STATION SYSTEMS
KEY TELEPHONE SYSTEM NO. 6A
INTERCOMMUNICATING LINE CIRCUIT
TWO-WIRE SELECTIVE SIGNALING

CHANGES

A. Changed and Added Functions

A.1 The single-link arrangement, using a 214B key telephone unit, is rated Mfr Disc.

A.2 A three-station station busy circuit, using a 227B KTU, replaces the two-station station busy circuit that used the 227A KTU, now rated Mfr Disc.

B. Changes in Apparatus

B.1 The 214B KTU is rated Mfr Disc.

B.2 The 227B KTU replaces the 227A KTU, which is rated Mfr Disc.

D. Description of Changes

D.1 The single add-on transfer circuit, Fig. 20, using a 227A KTU, is replaced by Fig. 37, which provides a choice between the 227B KTU for a maximum of three stations and the less costly 229B KTU for one station.

D.2 The ringing and tone control circuit, Fig. 30, using a 227A KTU, is replaced by Fig. 38, that specifies a 227B KTU. This change necessitates a change of the tie point for the externally mounted C5 diode.

D.3 The two-station station busy circuit, Fig. 35, using a 227A KTU, is replaced by the three-station station busy circuit, Fig. 39, using a 227B KTU. The increase of circuits per unit is due to the termination of previously unused wire spring relay contacts to spare terminals and the connection of each relay winding to individual terminals.

D.4 In Circuit Note 101 the J86471A, List 1 power plant was replaced with the J86471B, List 2 and the 29C1 and 30C1 power units were added.

D.5 Circuit Notes 103, 105, 107, and 113 were changed to reflect new circuit figures and key telephone units.

D.6 Note 114 was added.

D.7 The C or S leads on the station busy circuit, Fig. 35 were designated as CS.

D.8 The working limits, as defined in 1.02, Section III of the circuit description, shall now read "For off-premise stations that are included as part of the intercommunicating network, the maximum conductor loop resistance shall be 500 ohms when concerned with transmission. The working limits for the dialing supervision, tripping, and ringing circuits shall be 2500 ohms with a battery potential of 20 volts at the 225A key telephone unit and a minimum line insulation resistance of 10,000 ohms.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5336-APS-FNR

STATION SYSTEMS
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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit provides selective signaling intercommunicating facilities to 36 stations on a selector-only, or a single- or 2-talking link basis. Each station may selectively signal any of the other stations by using a one- or 2-digit dialing code or by using a signaling key. The circuit also provides for associating a central office or PBX line with an intercommunicating connection.

2. GENERAL

2.01 Key telephone system No. 6A is divided into three general arrangements, based on system complexity and system capabilities. The system design has been arranged to accommodate wide variations in the number of stations and their calling rates. Many of the optional features may be obtained by strapping changes. Most of the other features require the addition of key telephone units, but only the change from one to two talking links requires the substitution of one unit for another. The three general arrangements are:

(a) Selector-only - Intended for use where only the basic intercommunicating facilities are required.

(b) Single-talking link - Intended for use where a more elaborate intercommunicating system is required, such as one with flashing signal lamps on incoming calls, automatic cutoff, camp-on, etc.

(c) 2-talking link - An intercommunicating system which can furnish the same features as the single-link arrangement but with an additional talking link, which will more than double the system communicating capacity.

SECTION II - DETAILED DESCRIPTION

1. SELECTOR-ONLY ARRANGEMENT

LINE SEIZURE

1.01 When a station having access to the intercommunicating circuit picks up the line, relay A (Fig. 19) operates, operating relay B (Fig. 19). Relay B in operating (a) prepares the circuit for stepping the selector A, and (b) causes the busy lamps, if provided, to light steadily at all stations. A maximum of 20 lamps may be operated under control of a single relay contact, but the visual signaling capabilities of the system can be expanded through use of Fig. 16 and M option. In operation, one of the signaling paths is used for ground control of a slave relay (Fig. 16), the contacts of which then provide the visual signal control.

RELEASE OF PRELIMINARY PULSE

1.02 When the digit 1 is dialed initially or is registered in the selector due to handset fumbling on pickup, etc, a ground signal will be applied to the selector release magnet under control of the first selector bank (Fig. 19); relay RL (Fig. 2), if provided; and the operated T and released C relays (Fig. 19). The selector then returns to normal, and the selector circuit is ready to receive the first pulse train.

STATION SELECTION AND SIGNALING

1.03 Relays A and B (Fig. 19) have previously been operated.

A. Dial Selection - Nine Codes Maximum

1.04 Stations are selected by dialing a single digit (2 through 0, inclusive) associated with the desired station. As the dialing progresses, relay A (Fig. 19) releases and reoperates in unison with the dial pulses. The relay B (Fig. 19) is made to release slowly by means of the resistor B and the capacitor A.2, thus remaining operated during dialing. As relay A pulses, ground is connected under control of relay B to the rotary magnet, causing the selector A to step in unison with the dial pulses. The C relay (Fig. 19) (a) operates on the first release of the A relay, (b) short-circuits its secondary winding on its own contacts to make it release slowly, and (c) remains operated during the pulse train. This relay operates relay T (Fig. 19), which in turn connects resistor A and capacitor A.1 across its winding. During pulsing, the capacitor A.1 charges through the resistor A. At the completion of the pulse train, relays A and B remain operated and relay C releases. Upon release of the C relay, (a) a ground signal is connected to the first bank of the selector under control of relay T; (b) an audible signaling voltage is connected to the called station buzzer, bell, or ringer under control of the R leads, the second bank of the selector, and relays T and B; and (c) the operate path for relay T is opened. The release of relay T is delayed for a nominal 1-1/2 second period by means of the resistor-capacitor circuit across its winding, providing the timing interval used to control the audible signal. The release of the T relay (a) opens the ground signal to the first bank of the selector, and opens the audible signaling path to the second bank of the selector; and (b) connects a ground signal to the release magnet of selector A under control of relays A, B, and C and the selector off-normal contacts, thus returning the selector to normal.

B. Dial Selection - Over Nine Codes

1.05 Intercommunicating systems of more than nine codes make use of the transfer circuit (Fig. 2): one circuit for each nine additional codes. Stations associated with single-digit codes are selected and signaled as described in 1.04. Stations associated with 2-digit codes are selected by first dialing the tens-digit transfer code (see Circuit Note 104), followed by dialing the units digit. Numbers used for the tens digit may not be used for single-digit codes, and the total number of single-digit codes available is accordingly reduced by the number of transfer circuits provided.

1.06 When the transfer code is dialed, relays A, B, C, and T and selector A (Fig. 19) operate as described in 1.04. At the end of the pulse train, relay C releases, connecting a ground signal to one of the associated transfer circuits operating the RL relay (Fig. 2) under control of an SW lead, the first bank of the selector, and relays T and C. Relay RL operated (a) locks up under control of the B relay; (b) connects an operate path to the release magnet of the selector under control of relays B (Fig. 19) and TR (Fig. 2), the RL lead, and the selector off-normal contacts; and (c) completes an operate path to relay TR under control of the off-normal contacts of the selector and the ON lead. The release of the selector will cause relay TR to operate, which in turn (a) locks up under control of the RL and B relays and J lead; (b) transfers the R leads (connected to the second bank of the selector) from single-digit coded stations to a group of 2-digit coded stations; (c) opens the operate path for the selector release magnet; and (d) opens the operate path to other transfer, off-premise, and preset conference circuits which may be provided. The units digit of the code is then dialed, and, upon the completion of the second pulse train, the audible signal voltage is connected to the called station under control of the make contacts of relay TR. The remaining circuit operation is as described in 1.04.

C. Signal-Key Selection

1.07 A station may be selected through the operation of a signal key (Fig. 9), which will connect signaling voltage to a bell or buzzer at the called station. If a ringer is used at the called station, the signaling key may be used to operate a relay, which in turn can connect the signaling voltage. Since this arrangement gives the equivalent of an ordinary intercommunicating circuit, as covered in key telephone systems No. 1A1 and 1A2, it will not be covered in this drawing and may be provided on a local basis.

TALKING

1.08 Relays A and B (Fig. 19) have previously been operated. When the called station picks up in answer to the signals, a talking connection is established between the calling and the called stations. Talking battery for both stations is supplied through the windings of relay A.

DISCONNECTION

1.09 After all the stations disconnect, relay A (Fig. 19) releases and in turn releases relay B (Fig. 19). The release of the B relay (a) extinguishes the busy lamp, if provided; and (b) releases relays TR and RL (Fig. 2), if provided, thus restoring the circuit to normal.

CONFERENCING

D. Preset Conferencing

1.10 Preset conferencing is an optional feature which enables an intercommunicating station to select a group of stations through means of a dialed code or the operation of a signaling key. Each Fig. 32 (preset conference control circuit) can be used to provide two preset conferences of a maximum of six signaled stations. A number of preset conference arrangements may be included (a station may be included in different preset conference groups), limited only by those requirements stated in Circuit Note 104.

1.11 When the single-digit code reserved for calling a conference is dialed, the selector circuit operates as described in 1.04. Upon release of relay C (Fig. 19), a ground signal is connected to an associated preset conference control circuit under control of the C lead, the first bank of the selector, and relays T and C (Fig. 19). Ground on a C lead will cause the operation of relay RO1 (Fig. 32) through a B7 contact of either relay PC1 (Fig. 32) or relay PC2 (Fig. 32). Relay RO1 in operation will (a) connect battery to the PC1 and PC2 relays and (b) lock up under control of the relays PC1 and PC2. One of the PC relays will operate (the one associated with the C lead with the ground signal) and in operating (a) connect battery to its winding, (b) open the lockup and operate paths for relay RO1, and (c) connect audible signaling voltage to the called stations under control of the R leads. Relay T (Fig. 19), as described in 1.04, releases at the end of a nominal 1-1/2 second interval. This removes the ground signal from the C lead, causing the release of relay PC and thus opening the audible signaling path to the called stations. A maximum of three off-premise stations may be included in the conference by applying a ground signal to the off-premise circuit C lead under control of the PC1 relay and R option. This arrangement should be provided in accordance with Circuit Note 104. The preset conference control circuit may similarly be operated by applying a ground signal to an S lead under control of a signaling key (Fig. 9). The audible signal at the called stations will operate so long as the key is depressed.

1.12 The talking and disconnecting operations are as described in 1.08 and 1.09. Under the worst circuit conditions, this scheme will allow for a 7-station conference, maximum: six called stations and the calling station.

