CIVIL DEFENSE WARNING SYSTEM

(CDWS)

BELL AND LIGHTS SYSTEM

GENERAL DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section provides information formerly contained in Section 951-210-100, which is hereby canceled. This section also provides a redefinition of the meaning and application of civil defense warning (CDW) signals.

INTRODUCTION

A. Purpose of CDW System

1.02 The CDW system provides a rapid means of disseminating warning signals from keypoints and subkeypoints to warning stations and siren control stations. These signals are transmitted by dialing on private line signaling networks and are indicated at warning stations by bells and lights or by the operation of sirens. A typical arrangement of a CDW network is shown in Figure 1.

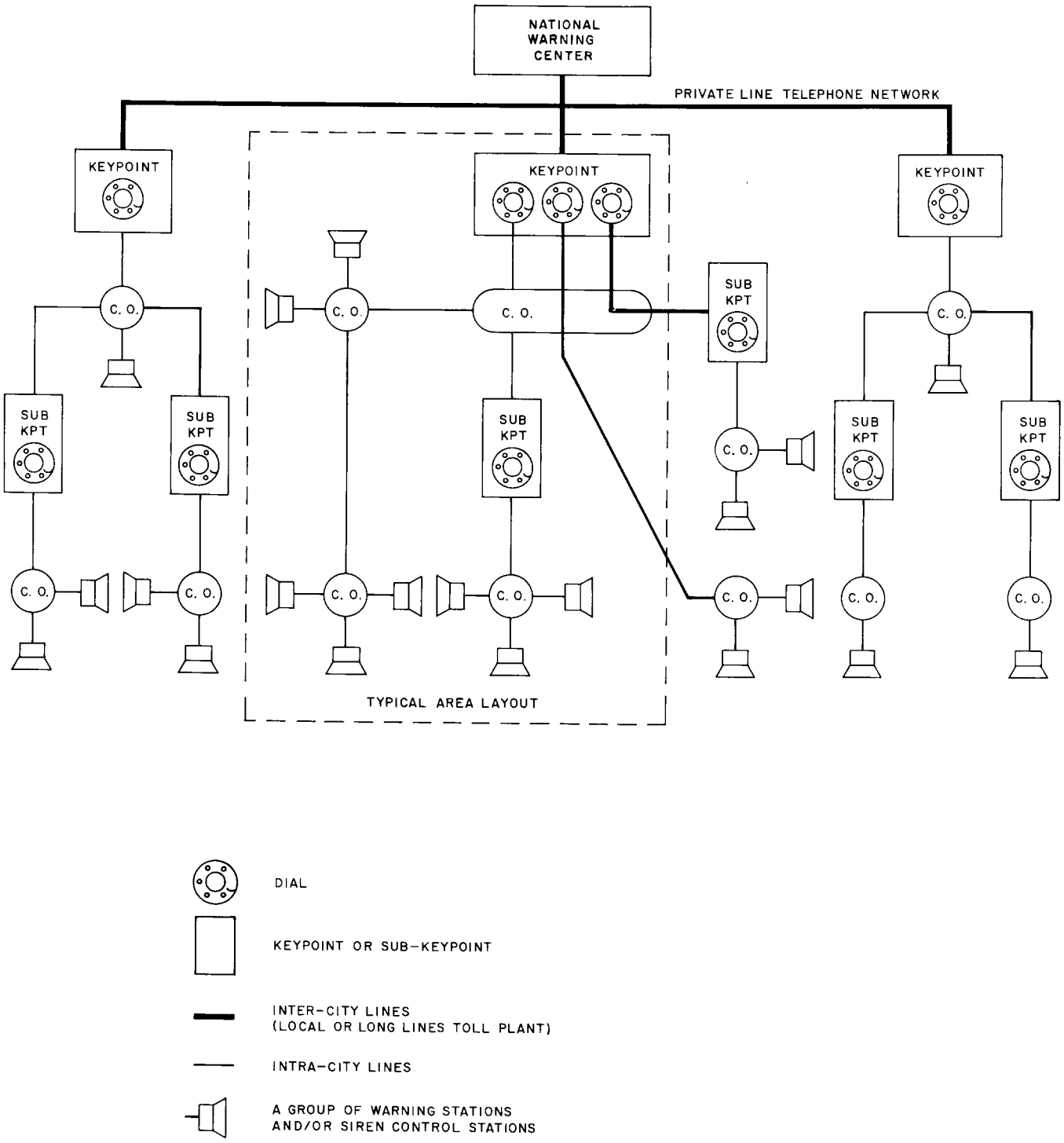

Fig. 1—Typical Arrangement of Civil Defense Warning Network for Dissemination to Keypoints, Subkeypoints, Warning Stations, and Siren Control Stations

B. Relation Between NAWAS and CDW Systems

1.03 The National Warning System (NAWAS) is sponsored and provided by the Office of Civil Defense. NAWAS National Warning Center I is collocated with North American Air Defense Command (NORAD) at Cheyenne Mountain, which allows NORAD to furnish warning information of national interest originating at NORAD or at Distant Early Warning (DEW line) installations. The warning information is transmitted to more than 1000 warning points. From keypoints in this network, CDW signals are relayed over private lines to subkeypoints, warning stations, siren control stations, and the public. Transmission of warnings from National Warning Center to the public may be divided into the following steps:

(1) From National Warning Center to keypoints by private line network.

(2) From keypoints to subkeypoints.

(3) From subkeypoints to warning and siren control stations.

(4) From siren control stations (using sirens or other attack warning devices) to the public.

1.04 Steps 2 and 3 may be combined so that a keypoint retransmits warnings directly to warning stations and siren control stations. The following CDW system description does not include Step 1.

