

**BELL SYSTEM PRACTICES**  
**Station Installation and Maintenance**

**SECTION C53.156**  
**Issue 1, June, 1953**  
**AT&T Co Standard**

## **1A1 KEY TELEPHONE SYSTEM**

### **DESCRIPTION**

#### **1. GENERAL**

1.01 This section describes the 1A1 key telephone system which provides station switching features similar in general to those of the 1A key telephone system. The line circuit of the 1A1 key telephone system is a three relay assembly as against the five relay assembly of the 1A key telephone system line circuit. The use of fewer relays plus the economy of space and the minimum of unused equipment will result in a considerable saving. The station switching features which are provided include pick-up of one or more lines of various types, holding on central office or P.B.X. lines, visual signals (incoming calls, holding, and busy), audible signals, intercommunication, dial selective signaling for intercommunication, push button signaling, exclusion and cut-off of extension stations, and cut-off or transfer of audible signals.

1.02 The 1A1 system, like the 1A system, is arranged so that the switching features required at each station may be provided on a feature basis. That is, a sufficient variety of key telephone sets, separate keys and associated key telephone units have been made available to meet the individual requirements for each station as well as the equipment requirements common to the entire system, instead of providing a number of specific plans which have more or less fixed combinations of line and station features.

1.03 The switching equipment is arranged on panel key telephone units, each unit providing one or more of the switching features available in the system. The features desired in any installation can, therefore, be obtained by furnishing the corresponding key telephone units. A few completely assembled combinations of key telephone units are available to provide the more commonly required feature combinations. The features provided in these assembled equipments (200A, B and C) consist of pick-up, hold, line and busy

lamp signals, etc., and the units are completely wired and assembled in an apparatus cabinet described later. The 200A, B and C key telephone units supersede the 50A, B and C key telephone units respectively of the 1A key telephone system.

1.04 The variety of key telephone sets made available for the 1A1 key telephone system provides the feature combinations required for the majority of the installations. The desired feature combination can be furnished for each station by selecting the proper key telephone set or separate key and when the features at all of the stations have been determined, the common equipment which is required for the installation can be selected. Where the exact combination of telephone set features desired is not available, sets with additional features should be used with the unneeded features left unconnected and blocked by the installer.

## 2. STATION APPARATUS

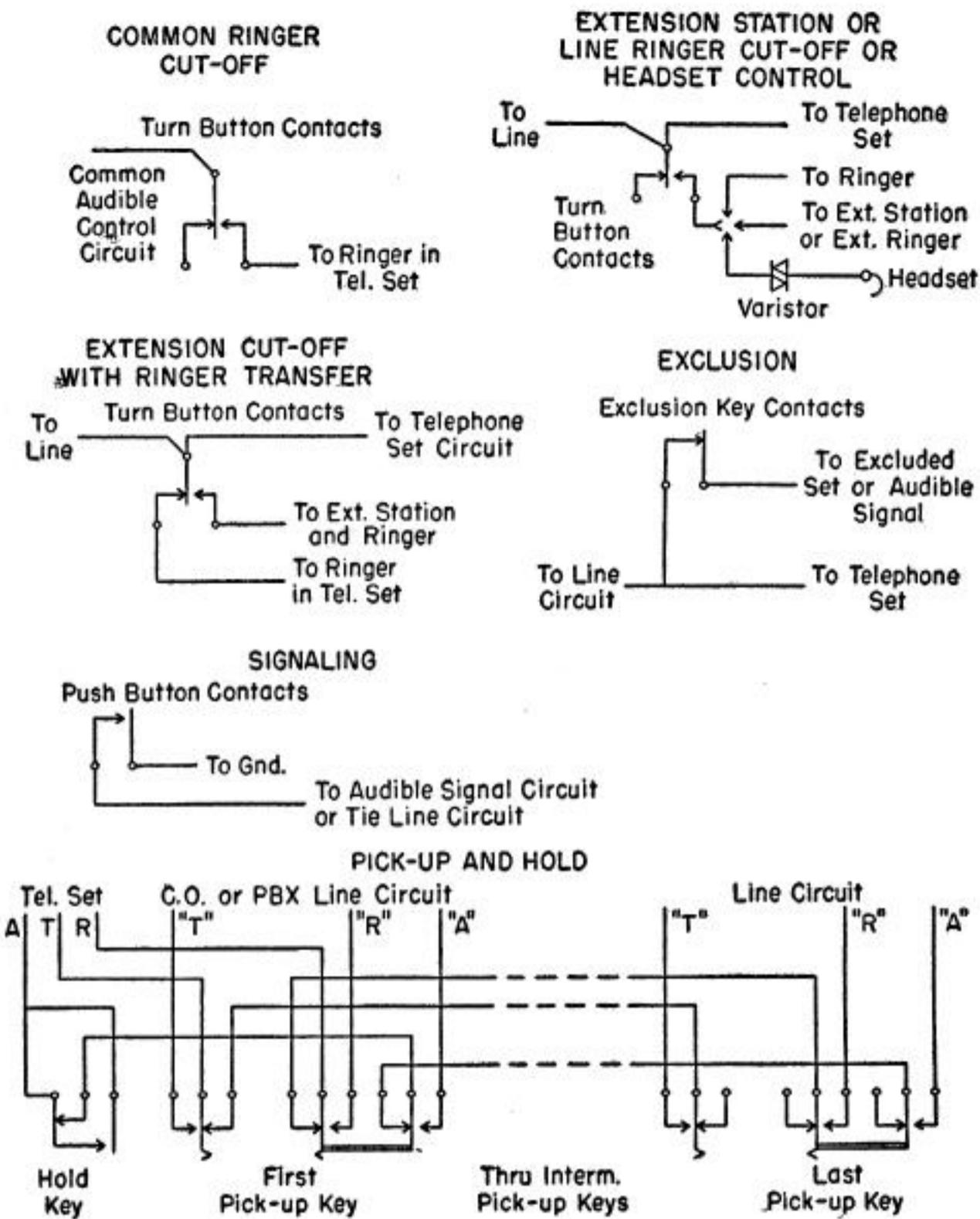
2.01 **Key Telephone Sets:** The key telephone sets are combined telephone sets similar in appearance to the keyless combined telephone sets. These sets include in a single housing the switching keys; signal lamps, if desired; subscriber set apparatus; ringer; and the additional cord conductors which are required for the keys and lamps. Where more than one line terminates in a set, the ringer may be connected to any one of the lines, with externally mounted ringers or ringers in adjacent sets being used for the rest of the lines. If desired, the ringer in the set may also be used as an audible signal common to all of the lines. The keys serve to switch the set talking circuit to any line. Sets having 4 and 6 button keys are equipped with a latch device which prevents the first two pickup keys being depressed at the same time. This prevents all pickup buttons from being locked simultaneously in the operated position. A magnetic shield around the induction coil and a balanced talking and ringing condenser unit are provided to prevent crosstalk between two lines when the ringer is on one of them and the set circuit is on the other. In order to provide this balance the condenser cover should be connected to the ring side of the line as covered in SD-69206-01, Note 3.05. As a further precaution against undesirable crosstalk, the cords are constructed in spiral pairs and fours so as to minimize any unbalance between cord conductors. The feature combination furnished by a given set may be varied to some extent by making suitable changes in the connections of some of the spade-tipped leads in the set as, for example, to associate a cut-off key with any one of the lines appearing in the set.

2.02 Key telephone sets provided for use in the 1A1 key telephone system have similar numerical and letter code designations to those of the 1A system except that manual sets have a second suffix letter "E" instead of "A" and the dial equipped sets have a second suffix letter "G" instead of "C", but differ from key telephone sets of the 1A system in that there is an additional make contact on the switch hook assembly through which the control lead "A" is connected to ground when the hand set is removed from the mounting. These new sets are wired in manufacture for use with the **1A** key telephone system and **must** be modified, as shown in SD-69206-01, for use with the 1A1 key telephone system.

2.03 Section C53.157 and the SD-drawings listed in Part 8 of this section, list the types of key telephone sets and separate keys available for the 1A1 system.

2.04 In the 4 and 6-button sets, the keys are located in a row in front of the dial. The switching features available are shown in Fig. 1 and in both the 4 and 6-button sets, a variety of different feature combinations are provided as in the 1A key telephone system. The pickup keys are interlocking push button keys. The common holding key is non-locking but is arranged to release any operated pick-up key, and the cut-off key is a locking turn button key similar to the one provided in the 410 and 510-type sets except that the signaling feature is not included. One or more non-locking signalling keys may also be provided. A removable transparent designation strip holder is provided and Form E-2804 or Form E-2961 is used with this holder to indicate the key functions. The designation strip holders P-482882 (4-button) and P-482883 (6-button) are used on these key telephone sets. Fig. 2 illustrates the general appearance of one of these sets and also shows relative locations and functions of the different types of keys.

2.05 Provision is also made in the 4 and 6-button sets for signal lamps, arranged to illuminate the transparent plastic key buttons of the pick-up keys.



Key Features of 4 and 6-button Key Telephone Sets

Fig. 1

2.06 The exclusion key, which is available in some of these sets is a part of the switch hook assembly and its contacts are operated by pulling up the right-hand plunger after the hand set has been removed. In the principal use of this key, while the key is operated, its contacts serve to disconnect one or more extension stations from a line, and when the hand set is replaced on the mounting, the exclusion key is automati-

cally restored to normal. The exclusion key used with the 6-button key telephone set is shown in Fig. 2.

