

111A KEY EQUIPMENT

DESCRIPTION AND USE

1.00 GENERAL

1.01 This section was formerly Station Installation and Maintenance Section C53.426, Issue 1. Except for editorial changes and renumbering for inclusion in the Station Operations Manual, no other revisions have been made.

1.02 This section covers the description and use of the 111A key equipment which was designed to meet the telephone requirements of the many Air Traffic Communications Stations (ATCS) [formerly Interstate Airways Communications (INSAC)] operated by the Federal Aviation Agency (FAA) throughout the country.

1.03 In this section references are made to a number of drawings designed to give a better understanding of the numerous circuits encountered when working on this equipment. These drawings are not meant to take the place of any existing drawings, but are intended to be used in conjunction with them to picture more clearly how the equipment ties together and what paths the various circuits follow. References to SD numbers and specific figures have been so made that these drawings and any existing drawings will have a common means of identification.

Description

1.04 The 111A key equipment is primarily for the use of the FAA at ATCSs. The equipment is arranged on a unit basis so that each installation provides for the specific needs of the location in which key equipment is employed. Each ATCS is equipped with a non-Bell System console mounted on a steel desk (see Fig. 1). The telephone panel (see Fig. 2 and 3) is located in the face of this console. The telephone lines are terminated in this panel and all other telephone equipment, except the hang-up type telephone

set and the common loudspeaker, will be in an apparatus cabinet located in an adjacent room. The power equipment is contained in a separate cabinet next to the apparatus cabinet. In this connection the 111A key equipment has been designed to require a minimum of maintenance at the console. This is done by providing remotely operated line pickup equipment whenever possible.

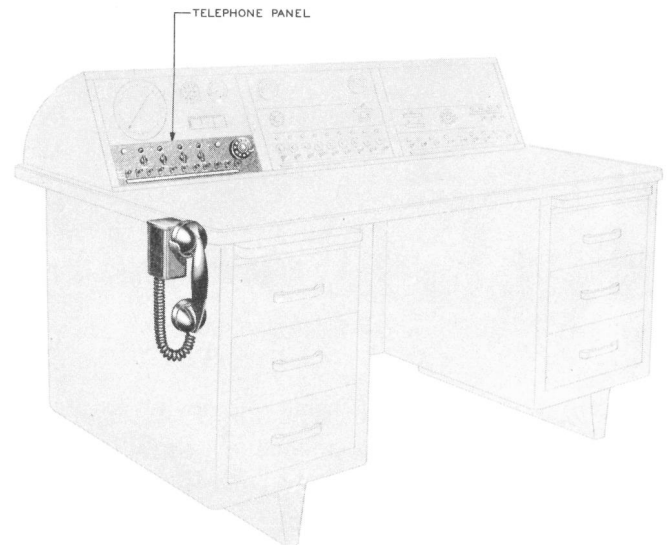


Fig. 1 — Telephone Panel (Lower Left) Mounted in FAA Air-Ground Operating Console — J53020A

2.00 OPERATING FEATURES

2.01 The functions of the 111A key equipment are to provide appropriate terminations for private local exchange or PBX lines and intercommunication lines to which the communicator must have access during the course of his radio contacts. Since one line will generally be a central office or airport PBX line, the remaining lines may be any combination of the following:

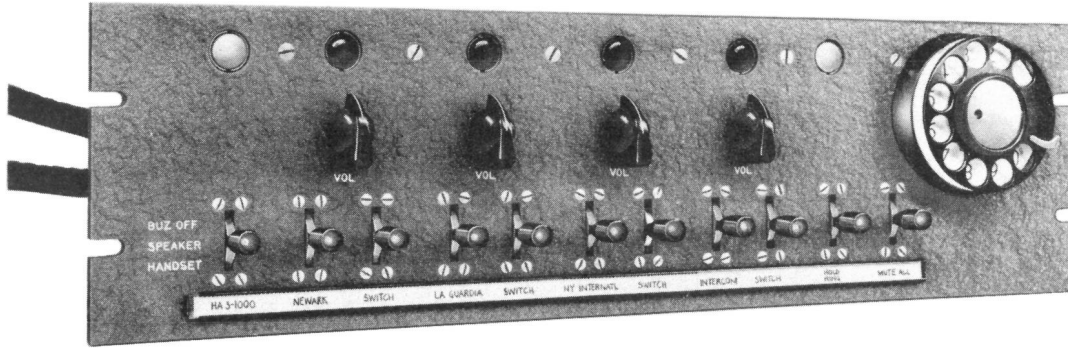


Fig. 2 — Telephone Panel — Front View — J53020A

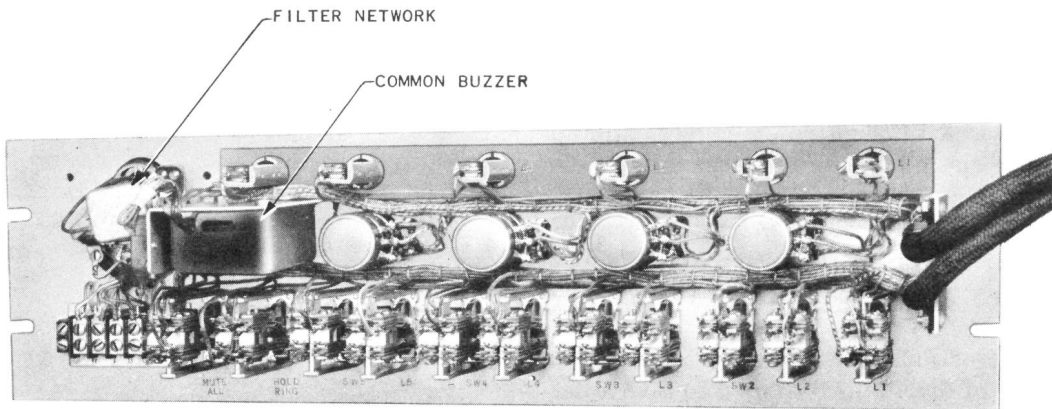


Fig. 3 — Telephone Panel — Rear View — J53020A

- 2-wire or 4-wire schedule F interphone lines for using loudspeaker signaling incoming and ringdown in the outgoing direction.
- 2-wire local airport private lines employing loudspeaker signaling incoming and 20-cycle ringing outgoing.
- 2-wire local airport private lines employing 20-cycle signaling in both directions.
- 2-wire dial intercommunicating lines.
- 2-wire loudspeaker intercommunicating lines.
- 2-wire dial selective signaling lines.

2.02 A visual busy line indication is provided by a lamp associated with each line; operation of these lamps is controlled by a voice-operated busy signal circuit. Provision is made for outgoing 600- to 1500-cycle selective signaling or ringing signaling on 4-wire interphone lines (see Fig. 4 and 5). These lines have both a visual and audible incoming signal indication, a flashing lamp which becomes steady when a call is answered, and a buzzer which may be provided with a cutoff key when desired. Multiple appearances of telephone lines at a number of 111A key equipment positions, each position being operated by a different attendant, are possible. The multiplying is accomplished by the use of both line and position equipment units furnished in accordance with line and position requirements of the installation. Existing 111A key equipments not arranged for multiplying cannot be readily changed and should be re-engineered if multiplying is required.