C. System Planning

1.05 A CDW system consists of a combination of station apparatus and interconnected central office equipment which allows numerous configurations. System planning is therefore essential in achieving a unique system design for each subdivision of the civilian organizations responsible for receiving retransmission of warnings. For the planning phase, the general principles discussed in the following paragraphs may be used.

1.06 From each keypoint, the warnings may be disseminated by any combination of four methods:

(1) To groups of warning stations and siren control stations in the same city:

(a) Served from the same central office, or

(b) Served from different central offices.

(2) To a subkeypoint in the same city.

(3) To a subkeypoint in a neighboring locality.

(4) To a group of warning stations and siren control stations in an adjacent city, town, or village.

1.07 A keypoint or subkeypoint from which warnings can be directly retransmitted to warning stations or siren control stations is called a control point. Unless there is only one central office in the network, a minimum of two control points should be provided. The one normally used is called the ***primary control point;*** the one intended for emergency use is called the ***alternate control point(s).***

1.08 The area served by each control point is dictated by local conditions and established by persons responsible for civil defense. The area is also influenced by the degree of centralized control which is satisfactory to adjacent communities. Complete centralized control is technically possible by arranging a CDW network with branches which are interconnected by automatic signal facilities, and which cover a large area. An extensive degree of centralization provides the advantage of fewer personnel responsible for warnings and dissemination. Decentralization requires more personnel and reduced permanent wire connections. Thus, centralization permits greater flexibility for special emergency procedures.

1.09 Warning stations are usually located in police stations, fire stations, schools, factories, or hospitals. Siren control station equipment at the public warning device is usually located on top of fire stations, power poles, or in factories. Control points are usually located in police stations, fire stations, or civil defense control centers.

1.10 The early phase of planning may be facilitated by preparation of a layout for the warning network. A typical layout indicating various types of central office equipment which may be used is shown in Figure 2. The layout procedure should include the following steps.

(1) Procure an area map and indicate the locations of control points, warning stations, sirens, and central offices.

(2) Select the type(s) of CDW central office equipment which accommodates local requirements.

(3) Select outside conductors to interconnect central office and station equipment.

D. System Capacity

1.11 A single dial may control a large number of warning stations or siren control stations. The capacity of a network is keyed to the required service for civil defense authorities. Three sizes of dial pulse receiving units are available. One has a capacity for 200 stations, another for 8 stations, and the third for 5 stations. Any number of these units may be interconnected in a single network within practical distances between the control points and warning stations. However, it is recommended that the number of interoffice links between any control point and any central office in the network be limited to ten. The public signal control circuit has a 30-line capacity and any number of these may be interconnected in a single network.

E. Types of Warnings

1.12 The CDW system is arranged to disseminate four signals:

(1) TEST

(2) LOCAL ALERT

(3) ATTACK WARNING

(4) LOCAL ALERT (optional)

The second and third warning signals are transmitted to both the Bell and Lights and a public signal system (siren control line). The first and third signals are transmitted to the Bell and Lights stations only. Interpretation of the first and fourth signals is the responsibility of local authorities.

2. SIGNALING PRINCIPLES

A. Dial Pulsing and Ringing Signals

2.01 The dials provided at the control points are connected to private line networks which terminate in central office dial pulse receiving equipment. This equipment translates dial pulse signals into ringing signals which are transmitted over lines to Bell and Lights stations. The dial pulse signals may be transmitted over long loops of the network when signaling repeaters are used. These pulse repeaters are similar to telegraph repeaters, except that they operate on 48 volts instead of 130 volts and include automatic alarm features. The ringing signals are transmitted over the relatively short end-links between the central offices and warning stations, and permit the use of visual and audible station equipment which does not require local power.

2.02 The 200-station capacity central office equipment is substantially the same system as that used for 4-party full selective ringing on subscriber telephone lines. Two types of ringing signals are provided by this system. One consists of superimposed negative and positive ringing voltages connected to the ring side of the line for number 1 and number 2 station signals, respectively. The other consists of superimposed negative and positive ringing voltages connected to the tip side of the line for number 3 and number 4 station signals, respectively.

2.03 The ringing signals from 5- or 8-station capacity central office equipment consist of a single superimposed ringing voltage in combination with two pairs to each station. These two pairs are arranged as three conductors by using both conductors of one pair as one conductor. Four signals are obtained by connecting the ringing voltage across any one of four different combinations of the three conductors.

2.04 The 5-station capacity equipment provides a continuous audible signal and a visual signal for each warning. Both the 200- and the 8-station equipment provide a coded audible signal and a visual signal for each warning.

