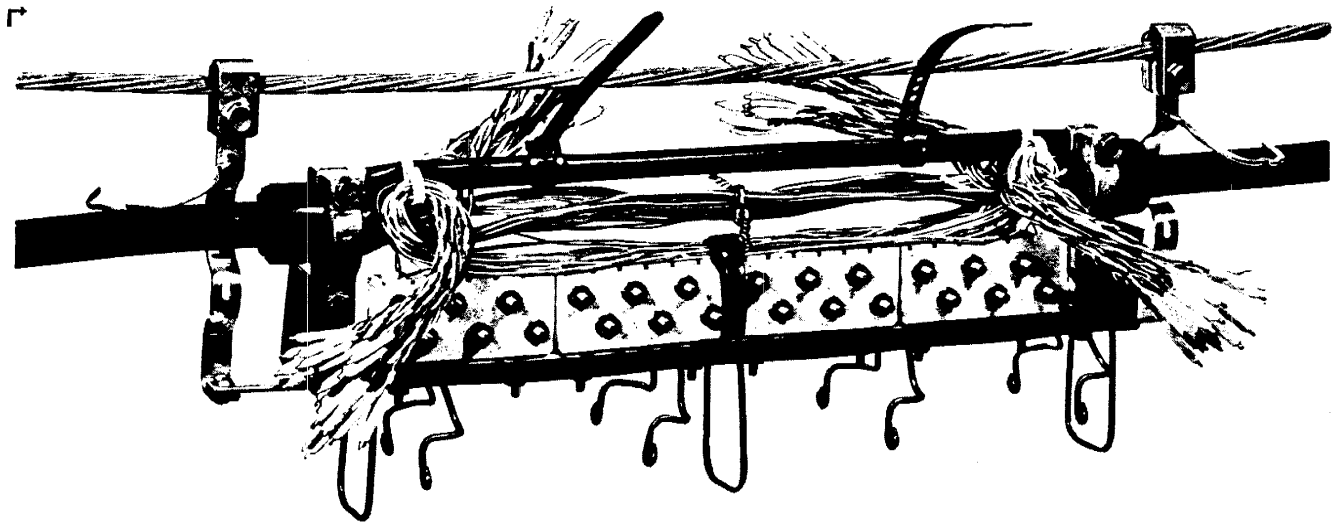


Fig. 10 – Four Terminal Blocks Terminated

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NOTE: The terminated pairs are folded back to gain access to the unterminated cable pairs for rearrangement.

Fig. 11 — Terminal Prepared for Rearrangement

#### At 1A1 or 1B1 Terminal Stub Locations

##### 5.08 Cable Pair

- (1) Cut the selected cable pair at the capped end of the opening.
- (2) Restore the binder group marker to the center. See 3.01 and 4.02.
- (3) Separate the cut cable pair from the remaining pairs and from the center binder group marker.

##### 5.09 Terminal Block Leads

- (1) Cut off (as close to the terminal block as feasible) one ring (or tip) lead to each binding post. This should be done for the initial furnished terminal block and for subsequent blocks.
- (2) Twist together the remaining leads for the assigned binding post to form a pair.
- (3) Loop the binding post pair through the tie rod clip.
- (4) Match the binding post pair with the cut cable pair and cut the pairs so they are of equal lengths. See Fig. 12.