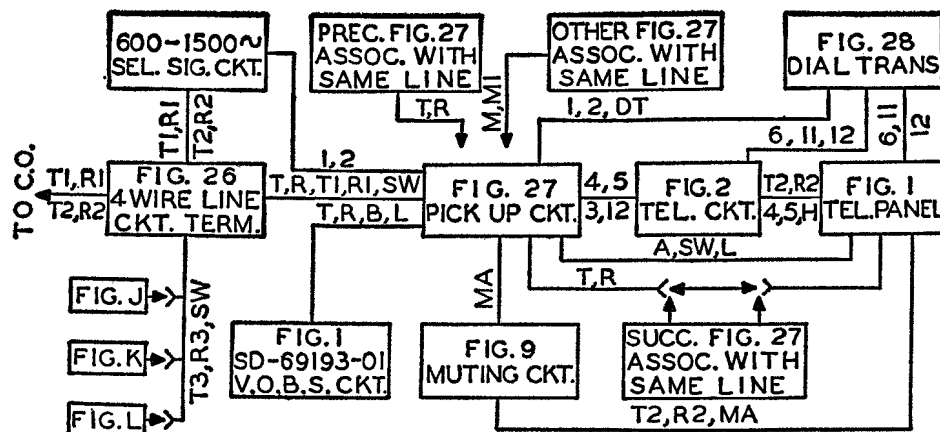


Fig. 4 - 4-wire Line Circuit with 600- to 1500-cycle Circuit

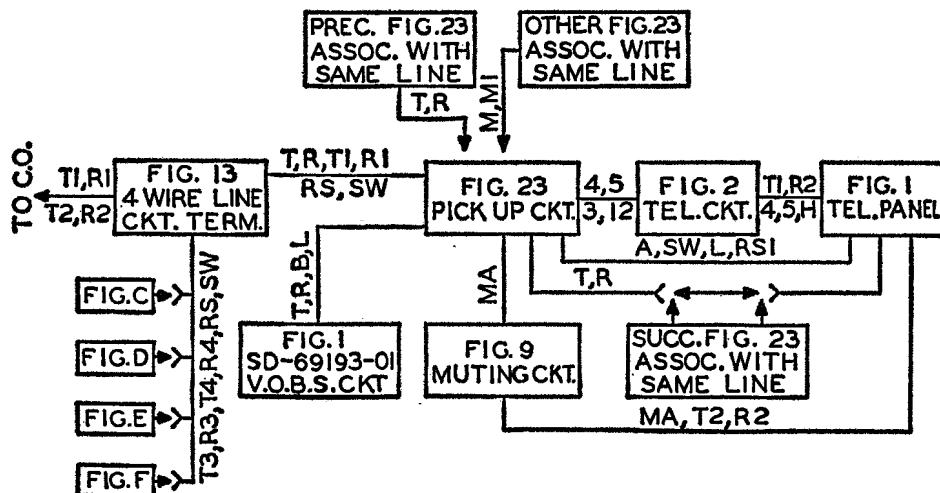


Fig. 5 - 4-wire Line Circuit with Key Signal

2.03 The 111A key equipment provides for a maximum of eight lines to be associated with the common loudspeaker. A resistor hybrid and muting circuit, at the input of the amplifier, combines all the lines before they are fed into the amplifier. This circuit is so designed that when the line pickup key is operated and the handset is lifted off the hook, the transmission levels of all the lines employing loudspeaker signaling are simultaneously reduced at the loudspeaker. This reduction of voice levels at the loudspeaker is referred to by the FAA as muting. By throwing a mute-all key, all the lines may be muted. Since a

1000-cycle tone may be used on a multistation private line for signaling stations, a filter is provided for reducing this 1000-cycle tone in the loudspeaker. Filters are also provided around the dial contacts and the common buzzer to reduce interference with the FAA radio circuits. In addition, variable transmission pads are inserted in the termination of the 4-wire interphone lines for controlling transmission levels on the lines. When the key equipment is unattended, a battery cutoff key may be operated to prevent unnecessary burning of the lamps.

2.04 The central office line circuit is for a standard manual- or dial-type 2-wire line (see Fig. 6). It is controlled by the first key position on the telephone panel. This pickup key is a 3-position key which, in its normal position, disconnects the telephone set from the central office line. With the key in its upward position, an incoming call gives only a flashing signal, and in its downward

In addition to these features, provisions are made to permit not more than one line to be connected to the telephone set at one time.