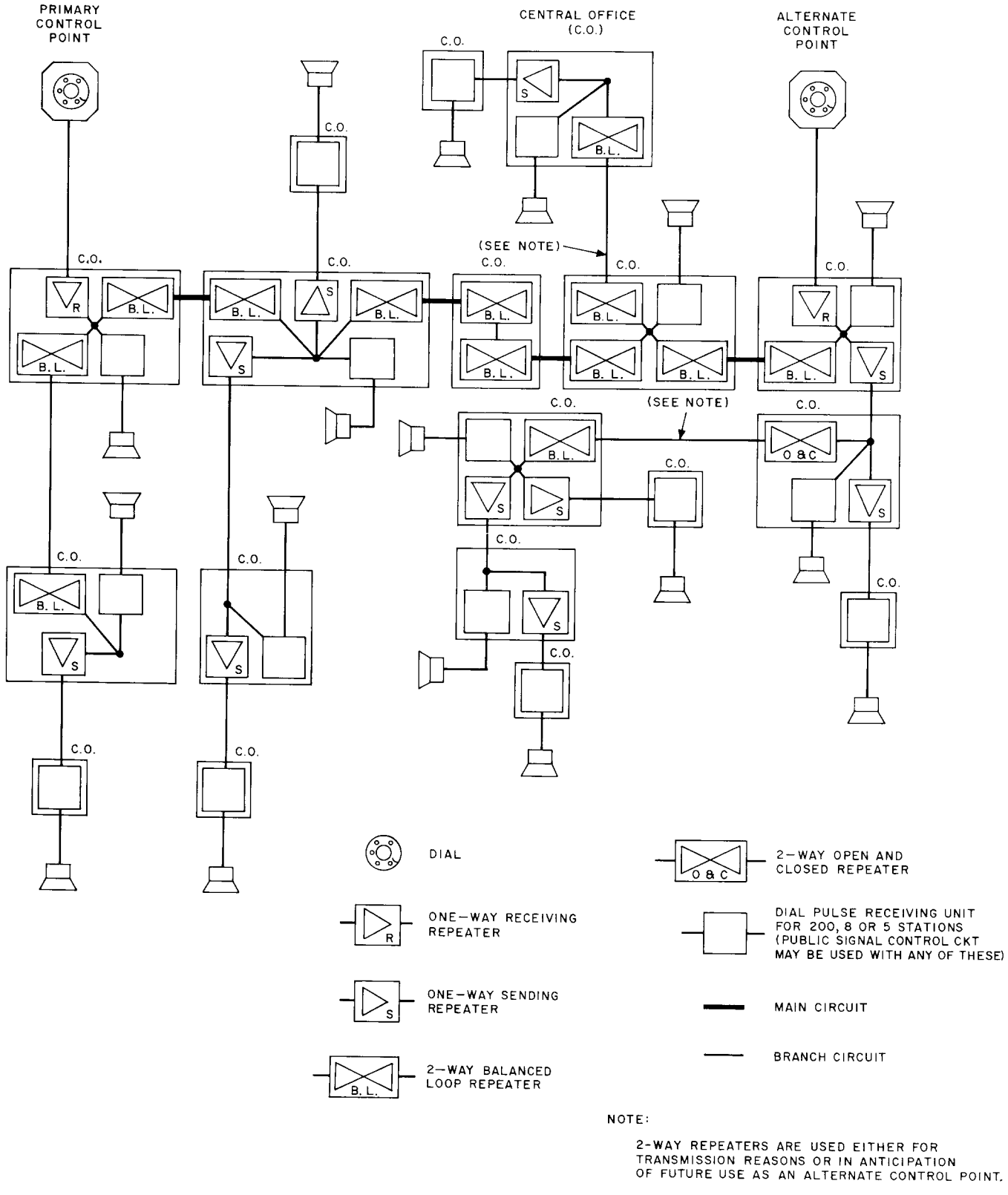

Fig. 2—Typical Arrangement of CDW Control Points and Central Office Showing the Use of Various Types of Central Office Equipment

B. Siren Control Signals

2.05 Operation of each siren is controlled by the application of 20 Hz ringing current to the siren control line. This current is steadily applied for the number 2 (LOCAL ALERT) signal and intermittently for the modulated number 3 (ATTACK WARNING) signal. The number 1 (TEST) and number 4 (LOCAL ALERT—optional) signals are not transmitted to the siren stations.

C. Signaling Repeaters

2.06 Four types of signaling repeater circuits are available for use in CDW networks. Two are of the 2-way type and two are of the one-way type. The one-way receiving circuit is designed primarily for repeating the pulses from the control point dial into the network. It is arranged to give a visual indication whenever the dial is used. The one-way sending circuit receives signals from one line or loop and retransmits them into another line or loop.

2.07 The two types of 2-way repeaters are the same on the line sides but are different on the loop sides. On the line side, each repeater operates on the principle of differential duplex on the tip side of the line with ground potential compensation on the ring side of the line.

2.08 For noncomposited lines having conductor loop resistances less than 1500 ohms, a simple balancing network is provided, and line compensating resistances are used to build the line out to approximately 1500 ohms. This network and the compensating resistances are also satisfactory for a signaling channel derived from a voice channel by means of a nonringthrough type of repeating coil. The signaling associated with such a voice channel must be 135 Hz or the voice frequency-type, such as 1000-20 Hz or single-frequency signaling.

2.09 The 2-way repeater circuits may also be connected to signaling channels derived from composite sets. The line compensating resistances are omitted for this arrangement and the network is adjusted to balance the actual line resistance.

2.10 The loop side of one of the 2-way repeaters operates on the principle of differential duplex without ground potential compensation. Because differential duplex signaling on a loop requires a signaling network to balance loop impedance, this type of repeater is called the ***balanced loop.***

2.11 The other 2-way repeater is the ***open and closed loop*** and operates on the loop side by opening and closing a metallic circuit rather than alternating battery and ground signals.

2.12 The one-way receiving circuit is used at central offices to receive the dial pulses originated by the dial at the control center, and to repeat the pulses into the repeater loop circuits and other associated circuits in the central office. A visual alarm feature indicates that a dial pulse has been received from the control point.

2.13 The one-way sending circuit which consists of a single polarized pulse repeating relay with a test jack, protection resistances, and line resistance compensation, may be connected to a pen register for control point dial pulse recording. This option may be used to verify accidental or unauthorized control point dial operation.

2.14 The 2-way repeaters have two principal advantages.

(a) Two-way signal transmission is permitted.

(b) Automatic alarm features isolate faulty network lines and cause audible and visual signals. However, one-way repeaters are less expensive and in most cases, 2-way repeaters are required for network main circuits which connect primary and alternate control points. One-way repeaters are usually adequate for branch lines which extend to central offices near the stations. When loop resistance between central offices is more than 1500 ohms, 2-way repeaters are required. In such cases, a strapping is provided on the 2-way repeater which limits its use to one-way operation. A special key may be installed for this purpose.

