PANEL SYSTEMS
SENDER MAKE BUSY FRAME
TELEPHONE CIRCUIT
WITH ASSOCIATED KEY AND LAMP CIRCUITS
FOR TALKING LINES AND TRUNKS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Drawing is reissued to revise cross connections to provide for use with No. 4 toll system.

D.2 Equipment note 202 is added.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340

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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 "Z" wiring is added in Fig. A. Note 109 covering the change is added and the change recorded in Note 108.

D.2 Prior to Issue 6-Note 105 was as follows: "Provide Fig. A in offices which are served by a central "A" switchboard. Otherwise provide Fig.B".

D.3 "With card holders" has been added at the hand set mountings in Fig. 1.

D.4 The cross connections are changed and equipment note 201 added.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit provides telephone and dial equipment for the sender make busy frame, together with means for connecting the telephone set alone to the associated test circuit, or both telephone and dial to the various talking trunks terminated at the frame.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.1 To provide means for connecting the telephone and dial to the various trunks, lines, and tie lines, communicating with other desks or frames (key and lamp circuits, Figures 2 and 3).

3.2 To provide means for connecting the telephone to the test circuit of the sender make busy frame.

3.3 To provide means for bridging the receiver of the telephone set directly across the listening taps to the test circuit so as to eliminate transmitter noise (key SCO).

3.4 To provide means for manual ringing in connection with the various trunks or tie lines.

3.5 To protect the telephone circuit against acoustic shocks which may accompany the operation of the dial or the various keys.

4. CONNECTING CIRCUITS

4.1 Local Station Line Circuit.

4.2 Trunk to Subscriber Line Circuit.

4.3 Tie Line Circuit, Two-Way Automatic.

4.4 Trunk Circuit to Switchboard, Two-Way Automatic, Four-Wire.

4.5 Tie Line Circuit to Supervisor, Two-Way Automatic, Four-Wire.

4.6 Key and Lamp Circuits at Other Maintenance Desks.

4.7 Local Frame Line Circuit.

4.8 Test Circuit for Sender Make Busy Frame.

DESCRIPTION OF OPERATION

5. OPERATION WITH TALKING TRUNKS

5.1 Telephone Circuit with Dial Feature, Figures 1 and A - Incoming Calls

Talking trunks of various kinds, such as trunks or tie lines from other desks, local station lines, and trunks from the final multiple, will terminate at this frame in the key and lamp arrangements shown in Figures 2 and 3. An incoming call will actuate the talking trunk relays and cause the lamp to flash or to light steadily, depending upon the arrangement of the trunk or tie line involved. To answer the call, the trunk key of figure 2, for example, is operated to its talk position. This grounds lead "K", extending to the trunk relays and grounds lead "ST" extending to Figure 1. At the same time, the trunk conductors are connected through to the outer side of the repeating coil. The trunk key also prepares a path for the telephone set by connecting together terminals 3 and 8 of the repeating coil. The trunk lamp now goes out or else lights steadily as a busy signal, depending upon the arrangement of the trunk.

Ringing is tripped through contacts of relay (TP), which momentarily short-circuits the outer side of the repeating coil. Meanwhile, slow release relay (SR) operates from ground on lead "ST" and prepares an operating path for relay (SO). The latter relay locks to lead "ST", opens the operating path of relay (SR), and prepares the circuit for operating relay (TP). Shortly afterward, relay (SR) restores and relay (TP) comes up, prepares a path for operating relay (C), and opens the short-circuit across tip and ring. A 250 ohm shunt is now left across the outer side of the repeating coil under control or relay (C), for a purpose to be explained in Section 7, below. The operation of relay (C) removes this shunt and connects the telephone circuit to the repeating coil, thus completing the connection. It should be explained that leads "T" and "R" of Figure A, extending to the test circuit, are normally connected in the latter circuit to leads "T1" and "R1", respectively. When Fig. A is used and a test circuit is not provided the "T" and "R" leads are connected to the "T1" and "R1" leads respectively with "Z" wiring.

If it is desired to hold the connection while the telephone set is momentarily used elsewhere, the trunk key of Figure 2 is advanced to the hold position. This operation removes ground from leads "K" and "ST", detaches the telephone circuit from the trunk, substitutes a holding bridge, and frees the telephone circuit for other uses.

Figure 3 is specified in place of Figure 2 in cases where the holding feature is not required. The circuit operation involving Figure 3 resembles that of Figure 2 except for the holding key feature.

5.2 Telephone Circuit with Dial Feature, Figures 1 and A - Outgoing Calls

An outgoing call is originated by operating the key of Figure 2 or Figure 3 to the talk position. This grounds leads "K" and "ST" and connects the telephone set to the trunk as previously described. If the trunk involved is of ringdown type, the ringing key must be used to signal the distant end. The operation of the ringing key also restores relays (C) and (TP), the former opening the telephone circuit the latter short-circuiting the repeating coil to absorb acoustic disturbances as will be explained in Section 7, below.