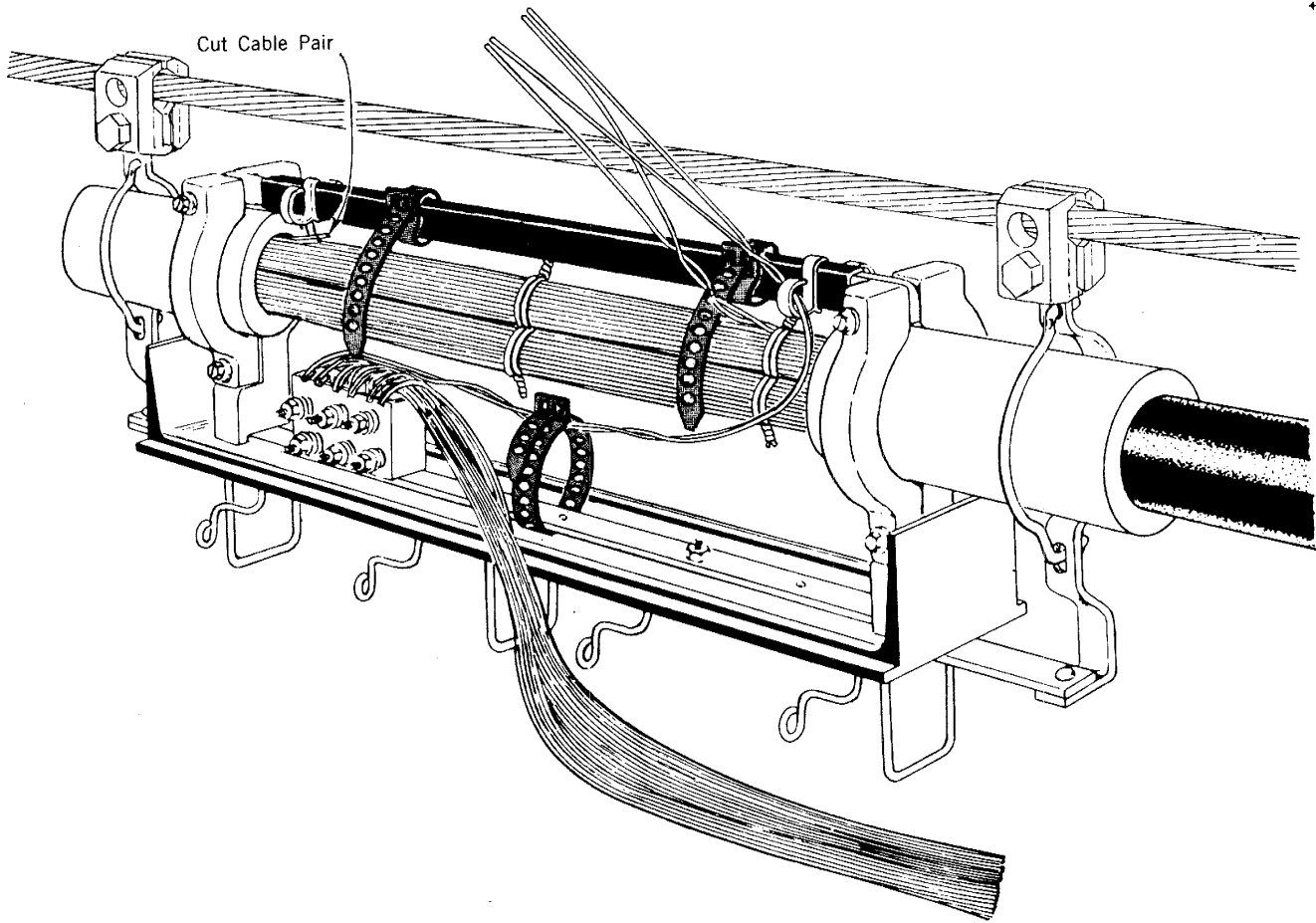
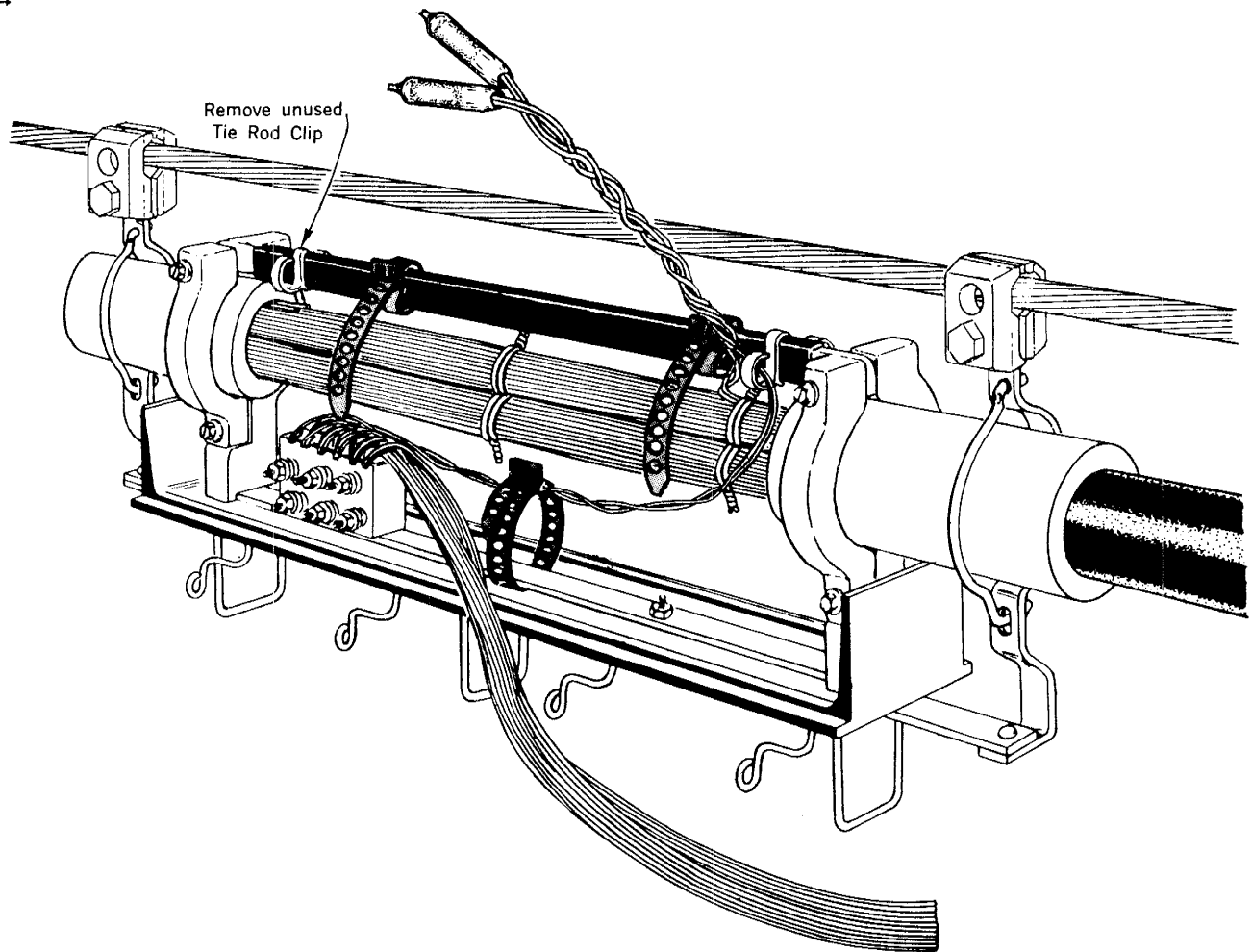