2.15 When not more than two lines of the 2-way signaling type are connected together in a central office with one or more dial pulse receiving units, each line is terminated in a balanced loop repeater. The loop circuit of one of these repeaters is then connected in series with the winding of the receiving relays of the dial pulse receiving units, or the sending relays of the one-way repeaters to the loop circuit of the other repeater. An open and closed loop repeater is provided on each 2-way

line, in addition to the first two, where three or more 2-way signaling lines are connected together in a central office. The loop side of each of these repeaters is connected in series with the loop circuits of the two balanced loop repeaters.

2.16 The methods by which the various types of repeaters may be interconnected with lines, loops, dial pulse receiving units, and public signal control circuits are shown in Figure 2.

D. Lines and Ranges

2.17 Lines between central offices may be an individual circuit or two one-wire dc signaling channels derived from composite sets or repeating coils. The maximum conductor loop resistance of each signaling pair is 1500 ohms over not more than 15 miles for the one-way circuits, or for 2-way repeaters equipped with the simplest networks. Greater conductor loop resistances are possible when the 2-way repeaters are equipped with more complicated balancing networks. Ranges of up to 50 miles of 19 gauge cable can be obtained over channels derived from composite sets on side circuits. Ranges of up to 100 miles can be obtained from composited phantom circuits.

2.18 For ranges beyond the limits of the signaling repeaters, a signal converter unit is available to allow use of toll telegraph facilities for connections between central offices. This signal converter unit uses two one-way loops (four wires) to connect to the telegraph circuit and relies upon the associated balanced or open and closed 2-way repeater for alarm and sectionalizing features.

2.19 Lines used in the signaling network should be protected from hazards of accidental contacts and sabotage by removal of bridged cable taps, locking cable terminals, etc.

2.20 Table A shows the maximum loop resistance permissible for reliable operation of the CDW station signal indicators with and without extension indicator(s) and extension ringer(s).

2.21 The range values as shown have been determined for ac voltages of 65 to 90 volts (with 45 to 52 volts dc), with earth potentials of 0 ±10 volts, and with loop leakage values of 15,000 and 50,000 ohms.

2.22 Limiting loop resistance between siren control stations and public signal circuits is shown in Table B. The values are based on a minimum ringing supply of 72 volts. The minimum insulation resistance is 10,000 ohms where the optional dc test feature is not included, and 30,000 ohms where the option is elected.

3. STATION APPARATUS

A. Dials for Sending Warnings

3.01 The dial provided at each control point is a 7F-3 dial with a modified spring block assembly, special cam, number plate, and fingerwheel. The modified spring block assembly and special cam are designed so that the percent break in the dial pulse is 50 ±2 percent. The fingerwheel has only five fingerholes corresponding to digits 2, 4, 6, 8 and 0. The holes are designated STOP, ①, ②, ③, and ④. The last fingerhole which corresponds to "0" is optional and may be used for other purposes (local disasters, etc).

3.02 The dial housing is a metal box 6 inches wide, 7-1/2 inches deep, and 4-1/2 inches high with a sloping front provided in a gray-green wrinkle finish. The dial is mounted in the face of a sloping front protected by a hinged cover with a plastic window. The cover is provided with a lock and key to discourage unauthorized use. The key should be used to open the cover; however, the cover may be forced open in case of emergency and cannot be reclosed without the key. The dialing assembly with the cover open is shown in Figure 3.

3.03 The dial assembly is equipped with feet for desk installations. The assembly may be wall mounted by removal of the feet and mounting of the housing so that the cover opens downward. This prevents obstruction of the use of the dial. The dial must be rotated 180 degrees.

B. Bell and Lights Indicators for Receiving Warnings

3.04 Signals are received at subkeypoints and warning stations by means of bells and lights or bells only. At each station equipped with lights, an indicator is provided (Fig. 4). The station signal indicator with a ringer and four lights is a modified 531A-3 subscriber set. When only a bell is to be furnished, a 531A (or equivalent) subscriber set may be used. An extension bell may be provided.

TABLE A

LINE TO CONNECTING CIRCUIT	AC VOLTAGE WITH 45V — 52V DC	MAXIMUM EARTH POTENTIAL (VOLTS)	MINIMUM INSULATION RESISTANCE (KILOHMS)	MAXIMUM CONDUCTOR LOOP — OHMS			
				MAIN INDICATOR ONLY	MAIN INDICATOR PLUS ONE EXTENSION INDICATOR*	MAIN INDICATOR PLUS ONE EXTENSION RINGER	MAIN INDICATOR PLUS TWO EXTENSION RINGERS*
	65 - 90	0		600	50	300	200
	70 - 90	0		1300	400	700	600
	70 - 90	± 5		800	150	400	200
2-Wire	70 - 90	±10		300	—	—	—
	75 - 90	0		1800	800	1200	1000
	75 - 90	± 5	15	1300	400	800	600
	75 - 90	±10		900	200	400	300
	80 - 90	±10		1300	400	900	700
	65 - 90	—		500	—	200	100
4-Wire	70 - 90	—		1000	200	500	400
	75 - 90	—		1500	600	1000	900
	65 - 90	0		1000	200	600	200
	70 - 90	0		1800	700	1200	700
	70 - 90	± 5		1300	300	800	400
2-Wire	70 - 90	±10		600	—	300	—
	75 - 90	0		2600	1000	1700	1200
	75 - 90	± 5	50	2000	700	1300	800
	75 - 90	±10		1600	400	800	500
	80 - 90	±10		2400	800	1500	900
	65 - 90	—		800	100	500	300
4-Wire	70 - 90	—		1500	400	800	700
	75 - 90	—		2000	700	1500	1100

* *Notes:*

1. The addition of an extension indicator or two extension ringers will reduce by one the number of lines which can be served by a given central office ringing source.
2. The extension ringers are the B1AL-type connected across the line in series with a 0.5 MF capacitor and a 3600-ohm resistor.