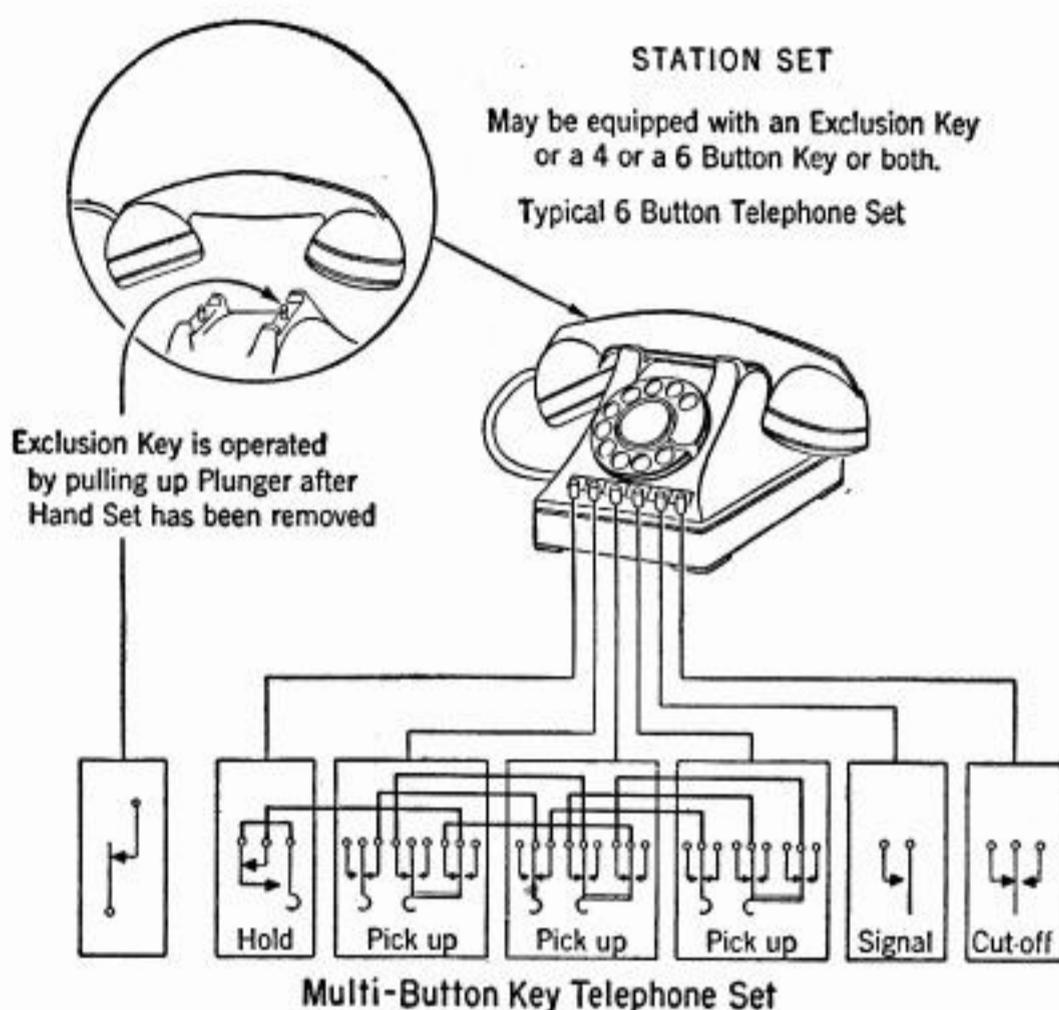


Fig. 2

2.07 The selection of the proper key telephone set for a given feature combination can be determined by reference to the table listed in Section C53.157 or the SD drawings listed at the end of this section. Inasmuch as a specific coded set has not been provided for every combination of key and set features, it is sometimes necessary to use a set with features which are left unused. Also, in some cases, it is necessary to change the connections of spade-tipped leads in a given coded set to secure the particular feature combination desired. SD-69206-01 drawings indicate how these changes are made.

2.08 **Connecting Blocks:** A ten terminal connecting block is used to terminate key telephone set cords having more than four conductors. This block may be used individually or in a multiple arrangement of up to four blocks using covers and backboards in accordance with instructions included in the section in the C30 Division entitled "Connecting Blocks—Installation."

2.09 **Separately Mounted Keys:** A number of separately mounted keys are provided for use with a 213-type hand telephone set or other station set. In general, these keys provide for feature combinations like those shown in Fig. 2 **with the exception of** (1) the exclusion feature, (2) the combination of central office and private lines with common signalling and holding keys, (3) the provision of more than one signalling key in combination with pickup keys, and (4) the provision of a signaling key with a cut-off key. The signaling keys listed in Section C53.157 are available where additional signaling keys are required. These separate keys and the feature combinations which they provide are listed in Section C53.157 and in the SD drawings listed at the end of this section. These keys are normally wired for use in the 1A key system and require minor modification for use in the 1A1 system. Designation card P-456510 contains all printed designations required with the separately mounted push button (and turn) keys.

2.10 **Subscriber Sets:** When separate keys and a hand telephone set such as the 213-type are required, a separate subscriber set will be necessary. When the ringer in this set is to be used as a line ringer, the 634CF subscriber set should be employed. This set is arranged to prevent undesirable crosstalk due to magnetic leakage between ringer and induction coil which might result from having the ringer on one line and the subscriber set circuit on another. If the subscriber set ringer is to be employed as a common ringer, the 684BA subscriber set or its equivalent may be used.

2.11 **Ringers, Buzzers and Lamps:** The ringer in a key telephone set may be used either as an individual ringer associated with one of the incoming lines or as a common ringer. When additional individual ringers are required, a separately mounted ringer such as the 531A subscriber set or the 584DE subscriber set may be employed. Either set may be used as a common ringer by reconnecting the ringer and condenser leads in accordance with SD-69207-01.

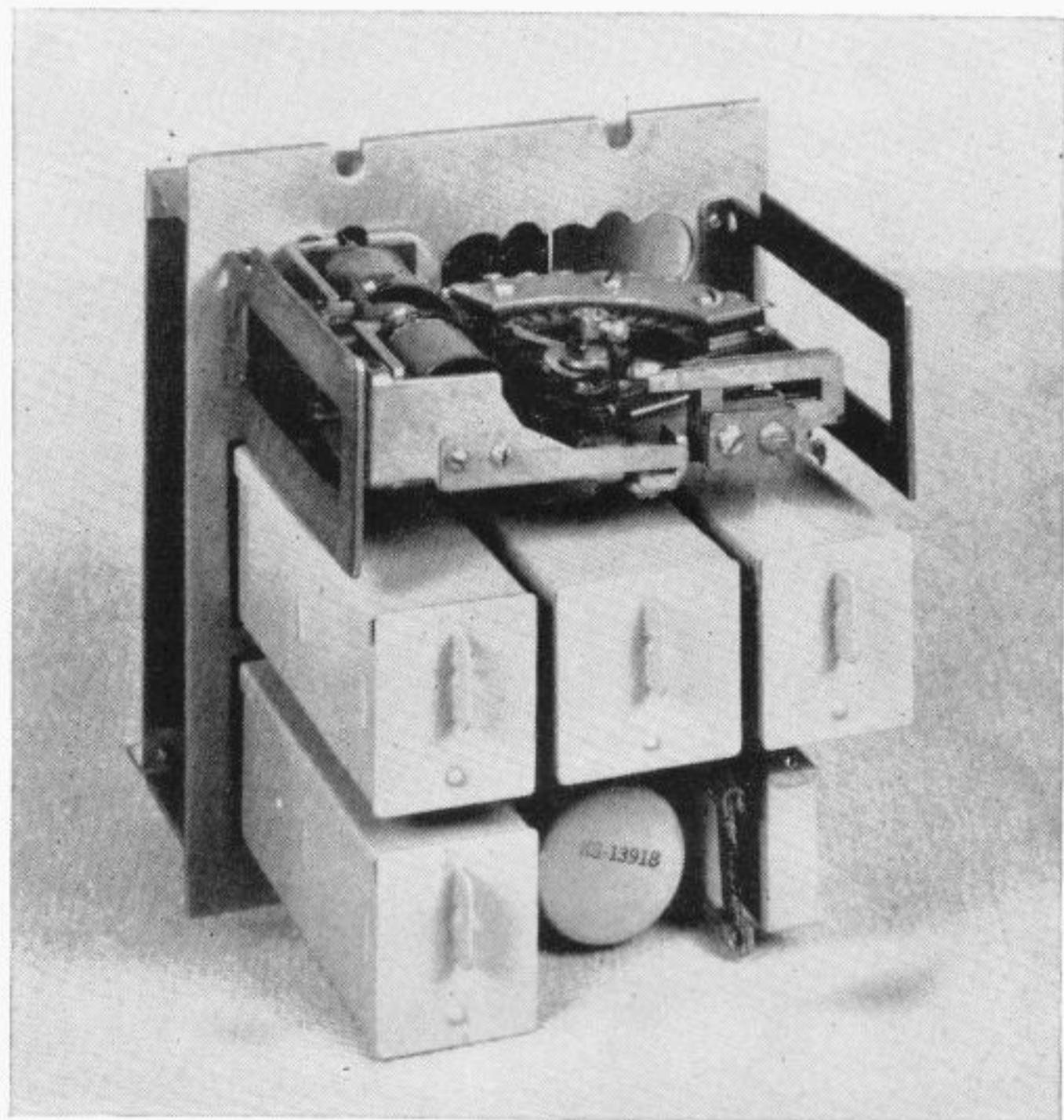
2.12 A 7-type buzzer may be mounted in any of the key telephone sets in place of the ringer, when desired, by employing a 36A bracket. The buzzer may be used as an intercommunicating signaling buzzer or as a common line signal. In the 4 and 6-button sets the buzzer may be installed with or without the cover, depending upon the volume required. The 36A bracket is also arranged to mount the 152A condenser, which should be used when radio frequency suppression is required for the buzzer.