Fig. 12 – Wire Arrangement at Stub Locations

5.10 *Terminate conductors as outlined in Section 632-205-204 and 632-205-205. The terminated pairs are then twisted together. See Fig. 13.*

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Fig. 13 – Terminated Pairs Twisted Together

5.11 Fig. 14 illustrates three terminated cable pairs held in place with B Cable Ties.

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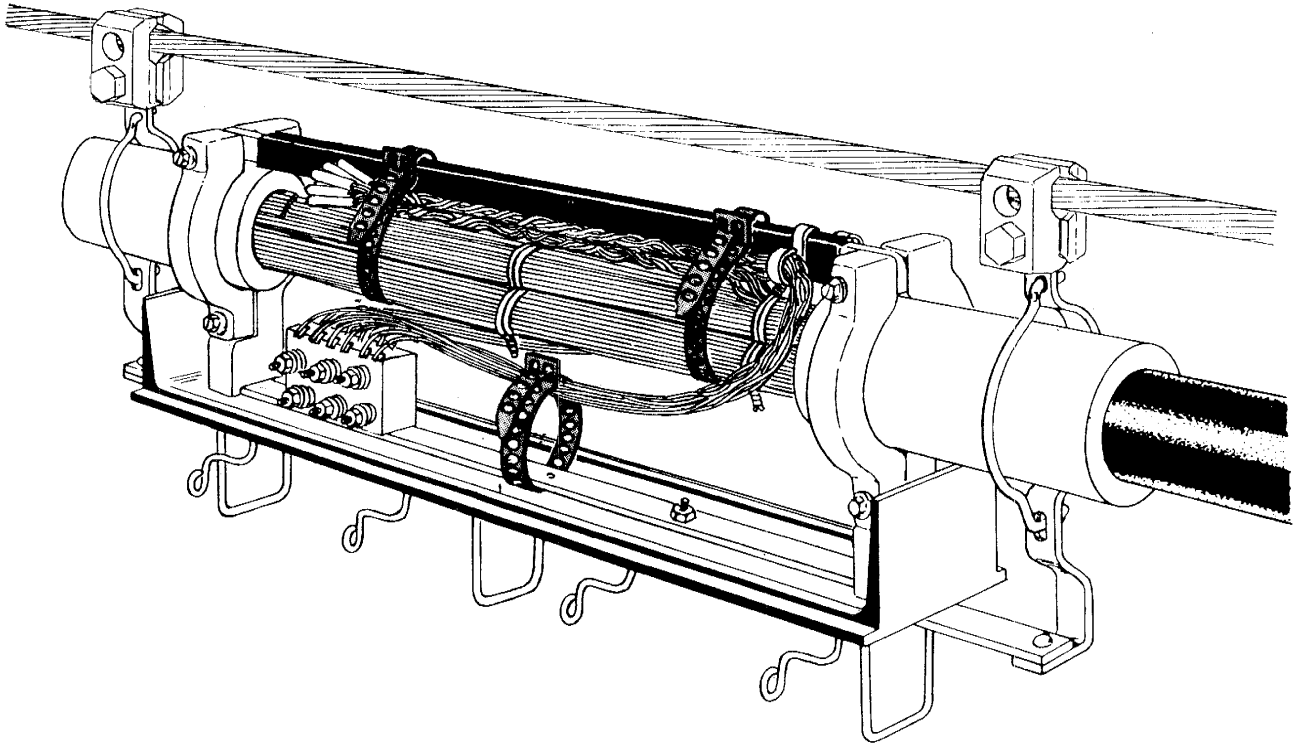