TABLE B

NO. OF SIREN CONTROL STATIONS PER LINE	MAX. CONDUCTOR LOOP RESISTANCES (OHMS)	
	WITHOUT DC TEST FEATURE	WITH DC TEST FEATURE
1	2700	1500
2	2000	1500
3	1400	1200
4	1000	850
5	700	600

3.05 One of the four lamps in the indicator lights during each signal. The significance of the individual lamps is distinguished by number designations. A light appears only while the bell is ringing. To silence the audible signal, a nonlocking ringer turn-off key may be provided. When a distinctive audible signal is required, one of the 41-type brass gongs of the ringer assembly can be replaced with a 40-type aluminum gong.

3.06 Most subkeypoints and warning stations are provided with indicator keys. These should be placed in an easily visible location so as to enable the attendant to verify transmission of warning signals.

3.07 In each central office, at least one indicator should be permanently installed to inform personnel when the system is in use and to verify circuit performance. When coded ringing is employed and only half of the stations receive signals at a time, indicators should be connected to an odd line termination which allows a rapid signal indication. An indicator equipped with a cord and plug is also required as a portable test unit for local tests on code distribution units.

C. Siren Station Equipment

3.08 The siren station equipment consists of a relay set which operates when 20 Hz current

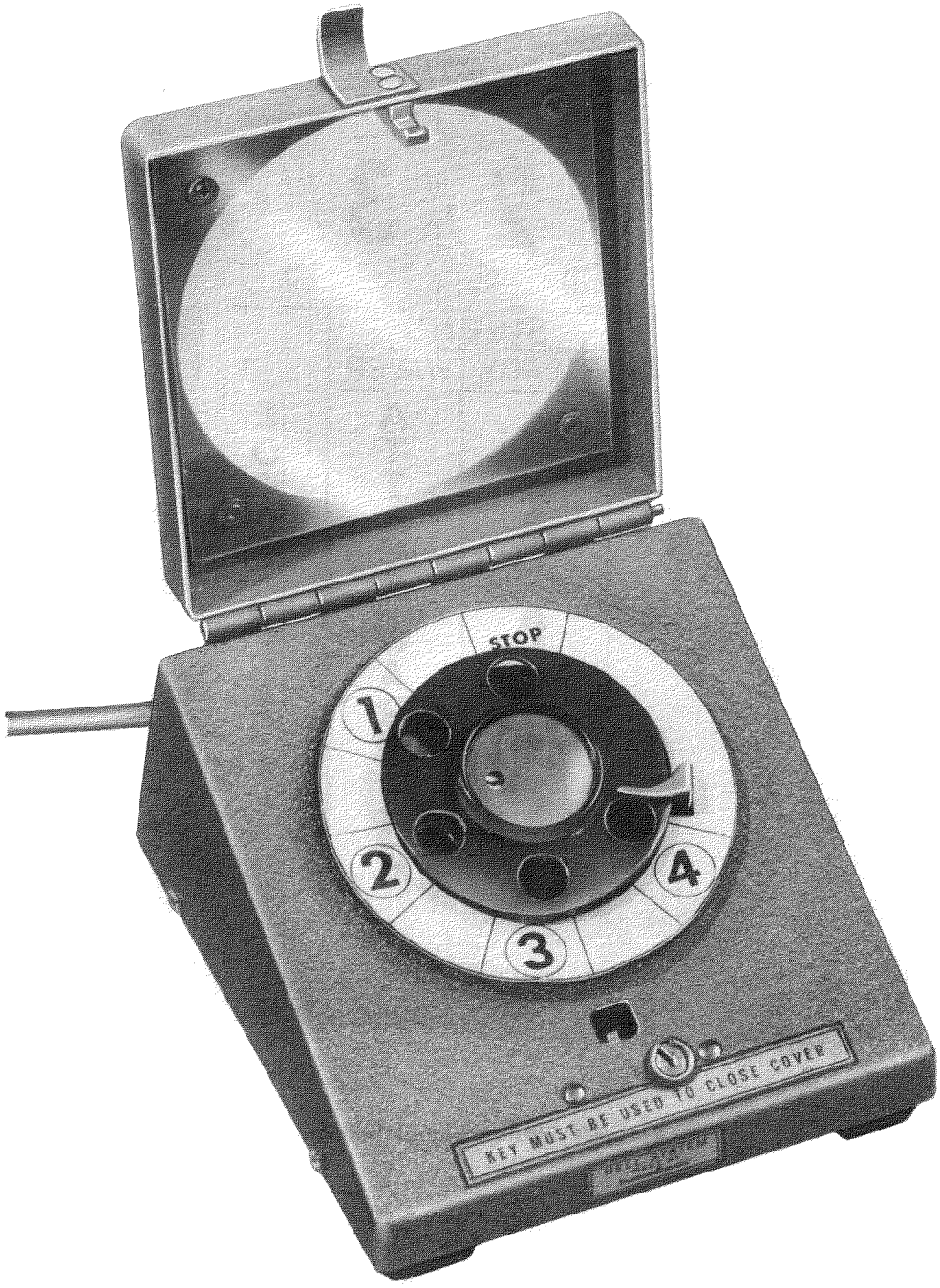

Fig. 3—CDW Dial with Cover Open

Fig. 4—CDW Station Signal Indicator

is connected to the siren line. The contacts of KS-16626, List 13 relay set have a 5-ampere capacity at 110 volts and 60 Hz. An additional relay will be provided by the subscriber if the inrush current exceeds 5 amperes. When the optional continuous line testing feature is provided, a resistor (such as KS-8512, List 6A) will be connected at the relay set terminal block to provide a continuous dc circuit across the line.