2.13 For installations requiring signal lamps, the illuminated button sets (444, 445, 464 and 465-types) may be used to provide a combined line and busy lamp in which the lamp flashes on incoming calls, the lamp lights steadily on originated, answered or held calls; or, if the "wink circuit" holding indication feature is provided, the lamp "winks" momentarily every second on held calls.

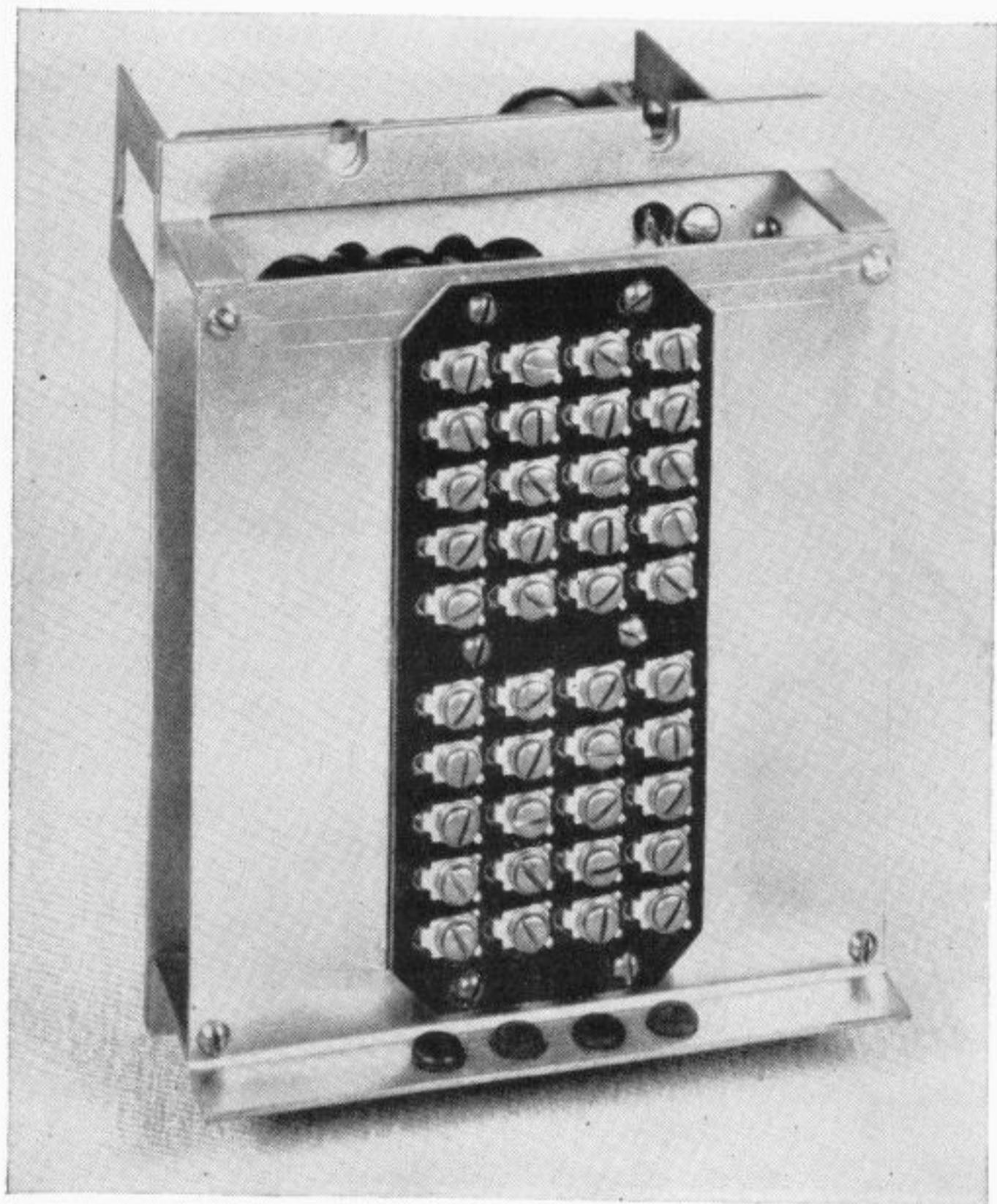
2.14 These same service features may be provided using suitable standard lamp indicators when desired by the customer or when local supply conditions make the latter arrangement desirable. Where both key telephone sets with illuminated key buttons and lamp indicators are used in the same system, A3, G2 or K2 lamps should be used in the lamp indicators depending on the lamp supply voltage available as outlined in Installation Section C53.158.

### 3. COMMON EQUIPMENT

3.01 **Key Telephone Units:** When line and signalling equipment common to an installation is required, it is provided in the form of key telephone units. These are small equipment units, each consisting of a panel approximately 7 inches high and varying in width from 2-5/8 inches to 5-11/16 inches to provide the circuit features desired. The panel is equipped with legs projecting towards the rear on which is mounted a terminal plate having terminals arranged for both solder and screw connections. The solder terminals are used for shop wiring and the screw terminals are for wiring placed by the installer. Two rows of these key telephone units can be mounted in the 6-plate apparatus cabinet per ED-95021-01. Fig. 3 shows a front and rear view of a panel type unit.



Front



Rear  
Fig. 3

3.02 Certain circuit features are provided only in key telephone units having an angle bracket type mounting which may be mounted with the panel type units using mounting assembly P-39A697 as shown in Fig. 4. This is a hinged assembly that may be swung open to permit adjustment of relays, etc. Using this type mounting assembly three angle bracket key telephone units may be mounted in one row on the front of the gate assembly of the 6-plate apparatus cabinet per ED-95021-01 and likewise, three assemblies may be mounted so that three key telephone units are on the rear of the gate assembly. Each of these key telephone unit mounting assemblies will hold one 3-1/2-inch wide angle-bracket key telephone unit and one 1-3/4-inch wide angle-bracket key telephone unit or three 1-3/4-inch wide key telephone units.

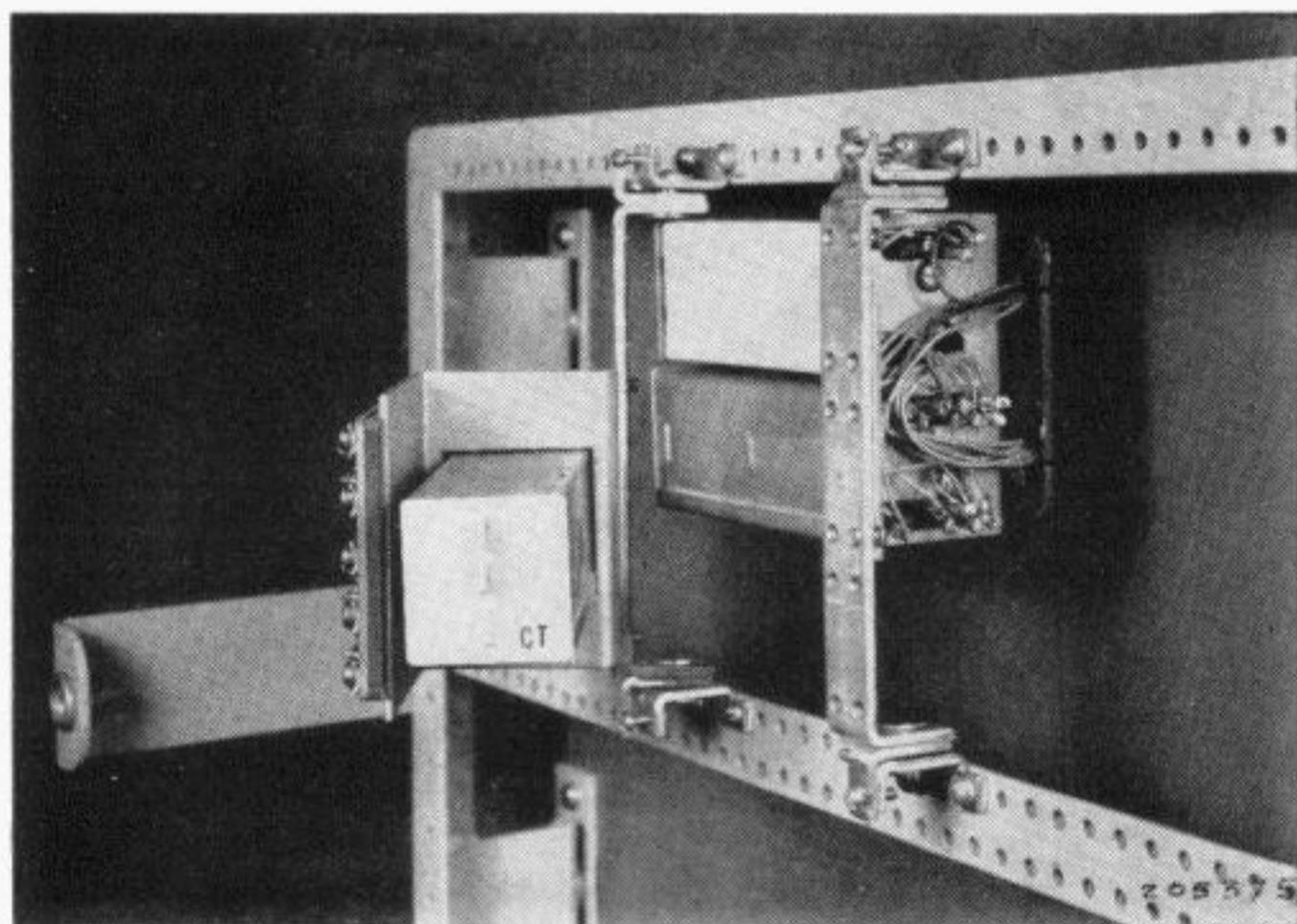


Fig. 4

3.03 The 200A, 200B and 200C key telephone units consist of an apparatus cabinet per ED-95021-01 equipped for 2, 3 or 4 central office or P.B.X. lines, respectively, in which the 202A and 209A key telephone units are assembled and wired. When other features of the 1A1 key telephone system, not furnished with 200A, B and C units, are desired they must be ordered separately and assembled in the apparatus cabinet. The 211A KTU which provides the ringing lamp circuit, audible

signal control circuit, battery feed circuit for intercommunicating line and the noise suppression circuit must, when required, be ordered separately, or the individual features of the 211A KTU provided by angle bracket type key telephone units can be ordered separately and mounted in the same cabinet.