Fig. 14 – Completed Termination of Three Cable Pairs

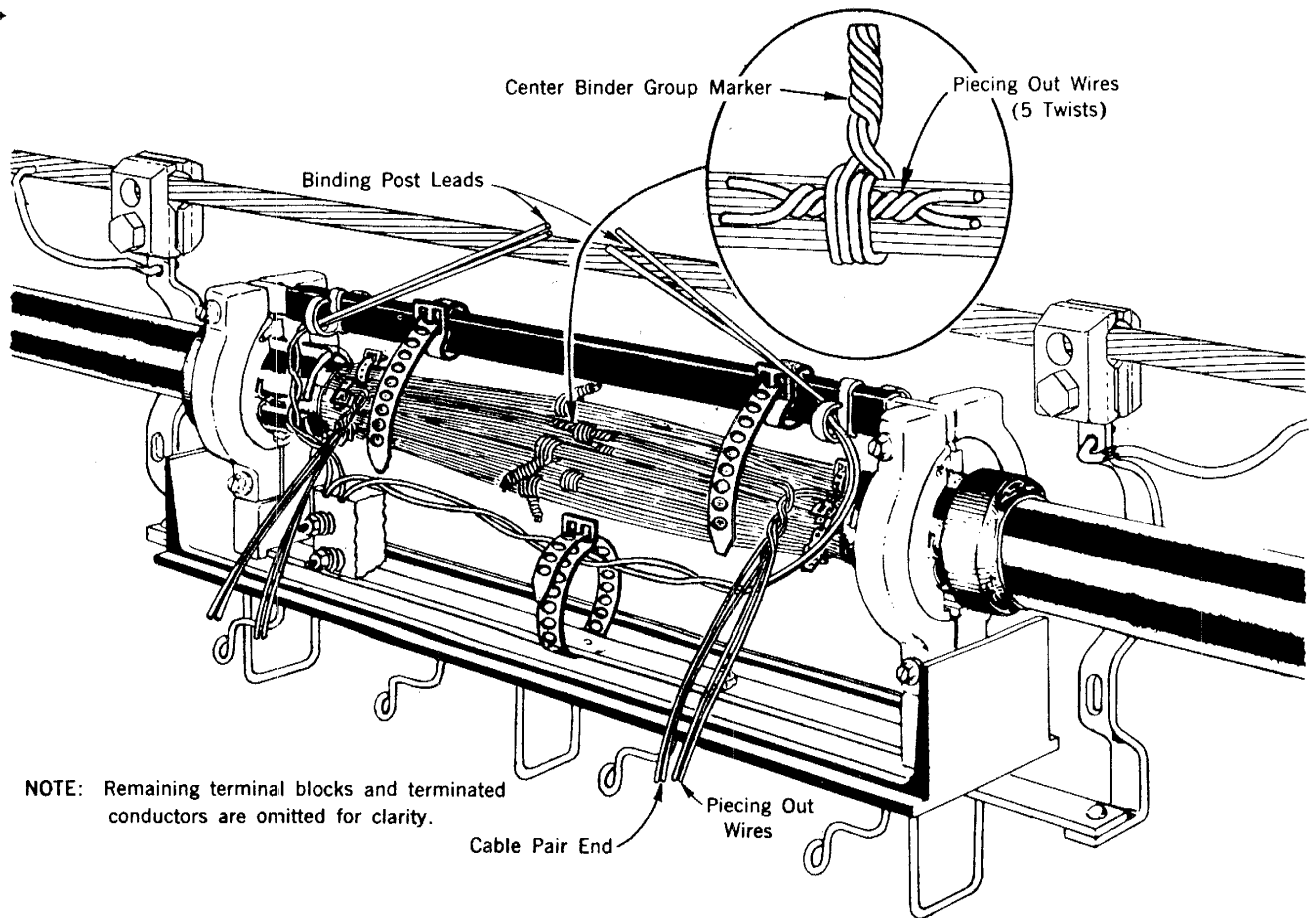
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## 6. REARRANGEMENT

6.01 If a binding post (whose leads are joined to a cable pair) is to be reassigned to a new cable pair, proceed as follows.

### At Loop Through Locations

- (1) Ascertain the binder group color and cable pair color for the pair to be restored.
- (2) Cut off the B Wire Connectors which join the binding post leads to this pair.
- (3) Separate the cut cable pair ends from the binding post leads.
- (4) Using approximately 20 inches of piecing-out paired wire having the same color insulation as the cut cable pair conductors, apply five tight twists at the center of the paired wires.
- (5) Thread the piecing-out wires through the center binder group marker from which the original cable pair was removed.
- (6) At each end of the opening (approximately 1 inch from the end binder group markers), apply two turns with the piecing-out wires and the cut cable pair ends. See Fig. 15.



**Fig. 15 — Applying Turns to Pairs**

(7) Cut the ends of the conductors to equal lengths and then join the conductors with B Wire Connectors as outlined in Sections 632-205-204 and 632-205-205.

(8) Twist the joined pair for each end back to the point of crossover. See Fig. 16.

(9) Rerminate the binding post leads to the new cable pair in the normal manner.