E. Inward or Add-On Conferencing

1.13 Inward or add-on conferencing is an optional feature which allows for the directing of a CO or PBX line to one or more of the intercommunicating stations. The CO or PBX call is picked up under the control of an associated key telephone system No. 1A, 1A1, or 1A2. When it is ascertained that one or more of the key telephone system No. 6A stations are to be conferenced with this call, a hold is placed on the CO or PBX line. The intercommunicating stations are then selected and signaled, and a local talking connection is established through the regular intercommunicating operations. After the intercommunicating connection is established, the outside call can be conferenced at any time through the operation of the associated signaling key (Fig. 9). The inward conferencing circuit will operate whenever the key is depressed. There are no guarding features associated with inward conferencing circuit operations such as will be found in single- or 2-link arrangements.

1.14 The operation of the signaling key, as described in 1.13, will cause the operation of relay N (Fig. 31), which in operating (a) causes that relay to lock up to the J lead; (b) opens the operate path of any other relay N which may be associated with this system, thus preventing the interconnection of two or more outside lines; (c) connects the transmission path of the CO or PBX line to relay A (Fig. 19); and (d) connects the A lead control to a line circuit. Any local intercommunicating station may drop off during the conference. As soon as the last intercommunicating station releases, relay N will return to normal, releasing the CO or PBX connection.

OFF-PREMISE EXTENSIONS

1.15 One of the optional features is a means for the connection of off-premise stations. Such stations are connected to the selector circuit under control of the off-premise circuit (Fig. 12), and are supplied with talking battery through the windings of relay P (Fig. 12). Dial pulses originated by the off-premise station are repeated by relay P and cause the selector circuit to operate and signal the called station described in 1.03 through 1.07. When the off-premise station is called, relay R (Fig. 12) is made to operate for a nominal 1-1/2 second period under control of a C lead and the selector circuit. The R relay may also be operated by applying a ground to the S lead under control of a signaling key. In this case, the audible signal at the off-premise station will continue as long as the signaling key is depressed. The R relay, in operating, connects ringing voltage to the T and R leads, signaling the called station. The called station on pickup will operate the P relay, which will complete the operating path for the C relay (Fig. 12). Operation of the C relay opens the operating path for relay R, which ensures that an audible signal will not be accidentally applied to the line while the off-premise station is in use. Visual signals are not provided at off-premise stations by this circuit, but conventional key telephone system No. 1A, 1A1 or 1A2, CO or PBX line circuits may be used in the same manner as for a central office line. The relay P releases after the off-premise station disconnects.

TIME-OUT CONTROL LEAD FOR KEY TELEPHONE SYSTEM NO. 1A OR 1A1

1.16 A ground signal CO lead is provided under the control of relay B (Fig. 19), which may be connected to an associated key telephone system No. 1A or 1A1 to prevent the operation of the time-out feature while a station is using the intercommunicating facilities.

2. SINGLE-TALKING LINK ARRANGEMENT

2.01 The following circuit description for single-talking link arrangement also pertains to the 234A key telephone unit (Fig. 22) (selector and transfer single-link circuit). There is one exception: Where a designated lead is stated to interconnect Fig. 19, 23, and 24, and the first Fig. 2, it is replaced by an internal strap within the 234A key telephone unit.

LINE SEIZURE

2.02 All stations are connected to the selector circuit (Fig. 19) under control of their associated station signaling circuit (Fig. 23 or 25). When a station picks up, the associated L relay (Fig. 23 or 25) operates but performs no useful function at this time. Relay A in the selector circuit (Fig. 19) also operates, operating relay B (Fig. 19). Relay B operated (a) prepares the circuit for stepping the A selector, and (b) applies a ground signal to the J lead, operating relay B1 (Fig. 24) under control of relay TB1 (Fig. 24).

2.03 When dial tone is provided, relay B applies ground to the ST lead to start vibrator B (Fig. 34), which applies dial tone to the tip side of the line, through the winding of relay A under control of the MS relay (Fig. 30). The operation of the B1 relay (a) lights the busy lamps steadily at all stations; (b) applies a ground start signal to the associated flashing circuit; (c) applies a ground signal to an associated key telephone system No. 1A or 1A1 time-out control circuit, if so connected; and (d) applies a ground signal to an associated Visual and Audible Signal Circuit, if provided.

RELEASE OF PRELIMINARY PULSE

2.04 When a digit 1 is dialed initially or is registered in the selector due to handset fumbling, etc, a ground signal will be applied to the selector release magnet under control of the first selector bank; relay RL (Fig. 2), if provided; the operated T relay (Fig. 19); and the released C relay (Fig. 19). The selector returns to normal, and the selector circuit is ready to receive the first pulse train.

STATION SELECTION

2.05 Relays A, B (Fig. 19), and B1 (Fig. 24) have been operated by pickup of the calling station as described in 2.02 and 2.03.

A. Dial Selection - Nine Codes Maximum

2.06 Stations are selected by dialing a single digit (2 through 0, inclusive) associated with the desired station. As the dialing progresses, relay A (Fig. 19) releases and reoperates in unison with the dial pulses. Relay B (Fig. 19) is made to release slowly by means of resistor B and capacitor A.2, thus remaining operated during dialing. As relay A pulses, ground is connected under control of relay B to the rotary magnet, causing selector A to step in unison with the dial pulses. The C relay (Fig. 19) (a) operates on the first release of the A relay, (b) short-circuits its secondary winding on its own make contacts to make it release slowly, and (c) remains operated during the pulse train.

2.07 When dial tone is provided, relay C applies ground to lead LK to operate relay MS (Fig. 30). Relay MS operated (a) locks up to the ST lead, and (b) opens the DT lead, supplying dial tone to the tip side of the line through the winding of the A relay. Relay C operates relay T (Fig. 19), which in turn connects resistor A and capacitor A.1 across its winding to allow the

network to charge during pulsing. At the completion of the pulse train, relays A and B remain operated and relay C releases. The release of the C relay (a) opens the operate path for the T relay, (b) connects a ground signal to the first bank of the selector under control of the T relay, and (c) connects a ground signal to the second bank of the selector under control of relays T and B and the camp-on control circuit (Fig. 34), if provided. The use of these ground signals is explained in 2.08. The release of relay T is delayed for a nominal 1-1/2 second period by means of the resistor-capacitor circuit across its winding, thus providing the timing interval used to control the audible signal on an incoming call, as explained in 2.15 through 2.20. The release of the T relay (a) opens the ground signal to the first and second banks of the selector, and (b) connects a ground signal to the release magnet of selector A under control of relays A, B, and C and the selector off-normal contacts, thus returning the selector to normal.

2.08 The ground signal on the second bank of the selector is connected under control of a C lead through the called station LS relay (Fig. 23 or 25) to operate relay BC (Fig. 24), which in turn operates relay BC1 (Fig. 24). Operation of relay BC1 connects battery to the B and BA leads, shorting the winding of relay BC and allowing the called station LS relay to operate. Relays BC and BC1 return to normal. Their purpose is to open the operate path of relay TB1 (Fig. 24) before the operation of relay LS. If this were not done, an operate path for relay TB1 would exist under control of the making continuity contacts PMEB4 and PMEB9 on relay LS and the calling station telephone set. Relay LS in operating (a) opens the operate path for the BC relay; (b) locks up to relay B1 (Fig. 24) under control of the H lead and the associated L relay (Fig. 23 or 25); (c) connects the called station signaling lamp to the lamp flashing circuit under control of the B1 relay; (d) connects the called station T and R leads to the battery-feed relay TB1 under control of the RO relay (Fig. 24); and (e) connects the ground signal which is on the C lead to an RO or RO2 lead, operating the audible signaling circuit as covered in 2.15 through 2.20. Relay CH (Fig. 24) may operate at this time but will perform no useful function.

B. Dial Selection - Over Nine Codes

2.09 Intercommunicating systems of more than nine codes make use of the transfer circuit (Fig. 2): one circuit for each nine additional codes. Stations associated with single-digit codes are selected and signaled as described in 2.06 through 2.08 and 2.13 through 2.20. Stations associated with 2-digit codes are selected by first dialing the tens-digit transfer code (see Circuit Note 104), followed by dialing the units digit. Single-digit numbers may not be used as station codes when they are used as tens digits for transfer codes.

2.10 When the transfer code is dialed, relays A, B, C, and T and selector A (Fig. 19) operate as described in 2.06 through 2.08. At the end of the pulse train, relay C (Fig. 19) releases, connecting a ground signal to one of the associated transfer circuits operating the RL relay (Fig. 2) under control of an SW lead, the first bank of the selector, and relays T and C. Relay RL operates, (a) locking up under control of the B relay; (b) connecting an operate path to the release magnet of the selector under control of relays B and TR (Fig. 2), the RL lead, and the selector off-normal contacts; and (c) completes an operate path to relay TR under control of the off-normal contacts of the selector and the ON lead. Release of the selector will cause relay TR to operate, which in turn (a) locks up under control of the RL and B relays; (b) transfers the C leads (connected to the second bank of the selector) from single-digit code stations to a group of 2-digit code stations; (c) opens the operate path for the selector release magnet; and (d) opens the operate path for other RL relays which may be provided. The units-digit code is then dialed,and, upon the completion of the second pulse train, a ground signal is connected to the called party station signaling circuit (Fig. 23 or 25) under control of the selected C lead. Further operation of the circuits during the dial selection process is as described in 2.06 through 2.08.

C. Signal-Key Selection

2.11 A station may be selected through the operation of a signal key (Fig. 9), furnished on a one-per-station per called-station basis. Operation of the signal key places a ground on the C lead of the called party station signaling circuit or long line circuit, causing relay LS (Fig. 23 or 25), to operate. The operation of the various circuits during the station selection process is as described in 2.06 through 2.08. The audible signal at the called station will operate so long as the key is depressed.

2.12 When interrupted ringing is provided, the audible signal at the called station will continue until the called station answers or the calling station abandons the call.

STATION SIGNALING

D. Visual Signals

2.13 Relay B1 (Fig. 24) operates on pickup and in operating (a) lights the busy lamps at all associated stations steadily; (b) applies a ground start signal to the flashing circuit (Fig. 14), to the TO lead to the Visual and Audible Signal Circuit, or to a flashing circuit of an associated key telephone system; and (c) connects a flashing lamp signal to the LF lead. When a station is selected, the associated relay LS (Fig. 23 and 25) operates, connecting the called station busy lamp to the flashing

circuit, providing the flashing lamp signal on an incoming call. The called station in answering operates relay TB1 (Fig. 24), which (a) opens the operate path for relay B1, and (b) lights the busy lamps at all associated stations steadily. The release of relay B1 connects a steady signal voltage to the called station busy lamp.

Installations Requiring More than 40 Line-Busy Lamps and a Need to Flash More than 20 Lamps at One Time

2.14 The visual signaling capabilities of the system are expanded through use of Fig. 16 and 17 and the M and V options. In operation, the usual visual signaling path is used for ground signal control of a slave relay, the contacts of which provide the visual signaling control.

E. Audible Signals

2.15 Three methods for audible signaling are provided: over T and R leads, over a separate signaling pair, and over a common audible circuit. Any combination may be incorporated in an installation, thereby providing facilities for either ac or dc signaling at associated stations. The particular details of the signaling arrangements are to be determined locally.