3.04 The coded key telephone units providing the relays and associated apparatus required for the various circuit functions of the 1A1 key telephone system are listed in Table 1.

**TABLE 1**

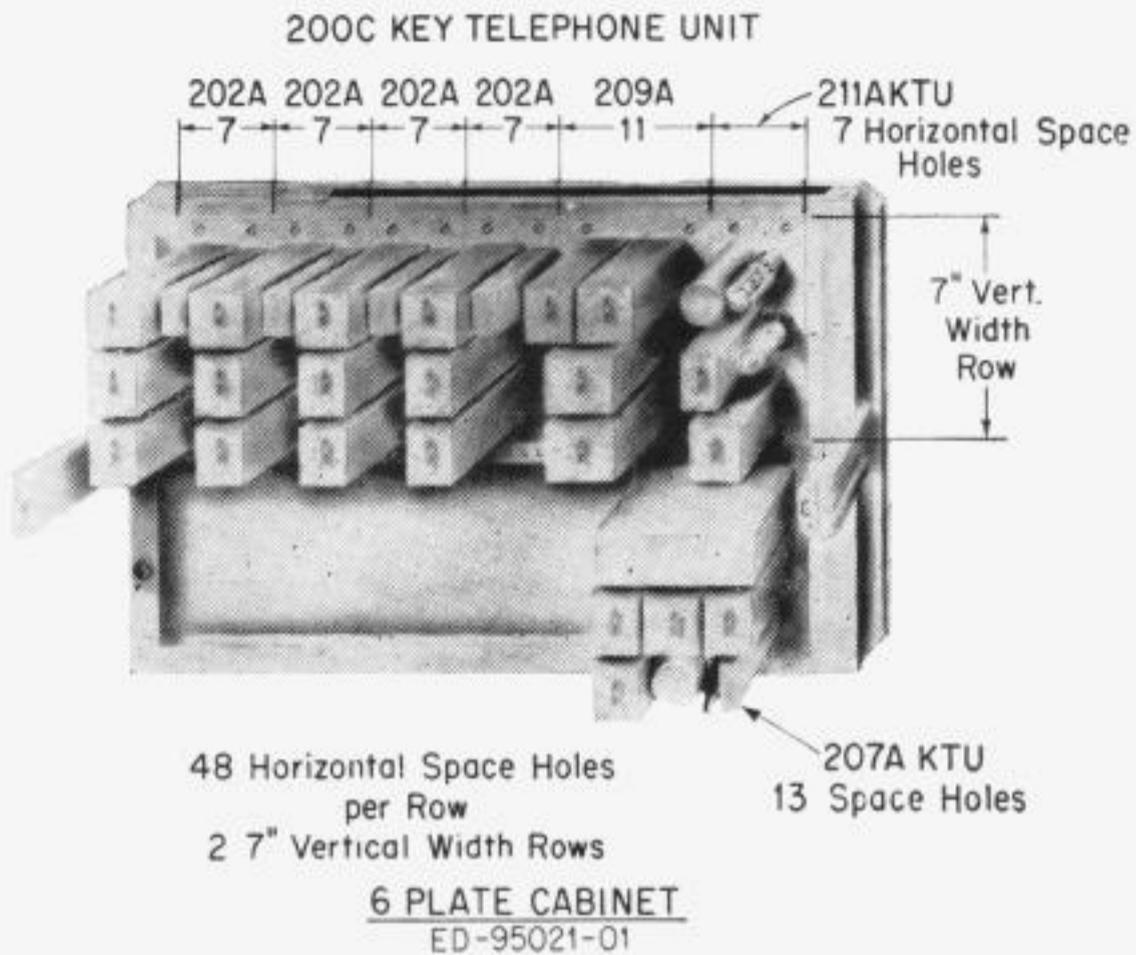
FEATURE OR OPTION	KTU CODE	NUMBER REQUIRED
CENTRAL OFFICE OR P.B.X. LINE CKT.	202A	1 per C.O. or P.B.X. line
TIE LINE CKT.— Automatic Ringdown	203A 204A	1 per Tie Line 1 per Tie Line
STATION LINE CKT.	205A	1 per Station Line
LAMP FLASHING AND INCOMING SIGNAL TIME OUT CKT. All lines held or wink used.	209A	1 per 5 Lines
One or more lines not held without wink.	209A	1 per 6 Lines
HOLD LAMP WINK CKT.	210A	1 per 5 Lines
MISC. COMMON EQUIPMENT	211A	1 per System
AUTOMATIC CUTOFF CKT.	26B	1 per Line
CUT THROUGH AND CONTROL CKT. FOR AUTO. CUTOFF CKT. Station cut off others not cut off during call.	29A	1 per Station or group of stations per Line
Station can not cut off not cut off during call.	29A	1 per Line
COMMON AUDIBLE SIGNAL *Part of 211 KTU	16A *	1 per group of stations Max. 10 7A buzzers, 9 7A bells or 12 ringers per group.
RINGING LAMP CIRCUIT *Part of 211A KTU	11A *	1 per System
INTERCOM. SIGNALLING CIRCUIT Where both code and selective sig. is required for any buzzer	3A *	1 per group on code signalling
BATTERY FEED NOISE SUPPRESSION CONDENSER	23A *	1 per System

TABLE 1—Continued

FEATURE OR OPTION	KTU CODE	NUMBER REQUIRED
INTERCOM. LINE BATTERY FEED CKT. *Part of 211A KTU	31A *	1 per Intercom. Line
DIAL SELECTIVE INTERCOM. LINE CKT.	207A	1 per Nine Station Intercom. Line
SIGNAL CKT. FOR FLASHING INTERCOM. LINE LAMPS AND AUTO. CUTOFF CONTROL CKT. With or without automatic cutoff	208A	1 per three Intercom. Stations
STATIONS CUTOFF CKT.	26B	1 per Intercom. Line
LAMP RESISTANCE CKT. FOR D-C LAMP POWER SUPPLY With or without flashing Ckt.	22 Type	1 per maximum 2 lamps per 3 lines or 6 lamps per line
AUDIBLE SIGNAL Buzzer, Bell or Ringer		1 per Station
VISUAL SIGNAL Lamp in Tel. Set or Indicator		1 per Station

3.05 **Apparatus Cabinets:** The apparatus cabinets described in Section C53.506 are used when a number of 1A1 key telephone units are mounted in one location.

3.06 One arrangement is that described in Paragraph 3.03 and the cabinet furnished has a glass fibre composition cover finished in a beige-gray color and treated on the inside with a sound absorbent material to minimize relay operation noise. Section C53.158 lists the mounting space requirements of the various key telephone units and Fig. 5 illustrates the space holes required for mounting the 202A, 207A, 209A and 211A key telephone units in the 6-plate cabinet. The cabinet may be floor mounted as covered in Section C53.506.



**Fig. 5**

3.07 When the common equipment requirements exceed the capacity of the unit panel cabinet described in Paragraph 3.06, the 11-, 18-, 26- or 45-plate cabinets described in Section C53.506 should be used. For these applications the 200-type KTU's are mounted on two P-37A502 (23 inches long) or P-37A823 (19 inches long) mounting bars. The bent angle bracket type KTU may be mounted on the 7-inch vertically spaced bars using mounting assembly P-39A697 or on bent mounting bars per ED-69143-01, G2. Key telephone units are omitted from the back of the top mounting bar assembly in the 11 and 18-plate cabinets in order to permit adequate space for the cables. Where a fuse panel is mounted on the back of the 11 or 18-plate cabinet in place of using the 201A KTU, it will be necessary to omit placement of key telephone units on the rear of the mounting bar assemblies which face the fuse panel. Where the bracket assemblies are located to the right, the mounting space on the rear at the extreme right should not be equipped when the right side of the cabinet is placed near a wall.

3.08 The unit panel cabinets 200A, B and C will be furnished by the W. E. Co. completely wired and equipped with KTU's ready to install. The individual mounting arrangements and KTU's may be obtained separately, if needed for additions or maintenance.