2.06 Four-wire interphone lines terminating in 111A key equipment may be switched in any combination. These switched connections are

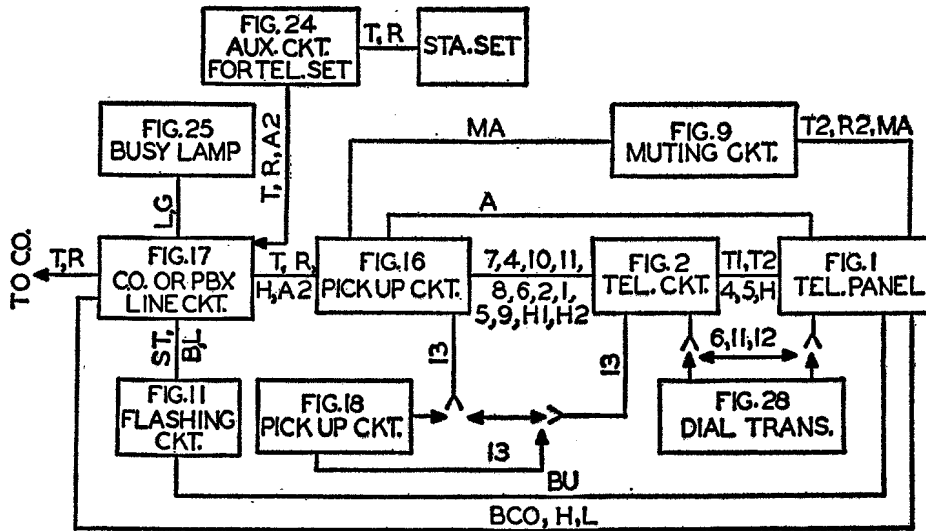


Fig. 6—Central Office or PBX Line

or talking position, the key connects the telephone set to the line. Operation of the nonlocking HOLD-RING key to the HOLD position lights the hold condition lamp indicator on the telephone panel. The line circuit should also be provided when dial intercommunicating lines or dial selective private lines are terminated in the 111A key equipment.

2.05 Two-wire or 4-wire interphone line circuits (see Fig. 7) are controlled by any of the four right-hand keys as they appear on the telephone panel. Incoming signaling on these lines is by loudspeaker voice calling. Outgoing signaling is by 20-cycle ringing. Incoming calls are picked up by operating the line key to the downward or talking position. This operation disconnects the interphone line from the common loudspeaker circuit and connects it to the telephone set. As the line key is operated, the transmission levels of all the other lines employing loudspeaker signaling are simultaneously reduced 10 db at the loudspeaker.

controlled by the switching key associated with each line pickup key. The operation of this key to the downward locking position will switch the interphones together at the central office and provide a station drop to the 111A key equipment of the highest numbered loop. In this connection it may be appropriate to know that the station loops from the central office to ATCS should be connected in the numerical order designated, starting at the left side of the telephone panel in either ascending or descending numerical order. The purpose of this arrangement is to provide a simple means for the communicator to identify which loop he will be able to talk and signal on after the switch is effected. This will always be on the loop of the highest numbered line coming into the conference bridge. Since signaling and switching are each accomplished at the central office, they may be controlled over the station loops in a number of ways. One way is to simplex each pair to derive control over each function.