4. CENTRAL OFFICE EQUIPMENT

A. Dial Pulse Receiving Units

4.01 A dial pulse receiving unit receives dial pulses transmitted from a control point dial and converts the pulses into ringing signals which are transmitted to the Bell and Lights stations. However, signals are not transmitted unless the

same digit is received twice in succession within 16 seconds. Three types of units are available which accommodate capacities of 200, 8, and 5 stations, respectively. The 200-station unit, which may be supplied in steps of 50, transmits coded visual and audible signals. The 8-station unit has a capacity of 8 stations and is a modified form of the 5-station unit. The public signal (siren) control circuit is arranged to receive and translate the warning signals from each of these units. Optional equipment which automatically terminates signals in approximately 3 minutes, is available for all three units.

4.02 Each of the dial pulse receiving units includes three lamps to indicate what type of pulses were received. These are designated PD (prime digit), WD (wrong digit), and TST (test). The PD lamp lights when the first pulse train of a regular warning code (4, 6, 8, or 0) is received to prime the system. The WD lamp lights if an improper or wrong series of pulses (corresponding to 1, 3, 5, 7, or more than 10) is received. The TST lamp lights when the test digit 9 is received.

B. Code Distributing Unit for 200 Stations

4.03 The basic dial pulse receiving and code distributing unit has a capacity of 200 stations with at least one line connector relay unit required for each code distributing unit.

4.04 The code distributing unit includes a pulse receiving circuit, a pulse checking unit, a code generating circuit, and a multicontact line connector relay circuit. This unit is arranged to receive and record the dial pulses sent from the control point, and to control the operations of the code generator and multicontact line connector relays so that the code ringing signals are distributed to the associated warning stations. An option is available so that the signal may also be transmitted to the public signal control circuit. The loops between the dials and this unit are monitored continuously for trouble conditions such as false ground or opens. Any pulse on the system produces visual and audible alarms in the central office.

4.05 When the control point attendant dials, the loop to this circuit is opened a number of times corresponding to the digit dialed. These pulses are counted by a counting relay chain similar to the one provided in the dial pulse register circuits in crossbar central offices. At the end of a series of pulses, one of the register relays will operate and lock up. The first digit is then stored while the pulses for the second digit are transmitted. A signal will not be transmitted unless the same digit is dialed twice in succession within 16 to 48 seconds. When the second series of identical pulses are received, the line connector relays operate. The line connector relays follow the coded signal from the code generator circuit and transmits the signal to the associated stations. When the STOP signal is dialed at the control point, or when the automatic signal terminating equipment functions, the circuit is restored.

4.06 The coded ringing signals are divided into two phases which are 180 degrees apart. One half of the stations are served from one phase and the other half from the other phase. The purpose of this ringing arrangement is to remain within the fusing capacity of the system.

4.07 An arrangement is available to provide continuous ringing for the number 4 signal. When this arrangement is employed, there must be a sufficient source of power to ring all lines simultaneously.

4.08 Optional wiring is provided which will restrict either one or both the TEST and ALERT signals from each of the first 50 station lines served by a 200-line unit. The remaining 150 lines of a 200-line unit can be arranged to receive either all four signals or only the ATTACK WARNING and number 4 signals. Wiring which provides these restrictions is accomplished at the central office.

C. Control Unit for Five Stations

4.09 The dial pulse receiving and control unit for 5 warning stations differs from the similar circuit for 200 lines, not only in its smaller capacity, but also in the method of transmitting signals to the stations and in the omission of positive superimposed ringing voltage. This circuit transmits negative superimposed ringing voltage for all signals. The ringing from a 5-station unit to station signal indicators is continuous for all signals and all stations.

4.10 Two pairs of wires are required from the 5-line unit to each station indicator. The two pairs are arranged as three conductors by using both sides of one pair as one conductor. This double conductor is connected to the station indicator

at the terminal which, if used with the 200-station unit, would be connected to local ground.

4.11 The 5-line unit is also equipped with the testing arrangement and lamps described in 4.02.

D. Control Unit for Eight Stations

4.12 The dial pulse receiving and control unit for 8 stations is similar to the 5-station unit, except a code ringing generator has been added which provides four audible coded signals. The unit normally accommodates four stations. However, an option is available which increases this number to eight. An option which provides a continuous number 4 signal is also available.

E. Public Signal Control Circuit

4.13 The optional public signal control circuit allows siren operation coincident with signal transmissions to Bell and Lights stations. The circuits are arranged to receive signal information from any dial receiving unit and transmit number 2 (LOCAL ALERT) and number 3 (ATTACK WARNING) signals to siren control stations.

4.14 The equipment consists of main units, the common control unit, and the line connector unit. The common equipment consists of control relays and the number 3 (ATTACK WARNING) signal generator. It is arranged to accommodate 30 siren lines. Line connector units are provided with 5- or 10-line capacity.

4.15 The circuits receive all four signals from the dial pulse receiving circuits. The public signal control circuit identifies the number 1 and number 4 signals as restricted and not to be transmitted to sirens. The control circuit also identifies number 2 and number 3 signals and causes all the siren units to operate.

4.16 Since the ATTACK WARNING siren signal is a warble or modulated signal, the circuit is arranged to provide an intermittent open and closed condition. Sirens are repeatedly started and stopped thereby generating the modulated signal. This successive starting and stopping of the sirens continues until STOP is dialed by the control point operator, or until the signal is automatically terminated by timing control (optional).

4.17 Reception of the LOCAL ALERT signal will start continuous operation of the sirens. The LOCAL ALERT signal may be manually terminated by dialing STOP after 3 to 5 minutes, or it may be automatically terminated by timing control (optional).