3.09 **Apparatus Box:** The 105B apparatus box, which may be used to mount the angle bracket type key telephone units as shown in Fig. 6, is a beige-gray finished metal box accommodating four 1-3/4-inch KTU's or their equivalent. The units are fastened to the base of the box by two machine screws in a position such that the relays will be horizontal when the apparatus box is mounted on a vertical surface. KS-5796, Lists 7, 8 and 9 backboards are available to mount 1, 2 or 3 apparatus boxes respectively. Distributing rings for the cabling within the box and fibre guard plates to cover the cable entrance holes are furnished with each box.

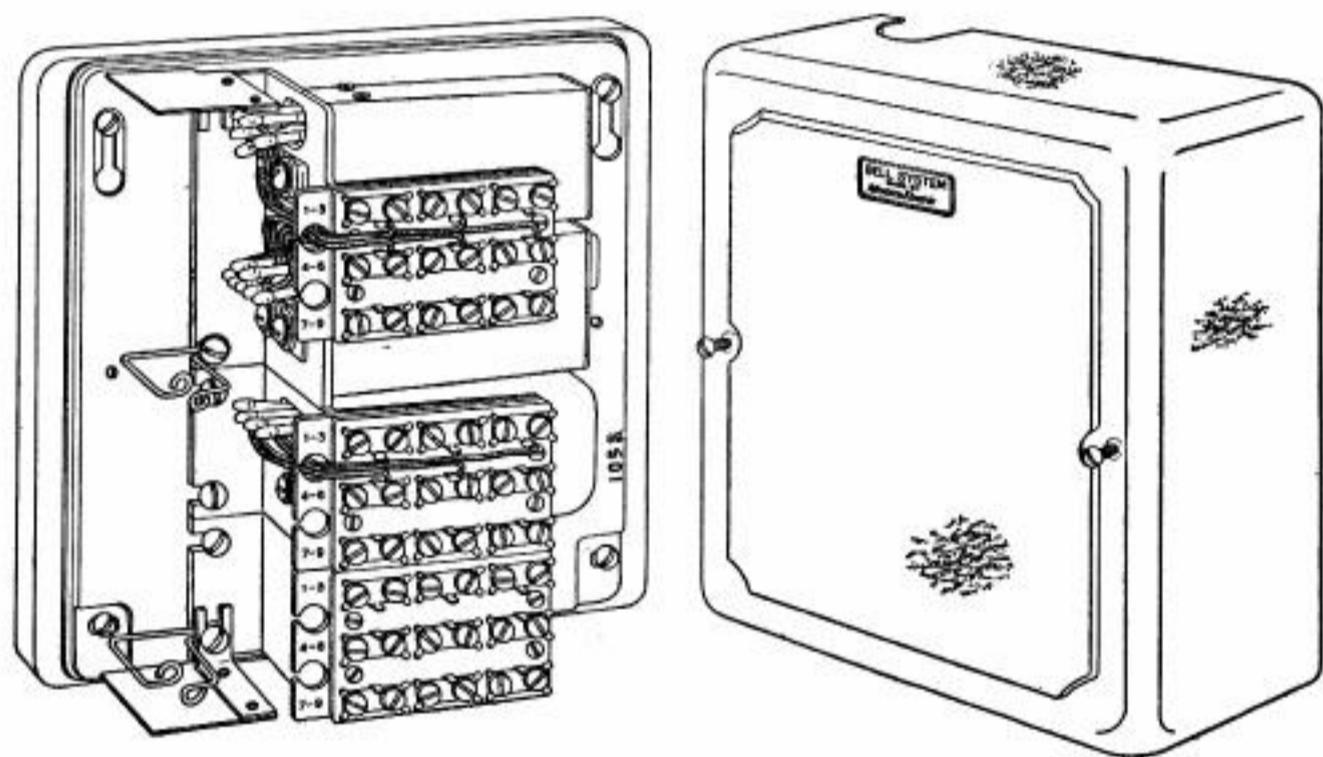


Fig. 6

3.10 **Relay Racks:** Mounting bars are available for mounting the key telephone units provided for the 1A1 system on relay racks as follows: 23-inch long horizontal bar P-37A502, 19-inch long horizontal bar P-37A823. On racks drilled on 1-inch centers for mounting 2-inch wide plates, two P-37A901 spacer bars are used to obtain correct vertical spacing of above mounting bars.

#### 4. OPERATING RANGES

4.01 The central office and P.B.X. line circuit ranges are equivalent to those of the connecting circuits with the exception of the 555 P.B.X. The supervisory relays of the 555 P.B.X. operate on somewhat lower currents than the hold relays of the 1A1 key telephone system. Conductor loop resistance limits for key telephone systems will be included on system range charts.

## 5. OPERATING FEATURES

5.01 **Pickup:** The key telephone sets and the separate keys for use with other telephone sets provide for connecting to central office, P.B.X., intercommunicating or tie lines. These keys are arranged so that when one pickup button is depressed any other operated pickup key is released before the contacts of the last operated key make.

5.02 **Incoming Ringing:** Incoming calls are indicated both audibly and/or visually by the usual station ringers, by lamps, or by buzzers or ringers operated in a local circuit. In the latter circuit, a steady audible signal is provided and the visual signal flashes intermittently (on 1/2 second per second). An incoming call is answered by depressing the pickup key associated with the line being rung, and removing the hand set from its mounting. By relay operation the flashing lamp changes to a steady light indicating that the line is in use. If the incoming call is not answered in approximately 30 seconds a time out feature is provided to release the locked in relays and the incoming flashing signal will stop.

5.03 **Holding:** A holding feature is provided for use by the subscriber which permits holding a central office or P.B.X. line while using a second line at the same station. The