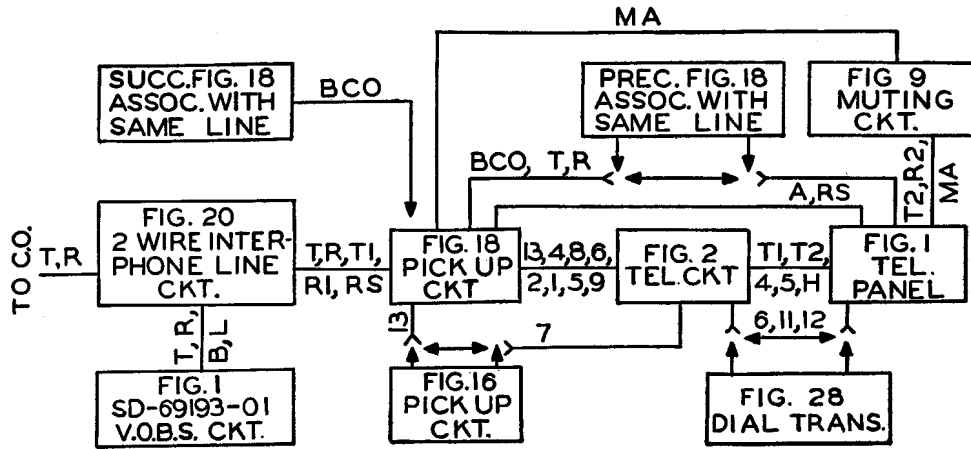


Fig. 7 - 2-wire Interphone Circuit - Incoming Voice Signal

2.07 Control of volume levels on individual lines is accomplished through the use of a variable H pad associated with each private line. The purpose of this control is to permit the communicator to adjust the voice levels of each incoming voice signal at the loudspeaker, so that relative and absolute levels which are satisfactory to him may be obtained.

2.08 Two-wire local private lines are generally employed to connect to local airlines' stations or other stations in the vicinity of the ATCS (see Fig. 8). They are arranged to connect to either one of two types of line circuits. One type uses voice signaling over the common loudspeaker, and the other type uses 20-cycle ringing for the incoming signal. Each type of line will be termi-

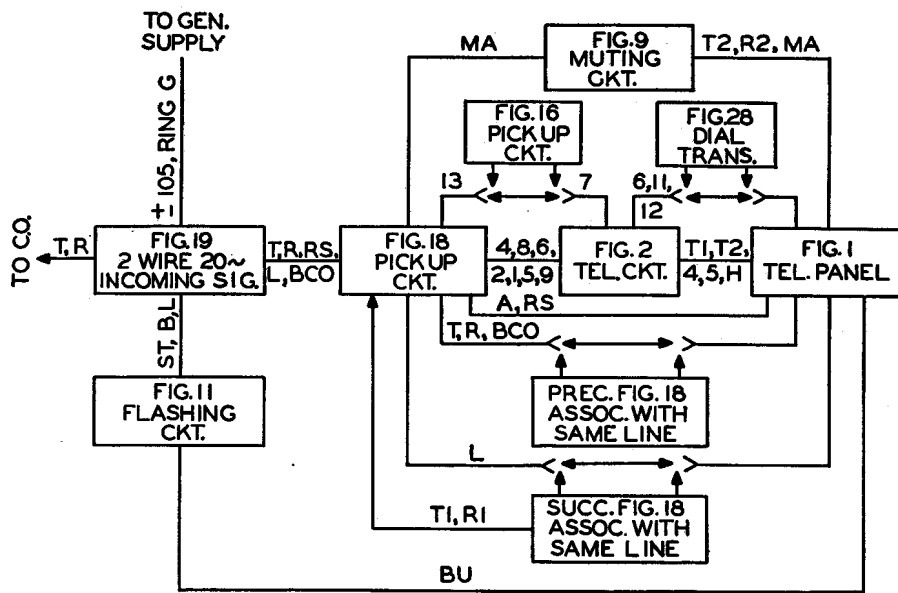


Fig. 8 - 2-wire Private Line Circuit - 20-cycle Incoming Signal

nated on the telephone panel in a private line key. The volume control will not be used when ringing is used for incoming signaling on these lines.

2.09 Two-wire dial or loudspeaker intercommunicating lines are used for intraoffice communication at the ATCS. Features for controlling this type of line are the same as for the central office line except that these lines cannot be switched. This line is generally a 701-, 740-, or 755-type PBX line. It is arranged to provide an audible buzzer, a flashing incoming signal, a steady busy signal, and holding. It should be connected to a private line type key, but the volume control will not be used.