4.18 Since sirens of various manufacture and size are employed, these circuits have been arranged so that by varying the number of relays and strapping, a suitable modulated frequency may be obtained. Available cyclical variations are shown in Table C. The same frequency of variation in the open and closed periods applies to all sirens connected to one unit. Other units in the same system may utilize different frequencies of variation.

TABLE C

SECONDS PER CYCLE	SECONDS OPEN	SECONDS CLOSED	IN STEPS OF
20	4 to 16	16 to 4	2 seconds
18	4 to 14	14 to 4	2 seconds
16	4 to 12	12 to 4	2 seconds
14	4 to 10	10 to 4	2 seconds
12	4 to 8	8 to 4	2 seconds
10	2 to 8	8 to 2	1 second
9	2 to 7	7 to 2	1 second
8	2 to 6	6 to 2	1 second
7	2 to 5	5 to 2	1 second
6	2 to 4	4 to 2	1 second
5	2 to 3	3 to 2	1 second
4	2	2	1 second

4.19 This circuit is provided with a continuous line test feature (optional). The test is accomplished by allowing a continuous flow of current to the station through marginal and sensitive relays at the central office, and a high resistance bridge installed across the line at the siren station. An alarm circuit is designed to accommodate one to ten continuous line test circuits, each of which is arranged for three siren lines. Continuous test capacity may be provided for 3 to 30 siren lines in steps of 3 lines.

F. Power for Code Ringing

4.20 The ringing codes are generated by relays which are actuated from a source of 60-ipm pulses. Pulses are counted and added by the relays

so as to produce the code signals for transmission to Bell and Lights stations as shown in Table D. The relays are mounted on the code distributing unit. A relay interrupter circuit is available to supply 60-ipm pulses in central offices when these pulses are not otherwise available.

TABLE D

SIGNAL	NOMINAL RINGING CODE	DETAILS OF EACH RINGING CYCLE
① (TEST)	2 Rings	0.5 second on 0.5 second off 0.5 second on 2.5 seconds off
② (LOCAL ALERT)	3 Rings	0.5 second on 0.5 second off 0.5 second on 0.5 second off 0.5 second on 1.5 seconds off
③ (ATTACK WARNING)	Continuous Short Rings	0.5 second on 0.5 second off
④ (LOCAL ALERT)	Steady	16.0 seconds on 16.0 seconds off

4.21 To assure proper visual signals from the station signal indicators, the voltage of both the positive and negative superimposing batteries should not be less than 45 volts. A separate 48-volt positive superimposing battery is required in each central office having a 200-station code distributing unit, even if a standard positive battery for 4-party telephone service is available in the office.

4.22 The 20-Hz voltage of the ringing supply to these indicators should be 65 volts minimum. If the minimum voltage is higher, greater signaling ranges may be obtained as indicated in 2.20.

4.23 Approximately 0.010 ampere of superimposed ringing current will flow in a line to one station indicator during each ringing period. In each line having two of these indicators, the current will be approximately 0.020 ampere. When the ringing interruptions are divided into two phases, 180 degrees apart, each 10 milliamperes of capacity in the ringing power plant will be adequate for two station indicators. Because of the large number of station indicators which may be operated simultaneously during the transmission of a signal, the capacity of many of the regular central office ringing plants will not be adequate. Where additional ringing supplies are needed, they may be provided by additional ringing generators.

5. METHODS OF OPERATION

A. Normal Operation

5.01 During normal operation, the primary control point attendant is the only person required to operate any particular CDW network. The procedure followed by the attendant upon receipt of a signal from the next higher echelon, is to select the same number on the face of the control point dial and dial the number twice.

5.02 The resulting dial pulses are transmitted over the signaling network to dial pulse receiving units. Each of these units converts the dial pulses into a particular signal code, and automatically sends the signal to its group of warning stations. This signal will continue until STOP is dialed, or the signal is terminated automatically in approximately 3 minutes by timing control (optional).

5.03 To ensure proper operation of the system, the attendant should always dial STOP once when changing from one signal to another. The system will not transmit a second signal within 16 to 48 seconds (depending upon the type of central office) after the previous one unless the network has been cleared by dialing STOP. After this time has expired, a failure to dial STOP between signals will not prevent the transmission of the new signal but may provide an incomplete audible code at the warning stations on the first ring. Since a second ring with a complete code would be repeated immediately, such an incomplete code would not be serious. However, it will be avoided if the prescribed order of operations is followed.

5.04 The PD lamp will light when the pulses for 4, 6, 8, or 0 (corresponding respectively to number 1, 2, 3, and 4) are received. If the same digit is subsequently received, that signal will be disseminated. However, the second digit must be received within 16 to 48 seconds or the equipment will time out and restore. The receipt of the

pulses for digit 2 corresponding to STOP will also restore the unit.

5.05 The WD lamp will light if an initial digit 1, 3, 5, or 7 is received, or if more than 10 pulses are received. This will lock the equipment out of service for 16 to 48 seconds, or until the digit 2 corresponding to STOP has been received. The same reaction will be obtained if the second digit is not the same as the first. To transmit a signal, the digits must be received as 4-4, 6-6, 8-8, or 0-0. Any other combination will not transmit a signal but will operate the central office major alarm, and will remove the equipment from operation under control of the digit 2 or the 16- to 48-second timing interval. The WD lamp will remain locked in until manually restored by operation of the WD key.

5.06 The TST lamp will light when the test digit 9 is received. Like the WD lamp, once lighted it will remain locked in until it is manually restored by the operation of the TST key.