Signaling over T and R Leads

2.16 The information in 2.06 through 2.08 covers the process of station selection and describes how a ground signal on the called station C lead causes operation of the associated relay LS (Fig. 23), which in turn connects that ground to the RO or RO2 lead. This signal will cause the operation of relay RO (Fig. 24) under control of relay RO1 (Fig. 32), if provided, and relay B1 (Fig. 24), connecting the T and R leads to the ringing-voltage source. The bridged ringer at the called station will operate, and continue to operate for a nominal 1-1/2 second period; the release of relay T (Fig. 19), as described in 2.06 through 2.08, will then open the operate path for relay RO (Fig. 24), disconnecting the ringing-voltage source.

2.17 When interrupted ringing is provided, however, this signal will cause the operation of relay CA2 (Fig. 30). The CA2 relay (a) locks up to the RO3 lead under control of the operated relay A (Fig. 19); (b) completes the path for the interrupted ground from the visual and audible signal equipment, which furnishes interrupted ground on lead RO to pulse relay RO (Fig. 24) under control of relay RO1 (Fig. 32), if provided, and relay B1, connecting the T and R leads to the ringing-voltage source. The operation of B1 relay (Fig. 24) applies ground to the TO lead, which starts the Visual and Audible Signal Circuit.

2.18 When audible tone is provided, B relay (Fig. 19) applies ground to the ST lead to start vibrator V (Fig. 34), which applies audible tone to tip side of the line under control of the RO relay (Fig. 24) and LS relay (Fig. 23 or 25). The bridged ringer at the called station will operate with interrupted ringing, and the audible tone will continue until the called station answers or the call is abandoned.

Signaling Over a Separate Pair

2.19 A separate signaling pair may be used where it is not convenient to signal over T and R leads. The operation and release of relay RO (Fig. 24) is as described in 2.16 through 2.18. Relay RO in operating connects an audible signaling voltage to the called station bell, buzzer, or ringer under control of the RS1 lead, the operated LS relay (Fig. 23 or 25), and the RS lead (see Circuit Note 105).

Common Audible Circuit at Station

2.20 Facilities are provided to enable operation of a common audible circuit at the called station. All common audible circuits of stations associated with this system must operate in the same manner; that is, the circuits must operate from the same signal source, such as a battery or ground. Relay RO (Fig. 24) operates and releases as described in 2.16 through 2.18. The operation of relay RO connects a signaling source to the called station common audible circuit under control of the RS2 lead, the operated LS relay (Fig. 23 or 25), and the R1 lead (see Circuit Note 105).

TALKING

2.21 Relays A, B (Fig. 19), B1 (Fig. 24), the calling station L relay (Fig. 23 or 25), and the called station LS relay (Fig. 23 or 25) have previously been operated. Relay RO (Fig. 24) must be released before further circuit action can take place.

F. Talking with Other Stations before the Called Station Answers

2.22 A station other than the called station may respond to the audible and visual signals and receive a talking connection with the calling station, talking battery being furnished from relay A (Fig. 19). The responding station relay L (Fig. 23 or 25) will operate, but performs no useful function at this time. The flashing signal at the called station continues until that station picks up or the call is abandoned.

G. Talking with the Called Station

2.23 The called station, in answer to the visual and audible signals, picks up and connects the associated telephone circuit to the T and R leads, causing operation of relay TB1 (Fig. 24). Relay TB1 in operating (a) opens the operate path for the B1 relay (Fig. 24), (b) connects a ground signal to

the A1 lead, and (c) connects a battery signal to the BA lead, preventing any further operation of relays BC and BC1 (Fig. 24).

2.24 When the ground signal is placed on the A1 lead, the calling station LS relay (Fig. 23 or 25), as well as the LS relays of any other stations which may have responded before the called station answered, will operate under control of the previously operated L relays (Fig. 23 or 25). The stations are now connected to the common battery feed relay TB1, and conversation may take place. The bridge across relay A (Fig. 19) has now been removed; therefore, relays A, B (Fig. 19), and B1 release.

2.25 When dial tone is provided, the release of relay B removes ground from the ST lead, (a) releasing relays MS (Fig. 30), and (b) stopping vibrator V (Fig. 34).

2.26 When interrupted ringing is provided, the release of relay A removes ground from the RO3 lead, releasing relay CA2 (Fig. 30). The release of relay CA2 removes interrupted ground signal from the RO relay (Fig. 24), stopping the interrupted ringing.

2.27 When audible tone is provided, the release of relay B removes the ground signal from the ST lead to vibrator V, stopping audible tone.

DISCONNECTION

2.28 As each station disconnects, the associated L and LS relays (Fig. 23 or 25) are released. The last station to release will open the operate path for relay TB1 (Fig. 24), causing its release. The system is now available for another talking connection.

AUTOMATIC CUTOFF

2.29 Such automatic cutoff is provided, as a wiring option, that each station, on pickup, can or cannot be connected to an existing talking connection. Operate battery for LS relays (Fig. 23 or 25) associated with stations which are to be cut off is under the control of the B lead and relay B1 (Fig. 24). As soon as the called station answers, relay B1 releases, opening the operate path for the LS relays of those stations which are to be cut off from the existing conversation. Operate battery for LS relays associated with stations which are not to be cut off is under the control of the BA lead and relay TB1 (Fig. 24). As soon as the called station answers, the operated TB1 relay connects a battery signal to the BA lead. This signal ensures an operated path for the LS relays, which allows stations so connected to come into an existing conversation at any time.

CONFERENCE CONNECTIONS

H. Preset Conference

2.30 Preset conference is an optional feature which enables an intercommunicating station to select a group of stations through means of a dialed code or the operation of a signaling key. Each Fig. 32 (preset conference control circuit) can be used to provide two preset conferences of a maximum six signaled stations each. Any number of preset conference arrangements may be included (a station may be included in different preset conference groups), limited only by those requirements stated in Circuit Note 104.

2.31 When the code reserved for calling a conference is dialed, the selector circuit operates as described in 2.05 through 2.12. Upon release of relay C (Fig. 19), a ground signal is connected to an associated preset conference control circuit under control of a C lead, the transfer circuit (if provided), the selector bank, and relays T and C (Fig. 19). Ground on a C lead will cause the operation of relay RO1 (Fig. 32) under control of a B7 contact of either relay PC1 (Fig. 32) or relay PC2 (Fig. 32) and the B1 relay (Fig. 24), which in operating will (a) connect battery to the PC1 and PC2 relays, (b) lock up under control of the PC relays, and (c) open the operate path for relay RO (Fig. 24). This delays operation of audible signaling until the called station LS relays (Fig. 23 or 25) have operated. One of the PC relays (the one associated with the C lead with the ground signal) will operate, and in operating will (a) connect battery to its winding, (b) open the lockup and operate paths for relay RO1, and (c) connect a ground signal to operate the called station LS relays.

2.32 Relay T (Fig. 19) releases at the end of a nominal 1-1/2 second interval, removing the ground signal from the C lead. This causes the release of relay PC, thus opening the audible signaling control to the called stations. This circuit may similarly be operated by applying a ground signal to an S lead under control of a signaling key (Fig. 9). The audible signal at the called stations will operate so long as the key is depressed.

2.33 When interrupted ringing and audible tone are provided, however, relay T (Fig. 19) releases at the end of a nominal 1-1/2 second interval, removing the ground signal from the C lead. This causes the release of relay PC, thus opening the ground signal to the RO2 lead. The CA2 relay (Fig. 30) has already been locked up by the RO3 lead, and interrupted ringing and audible tone are being supplied until a called station answers or the call is abandoned. This circuit may similarly be operated by applying a ground signal to an S lead under control of a signaling key. The audible signal at the called stations will operate until a called station answers or the call is abandoned.

2.34 The LS relays in operating will lock up to relay B1 through the winding of relay CH (Fig. 24), causing it to operate, since there are at least two relays being held over the common lockup path. After the

first called station answers, a hold path is provided for relay B1 under control of relays TB1 (Fig. 24) and CH. As each called station answers, the lockup path for the associated LS relays is transferred from the B1 to the TB1 relay. When the last signaled station answers, the operate path for relay CH will be opened and the relay will release. In this way, a flashing signaling lamp will be maintained at all called stations and at the calling station after the first conference station picks up, until all stations have answered. This flashing lamp is used to indicate just when the called conference is completed. The other talking and disconnect operations are as described in 2.21 through 2.28. Under the worst circuit conditions, this scheme will allow for a 7-station conference maximum: six called stations and the calling station.

I. Selected Conference

2.35 A selected conference may be called through the operation of a number of signaling keys furnished on a one-per-station per called-station basis. Circuit operation is as described in 2.11, 2.12, and 2.30 through 2.34. All conferenced stations must be signaled by the operation of the signaling key before the first called station picks up. Under the worst circuit conditions, this scheme will allow for a 7-station conference maximum: six called stations and the calling station.

J. Conference Time-Out

2.36 Conference time-out is a separate optional feature that is provided as part of the preset conference unit. This circuit releases the unanswered stations from the signaling circuit 30 seconds after the calling station starts the call. Only one Fig. 33 per system need be connected.

2.37 When the station making the preset or selected conference call picks up, relay B1 (Fig. 22 or 24) operates as described in 2.02 and 2.03 and applies ground to the TD lead, which starts to heat the instant reset thermal time-delay relay TD (Fig. 33). During the heating period, contacts 1-8 of TD relay open. At the end of the heating period, contacts 5-7 close, operating TDA relay.

2.38 The operation of the TDA relay (a) opens the ground from B1 relay over the TD lead, which stops the heating of the TD relay, starting the cooling period; and (b) locks up through its own make contact to the TD lead. The total time-out includes the heating and cooling periods. After 30 seconds, the cooling period ends, and contacts 1-8 of TD relay close and connect ground over the CTO lead to the CH relay (Fig. 22 or 24), shunting it and causing it to release. This is the same effect as if all stations answered and CH relay released, as described in 2.30 through 2.34.

2.39 For other calls, TD relay will heat and then TDA relay (Fig. 33) will operate. Since relay CH (Fig. 22 or 24) may or may not operate (2.06 through 2.08), and performs no useful function at this time, shunting down of its winding, if it operates, will also perform no useful function.

K. Inward or Add-On Conference

2.40 Inward or add-on conferencing is an optional feature which allows for the directing of a CO or PBX line to one or more of the intercommunicating stations. The CO or PBX call is picked up under the control of an associated key telephone system No. 1A, 1A1, or 1A2. When it is ascertained that one or more of the key telephone system No. 6A stations are to be conferenced with this call, a hold is placed on the CO or PBX line. The intercommunicating stations are then selected and signaled, and a local talking connection is established through the regular intercommunicating operations. After the intercommunicating connection is established, the outside call can be conferenced at any time through the operation of the signaling key (Fig. 21).