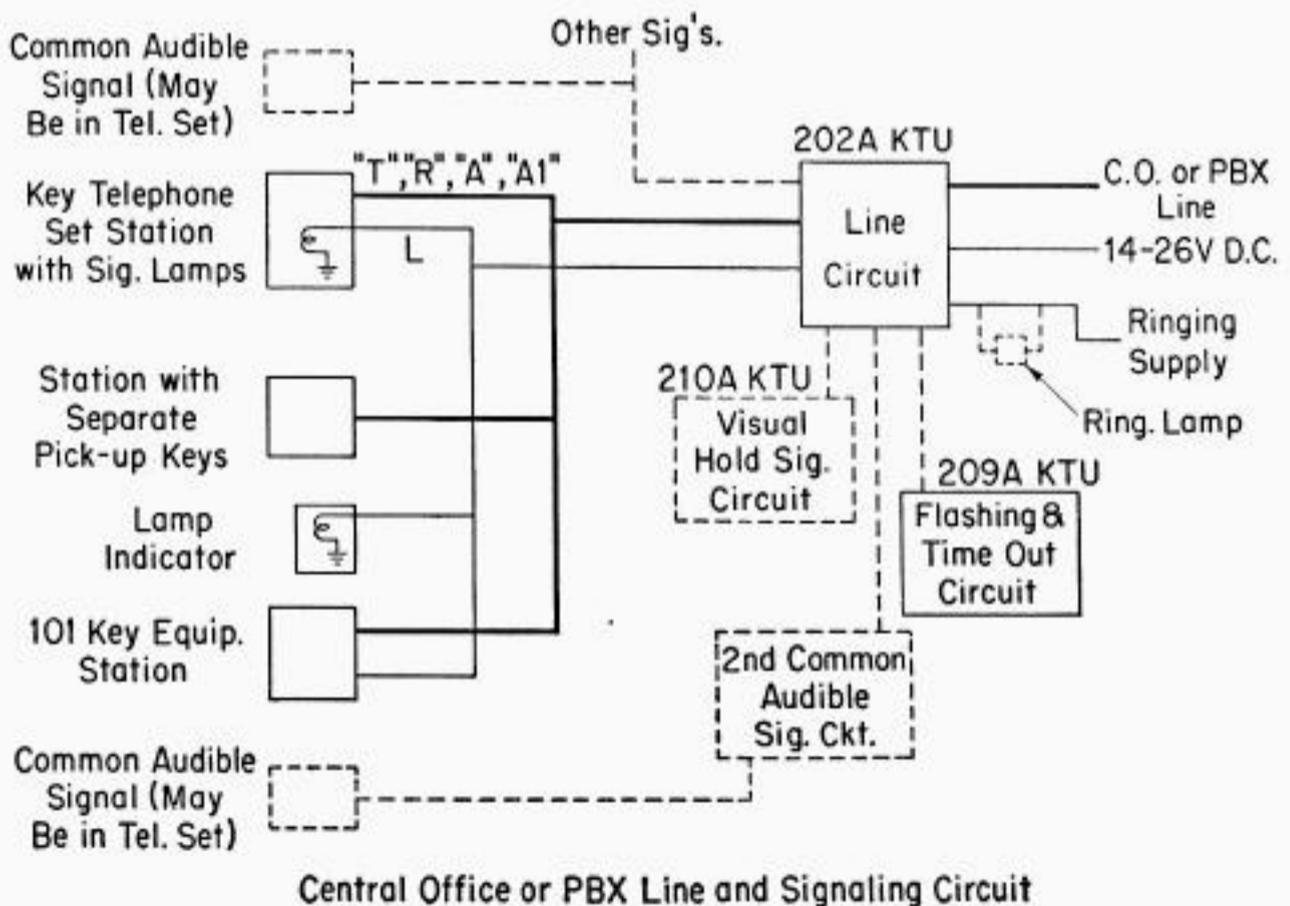


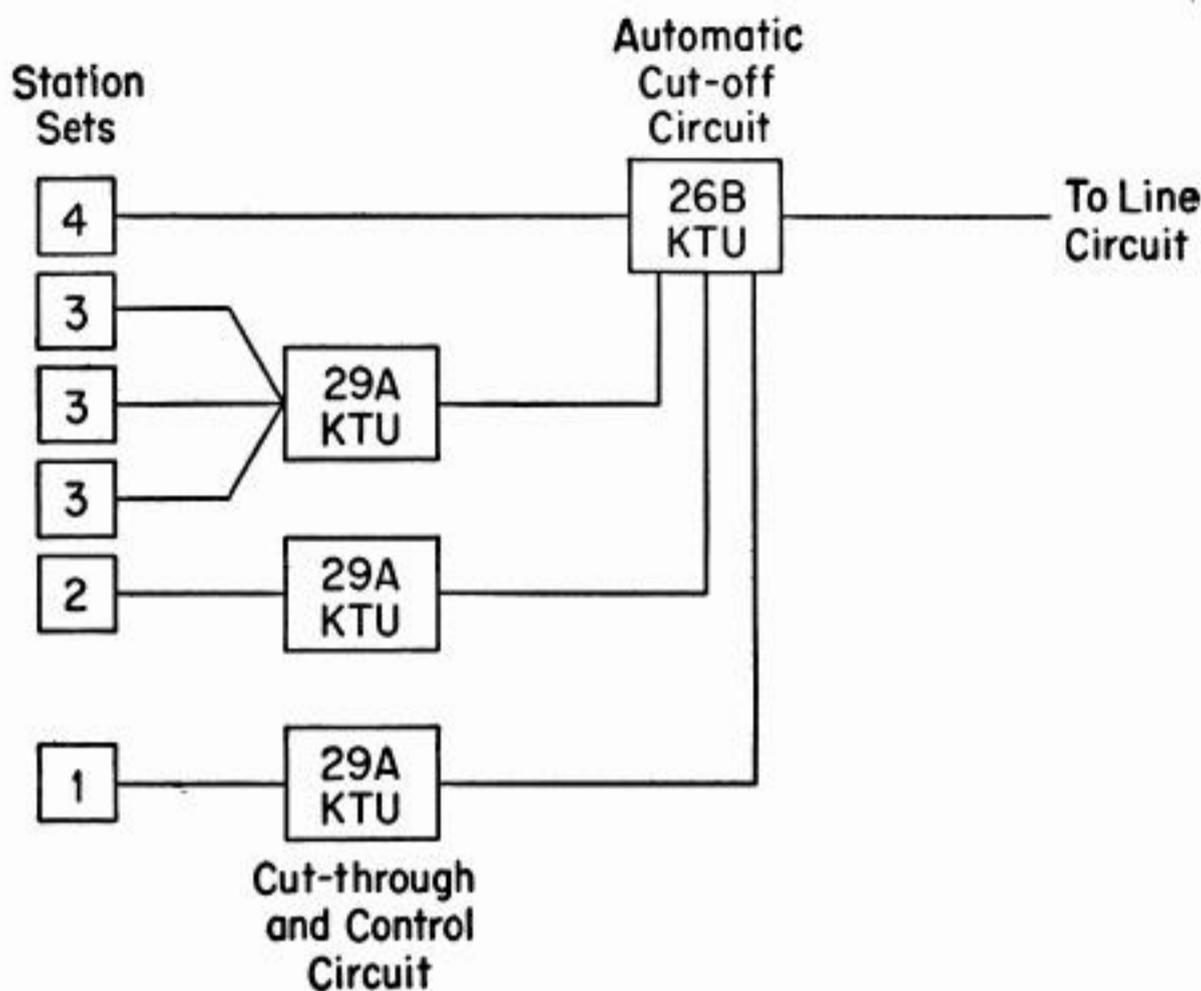
Fig. 7

hold is removed when the line is picked up again by operation of the pickup button with the hand set off its mounting or when the line is opened momentarily at the central office or P.B.X. Where a steady busy lamp indication is provided the busy indication stays on while the line is held. By means of a "wink" circuit (210A KTU), the signal lamp of the line being held, winks out each second (off about .03 second per second) during the interval the line is being held. Fig. 7 is a diagram of the above features.

5.04 **Exclusion:** The exclusion feature is provided to insure privacy of conversation by cutting off other stations, having access to the same line, for the duration of the call. The exclusion key is part of the right hand switchhook plunger and is operated by pulling the plunger up. Operation of the exclusion key may disconnect one or more stations from a given line. The exclusion keys are wired in series so that the station electrically nearest the line circuit unit will exclude all other stations. While the exclusion key is operated, the other plunger may be used for flashing without releasing the exclusion plunger. Excluded stations are automatically restored when the plunger is restored to normal.

5.05 **Cut-off—Manual:** The turn button key of the multi-button key telephone sets may be rotated manually to (1) cut off an extension station or ringer for as long a period as desired, (2) to disconnect the ringer in the set and connect an extension station or ringer or (3) to control a listening-in set. When more than one cut-off key is required at a station additional separate lever type keys externally mounted must be employed. SD-69206-01 shows the wiring changes in the multi-button key telephone set necessary to perform the above operations with the cut-off key. Cut-off of a common ringer in the set may also be accomplished with the exclusion key. Thus when the set is in use the common ringer, indicating an incoming call on another line, is silenced by pulling up the exclusion key button. The ringer is reconnected automatically when the hand set is replaced on the mounting. For connections see SD-69206-01.

5.06 **Cut-off—Automatic:** Four optional arrangements are provided to automatically cut-off stations from the line. These are diagrammed in Fig. 8.



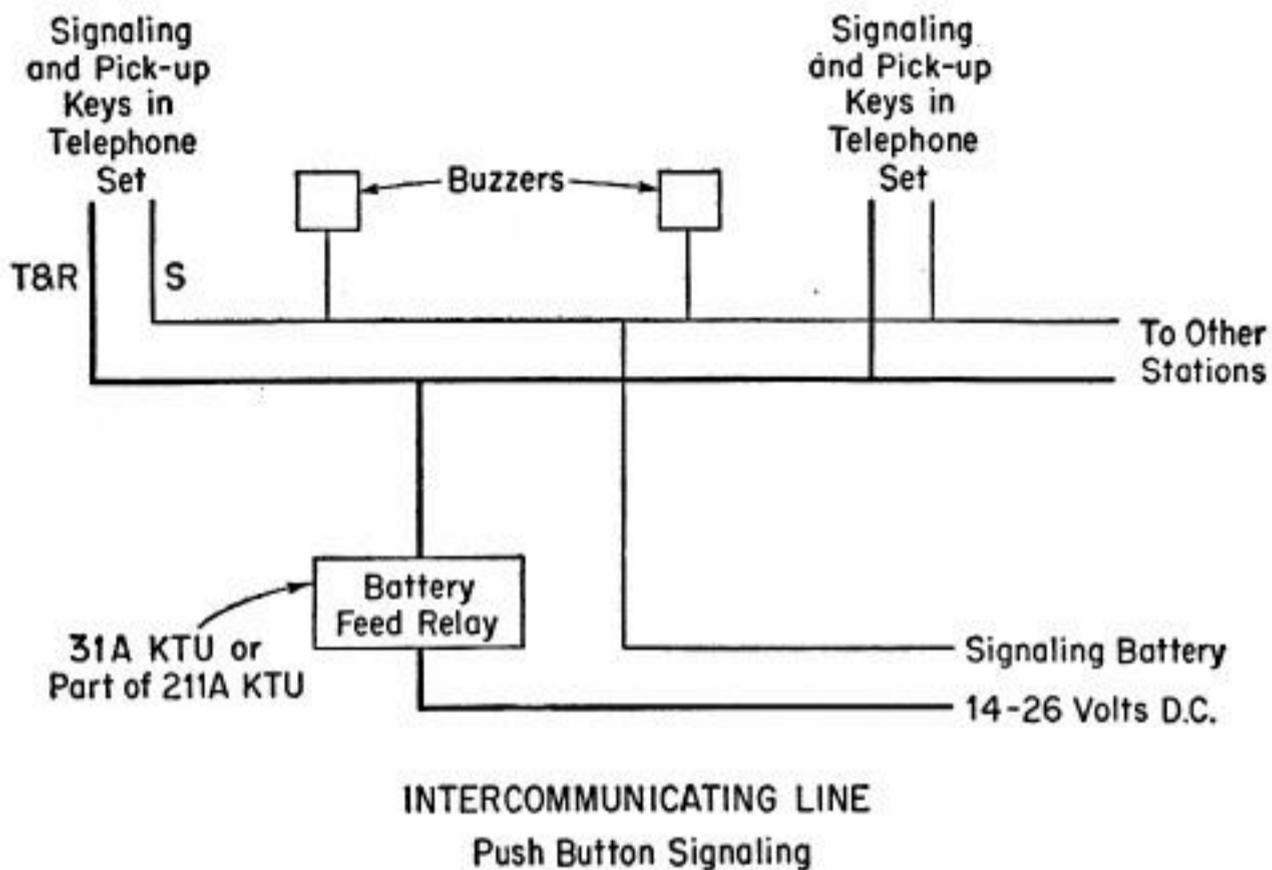
- Sta. 1 Station can cut-off others and cannot be cut-off
- Sta. 2 Station can cut-off others and can be cut-off except during a call
- Sta. 3 Station or group of stations cannot cut-off others and can be cut-off except during a call
- Sta. 4 Station cannot cut-off others and can be cut-off at any time

### Cut-off and Control Circuit

Fig. 8

**5.07 Intercommunicating Line:** The intercommunicating line consists of a pair of wires appearing at any desired number of stations and permits local telephone conversations between stations associated with a given system. One or more intercommunicating lines may be provided. Each intercommunicating line requires a separate battery feed supply relay or coil. The simplest arrangement requiring the use of push button and buzzer signals is shown in Fig. 9 and entails the use of either a 31 KTU or the battery feed relay of the 211A KTU. A busy lamp indication can be provided with either of the relays men-

tioned. When the busy lamp indication is provided the time out circuit of incoming signals is disabled.