5.07 When sirens are involved, the public signal control unit receives the signals from dial pulse receiving units. When the sirens are to be operated, signals are transmitted to siren control stations. The TEST signal (dialed twice) or the optional signal (dialed twice) will not operate the sirens under any conditions. The number 2 (LOCAL ALERT) signal (dialed twice) starts the sirens operating continuously. The number 3 (ATTACK WARNING) signal (dialed twice) will start the sirens operating intermittently (warbling). Any of these four signals may be terminated by dialing STOP (once), or by the optional automatic timing control.

5.08 The number 3 (ATTACK WARNING) signal from the sirens is a warble or modulated signal produced by automatically starting and stopping the sirens. However, the duration of this interval will be determined by the control point operator or by the optional automatic timing control.

5.09 To verify system operation and assure that the proper signal digit has been dialed, the control point attendant should observe the station signal indicator which is normally installed adjacent to each control point dial. When the system controls only sirens, a 531-type subscriber set (or equivalent) will be provided. In this case, the bell will respond coincidentally with siren operation which provides a system operational verification. When the system controls sirens and indicators with bell and lights, the station signal indicator and the subscriber set may be provided to verify operation of both control units.

B. Emergency Operation

5.10 During an emergency, the method of operation remains the same except when part of the main signaling network has been destroyed. It may then be impossible for the primary control point attendant to transmit signals to all stations. Under such conditions, the remaining section(s) may be served by an alternate control point(s) and the method of operation will differ in each case. Available commercial telephones and notification methods for bringing alternate control points into operation are influential factors during an emergency. It is essential that emergency operating plans include arrangements for prompt trouble reporting, which affects networks signaling to telephone company maintenance personnel and local civil defense personnel.

5.11 When a code distributing or control unit is isolated from the signaling network as the result of an emergency, signals may be disseminated directly from the code sending unit, the one-way sending repeater test circuit, or the digit 9 jack on the central office one-way sending repeater, without damaging station loop facilities. The procedure for this type of operation is as follows.

(1) Connect a regular dial hand test set to a jack on one of the units.

(2) Dial the digit corresponding with the signal (dial twice); or

(3) Dial the digit 2 once for STOP. This procedure should be undertaken only by telephone company personnel and only upon specific directions from identifiable and responsible sources in accordance with an emergency operations plan.

6. ALARMS

6.01 Four types of central office alarms are provided with these CDW systems:

(a) The usual fuse alarm associated with the power and ringing supply circuits.

(b) The control point dial alarm lamp, which indicates that a pulse has been transmitted from a dial at the control point to the 1-way receiving repeater in a nearby central office.

(c) The major central office alarm which indicates that any pulse (warning digit, prime digit, wrong digit, test, or trouble condition) has been transmitted over the network.

(d) Line trouble alarms indicate trouble conditions which would prevent the transmission of signals over any part of the CDW network.

6.02 During the transmission of a signal, the resistance lamps, through which ringing current is supplied to loops for operation of station signal indicators, should be observed to verify that none are lighted. A lighted lamp indicates a short circuit or ground which must be promptly corrected. A special notice should be given to the warning station in the event that the station signal indicator does not operate.

6.03 The control point dial alarm is energized from the one-way receiving repeater. The CTL PT ALM (formerly ALM) lamp in the one-way receiving repeater will light and lock in for each received pulse. The signal remains lighted until manually released by CA key operation. The signal allows maintenance personnel to maintain records of CDW network use and to provide rapid detection of false operations.

6.04 When a pulse is transmitted over the network, the central office major alarm operates and the control unit DP ALM lamp lights. The alarm may be released by the turnoff key adjacent to the lamp. For unattended offices, the alarm may be released by dialing a particular code from a remote master office, or by local switchboard key operation. The cause of the pulse transmission may be determined by examination of the control point dial alarm lamp, the PD lamp, the WD lamp, and the TST lamp.

6.05 The three types of line trouble alarms are as follows:

(a) A section isolating alarm indicating that a trouble which produced a break signal for more than approximately 0.5 second has occurred on a line served by a 2-way repeater, and the repeater has automatically isolated the faulty line. Such troubles cause lamps to light on each repeater in the circuit, and central office audible and visual alarms to operate.

(b) For siren lines which are arranged to be continually tested, an open, short, or ground condition will cause a central office audible and visual alarm to operate. A relay rack alarm lamp is provided for visual indication of faulty siren lines.

(c) Dial pulse receiving unit alarm indicates faulty lines on the one-way section.

7. MAINTENANCE FEATURES

7.01 The following arrangements are provided to test the CDW equipment:

(1) Observation and tests of system performance with the regularly scheduled system tests by civil defense personnel. This includes observing the signal indicators, alarm lamps, and ringing lamps associated with the dial pulse receiving and code distributing units in the central offices. The operation of the sirens should also be verified.

(2) A test circuit for central office one-way receiving repeaters serves a control or alternate control point. The circuit is arranged for a fixed jack-ended dial to be connected which enables digit 9 dialing for a signaling network test. Standard portable test sets may be used with the test circuit for system pulsing tests.

(3) A regular dial hand test set may be plugged into dial pulse receiving units to test individual units without disturbing equipment in other central offices, or causing transmission of signals to warning or siren stations.

(4) A repeater test circuit may be provided with 2-way repeaters. Standard portable test sets may be connected to the circuit to make 2-way pulsing tests of individual sections on the main network.

(5) A test jack circuit may be provided with one-way sending and 2-way open and closed repeaters. A regular dial hand test set may be used with the circuit which allows a digit 9 to be dialed for an operation test of a single leg.

(6) Test of station signal indicators:

(a) May be tested from local test desk using the +STA and -STA keys.

(b) May be tested from CDW equipment on the relay rack using a test circuit (option) which produces each of the four ringing currents for the four signals.

7.02 For repeater test method of similar equipment, refer to Section 312-XXX-XXX.