2.10 A busy signal lamp is provided for use with each 2-wire and 4-wire line associated with the common loudspeaker and is lighted by a voice-operated busy signal whenever there is speech present on the line, regardless of the source (see Fig. 9 and 10 for busy signal unit). This busy lamp is furnished in order that the communicator may associate the loudspeaker voice signals with the appropriate line. The circuit employed in this voice-operated signal is based upon the principle of rectified reaction. This type of circuit, which

is a form of positive feedback, provides a large change in plate current for a small change in signal input level. At very low input levels the plate current is small. As the input increases, the plate current increases, slowly at first, and then rises abruptly for a small further increase in input. The operate value of the relay in the plate current circuit is chosen to permit it to operate on the steep portion of the plate current curve (see Fig. 11). Maximum sensitivity is obtained by causing the relay to operate at as low an input value as possible. This condition may be controlled over a limited range by adjusting the BIAS control. The over-all sensitivity, however, is controlled by adjusting the SENS control.

2.11 The characteristics of the voice-operated busy signal may be summarized as follows:

- Bridging impedance is 4000 ohms.
- Bridging loss across 600 ohms is less than 1 db over the voice-frequency range.
- Nominal sensitivity is -30 dbm. Maximum (1000 cycle) sensitivity is 38 dbm ± 1 dbm.
- The release time is adjustable between 3 and 10 seconds.