2.41 A signal key is required for each add-on conference control circuit (Fig. 31). These keys may be multipled if more than one station is to originate the same add-on conference circuit. A single-line add-on transfer circuit (Fig. 20) is also required for each add-on conference control circuit (Fig. 31). If more than one CO or PBX line is to be provided with the add-on conference control feature, it is necessary to use a separate add-on conference control circuit (Fig. 31) for each CO or PBX line, and a multiple add-on transfer circuit (Fig. 36), which can be connected to as many as seven add-on conference control circuits.

2.42 When the called station on the intercommunicating system answers, the LS relay (Fig. 23 or 25) of the calling station operates. When relay LS operates, a ground is connected to the AU lead, which operates the MS relay (Fig. 20) or the A relay (Fig. 36). The operation of the signaling key connects a ground signal under control of the S1 and M leads and the operated LS and MS or A relays, causing the operation of relay M (Fig. 31). (See Circuit Note 105.) Relay M in operating (a) locks up to the A1 lead; (b) opens the operate path of any other relay M which may be associated with this system, thus preventing the interconnection of two or more outside lines; (c) connects the transmission path of the CO or PBX line to the talking link; and (d) connects the A lead control to a 1A1 line circuit. Any local intercommunicating station may drop off during the conference. As soon as the last intercommunicating station releases, relay M will return to normal, releasing the CO or PBX connection.

OFF-PREMISE EXTENSIONS

2.43 Intercommunicating connections between off-premise and local stations may be obtained under the control of Fig. 12. Any 2-wire line which may be extended through conventional local plant long line circuits or toll circuits may be used for this connection. Busy lamps cannot be provided at the off-premise stations because of loop ranges involved. The off-premise connection may terminate in a key telephone system No. 1A, 1A1, or 1A2, CO or PBX line circuit, if desired, to provide flashing lamps and common audible signals. With a key telephone system termination, the busy lamps will be operated only when the off-premise station is busy.

L. Local to Off-Premise Call

2.44 The off-premise stations are selected by dialing or by the operation of a signaling key, as described in 2.05 through 2.12. At the completion of the pulse train, a ground signal causes relay R (Fig. 12) to operate under control of a C lead, the selector circuit, and Fig. 2, if provided. Relay R in operating (a) opens the transmission path between the off-premise and local stations; (b) connects ringing voltage to the off-premise station T and R leads, causing operation of a bridged ringer or ringup circuit at the distant end; and (c) connects a ground signal over a separate CL lead to the off-premise station LS relay (Fig. 23 or 25), causing its operation. The R relay may also be operated by applying a ground to the S lead under control of a signaling key. In this case, the audible signal at the off-premise station will continue as long as the signaling key is depressed.

2.45 When interrupted ringing and audible tone are provided, the LS relay (Fig. 23 or 25) operation transfers the C ground to the RO2 lead. The RO relay (Fig. 24), operates as described in 2.16 through 2.18, supplying an interrupted ground to the RS lead, which operates and releases relay R (Fig. 12), providing interrupted ringing and audible tone. Relay R will release at the end of the nominal 1-1/2 second period provided by the selector circuit, reconnecting the transmission path. On pickup, the P relay (Fig. 12) will operate through the off-premise telephone circuit, in turn operating relays C (Fig. 12) and TB1 (Fig. 24). Operation of relay C opens the audible signaling path for the off-premise station. Operation of relay TB1 connects a ground signal to the A1 lead, which causes the calling station telephone circuit to be connected to the common battery feed relay, as described in 2.23 through 2.27. Talking battery for the off-premise stations is supplied from relay P, and for the local station from relay TB1. The local station disconnects, and the off-premise station on disconnecting causes the release of relays P and C. The last station to disconnect releases relay TB1, returning the circuit to normal.

M. Off-Premise to Local Call

2.46 When initiating a call, the off-premise station is connected to the selector circuit under control of the associated LS (Fig. 23 or 25) and P (Fig. 12) relays. Relay P operates on loop current and, on dialing, repeats dial pulses, which in turn cause the selector circuit to operate as described in 2.05 through 2.12.

CAMP-ON

2.47 The use of this feature introduces a possibility of mutilating dial pulses of calls in process, since the person coming in over the busy lamps has no way of knowing that a call is being dialed. Therefore, its use should preferably be limited to calls of an urgent nature. Camp-on is an optional feature which allows a station to pick up, dial, and select a station while the intercommunicating system is in use. The code is stored, and the system is then reserved, or camped on. As soon as the system is free to accept another call, the previously selected station is automatically signaled without further operation on the part of the calling station. Stations which are connected so that they are not automatically cut off cannot camp on the system, since on pickup they are automatically transferred onto the talking connection. The intercommunicating system is in use, and the busy lamps, if provided, are lighted steadily at all stations. The communicating stations have the relays of their associated station signaling circuits operated, and the battery feed relay TB1 (Fig. 24) is operated, preventing further operation of relay B1 (Fig. 24).

2.48 A station wishing to camp on the system picks up and is connected to the selector circuit under control of the associated LS relay (Fig. 23 or 25). The code is dialed; the selector operates as described in 2.05 through 2.12; and at the completion of the pulse train a ground signal is connected to relay BY1 (Fig. 34) under control of the BY1 lead, the selector A off-normal contacts, and the released B1 relay. The ground signal will also be connected to the C leads until relay BY (Fig. 34) operates. The LS relays associated with stations that are automatically cut off will not have battery connected to their winding and so will not operate. The LS relay associated with stations that are not automatically cut off may buzz until relay BY operates. Relay BY1 in operating (a) connects through the BY1 lead to operate the BY relay, (b) opens the lock-up path for the BY relay, and (c) opens various control paths which are used in the process of camp-on. Relay BY1 is slow to release, and when a 2-digit code is dialed, BY2 will remain operated over the interval needed to operate the transfer circuit, thus preventing a camp-on when a transfer code is dialed. Relay BY under the control of the release of the BY1 relay (a) locks up to relay B (Fig. 19), under control of relay TB1 and the LU and J leads; (b) opens its

operate path as well as the operate path for the BY1 relay; (c) holds relay T (Fig. 19) operated under control of the TC lead and Fig. 32, if provided, preventing the release of the selector and thus registering the dialed code; (d) connects a start signal to the associated flashing circuit or Visual and Audible Signal Circuit; and (e) connects the BZ lead to the winding of relay A (Fig. 19). Vibrator V (Fig. 34) operates when the B relay (Fig. 19) places ground on the ST lead, and a tone signal, resulting from the discharge across the operating winding, is connected to the calling station telephone set under the control of the operating flashing circuit and BZ lead. This signal indicates to the calling station, as well as to any other station which may pick up, that the system is now camped on. If the calling station abandons the camp-on, the BY relay will release, releasing control of the camped-on station.

2.49 The TB1 relay will release when the last station associated with the talking connection hangs up, causing relay BY to release. The release of relay BY allows the B1 relay to operate, and closes through a ground signal to the called station LS relay under control of the previously operated selector circuit. The LS relay operates, and the called station is signaled.

STATION BUSY

2.50 The station busy circuit (Fig. 35) is intended to be used with key telephone system No. 6A stations that are also connected to CO or PBX lines. This circuit will connect a busy tone to a calling key telephone system No. 6A station, and operates the camp-on circuit when a station that is connected to Fig. 35 and is busy with a CO or PBX call, is signaled on the 6A system. Fig. 35 may be connected to two stations. The BL lead of the telephone station and the A lead of the 6A pickup key are connected to Fig. 35.

N. Station Is Busy with a CO or PBX Call

2.51 When a station goes off-hook, the associated station-busy relay in Fig. 35 (either CA2 or MS) operates over the BL lead. If the busy station is signaled on key telephone system No. 6A from another station, the ground signal over the C or S lead is connected to the SB lead through a make contact of the station-busy relay. This in turn operates the BY relay of the busy signal and camp-on control circuit (Fig. 34), which performs as described in 2.47 through 2.49. Relay BY locks up through make contacts of the station-busy relay, which connect the LU and J leads.

O. Station Makes a Key Telephone System No. 6A Call

2.52 When a station goes off-hook and the intercommunication pickup key is operated, the station-busy relay will be shunted down or prevented from operating by the ground connection from the A lead of the station to the CB1 or CB2 shunt resistor. A ground signal from the C or S lead will go through break contacts of the station-busy relay to the F lead of the station signaling circuit, operating the called LS relay and associated circuits, as described in 2.13 through 2.20.

P. Camp-On plus Station Busy

2.53 When a station-busy circuit (Fig. 35) is operated, the lockup path through an SB relay is partially completed for the BY relay (Fig. 34) by connecting together the LU and J leads. If the camp-on feature is used by a station not equipped with the station-busy feature, the BY relay will operate and lock up, as described in 2.47 through 2.49. If the camped-on station concludes the intercommunication call while a station-busy condition is operated, the camp-on circuit will not cut through until all station-busy circuits are released. This is due to the parallel lockup path of the BY relay through the station-busy relay contacts.

TIME-OUT CONTROL LEAD FOR KEY TELEPHONE SYSTEM NO. 1 OR 1A1

2.54 A ground signal is provided under the control of relay B1 and relay TB1 (Fig. 24), which may be connected to an associated key telephone system No. 1A or 1A1 or to a Visual and Audible Signal Circuit, to prevent the operation of the time-out feature while a station is using the intercommunicating facilities. This is needed particularly when the associated key telephone system flashing circuit is used for key telephone system No. 6A.

3. TWO-TALKING LINK ARRANGEMENT

LINE SEIZURE

3.01 All stations are connected to the selector circuit (Fig. 19) under control of their associated station signaling circuits (Fig. 26 or 28). When a station picks up, the associated relay L operates but performs no useful function at this time. Relay A in the selector circuit (Fig. 19) also operates, operating relay B (Fig. 19). Relay B operated (a) prepares the circuit for stepping the A selector, and (b) applies a ground signal to the J lead, operating relay B1 (Fig. 27) under control of relay TB1 (Fig. 27).

3.02 When dial tone is provided, relay B applies ground to the ST lead to start vibrator V (Fig. 34), which applies dial tone to the tip side of the line through the winding of relay A under control of the MS relay (Fig. 30). The operation of the B1 relay (a) lights the busy lamps steadily at all stations, (b) applies a ground start

signal to the associated flashing circuit, and (c) applies a ground signal to an associated key telephone system No. 1A or 1A1 time-out control circuit (if so connected) or Visual and Audible Signal Circuit (if provided).

3.03 A maximum of 20 lamps may be operated under control of a single relay contact, but the visual signaling capabilities of the system can be expanded through use of Fig. 16 and M option. In operation, one of the signaling paths is used for ground control of a slave relay (Fig. 16), the contacts of which then provide the visual signal control.