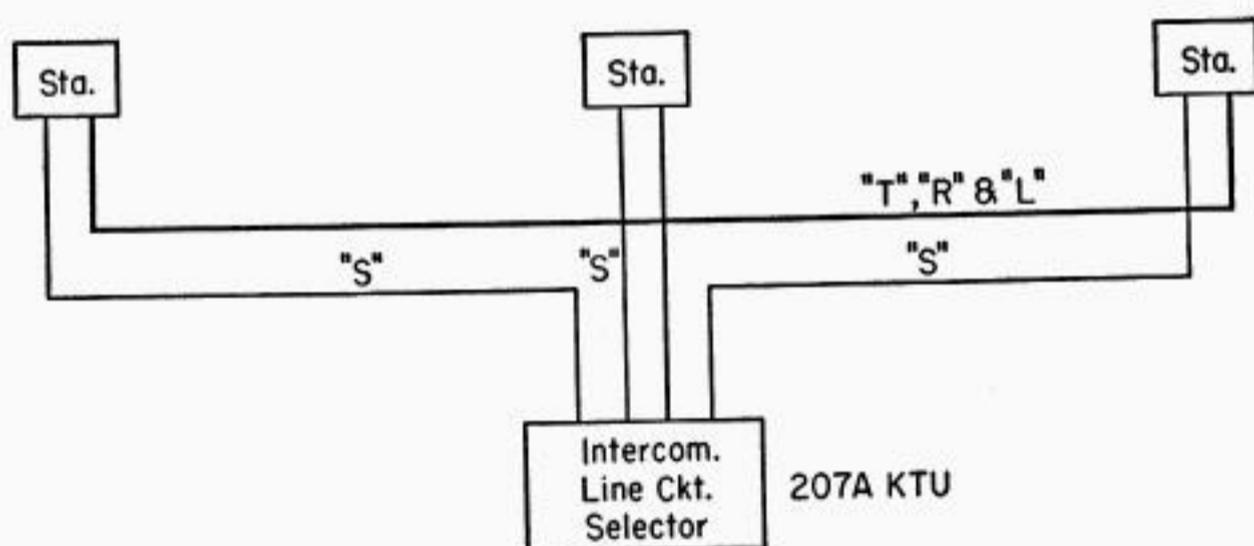


**Fig. 9**

**5.08 Intercommunication Signaling:** Consists of a push button and buzzer arrangement which is used to summon a desired station to the intercommunicating line for the purpose of obtaining information, transferring calls, etc., or by dialing the desired station as covered in Paragraph 5.09. The signaling buttons in the 4 and 6-button sets or in separate keys, may be employed to operate buzzers for intercommunicating signaling. When more signaling keys are required at a station than are available in any suitable key telephone set or in any of the separate keys the separate push buttons listed in Section C53.157 may be provided. No auxiliary equipment is required for buzzer signaling when all of the buzzers are operated either selectively or on a code ringing basis, but when some of the signaling keys are used for selective buzzer operation and others are employed to operate the same buzzers on a code signalling basis, the 3A key telephone unit will be required as a part of the common equipment. This unit consists of a relay which is arranged to energize a number of buzzers simultaneously when the relay is operated by means of a code signaling key. Selective signaling keys may be connected directly to their respective buzzers. An additional signaling feature is provided

in the 465 HE and 465 HG sets. These sets can be arranged to have a common non-locking key for signaling on 2 or 3 private or intercommunicating lines. However, the automatic cut-off feature cannot be used on private lines when using this button signaling feature with these sets since the signal replaces the "A" lead to the line circuit.

**5.09 Dial Selective Intercommunicating Line:** The intercommunicating line arrangement shown in Fig. 10 uses the station dial for selecting any one of nine stations to be signaled. When the pickup key associated with the intercommunicating line is depressed the single digit selector of the 207A KTU is stepped by the dial pulses to connect the audible signal of the station dialed to the signaling circuit. With this system the audible signal is operated **once** for an interval of about 2 seconds. By redialing the same digit, after about 5 seconds delay, the station can be resignaled. If desired, provision is made for a steady lamp busy indication at all stations as soon as a station is connected to the line preparatory to originating a call.

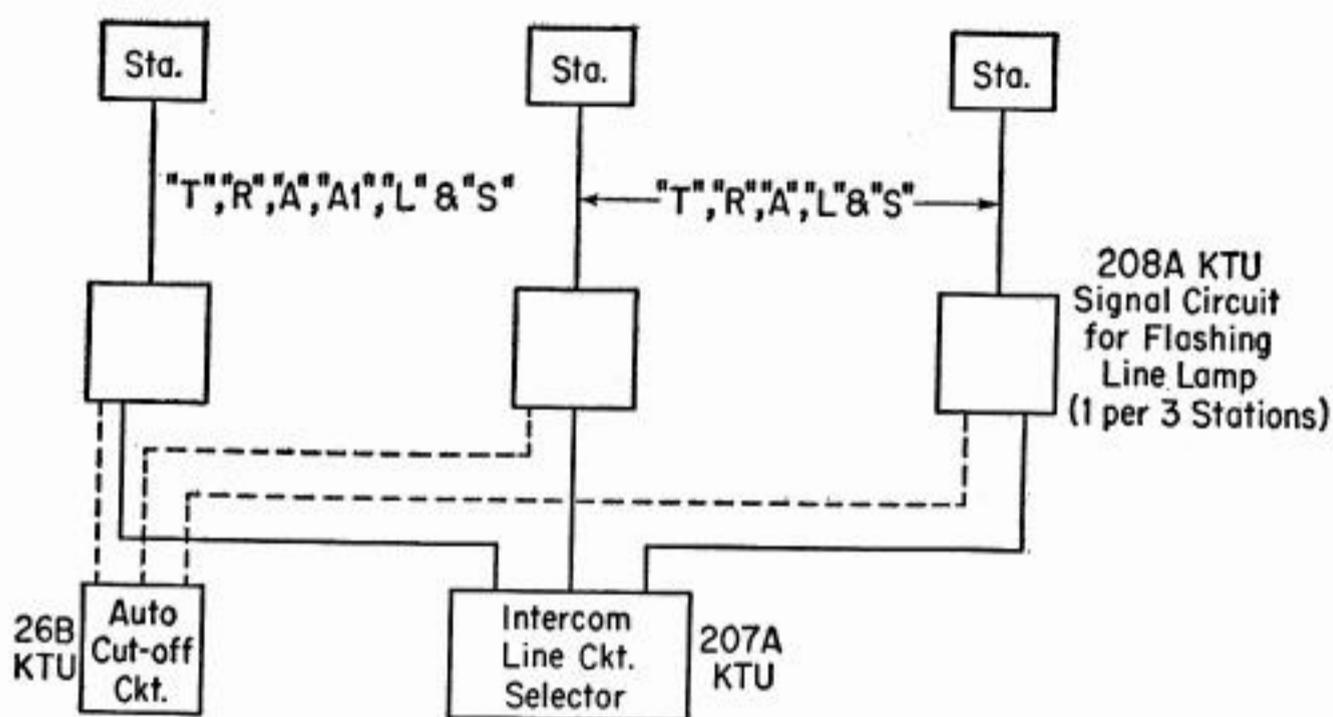


INTERCOMMUNICATING LINE  
Dial Selective Signaling

**Fig. 10**

**5.10** Visual signals at the intercommunicating stations may also be provided to supplement the audible signal using the 208A KTU in association with the above circuit. The signal lamp flashes at the station signalled while the lamps at the other stations are lighted continuously. When the called station answers its flashing lamp reverts to a steady visual signal and the lamps at all stations are lighted continuously while the intercommunicating line is in use. On an optional basis, the

intercommunicating station may be arranged to automatically cut off all other stations from the line, when the line is seized by one of the stations. The circuit is arranged to reconnect only the station whose number has been dialed by the calling station. This arrangement is diagrammed in Fig. 11.