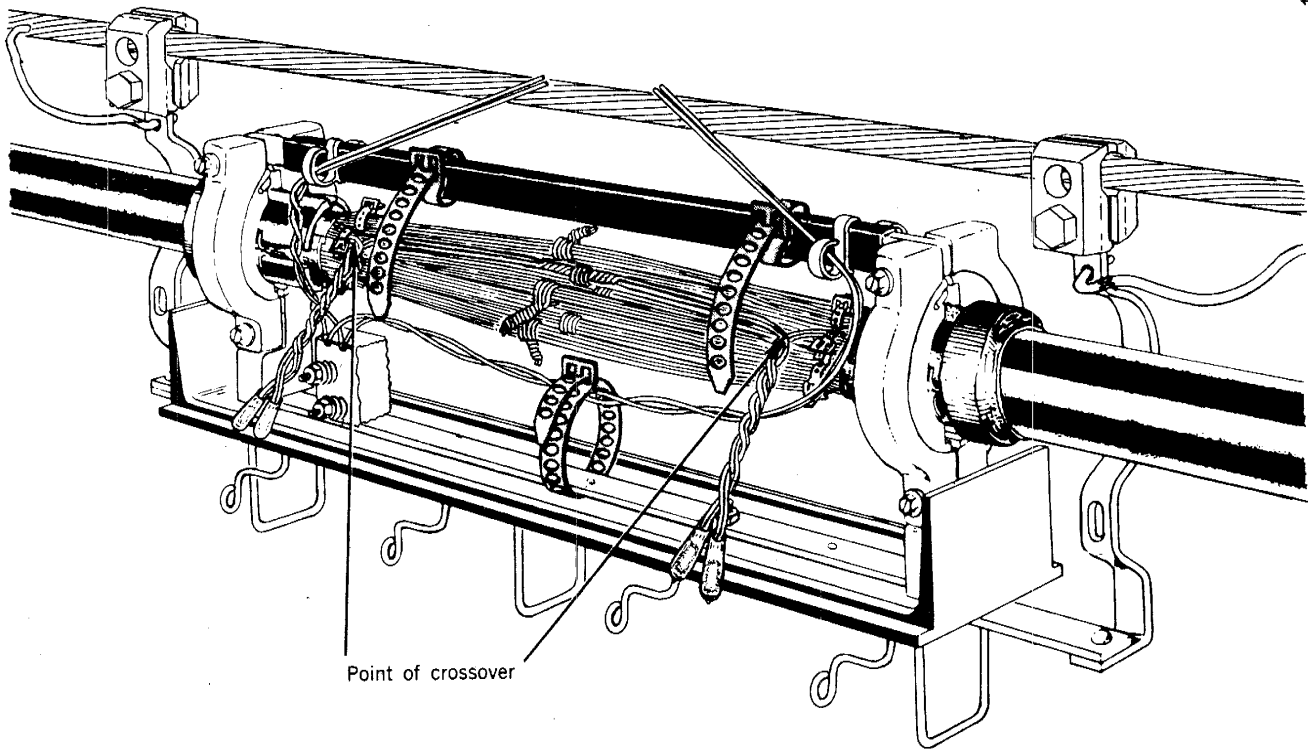
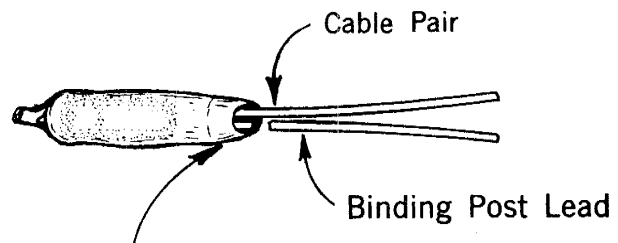


Fig. 16 — Piecing Out Completed

- (10) If a pieced-out cable pair is reassigned, **cut off the B Wire Connectors** which join the piecing-out wires to the cable pair ends. Remove the piecing-out wires from the center binder group marker and then handle the cable pair ends in the normal manner.

#### At 1A1 or 1B1 Terminal Stub Locations

- (11) Ascertain the binder group color and cable pair color of the pair to be restored.
- (12) Cut off the binding post leads **only** at the B Wire Connector which joins these leads to the old cable pair. See Fig. 17.
- (13) **Twist together the old cable pair conductors (whose ends are cleared with the B Wire Connectors) for a few turns and replace in the original center binder group marker.**



Cut the Binding Post Lead inside the plastic covering of the B Wire Connector.

Fig. 17 — Cutting Binding Post Lead

- (14) Reterminate the binding post leads to the new cable pair in the normal manner.
- (15) If a cable pair (whose ends are cleared with B Wire Connectors) is reassigned, cut off the connectors and then terminate the conductors in the normal manner.



## 3A1 CLOSURE

### DESCRIPTION AND INSTALLATION

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5. INSTALLATION OF CABLE, PROTECTORS, AND WIRES . . . . .	4

24- or 26-gauge conductors. Therefore, the closure may be used to terminate 24- or 26-gauge PIC cables up to 1 inch in diameter on any exterior building wall.

**1.04** *Do not store or leave any combustible material inside the closure.*

#### 2. DESCRIPTION

**2.01** The 3A1 Closure, illustrated in Fig. 1, consists of a base provided with a B Cable Tie, three grommets, and a cover. The cover has a locking screw for securing it to the base. Two sealing clamps and four No. 10-32 by 1/2-inch machine screws (packaged) are provided with each closure.

**2.02** Optional parts, which are not furnished with the closure and must be ordered separately as required, are as follows:

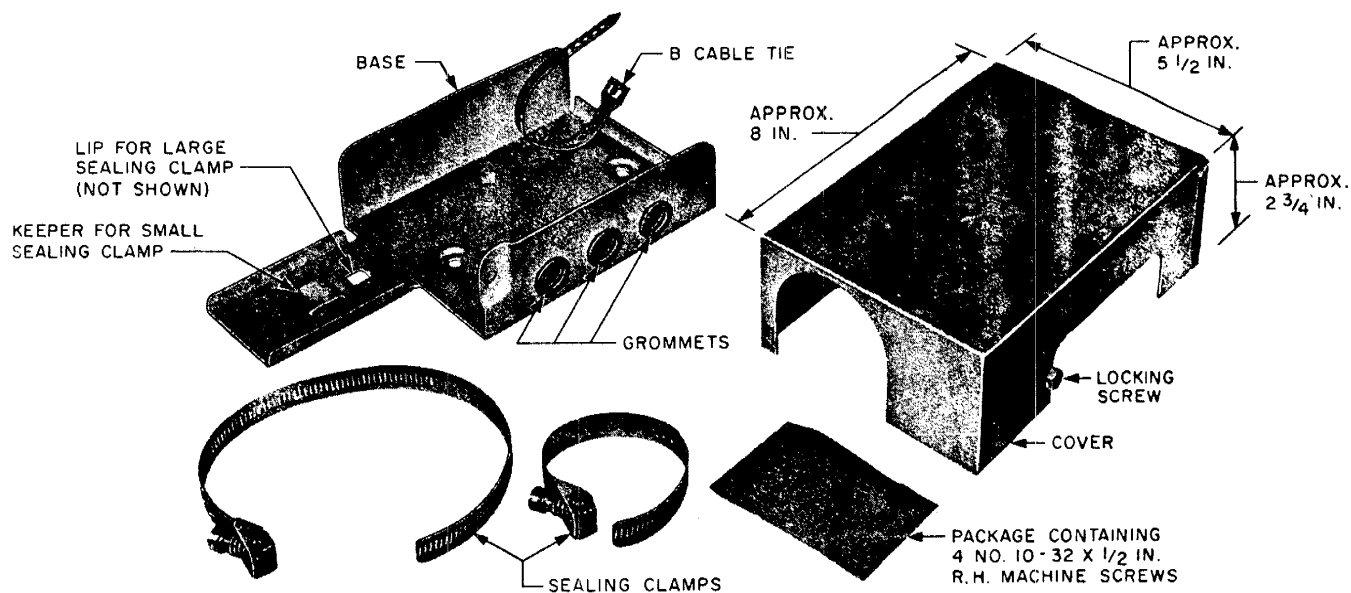
- (a) No. 2 U-Guard—For protecting the cable above ground level.
- (b) 123A1A Station Protector—One-pair station protector.

#### 1. GENERAL

**1.01** This section covers the description and installation of the 3A1 Closure in buried distribution systems.

**1.02** This section is revised to eliminate the requirement that the 3A1 Closure be installed only on fireproof walls.

**1.03** This closure can effectively contain any internal fire that might develop from fusing



**Fig. 1—3A1 Closure and Furnished Parts**

**SECTION 631-600-204**

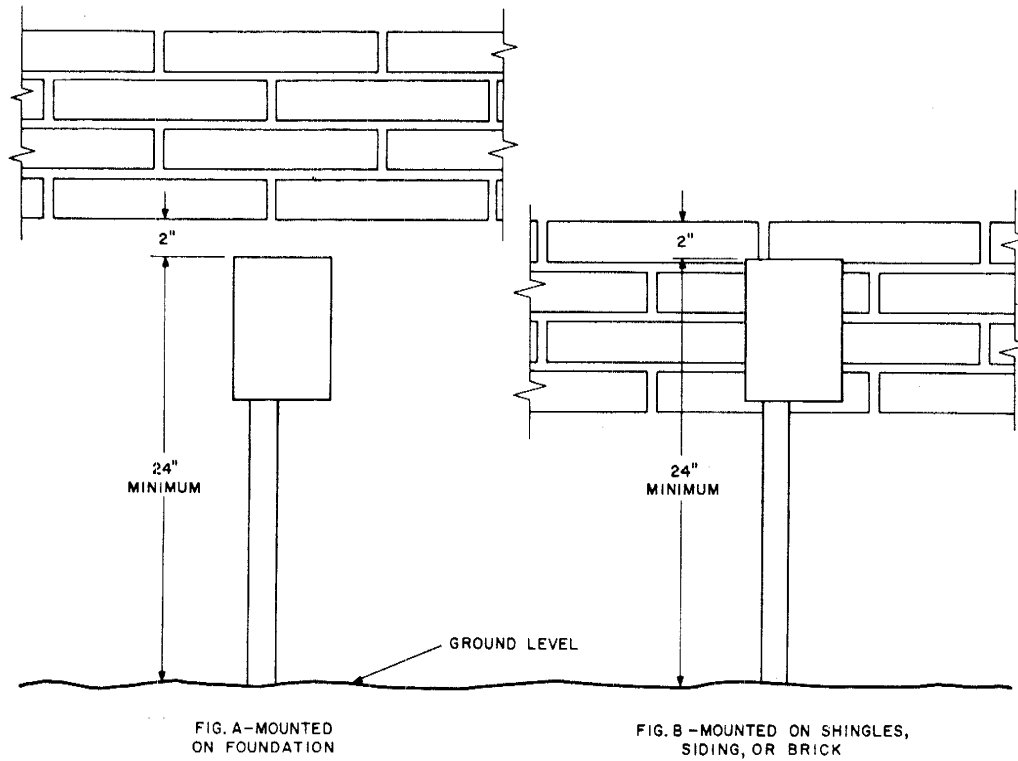
(c) 128A1A Station Protector—Two-pair station protector.

**3. PLACING**

**3.01** The 3A1 Closure should be mounted as illustrated in Fig. 2. Note that the closure should be placed with the top a minimum of 24 inches above ground level.