RELEASE OF PRELIMINARY PULSE

3.04 When the digit 1 is dialed initially or is registered in the selector due to handset fumbling, etc, a ground signal will be applied to the selector release magnet under control of the first selector bank; relay RL (Fig. 2), if provided; the operated T (Fig. 19); and the released C relays (Fig. 19). The selector returns to normal, and the selector circuit is ready to receive the first pulse train.

STATION SELECTION

3.05 Relays A, B (Fig. 19), and B1 (Fig. 27) have previously been operated.

A. Dial Selection - Nine Codes Maximum

3.06 Stations are selected by dialing a single digit (2 through 0, inclusive) associated with the desired station. As the dialing progresses, relay A (Fig. 19) releases and reoperates in unison with the dial pulses. Relay B (Fig. 19) is made to release slowly by means of resistor B and capacitor A.2, thus remaining operated during dialing. As relay A pulses, ground is connected under control of relay B to the rotary magnet, causing selector A to step in unison with the dial pulses. A slow-releasing relay C (Fig. 19) operates on the first release of relay A and remains operated during the pulse train. This relay operates relay T (Fig. 19), which in turn connects resistor A and capacitor A.1 across its winding to allow the network to charge during pulsing.

3.07 When dial tone is provided, relay C applies ground to lead LK to operate relay MS (Fig. 30). Relay MS operated (a) locks up to the ST lead, and (b) opens the DT lead, supplying dial tone to the tip of the line through the winding of relay A. At the completion of the pulse train, relay A remains operated and relay C releases. The release of the C relay (a) opens the operate path for the T relay, (b) connects a ground signal to the first bank of the selector under control of the T relay, and (c) connects a ground signal to the second bank of the selector under control of relays T and B and the camp-on control circuit (Fig. 34), if provided. The use of these ground signals is explained in 3.08. The release of relay T is delayed for a nominal 1-1/2 second period by means of the resistor-capacitor circuit across its winding, thus providing the timing interval used to control the audible signal on an incoming call, as explained in 2.15 through 2.20. The release of the T relay (a) opens the ground signal to the first and second banks of the selector; and (b) connects a ground signal to the release magnet of selector A under control of relays A, B, and C and the selector off-normal contacts, thus returning the selector to normal.

3.08 The ground signal on the second bank of the selector is connected under control of a C lead through the called station LS relay (Fig. 26 or 28) to operate relay BC (Fig. 27), which in turn operates relay BC1 (Fig. 27). Operation of relay BC1 connects battery to the B and BA leads, shorting the winding of relay BC and allowing the called station LS relay to operate. Relays BC and BC1 return to normal; they are used to open the operate path of relay TB1 (Fig. 27) before the operation of relay LS. If this were not done, an operate path for relay TB1 would exist under control of the making continuity contacts PMEB4 and PMEB9 on relay LS and the calling station telephone set. Relay LS in operating (a) opens the operate path for the BC relay; (b) locks up to relay B1 (Fig. 27) under control of the H lead and the associated L relay (Fig. 26 or 28); (c) connects the called station signaling lamp to the lamp flashing circuit under control of the B1 relay; (d) connects the called station T and R leads to the battery feed relay TB1 under control of the RO relay (Fig. 27); and (e) connects the ground signal which is on the C lead to the RO or RO2 lead, operating the audible signaling circuit, as described in 3.15 through 3.19. Relay CH (Fig. 27) may operate at this time but will perform no useful function. Should the station selected be one which is busy on another talking link, a busy tone will be returned to the calling station, as described in 3.20.

B. Dial Selection - Over Nine Codes

3.09 Intercommunicating systems of more than nine codes make use of the transfer circuit (Fig. 2): one circuit for each nine additional codes. Stations associated with single-digit codes are selected and signaled as described in 3.06 through 3.08 and 3.13 through 3.20. Stations associated with 2-digit codes are selected by first dialing the tens-digit transfer code (see Circuit Note 104), followed by dialing the units digit. Single-digit numbers may not be used as station codes when they are used for transfer codes.

3.10 When the transfer code is dialed, relays A, B, C, and T and selector A

(Fig. 19) operate as described in 3.06 through 3.08. At the end of the pulse train, relay C releases, connecting a ground signal to one of the associated transfer circuits, operating the RL relay (Fig. 2) under control of an SW lead, the first bank of the selector, and relays T and C. Relay RL operated (a) locks up under control of the B relay; (b) connects an operate path to the release magnet of the selector under control of relay B, and to relay TR (Fig. 2), the RL lead, and the selector off-normal contacts; and (c) completes an operate path to relay TR under control of the off-normal contacts of the selector and the ON lead. Release of the selector will cause relay TR to operate, which in turn (a) locks up under control of the RL and B relays and J lead; (b) transfers the C leads (connected to the second bank of the selector) from single-digit code stations to a group of 2-digit code stations; (c) opens the operate path for the selector release magnet; and (d) opens the operate path for other RL relays which may be provided. The units-digit code is then dialed, and, upon the completion of the second pulse train, a ground signal is connected to the called party station signaling circuit (Fig. 26 or 28) under control of the selected C lead. Further operation of the circuits during the dial-selection process is as described in 3.06 through 3.08.

C. Signal-Key Selection

3.11 A station may be selected through the operation of a signal key (Fig. 9) furnished on a one-per-station per called-station basis. Operation of the signal key places a ground on the C lead of the called party station signaling circuit or long line circuit, causing relay LS (Fig. 26 or 28) to operate. The operation of the various circuits during the station-selection process is as described in 3.06 through 3.08. The audible signal at the called station will operate so long as the key is depressed.

3.12 When interrupted ringing is provided, the audible signal at the called station will continue until the called station answers or the calling station abandons the call.

STATION SIGNALING

D. Visual Signals

3.13 Relay B1 (Fig. 27) operates on pickup and in operating (a) lights the busy lamps at all associated stations steadily; (b) applies a ground start signal to the flashing circuit (Fig. 14), to a flashing circuit of an associated key telephone system, or to the TO lead to the Visual and Audible Signal Circuit, if provided; and (c) connects a flashing lamp signal to the LF lead. When a station is selected, the associated relay LS (Fig. 26 or 28) operates, connecting the called station busy lamp to the flashing circuit, providing the flashing lamp signal on an incoming call. The called station in answering operates relay TB1 (Fig. 27), which (a) opens the operate path for the B1 relay, and (b) lights the busy lamps at all associated stations steadily. The release of relay B1 connects a steady signal voltage to the called station busy lamp.

Installations Requiring More than 40 Line-Busy Lamps and a Need to Flash More than 20 Lamps at One Time

3.14 Upon transfer, the steady lamp is maintained at the connected stations under control of the associated LT relay (Fig. 26 or 28). The visual signaling capabilities of the system are expanded through use of Fig. 16 and 17 and the M and V options. In operation, the usual visual signaling path is used for ground signal control of a slave relay, the contacts of which provide the visual signaling control.

E. Audible Signals

3.15 Three methods for audible signaling are provided: over T and R leads, over a separate signaling pair, and over a common audible circuit. Any combination may be incorporated in an installation, thereby providing facilities for either ac or dc signaling at associated stations. The particular details of the signaling arrangements are to be determined locally.

Signaling over T and R Leads

3.16 The information in 3.06 through 3.08 covers the process of station selection and describes how a ground signal on the called station C lead causes operation of the associated relay LS (Fig. 26 or 28), which in turn connects that ground to the RO or RO2 lead. This signal will cause the operation of relay RO (Fig. 27) under control of relay RO1 (Fig. 10), if provided, and relay B1 (Fig. 27), connecting the T and R leads to the ringing-voltage source. The bridged ringer at the called station will operate, and continue to operate for a nominal 1-1/2 second period; the release of relay T (Fig. 19), as described in 3.06 through 3.08, then will open the operate path for relay RO, disconnecting the ringing-voltage source.

3.17 When interrupted ringing is provided, however, this signal will cause the operation of relay CA2 (Fig. 30). The CA2 relay (a) locks up to the RO3 lead under control of the operated A relay (Fig. 19); (b) completes the path for the interrupted ground from the visual and audible signal equipment, which furnishes interrupted ground on lead RO to pulse relay RO (Fig. 27) under control of relay RO1 (Fig. 32), if provided, and relay B1, connecting the T and R leads to the ringing-voltage source.

Signaling over a Separate Pair

3.18 A separate signaling pair may be used where it is not convenient to signal over T and R leads. The operation and release of relay RO (Fig. 27) is as described in 3.16 and 3.17. Relay RO in operating connects an audible signaling voltage to the called station bell, buzzer, or ringer under control of the RS1 lead, the operated LS relay (Fig. 26 or 28), and the RS lead (see Circuit Note 105).

Common Audible Circuit at Station

3.19 Facilities are provided to enable operation of a common audible circuit at the called station. All common audible circuits of stations associated with this system must operate in the same manner; that is, the circuits must operate from the same signal source, such as battery or ground. Relay RO (Fig. 27) operates and releases as described in 3.16 and 3.17. The operation of relay RO connects a signaling source to the called station common audible circuit under the control of the RS2 lead, the operated LS relay (Fig. 26 or 28) and the R1 lead (see Circuit Note 105).

F. Busy Signal

3.20 In 3.06 through 3.08, the process of station selection is covered and the placing of a ground signal on the called station C lead is described. Should the selected station be busy on the secondary link, this signal will be connected to the BY lead under the control of the operated LT relay (Fig. 26 or 28), causing operation of relay BY (Fig. 34). Relay BY in operating (a) locks up to relay B under control relays LTR and H (Fig. 27) and the LU and J leads; and (b) connects the BZ lead to the winding of relay A (Fig. 19). Vibrator V operates when a ground is placed on the ST lead by relay B (Fig. 19), and a tone signal indicating that the calling station telephone is connected to the called station telephone set under control of the operating flashing circuit and the BZ lead. This signal results from the discharge across the operating vibrator winding.

TALKING

3.21 Relays A, B (Fig. 19), B1 (Fig. 27), the calling station L relay (Fig. 26 or 28), and the called station LS relay (Fig. 26 or 28) have previously been operated. Relay RO (Fig. 27) must be released before further circuit action can take place.

G. Talking with Other Stations before the Called Station Answers

3.22 A station other than the called station may respond to the audible and visual signals and receive a talking connection with the calling station, talking battery being furnished from relay A (Fig. 19). The responding station relay L (Fig. 26 or 28) will operate, but performs no useful function at this time. The flashing signal at the called station continues until the call is abandoned or that station picks up.