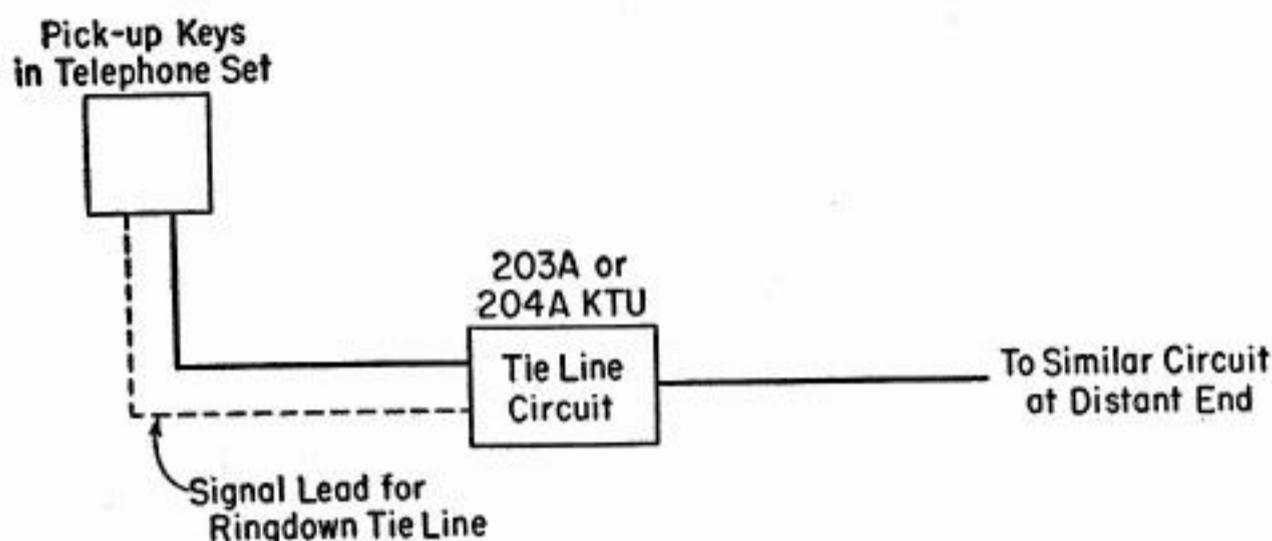
INTERCOMMUNICATING LINE  
Dial Selective Audible and Visual Signals

Fig. 11

5.11 At stations of principals where it is desired to have calls answered by the secretary or an answering clerk, an extension of the principal intercommunicating station may be provided at the secretary's or clerk's station. An answering station may be arranged to answer several stations by terminating each of the stations at a separate key button position in a key telephone set. Where automatic cut-off is provided, the extension answering station would not be cut off from the principal's station.

5.12 **Tie Line Circuits:** When two subscribers, generally not on the same premises, desire rapid connection with each other without the necessity of routing the call through a P.B.X. or central office, a direct tie between the stations may be provided. Two circuit arrangements are available, each requiring similar equipment at the distant end. In the first, (ringdown tie line) the distant station is signalled by manually operating a signal button to supply ringing current to signal the distant station. The second (automatic tie line) provides for automatically signaling the distant station on outgoing calls.

Both circuits may provide the visual and audible signals provided for central office or P.B.X. lines. Fig. 12 shows the arrangement for tie line service.



RINGDOWN AND AUTOMATIC LINE CIRCUITS

Tie Line Circuits

Fig. 12

5.13 In some cases the ringdown tie line may be arranged over a subscriber pair terminated at the distant end with an ordinary telephone and ringer. In this case the circuit is arranged for manually ringing the distant station, and for automatic signaling of the 1A1 key telephone system station when the handset is removed from the switch-hook at the distant station. This circuit differs from the ringdown tie line circuit in that the distant station requires no line circuit or other additional equipment. This circuit arrangement using the 205A KTU is shown in Fig. 13.

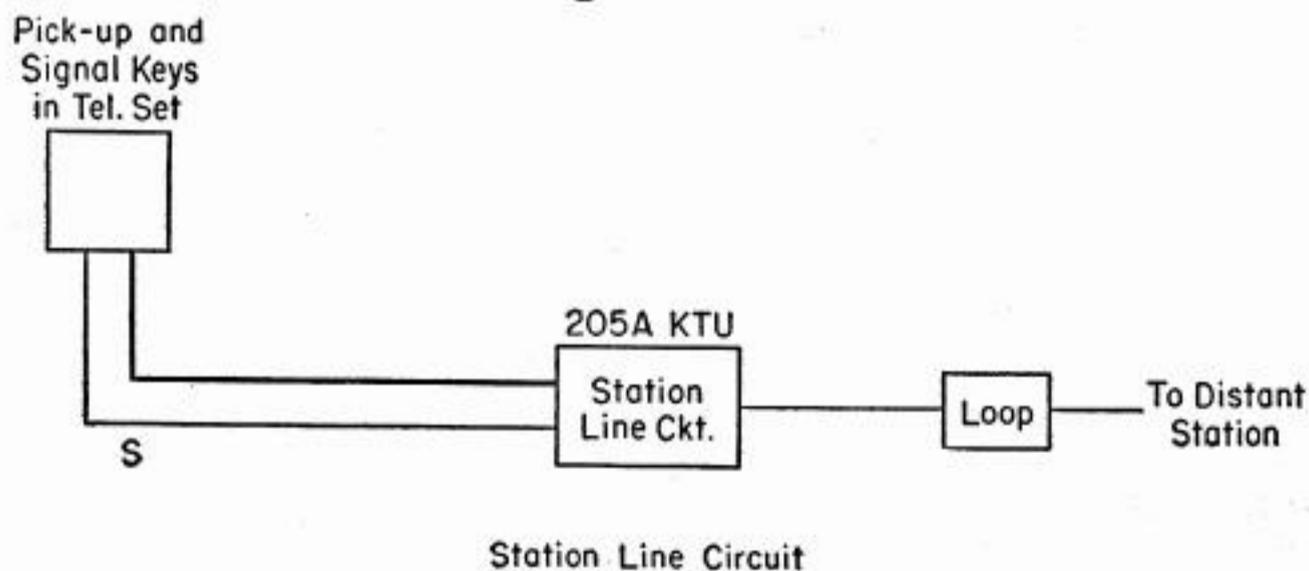


Fig. 13

## 6. WIRING MODIFICATIONS

6.01 The 1A1 key telephone system was designed to provide the various features on a unit basis and certain wiring arrangements are optional. Therefore, these optional connections may be placed in the field to tailor the circuit features to the subscriber's requirements. Other modifications are required on apparatus such as the key telephone sets and separately mounted keys which are used generally with other systems.

6.02 **Key Telephone Sets:** The multi-button key telephone sets having the "A" lead control contacts are wired in manufacture for use in the 1A system and **must be modified for use in the 1A1** system as shown in SD-69206-01. This involves the switch contact leads, the ringer and ringing condenser leads and the exclusion key and cutoff key leads where the latter features are provided. When the 465 HE or 465 HG set is arranged for common signaling on 2 or 3 private or intercommunicating lines, minor modification of the set wiring as covered in FB 69207-01 is necessary.

6.03 **Keys:** 6000D-type keys when used with the 1A1 system must be reconnected as shown in SD-69207-01.

6.04 **Key Telephone Units:** The cross-connection information for the various key telephone units used in a 1A1 system is shown in SD-69199-01 and SD-69203-01. Although the majority of these connections will be placed by the supplier, it will be necessary to add the power supply connections between units as required by the installation. Where features are added or changed on the subscriber's premise the wiring changes indicated will be required.

6.05 **Radio Frequency Noise Suppressors:** The 61P filter is furnished only when specified to suppress radio frequency induction from the dial. The 152A condenser is also furnished only when specified and is used to suppress radio frequency induction from the 7-type buzzer operating on direct current.

6.06 **Noise Isolators:** In locations where the room noise is low and the noise of the dial selector circuit, or visual signal control relays is objectionable, rubber noise isolators may be applied between the KTU and the mounting bar. Two of these units are required for each of the three types of KTU's as listed in the "Supplies Section." These units are marked with a dot on the surface against which the KTU is assembled. The isolator should be mounted with the dot away from the center of the mounting space between the bars, using the smaller

diameter screws furnished to mount the isolator to the mounting bar.

6.07 **Varistors:** The 400A varistor used on the 29A KTU must be ordered separately and wired in by the installer as shown in SD-69203-01.

6.08 In order to permit the use of two ringing bridges without false operation of the hold relay, a 316A varistor has been bridged across both the windings of the (H) relay.

## 7. POWER SUPPLY

7.01 The 1A1 key telephone system is designed to operate from the 101G power plant. This provides the following voltage supplies required by the system.

Relays and talking circuits	14-28 volts d-c
Dial Intercom. Selector Circuit	18-28 volts d-c
Lamps	10 volts a-c
Ringers	105 volts 20 cps
Buzzers	16-20 volts a-c 18-28 volts d-c

7.02 The power requirements may be determined from data given on the circuit drawings and in the section covering installation of these equipments. Power supply arrangements based on these requirements, are suitable and are covered in sections in the C50 division covering Power Supply Arrangements for Station Systems.

7.03 The fusing requirements and arrangements recommended as well as the current values used in computing power load are included on circuit drawings SD-69199-01 and SD-69203-01. Other power supply arrangements may be used following the recommendations given in C50 division entitled, "Power Supply Arrangements for Station Systems." 22-type KTU's equipped with resistors and terminals for terminating lamp leads to the key telephone sets are available to limit the lamp current as required.

7.04 When a common source of d-c supply is used for the talking circuit and to operate audible signals the noise suppression circuit of the 211A KTU, 23A KTU or a 1100 mf condenser per KS-8056 should be bridged across the common supply.

7.05 Ringing current may be supplied from the central office or P.B.X. in connection with ringdown tie lines. The ringing lamps furnished in the 211A KTU or the 11A KTU will be required in this connection.

7.06 As indicated on SD-69199-01 and SD-69203-01, individual circuit fuses are not usually required for the system except where the battery furnishing the supply is not readily accessible for prompt replacement of fuses and multiplied pairs are used for the battery feeder, or where the system load current is more than the capacity of a single fuse.

7.07 201A KTU or 21A KTU may be used to mount fuses required at the apparatus cabinet.

## 8. CIRCUIT DRAWINGS

8.01 The following circuit drawings for the 1A1 key telephone system are available in handbook size.

1A1 key telephone system

Line and signaling circuit SD-69203-01

Key and telephone circuit arranged for pickup, holding, exclusion, cut-off, and visual and audible signals

SD-69206-01

Intercommunicating line circuit with dial selection of stations

SD-69199-01

101G Power plant supply circuit

SD-81135-01

Separately mounted keys

SD-69207-01