**3.02** Attachments should be made as follows:

- (a) Shingles or Siding - Use 2-inch No. 14 rh galvanized wood screws. Drill a 1/8-inch lead hole to prevent splitting of shingles or siding.
- (b) Foundation or Brick - Use 1/4- by 1-inch hammer drive anchors or equivalent.



**Fig. 2—Mounting 3A1 Closure**

#### 4. PREPARATION OF SHEATH OPENING

4.01 Remove the cable sheath and prepare the tabs as follows:

(a) Place the B Paper Tape Markers on the sheath as illustrated in Fig. 3. *These dimensions must be measured accurately. A good housekeeping job cannot be done if the sheath opening is too long or too short.*

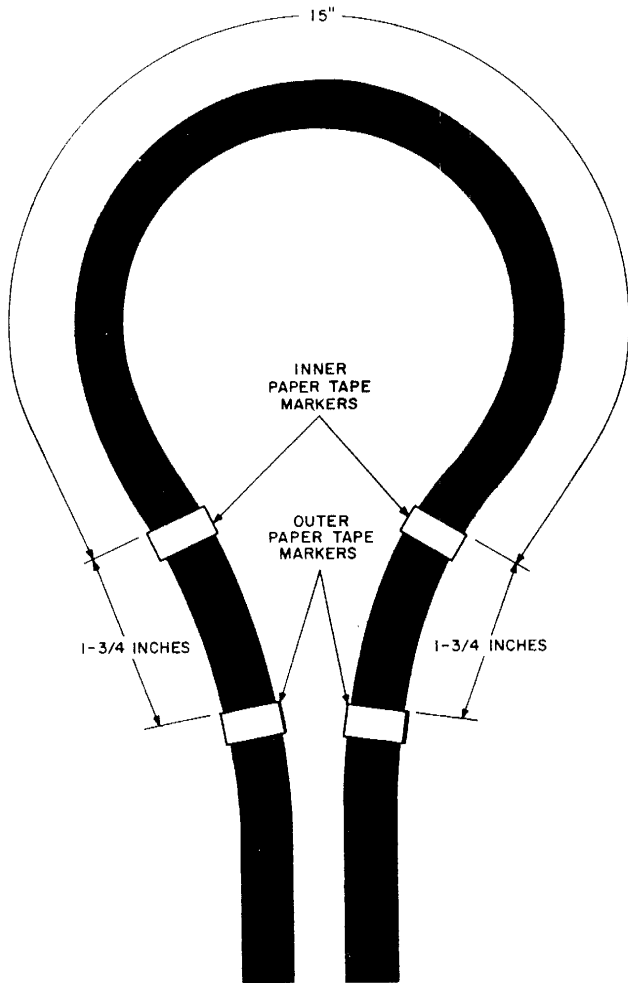


Fig. 3—Paper Tape Marker Installed

(b) Remove the sheath between the inner tape markers. Remove the inner tape markers.

(c) Prepare four tabs of approximately equal width by making longitudinal cuts through the polyethylene and metal layers to the edge of the outer tape markers, as illustrated in Fig. 4. *To avoid damage to the core, first tab the polyethylene and then tab the underlying metal layer.* Remove the outer tape markers. On the PAP sheath cable, tab only the aluminum and the outer polyethylene covering.

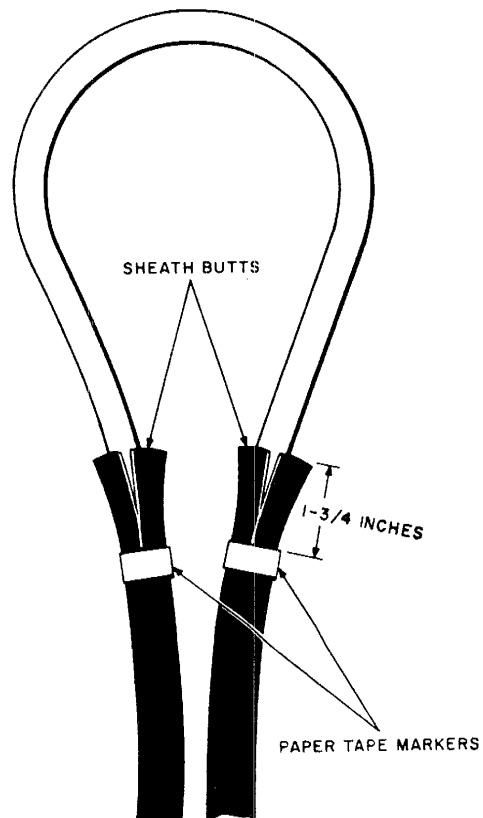


Fig. 4—Preparing Tabs

4.02 Install a P-18E113 Inner Sheath Clamp on cables up to 0.6 inch in diameter and a P-18E115 Clamp on cables 0.7 through 1 inch in diameter as shown in Fig. 5. *Do not apply tape over the ears of the inner sheath clamp. Do not substitute bonding ribbon or B Bond Clips for inner sheath clamp. They do not provide adequate mechanical strength, protective grounding, or inductive noise shielding.*