H. Talking with the Called Station - Secondary Link Free

3.23 The called station, in answer to the audible and visual signals, picks up and connects the associated telephone circuit to the T and R leads, causing operation of relay TB1 (Fig. 27). Relay TB1 in operating (a) opens the operate path for the B1 relay (Fig. 27); (b) connects a ground signal to the A1 lead; (c) connects a battery signal to the BA lead, preventing any further operation of the BC and BC1 relays (Fig. 27); and (d) connects an operate path to relay LTR (Fig. 27) under the control of relays CH (Fig. 27) and H (Fig. 27). When the ground signal is placed on the A1 lead, the calling station LS relay (Fig. 26 or 28), as well as the LS relays of any other stations which may have responded before the called station answered, will operate under control of the previously operated L relays (Fig. 26 or 28). The stations are now connected to the TB1 relay, and the bridge across relay A (Fig. 19) is removed, allowing the relays of the selector circuit to return to normal.

3.24 When dial tone is provided, the release of relay B of the selector circuit (Fig. 19) removes ground from the ST lead, (a) releasing relay MS (Fig. 30), and (b) stopping vibrator V (Fig. 11).

3.25 When interrupted ringing is provided, the release of relay A removes ground from the RO3 lead, releasing relay CA2 (Fig. 30). The release of relay CA2 removes interrupted ground signal from the RO relay (Fig. 27), stopping the interrupted ringing.

3.26 When audible tone is provided, the release of relay B removes the ground signal from the ST lead to the vibrator V, stopping audible tone.

3.27 The operation of relay LTR will cause a ground signal to be placed on the LTR lead. This signal will operate all LT relays (Fig. 26 or 28), which have their associated LS relays operated. Relay LT in operating (a) locks up to the TH lead under control of the associated LS relay and the operated LTR relay, (b) transfers the C lead from the audible signaling circuit to the busy signal control circuit, (c) opens the audible signaling path to the associated station, (d) transfers control of the visual signal, (e) transfers control of the holding path of the associated LS relay from the TB1 relay to the TB2 relay (Fig. 27), and (f) transfers the T and R leads to relay TB2, causing its operation through the connected telephone circuits. The operation of relay

TB2 places a ground signal on the A2 lead, which holds the operated station LS relays operated and causes relay H (Fig. 27) to operate. Relay H in operating (a) provides a ground signal to hold operated the LT relays for the length of the call, and (b) releases relay LTR, thus removing the ground transfer signal from the LTR lead. These means enable stations, which on pickup were first connected to the TB1 relay (primary link) to be immediately connected to the TB2 relay (secondary link). Conversation may now take place; the talking supply is being furnished from the common battery feed relay (TB2).

I. Talking with the Called Station - Secondary Link Busy

3.28 The called station, in answer to the audible and visual signals, picks up and connects the associated telephone circuit to the T and R leads, causing operation of relay TB1 (Fig. 27). Relay TB1 in operating provides those functions described in 3.23 through 3.27. The transfer operation will not take place, since the operated relay H prevents operation of the transfer functions until it is released. Talking battery will be supplied to those stations now connected to the TB1 relay (primary link), and a conversation independent of the one on the secondary link may now take place.

J. Link Transfer during a Call

3.29 Should the stations which are connected on the secondary link hang up while there are stations connected to the primary link, those stations on the primary link will automatically be transferred to the secondary-link connection. A small click may be heard during this transfer operation as a result of the change in the battery supply. The system will then be free for another call.

3.30 After all stations on the secondary link hang up, relay TB2 (Fig. 27) will release, releasing relay H (Fig. 27). The release of relay H completes the operate path for relay LTR (Fig. 27), which, in operating, places the ground transfer signal on the LTR lead. This causes all stations which are connected to the primary link to be transferred to the secondary link, as described in 3.23 through 3.27.

DISCONNECTION

K. From Primary Link

3.31 As each station disconnects, the associated L and LS relays (Fig. 26 or 28) are released. The last station to release will open the operate path for relay TB1 (Fig. 27), causing its release. The system is now available for another call.

L. From Secondary Link

3.32 As each station disconnects, the associated L, LS, and LT relays (Fig. 26 or 28) are released. The last station to release opens the operate path for relay TB2 (Fig. 27), which releases, releasing relay H (Fig. 27). If the primary link is busy, the transfer operation will take place before the system is again available to take another call.

AUTOMATIC CUTOFF

3.33 Automatic cutoff for stations which happen to be connected to the primary link is controlled by means of such a wiring option that each station, on pickup, can or cannot be connected into an existing conversation. Operate battery for LS relays (Fig. 26 or 28) associated with stations which are to be cut off is under the control of the B lead and relay B1 (Fig. 27). As soon as the called station answers, relay B1 releases, opening the operate path for the LS relays of those stations which are to be cut off from the existing conversation. Operate battery for LS relays associated with stations which are not to be cut off is under the control of the BA lead and relay TB1 (Fig. 27). As soon as the called station answers, the operated TB1 relay connects a battery signal to the BA lead. This signal ensures operate battery for the LS relays, which allows stations so connected to come into an existing conversation at any time.

3.34 Automatic cutoff is, in effect, always provided on the secondary link, since only those stations which are connected to the primary link at the time of transfer are transferred. Once this transfer is completed, no other stations can join those so connected.

CONFERENCE CONNECTIONS

M. Preset Conference

3.35 Preset conference is an optional feature which enables an intercommunicating station to select a group of stations through means of a dialed code or the operation of a signaling key. Each Fig. 32 (preset conference control circuit) can be used to provide two preset conferences of a maximum six signaled stations each. Any number of preset conference arrangements may be included (a station may be included in different preset conference groups), limited only by those requirements stated in Circuit Note 104.

3.36 When the code reserved for calling a conference is dialed, the selector circuit operates as described in 3.05 through 3.12. Upon release of relay C (Fig. 19), a ground signal is connected to an

associated preset conference control circuit under control of a C lead; the transfer circuit, if provided; the selector bank; and relays T (Fig. 19) and C. Ground on a C lead will cause the operation of relay RO1 (Fig. 32), under control of a B7 contact of either relay PC1 (Fig. 32) or relay PC2 (Fig. 32) and the B1 relay (Fig. 27), which in operating will (a) connect battery to the PC1 and PC2 relays, (b) lock up under control of the PC relays, and (c) open the operate path for relay RO (Fig. 27). This delays operation of audible signaling until the called station LS relays (Fig. 26 or 28) have operated. One of the PC relays (the one associated with the C lead with the ground signal) will operate, and in operating will (a) connect battery to its winding, (b) open the lockup and operate paths for the RO1 relay, and (c) connect a ground signal to operate the called station LS relays.

3.37 Relay T (Fig. 19) releases at the end of a nominal 1-1/2 second interval, removing the ground signal from the C lead. This causes the release of relay PC, thus opening the audible signaling control to the called stations. This circuit may similarly be operated by applying a ground signal to an S lead under control of a signaling key. The audible signal at the called stations will operate so long as the key is depressed.

3.38 When interrupted ringing and audible tone are provided, however, the T relay (Fig. 19) releases at the end of a nominal 1-1/2 second interval, removing the ground signal from the C lead. This causes the release of the PC relay, thus opening the ground signal to the RO2 lead. The CA2 relay (Fig. 30) has already been locked up by the RO3 lead, and interrupted ringing and audible tone are being supplied until a called station answers or the call is abandoned. This circuit may similarly be operated by applying a ground signal to an S lead under control of a signaling key. The audible signal at the called station will be an interrupted ring, and will continue until the called party answers or the call is abandoned.

3.39 The LS relays in operating will lock up to relay B1 through the winding of relay CH (Fig. 27), causing it to operate, since there are at least two relays being held over the common lockup path. The operation of relay CH opens the operate path for relay LTR (Fig. 27), preventing the transfer operation until all signaled stations have picked up. After the first called station answers, a hold path is provided for relay B1 under control of relays TB1 and CH (Fig. 27). As each called station answers, the lockup path for the associated LS relays is transferred from the B1 to the TB1 relay. When the last signaled station answers, the operate path for relay CH will be opened and the relay will release. In this way, the transfer operation is controlled, and a flashing signaling lamp will be maintained at all called stations and at the calling station after the first conferenced station picks up, until all stations have answered. This flashing lamp is used to indicate just when the called conference is completed.

3.40 Should some of the signaled stations be busy on the secondary link, the calling party will receive the busy signal, operated as described in 3.20, until the first station answers. As soon as all the stations which are not busy have answered, the flashing lamp signal will stop.

3.41 The other talking, transfer, and disconnect operations are as described in 3.21 through 3.32. Under the worst circuit conditions, this scheme will allow for a 7-station conference, maximum: six called stations and the calling station.

N. Selected Conference

3.42 A selected conference may be called through the operation of a number of signaling keys furnished on a one-per-station per called-station basis. Circuit operation is as described in 3.11, 3.12, and 3.35 through 3.41. All conferenced stations must be signaled by the operation of the signaling key before the first called station picks up. If a called station is busy, the busy signal will be connected to the calling station, as described in 3.20. Under the worst circuit conditions, this scheme will allow for a 7-station conference, maximum: six called stations and the calling station.

O. Conference Time-Out

3.43 Conference time-out is a separate optional feature that is provided as part of the preset conference unit. This circuit releases the unanswered stations from the signaling circuit 30 seconds after the calling station starts the call. Only one Fig. 33 per system need be connected.

3.44 When the station making the preset or selected conference call picks up, relay B (Fig. 27) operates as described in 3.01 through 3.03 and applies ground to the TD lead, which starts to heat the instant reset thermal relay TD (Fig. 33). During the heating period, contacts 1-8 of TD relay open. At the end of the heating period, contacts 5-7 close, operating TDA relay.

3.45 The operation of the TDA relay (a) opens the ground from B1 relay over the TD lead, which stops the heating of the TD relay, starting the cooling period; and (b) locks up through its own make contact to the TD lead. The total time-out includes the heating and cooling periods. After 30 seconds, the cooling period ends, and contacts 1-8 of TD relay close and connect ground over the CTO lead to the CH relay (Fig. 27), shunting it and causing it to release. This is the same effect as if all stations answered and CH relay released, as described in 3.35 through 3.41.

3.46 For other calls, TD relay will heat and then TDA relay (Fig. 33) will operate. Since relay CH (Fig. 27) may or may not operate (3.06 through 3.08) and performs no useful function at this time, shunting down of its winding, if it operates, will also perform no useful function.

P. Inward or Add-On Conference

3.47 Inward or add-on conferencing is an optional feature which allows for the directing of a CO or PBX line to one or more of the intercommunicating stations. The CO or PBX call is picked up under the control of an associated key telephone system, No. 1A, 1A1, or 1A2. When it is ascertained that one or more of the key telephone system No. 6A stations are to be conferenced with this call, a hold is placed on the CO or PBX line. The intercommunicating stations are then selected and signaled, and a local talking connection is established through regular intercommunicating operations. After the intercommunicating connection is established, the outside call can be included in the connection at any time through the operation of the signaling key (Fig. 21).