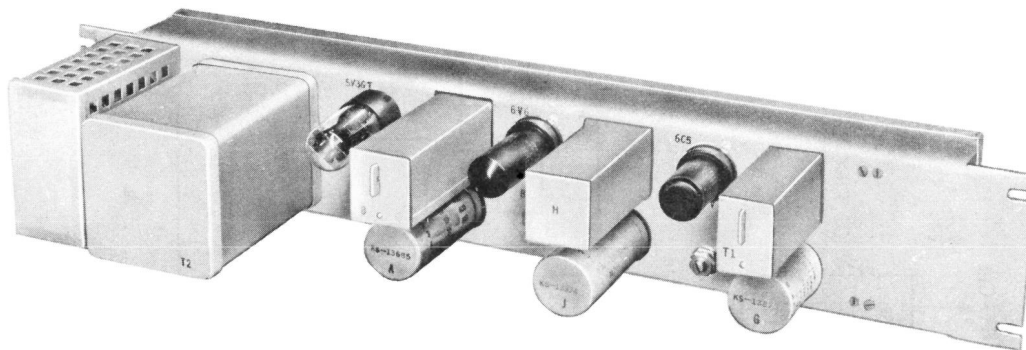


Fig. 9 — Voice-operated Busy Signal Panel — Front View — J53020K

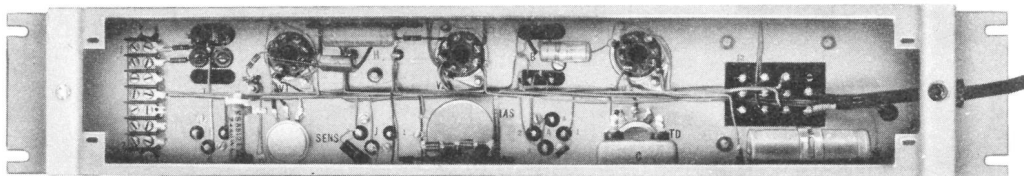


Fig. 10 — Voice-operated Busy Signal Panel — Rear View — Cover Removed — J53020K

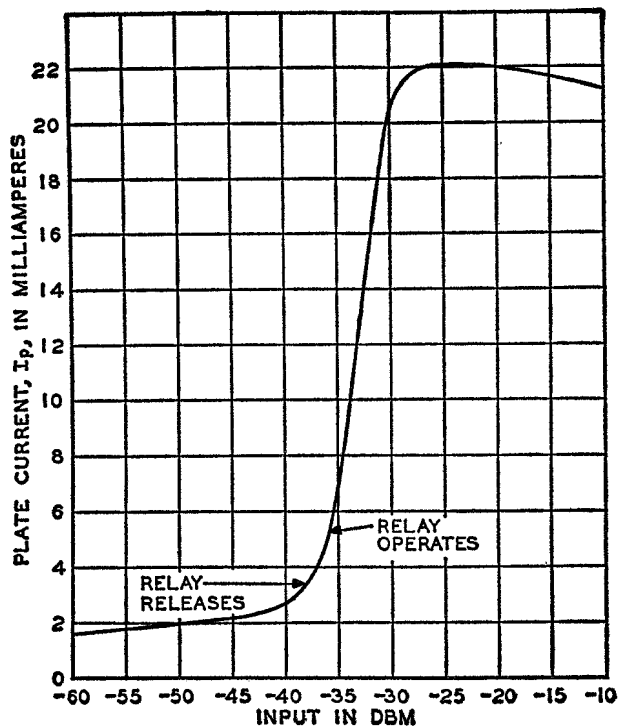


Fig. 11 — Seizure Characteristic Voice-operated Busy Signal

- Nominal frequency range is 200 to 5000 cycles.
- Power consumption is approximately 55 watts at 120 volts ac. This power includes filament and plate supplies.

3.00 EQUIPMENT FEATURES

3.01 The telephone panel contains the line and switching keys, the HOLD-RING key, and the MUTE-ALL key, all used for control of the telephone lines. Also mounted on the panel are the busy lamps and hold lamps for visual busy and holding indication, volume controls for individually adjusting volume level of the loudspeaker lines, and a dial for use on dial lines. On the rear of the panel are mounted the common buzzer and filters for the buzzer and dial circuits. Each panel is equipped with two cords; one end connected to the units on the panel, and the other end equipped with spade terminals for connecting to connecting blocks on back of console desk (see Fig. 2 and 3).

3.02 Relay Units: The telephone circuit, resistor hybrid and muting circuit, supplementary resistor hybrid for five to eight loudspeaker lines, and central office or PBX line circuit are all single-circuit units surface wired on 23-inch by 2-inch mounting plates.

4.00 COMMON FEATURES

4.01 The common loudspeaker is a Western Electric Company 755A loudspeaker contained in a slope front walnut-finished cabinet. It may be ordered separately as KS-120406, but it is usually furnished with the common equipment under J53020L. The FAA has requested that this speaker unit be mounted on a bracket which is suspended from the ceiling of the ATCS control room. The amplifier is usually either a 124D or 142B amplifier and is installed in the 7-foot enclosed cabinet located in the terminal room.

4.02 The resistor hybrid and muting circuit is provided at the input to the amplifier in order that all lines employing incoming loudspeaker signals may be combined before being fed into the amplifier which is common to all the telephone lines. This bridging circuit employs a resistor hybrid network which introduces a 21.5-db loss on each line. It also provides a 70-db loss between lines connected to a common bridge, thereby minimizing crosstalk. The 21.5-db loss on each line is compensated for by providing added gain in the amplifier. Muting is accomplished by inserting a 10-db pad at the input of the amplifier whenever the communicator operates a line pickup key or when, for any reason, he operates the MUTE-ALL key. This circuit also provides for reducing the 1000-cycle ringing tone at the loudspeaker. This tone may be present on a multistation line whenever a station rings out toward the Air Traffic Control Center.

4.03 The telephone circuit consists of a handset mounting, a handset, and a dial. This circuit can be used for either 2-wire or 4-wire operation and is automatically connected for either type of operation as the appropriate line pickup key is operated.

SECTION C71.303

4.04 The 111A key equipment requires 110-volt ac commercial power, 20- to 25-volt dc power, and 20-cycle ringing power. Three sets of duplex 110-volt receptacles are provided in the equipment cabinet for connecting the voice-operating busy signals, the amplifier, and the 20-cycle subcycle, when furnished. The 110-volt supply is

generally connected by the customer. A separate power receptacle, outside the cabinet, will be required to furnish commercial power to the 101E power plant (see the C Section covering power supplies). The 20-cycle ringing current will generally be obtained from the nearest central office but may be provided locally where necessary.