It may be necessary to use the dial instead of the ringing key for setting up the connection, as in the case of trunks terminating at subscriber line circuits in dial offices. When the dial is pulled off-normal, relays (C) and (TP)

release, the former opening the telephone circuit and the latter applying a short-circuit across the repeating coil, to provide a suitable dialing path. Relay (FP) operates from the front contact of the dial shunt springs and opens the circuit or relay (C). The impulses are sent out as the dial returns, and when the dial has completely restored to normal, the circuit of relay (FP) is opened and that of relay (TP) again closed. Relay (TP), upon operating momentarily leaves the 250 ohm shunt bridged around the repeating coil for a purpose to be explained in Section 7, below, and prepares the operating path of relay (C). Relay (FP) restores shortly afterward, whereupon relay (C) comes up, removes the 250 ohm shunt from the repeating coil and again connects the telephone set into the circuit.

In case where the talking trunk is an automatic tie line, the ground on lead "K" is sufficient to bring in the call at the distant end. If the talking trunk involved is of ringdown type, the ringing key must be used to signal the distant desk. Likewise, when the talking trunk in question is a tie line to an "A" supervisor, and the supervisor's set is not occupied when the ground signal is given over the "K" lead, an audible signal may be sent by operating the ringing key.

5.3 Operation with Test Cord - Figures 1 and A

The telephone circuit is made up of Figures 1 and A in offices served by a central "A" switchboard, since in these cases it is necessary to handle some of the sender monitor functions at the sender make busy frame. For that purpose the frame must be equipped with certain testing facilities and with a dialing feature, the connections for which are shown in Fig. A.

The telephone circuit is connected into the test circuit by way of leads "T" and "T1" and "R" and "R1", these pairs of leads being normally connected together at relay contacts in the test circuit. When certain test circuit keys are operated, leads "T" and "R" are split off from leads "T1" and "R1", respectively, and the telephone is connected directly to the test circuit. The lead "ST" coming from the test circuit serves the same purpose as does the "ST" lead extending to the key and lamp circuits, Figures 2 and 3.

In cases where transmitter noise interferes with reception, secondary cutout key (SCO) may be operated. This key eliminates the induction coil from the connection and bridges the receiver directly across the listening taps T and R.

The telephone jacks of Figure A make it possible for the maintenance man to use a headset in place of the regular hand set whenever he finds it convenient to do so.

5.4 Operation with Frame Line Circuit

This telephone circuit provides convenient means of access to the local frame line circuit, for use by maintenance men working at the sender make busy or sender test frames. One of the trunk keys of Figure 2 or 3 may be set aside for this purpose, leads "T" and "R" being connected to the corresponding leads of the frame line circuit and leads "K" and "L" left unconnected. No talking battery is drawn from the frame line circuit in this case, since the sender make busy frame telephone circuit is provided with its own transmitter battery supply.

6. TELEPHONE CIRCUIT WITHOUT DIAL FEATURES - FIGURES 1 AND B

The circuit operation of Figs. 1 and B in connection with the talking trunks and the frame line circuit is the same as described in section 5 above, except that no relay action is involved.

7. ABSORPTION OF ACOUSTIC SHOCKS

7.1 It will be noted that contact sequences are specified in connection with the key of Fig. 2. Thus lead "ST" is grounded only after the trunk conductors have been extended through to the repeating coil. This is done in order to insure that ringing will be tripped through the contacts of relay (TP), on incoming calls, before the slow relay train involving relays (SO) and (SR) is allowed to start. Otherwise, a part or all of the delay interval, which is intended to be introduced before the telephone set is connected into the circuit, might be lost.

7.2 The circuit through leads "T1" and "R1" of Fig. 2 is likewise closed after the trunk is connected through to Fig. 1, in order that the repeating coil may have a chance to build up before the telephone set is connected to it.

7.3 When the trunk key of Fig. 2 is advanced to its hold position, the circuit controlled by leads "T1" and "R1" is opened before the holding bridge is applied across the trunk. Thus the telephone set is detached from the repeating coil before the outer side of the coil can be subjected to a momentary short-circuit at the contacts of the holding key.

7.4 A contact sequence is also provided at (RING) key. At this key, the circuit controlling relays (TP) and (C) is broken ahead of the tip and ring conductors when the key is operated. This means that when the key is restored, the line discharge is taken up through the short-circuit controlled by relay (TP), before that relay is allowed to reoperate and expose the repeating coil to the line.

7.5 At relay (C), arrangements are made for breaking the 250 ohm shunt around the repeating coil before the ring conductor of the telephone set is connected through, so that the repeating coil builds up before the telephone set is attached to the coil. The contacts of relay (C) producing the effect just described have a natural sequence relation which is satisfactory for the purpose so long as the relay is in normal adjustment.

7.6 The action of relays (SR), (SO), (TP) and (C), and their use in preventing clicks when ringing is tripped and when dialing is in progress, has already been touched upon. An additional function of the 250 ohm shunt besides that mentioned in Section 7.5 above is to prevent false impulses on outward dialed calls. This resistance, momentarily, shunted acound the repeating coil is described in Section 5.2 above, allows the impedance of the pulsing circuit to build up in steps after the dial restores, and thus prevents excessive disturbance to the pulsing relay.

7.7 The Varistor

The resistance of the varistor becomes less as a voltage across its terminals is increased. This characteristic of the varistor when placed in multiple with the receiver reduces the volume of tone to the receiver to a greater extent when the volume is loud than when the volume is normal. In this way the intensity of clicks and loud volume are reduced without appreciably affecting the volume of normal transmission.

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