3.48 A signal key is required for each add-on conference control circuit (Fig. 31). These keys may be multipled if more than one station is to originate the same add-on conference circuit. A single-line add-on transfer circuit (Fig. 20) is also required for each add-on conference control circuit (Fig. 31). If more than one CO or PBX line is to be provided with the add-on conference control feature, it is necessary to use a separate add-on conference control circuit (Fig. 31) for each CO or PBX line, and a multiple add-on transfer circuit (Fig. 36), which can be connected to as many as seven add-on conference control circuits.

Connecting Outside Line to Secondary Link

3.49 Should the local intercommunicating connection be on the secondary link, the LT relay (Fig. 26 or 28) will be operated. The operation of the signaling key, as described in 3.47 and 3.48, will cause the operation of relay N (Fig. 31) through the normal made contacts of the MS relay (Fig. 20) or A relay (Fig. 36) (under control of the LT relay). Relay N in operating (a) locks up to the TH lead; (b) opens the operate path of any other relay N which may be associated with this system, thus preventing the interconnection of two or more outside lines; (c) connects the transmission path of the CO or PBX line to the secondary link; and (d) connects the A lead control to a line circuit.

Connecting Outside Line to Primary Link

3.50 Should the local intercommunicating connection be on the primary link, the LS relay (Fig. 26 or 28) will be operated, placing a ground on the AU lead and operating relay MS (Fig. 20) or A relay (Fig. 36). The operation of the signaling key, as described in 3.47 and 3.48, will cause the operation of the M relay (Fig. 31) through the made contacts of the MS or A relay, under control of the LS relay. The operation of the M relay (a) causes that relay to lock up to the A1 lead; (b) opens the operate path of any other relay M which may be associated with this system, thus preventing the interconnection of two or more outside lines; (c) connects the transmission path of the CO or PBX line to the primary link; and (d) connects the A lead control to the line circuit.

Transfer of Conference Connection

3.51 The transfer signal, a ground on the LTR lead, will operate relay N (Fig. 31) under control of relay M (Fig. 31). Relay N in operating will lock up and transfer control of the inward conference call from the primary to the secondary link. When using any of the different link connections, any local intercommunicating station may drop off during the process of the call. As soon as the last intercommunicationg station releases, relay M or N releases, releasing the CO or PBX connection. The other circuit operations are as described in previous sections.

OFF-PREMISE EXTENSIONS

3.52 Intercommunicating connections between off-premise and local stations may be obtained under the control of Fig. 12. Any 2-wire line which may be extended through conventional local plant long line circuits or toll circuits, may be used for this connection. Busy lamps cannot be provided at the off-premise stations because of the loop ranges involved. The off-premise connection may terminate in a key telephone system No. 1A, 1A1, or 1A2, CO or PBX line circuit, if desired, to provide flashing lamps and common audible signals. With a key telephone system termination, the busy lamps will be operated only when the off-premise station is busy

Q. Local to Off-Premise Call

3.53 The off-premise stations are selected by dialing or by the operation of a signaling key, as described in 3.05 through 3.12. At the completion of the pulse train, a ground signal causes relay R (Fig. 12) to operate under control of a C lead, the selector circuit, and Fig. 2, if provided. Relay R in operating (a) opens the transmission path between the off-premise and local stations; (b) connects ringing voltage to the off-premise station T and R leads, causing operation of a bridged ringer or ringup circuit at the distant end; and (c) connects a ground signal over a separate CL lead to the off-premise station LS relay (Fig. 26 or 28),

causing its operation. The R relay may also be operated by applying a ground to the S lead under control of a signaling key. In this case, the audible signal at the off-premise station will continue as long as the signaling key is depressed.

3.54 When interrupted ringing is provided, the operation of the LS relay (Fig. 26 or 28) transfers the C ground to the RO2 lead. The RO relay supplies an interrupted ground to the RS lead, which operates and releases relay R (Fig. 12), providing interrupted ringing. Relay R will release at the end of the nominal 1-1/2 second period provided by the selector circuit reconnecting the transmission path. On pickup, the P relay (Fig. 12) will operate through the off-premise telephone circuit, in turn operating relays C (Fig. 12) and TB1 (Fig. 27). Operation of relay C opens the audible signaling path for the off-premise station. Operation of relay TB1 connects a ground signal to the A1 lead, which causes the calling station telephone circuit to be connected to the common battery feed relay, as described in 3.23 through 3.27. Talking battery for the off-premise stations is now supplied from relay P, and for the local station from relay TB1. Further circuit operation during talking and transfer is as described in 3.21 through 3.30. The local station disconnects, and the off-premise station on disconnection causes the release of relays P and C. The last station to disconnect releases relay TB1 or relay TB2 (Fig. 27), thus returning the circuit to normal.

R. Off-Premise to Local Call

3.55 When initiating a call, the off-premise station is connected to the selector circuit under control of the associated LS relay (Fig. 26 or 28) and P relay (Fig. 12). Relay P operates on loop current and, on dialing, repeats dial pulses, which in turn cause the selector circuit to operate as described in 3.05 through 3.12.

CAMP-ON

3.56 Camp-on is an optional feature which allows a station to pick up, dial a code to select a station, and then reserve, or camp on, the system until the called station is free to answer or the system is free to take another call. As soon as the desired station is free, or as soon as the system is available to take another call, the previously selected station is automatically signaled without further operation on the part of the calling station.

S. Camp-On Operation When Both Talking Links Are Busy

3.57 The use of this feature introduces a possibility of mutilating dial pulses of calls in process, since the person coming in over the busy lamps has no way of knowing that a call is being dialed. Therefore, its use should preferably be limited to calls of an urgent nature. Stations which are connected so that they are not automatically cut off cannot camp on the system under these conditions, since, on pickup, they are automatically transferred onto the primary talking link. The busy lamps are lit steadily at all stations; the communicating stations have the relays of their associated station signaling circuits operated, and the battery feed relay TB1 (Fig. 27) is operated, preventing further operation of relay B1 (Fig. 27).

3.58 A station wishing to camp on the system picks up and is connected to the selector circuit under control of the associated LS relay (Fig. 26 or 28). A code is dialed; the selector operates as described in 3.05 through 3.12; and at the completion of the pulse train, a ground signal is connected to relay BY1 (Fig. 11) under control of the BY1 lead, the selector A off-normal contacts, and relays B1, LTR, and TB2 (Fig. 27). The ground signal will also be connected to the C leads until relay BY (Fig. 11) operates. The LS relays associated with stations that are automatically cut off will not have battery connected to their winding and so will not operate. The LS relays associated with stations that are not automatically cut off may buzz until relay BY operates.

3.59 Relay BY1 in operating (a) connects through the BY1 lead to operate the BY relay, (b) opens the lockup path for the BY relay, and (c) opens various control paths which are used in the process of camp-on. Relay BY1 is slow to release, and when a 2-digit code is dialed, BY1 will remain operated over the interval needed to operate the transfer circuit, thus preventing a camp-on when a transfer code is dialed. Relay BY under the control of the release of the BY1 relay (a) locks up to relay B (Fig. 19) under control of relay TB1 and relays LTR and H (Fig. 27) and the LU and J leads; (b) opens its operate path as well as the operate path for the BY1 relay; (c) holds relay T (Fig. 19) operated under control of the TC lead and Fig. 32, if provided, preventing the release of the selector and thus registering the dialed code; (d) connects a start signal to the associated flashing circuit or Visual and Audible Signal Circuit; and (e) connects the BZ lead to the winding of relay A (Fig. 19). Vibrator V (Fig. 34) operates when the B relay (Fig. 19) places ground on the ST lead, and a tone signal, resulting from the discharge across the operating winding, is connected to the calling station telephone set under the control of the operating flashing circuit and the BZ lead. This signal indicates to the calling station, as well as to any other station which may pick up, that the system is now camped on. Should the calling station abandon the camp-on, relay BY will release, releasing the control of the camped-on station.

3.60 The system will be camped on until the called station hangs up or a link is released, if the called station was not on a link. If the called station is on the second link and hangs up first, the transfer operation will be completed by the release of relay TB2 (Fig. 27), and the transfer operations will allow relay BY to release. If the called station is on the primary link and hangs up first, relay TB1 will release and the transfer operation will be completed by the release of relay BY (Fig. 34). Relay BY is shunted down by the circuit through the BY resistor, controlled by the break contacts of the released relays TB1A and B1A, which had been operated by relays TB1A and B1, respectively; released relay BY1 and relay BY make contact. The release of relay BY closes a ground signal to the called station LS relay under control of the previously operated selector unit. The LS relay operates, and the called station is signaled.

T. Camp-On Operation When the Called Station Is Busy on the Second Link and the Primary Link Is Free

3.61 All stations which on dialing happen to encounter a station that is busy on the second link may camp on the system until that station is free to answer a call, if the option is provided. Should a busy station be selected, the ground signal used to operate the associated LS relay (Fig. 26 or 28) will operate relay BY (Fig. 34) under control of the called station operated relays LS and LT (Fig. 26 or 28) and the BY lead. Relay BY will lock up and operate the camp-on control and tone signals, as described in 3.56 through 3.60. If the camp-on is abandoned, the camp-on control will be released. After all stations have disconnected from the second link, relay BY will release and allow for the automatic signaling of the selected station under the control of previously operated selector circuit.

STATION BUSY

3.62 The station busy circuit (Fig. 35) is intended to be used with No. 6A stations that are also connected to CO or PBX lines. This circuit will connect a busy tone to a calling No. 6A station, and operates the camp-on circuit when a station that is connected to Fig. 35 and is busy with a CO or PBX call, is signaled on the 6A system. Fig. 35 may be connected to two stations. The BL lead of the telephone station and the A lead of the 6A pickup key are connected to Fig. 35.

U. Station Is Busy with a CO or PBX Call

3.63 When a station goes off-hook, the associated station-busy relay in Fig. 35 (either CA2 or MS) operates over the BL lead. If the busy station is signaled on No. 6A from another station, the ground signal over the C or S lead is connected to the SB lead through a make contact of the station-busy relay. This in turn operates the BY relay of the busy signal and camp-on control circuit (Fig. 34), which performs as described in 3.56 through 3.61. Relay BY locks up through make contacts of the station-busy relay, which connect the LU and J leads.

V. Station Makes a Key Telephone System No. 6A Call

3.64 When a station goes off-hook and the intercommunication pickup key is operated, the station-busy relay will be shunted down or prevented from operating by the ground connection from the A lead of the station to the CB1 or CB2 shunt resistor. A ground signal from the C or S lead will go through break contacts of the station-busy relay to the F lead of the station signaling circuit, operating the called LS relay and associated circuits, as described in 3.13 through 3.20.