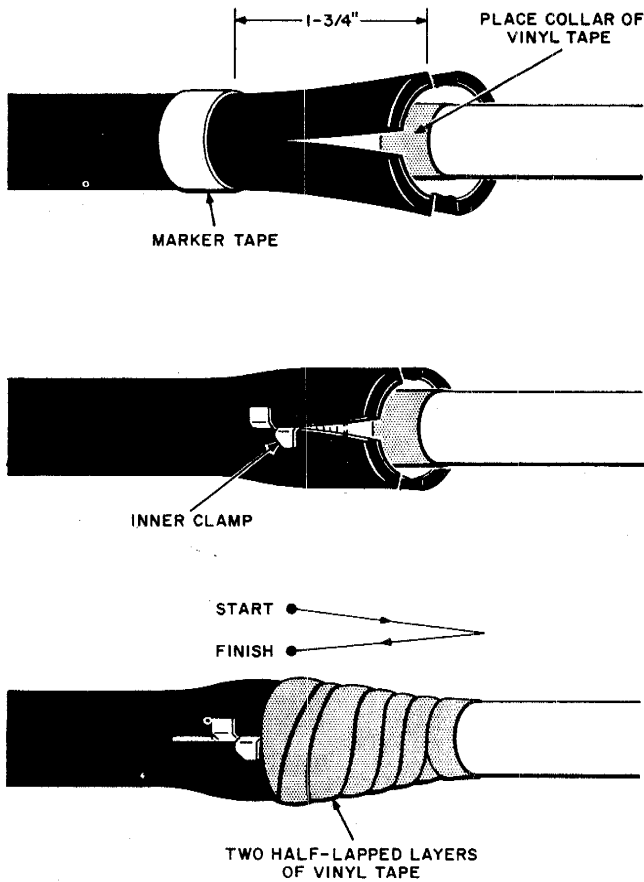


Fig. 5—Installation of Inner Sheath Clamp

5. INSTALLATION OF CABLE, PROTECTORS, AND WIRES

5.01 Place the small sealing clamp through the keeper on the base (Fig. 1). Tighten the clamp on the cable butts and inner sheath clamps, as shown in Fig. 6. Make sure that the sealing clamp screw is centered on the cable loop, as illustrated in Fig. 6, to permit proper mounting

of the U-Guard. *Tighten the sealing clamp securely, making sure of metal-to-metal contact between the inner clamps and the sealing clamp. This ensures adequate mechanical strength, protective grounding, and inductive noise shielding.*

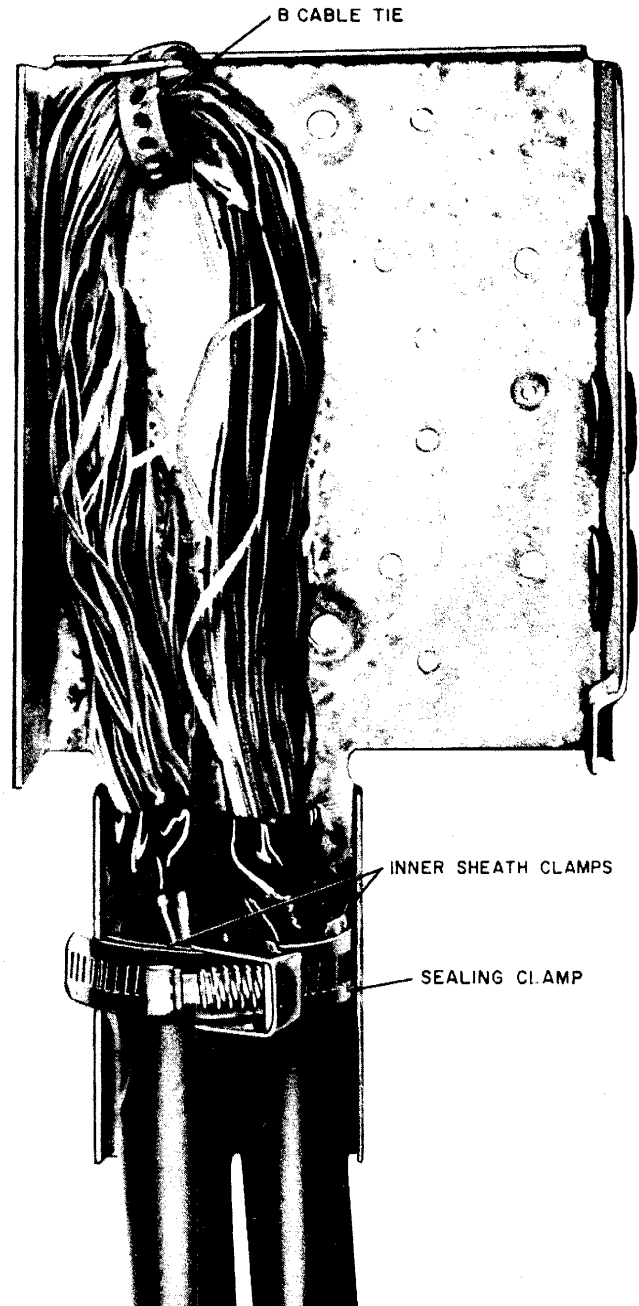


Fig. 6—3A1 Closure in Place Without Cover and U-Guard