W. Camp-On plus Station Busy

3.65 When a station-busy circuit (Fig. 35) is operated, the lockup path through an SB relay is partially completed for the BY relay (Fig. 34) by connecting together the LU and J leads. If the camp-on feature is used by a station not equipped with the station-busy feature, the BY relay will operate and lock up, as described in 3.56 through 3.61. If the camped-on station concludes the intercommunication call while a station-busy condition is operated, the camp-on circuit will not cut through until all station-busy circuits are released. This is due to the parallel lockup path of the BY relay through the station-busy relay contacts.

TIME-OUT CONTROL LEAD FOR KEY TELEPHONE SYSTEM NO. 1A OR 1A1

3.66 A ground signal is provided under the control of relays B1 and TB2 (Fig. 27), which may be connected to an associated key telephone system No. 1A or 1A1 or to Visual and Audible Signal Circuit, to prevent the operation of the time-out feature while a station is using the intercommunicating facilities. This is needed particularly when the associated key telephone system flashing circuit is used for key telephone system No. 6A.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 The maximum station conductor loop resistance is 50 ohms, allowing under worst circuit conditions a conference connection of seven stations, maximum. For transmission limitations see Bell System Practices.

1.02 For off-premise stations that are included as part of the intercommunicating network, the maximum conductor loop resistance shall be 2500 ohms, with a battery potential of 20 volts at the 225A key telephone unit and a minimum line insulation resistance of 10,000 ohms.

2. FUNCTIONAL DESIGNATIONS

None

3. FUNCTIONS

SELECTOR-ONLY ARRANGEMENT

3.01 Provides intercommunication facilities for approximately 36 stations

3.02 Provides means whereby station selection is accomplished by a dial using one digit for a maximum of nine codes, and one or two digits for more than nine codes.

3.03 Provides a single, nominal 1-1/2 second audible signal at the desired station on incoming calls signaled over a separate signaling pair.

3.04 Provides cancellation of a preliminary pulse which may be registered in the selector due to handset fumbling, etc.

3.05 Provides means for operating visual busy signals.

3.06 Provides talking battery for the stations interconnected by this line circuit.

3.07 Provides means for originating a 7-station conference (maximum) connection by use of a dialed code.

3.08 Provides means for key telephone system No. 1A, 1A1, or 1A2 stations equipped with the hold feature to conference a CO or PBX line and the intercommunication line.

3.09 Provides means for connecting off-premise stations as part of the intercommunicating network.

3.10 Provides the operation of signal lamps as stations associated with connecting installations by means of lamp relay circuits.

3.11 Provides intercommunication for stations associated with separate installations of key telephone system No. 1A, 1A1, or 1A2 key and telephone circuit; attendant telephone and key circuit of key equipment No. 100, 101A, 101B, or 102A; or any combination of these systems or equipments.

SINGLE-LINK ARRANGEMENT

3.12 Provides functions listed in 3.01 through 3.11.

3.13 Provides selective and code signaling by means of signaling keys, as well as dial selective signaling.

3.14 Provides flashing of signaling lamps on an incoming call.

3.15 Provides means for operating the station audible signal over the T and R leads, or over a separate signaling pair.

3.16 Provides means for operating a common audible signal at the called station.

3.17 Provides a selector and a primary talking link. The selector is used in the process of station selection and as a talking battery supply with any of the other associated stations before the called station answers. The primary link is used as the talking path between the called and calling stations.

3.18 Provides automatic cutoff of all, some, or none of the associated stations whenever the intercommunicating system is in use.

3.19 Provides key selection of a maximum of six stations for a conference connection.

3.20 Provides means whereby all conferenced stations receive a flashing lamp signal, which is maintained until all stations which are to be part of the conference have been connected. The calling station receives this signal as soon as the first called station answers.

3.21 Provides a time-out for conference calls to release unanswered stations 30 seconds after conference call is originated.

3.22 Provides means for the use of camp-on.

3.23 Provides a busy tone to the station originating camp-on, and to any other stations which may try to originate a call after the system has been camped on.

3.24 Provides dial tone to the calling station when the selector has been seized.

3.25 Provides an interrupted ringing signal on an incoming call.

3.26 Provides an interrupted audible tone at the calling station on an outgoing call.

TWO-TALKING LINK ARRANGEMENT

3.27 Provides station-busy feature that operates the busy signal and camp-on control circuit when a called station is busy with a CO or PBX call.

3.28 Provides functions listed in 3.01 through 3.27.

3.29 Provides a secondary talking link which enables one system to carry two simultaneous and independent conversations.

3.30 Provides a busy signal to the calling station when the called station is busy or when some of the stations which are to be part of a conference connection are busy.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on the keysheet, the connecting information thereon is to be followed.

4.02 The following are typical connecting circuits:

(a) Standard 2-wire common battery telephone circuits.

(b) Key Telephone System No. 1A - Key and Telephone Circuits such as SD-69133-01 and SD-69208-01.

(c) Key Telephone System No. 1A - Line and Signaling Circuits - SD-69136-01 and SD-69091-01.

(d) Key Telephone System No. 1A - Attendant Telephone and Key Circuit Using Key Equipment No. 101A Key Unit - SD-69196-01.

(e) Key Equipment No. 101A or 101B Telephone and Key Circuit - SD-69195-01.

(f) Key Telephone System No. 1A1 - Key and Telephone Circuits such as SD-69219-01.

(g) Key Telephone System No. 1A1 - Line and Signaling Circuit - SD-69203-01.

(h) Key Telephone System No. 1A1 - Joint Use Line Circuit - SD-69230-01.

(i) Key Equipment No. 100 - Line and Auxiliary Signal Circuit - SD-69000-01.

(j) Key Equipment No. 102A - Attendant Telephone and Key Circuit - SD-69159-01.

(k) Visual and Audible Signal Circuits - SD-69294-01.

(l) Key Telephone System No. 6A - Touch-Tone Adapter Circuit - SD-69447-01.

(m) Key Telephone System No. 1A2 - 500-Type Key Service Units - SD-69476-01.

5. TRANSMISSION INFORMATION

5.01 Transmission will be within satisfactory limits when as many as seven stations are connected on a conference call with loops not exceeding 50 ohms. See Bell System Practices for transmission limits with off-premise extensions and connections involving CO or PBX lines.

SECTION IV - REASONS FOR REISSUE

A. Changed and Added Functions

A.1 A 30-second time-out circuit has been provided to release unanswered station signaling circuits for conference calls.

A.2 A station-busy circuit has been added for use with stations that are connected to a CO or PBX line.

A.3 The camp-on control circuit for a 2-talking link arrangement has been changed to cut through at all times when the primary link becomes available and the called station is idle.

B. Changes in Apparatus

B.1

REMOVED	REPLACED BY
217A KTU	217B KTU
224A KTU	224B KTU
229A KTU	229B KTU

D. Description of Changes

D.1 Due to circuit rearrangements, certain figures were rated Mfr Disc. and replaced with others as indicated by the following table:

Mfr Disc.	Replaced by
Fig. 10	Fig. 32
Fig. 11	Fig. 34
Fig. 29	Fig. 36

D.2 The preset conference circuit (Fig. 10) was replaced by Fig. 32, which is combined with Fig. 33, conference time-out circuit, on a new 217B KTU.

D.3 Reference to Fig. 32 for leads B2, C, CD, R, RO, RO1, S, SG and TC has been added to Fig. 1 through 12, 19, and 22 through 28, where required.

D.4 The busy signal and camp-on control circuit (Fig. 11) was replaced by Fig. 34, the new 224B KTU, which has added circuitry to improve the camp-on circuit.

D.5 Reference to Fig. 34 for leads AT, BI, BY, BY1, BZ, BZ1, DT, GN, J, LU, SG, ST, TC, and Z has been added to Fig. 1, 4, 6, 7, 8, 10, 14, 18, 19, 22, 24, 26, 27, 28, and 30, where required.

D.6 Leads B1 and TB1 between Fig. 27 and Fig. 34 have been added to the camp-on control circuit.

D.7 The multiple add-on transfer circuit (Fig. 29) was replaced by Fig. 36, which has added wired relay contacts.

D.8 Reference to Fig. 36 for leads AU, AX, M, N, PB, R1, RS, RS1, RS2, and S1 has been added to Fig. 13, 21, 22, 23, 24, 26, 27, 28, and 31, where required.

D.9 Fig. 33 has been added to show connections for the conference time-out feature.

D.10 Connections per wiring option AR for leads TD and CTO from Fig. 33 to Fig. 22, 24, or 27 have been added.

D.11 Fig. 35 has been added to show connections for two station busy circuits.

D.12 Circuit Note 113 has been added to explain use of the station busy feature.

D.13 Connections per wiring option AS, without station busy circuit, and wiring option AT, with station busy circuit, to Fig. 35, have been added for the F lead on Fig. 3, 5, 6, 8, 22, 23, 25, 26, and 28.

D.14 Connections for the station busy circuit (Fig. 35) per wiring option AT have been added for the J lead to Fig. 1, 19, and 22 for the LU and SB leads to Fig. 11 and is shown on Fig. 34, and for the CS lead to Fig. 3, 5, 6, 8, 22, 23, 25, 26, and 28.

D.15 Circuit Note 112 has been added to explain the use of the LU resistor on Fig. 11.

D.16 Reference to SD-69294-01 has been added to Circuit Note 108.

D.17 In Circuit Note 105, reference to Fig. 36 and 229B KTU has replaced Fig. 29 and 229A KTU, respectively.

D.18 In Circuit Note 103, Fig. 10, 11, and 29 were rated Mfr Disc.; Fig. 32 through 36 were added; options AQ, AR, AS, and AT were added; added to option AE is "or off-premise station when interrupted ringing is provided"; added to option AF is "when single spurt ringing is provided".

D.19 On Fig. 101, reference to Fig. 32 and 217B KTU has been added.

D.20 On Fig. 102, 13, and 31, connections to KTS No. 1A2 from KTS No. 6A have been added for add-on conference control circuit.

D.21 On Fig. 103, 104, 105, and 108, the new 217B KTU preset conference unit has been added.

D.22 On Fig. 104, 105, and 108, reference to the conference time-out feature has been added.

D.23 On Fig. 104, 105, and 108, the new 224B KTU camp-on control unit has been added.

D.24 Reference to KTS No. 1A2 has been added to Circuit Note 106 and to Fig. 102, 103, 104, 105, 108, 4, 7, 13, 22, 24, 27, and 31.

D.25 An AQ option for the busy signal and camp-on control circuits has been added to Fig. 11 and is shown on the new Fig. 34 when the 207B KTU is used in the system.

D.26 On Fig. 7 and 27, internal wiring to terminal 5D has been added to agree with 222A KTU circuit.

D.27 On Fig. 26, terminal 40A on the 222A KTU was incorrectly identified.

D.28 On Fig. 11, the correct KS specification numbers for the AT capacitor and AT resistor have been shown.

D.29 The current drain data for the conference time-out and station busy circuits have been added to Information Note 301 and revised for an installation with the camp-on circuit.

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