

PANEL SYSTEMS
CALL DISTRIBUTING B SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The additional connection "to the last unit of a group" for the "AB" lead from the position busy and N.A. circuit was added in Figures K, L, M, 2L, 54 and 55 on this issue of the

circuit to insure that only one position unit of a group would be put out of service in the event of a break in the multiple of this lead.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-LBS-FJS

PANEL SYSTEMS
CALL DISTRIBUTING & SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

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tion unit of a group would be put
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All other headings, No change.

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The additional connection "to the
last unit of a group" for the "AB"
lead from the position unit and N.A.
circuit was added in Figures K, L, M,
N, O and P on this issue of the
CD, 24 and 25 on this issue of the

WILL TELEPHONE LABORATORIES, INC.

DEPT. 2240-122-112

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO ADDED
OR REMOVED APPARATUS

C.1 The adjustment for

| | | | <u>Soak</u> | <u>Opr.</u> | <u>Hold</u> | <u>Rel.</u> |
|------------------|-----|--------|-------------|-------------|-------------|-------------|
| (R02) relay Y99 | was | Test | 18 | 9.4 | 0.9 | 0.3 |
| | | Readj. | 18 | 8.9 | 0.8 | 0.5 |
| (TD1) relay Y107 | | Test | 18 | 14.3 | 1.6 | 0.9 |
| | | Readj. | 18 | 13.6 | 1.5 | 1.1 |
| (R01) relay Y166 | | Test | 16 | 11.5 | 1.3 | 0.6 |
| | | Readj. | 16 | 10.9 | 1.2 | 0.9 |

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-HCM-FJS

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO ADDED
OR REMOVED APPARATUS

C.1 The adjustment for

| | Test | Soak | Op. | Hold | Rel. |
|---------------------|--------|------|------|------|------|
| (R02) relay Y99 was | Test | 18 | 9.4 | 0.9 | 0.3 |
| | Readj. | 18 | 8.9 | 0.8 | 0.3 |
| (T01) relay Y107 | Test | 18 | 14.3 | 1.5 | 0.9 |
| | Readj. | 18 | 13.8 | 1.5 | 1.1 |
| (R01) relay Y186 | Test | 18 | 11.5 | 1.3 | 0.6 |
| | Readj. | 18 | 10.9 | 1.3 | 0.9 |

All other readings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3540-HCM-713

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In Figure 29, lead "A" to "A" and
"B" grouping circuit is added, to
provide connection to a similar lead
added in the grouping circuit for use

when a C.D. "B" position is grouped to
an adjacent "A" position equipped with
a combined "A and B" telephone cir-
cuit.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-WCJ-FJS

CD-21104-01
Issue 16-D
Appendix 2-B
Reg. Iss. 30-8

CIRCUIT DESCRIPTION
SYSTEMS DEVELOPMENT DEPARTMENT

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

when a C.D. "B" position is grouped to
an adjacent "A" position equipped with
a combined "A" and "B" telephone cir-
cuit.

All other headings, No change.

D. DESCRIPTION OF CIRCUIT CHANGES
D.1. In Figure 22, lead "A" to "A" and
"B" grouping circuit is added, to
provide connection to a similar lead
added in the grouping circuit for use

CHANGES

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-WC1-112

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES.

C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO ADDED
OR REMOVED APPARATUS.

C.1 The release adjustment for relay
RO1 was, readj. 0.7
RO2 0.4
TD1 1

C.2 Added test note "Adjacent relays
shall not be energized. See
B.S.P."

C.3 Added insulate inf. for relays
RO1 on ckt. req. tables.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340 WCJ-FJS

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

C.2 Added test note "Adjacent relays
shall not be energized. See
B.2.F."
C.3 Added insulate int. for relays
ROI on ckt. relays.

CHANGES
C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO ADDED
OR REMOVED APPARATUS

C.1 The release adjustment for relay
ROI was, readj. 0.7
0.4
1
TDI

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340 WCL-713

PANEL SYSTEMS
CALL DISTRIBUTING "B" SWITCHBOARD
POSITION, TELEPHONE AND TONE CIRCUIT

CHANGES

A. CHANGED AND ADDED FUNCTIONS

- A.1 Provision is made for grouping to an "A" position not arranged for combined "A" and call distributing "B" operation.

B. CHANGES IN APPARATUS

- B.1 Added in Fig. 29, relay (HC) R1226.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Figure 29 and wiring "AP" in Figures 1 and 28 is added to provide for operation of this circuit from an adjacent "A" position not arranged for "B" switchboard operation but equipped with a telephone circuit for combined "A" and C.D. "B" operation.

- D.2 In this connection, note 142 is added, note 126 is rated, "AO" wiring is designated and connecting information to Fig. 29 added to leads H1, H2 and A.

- D.3 This change provides for operation of added relay (HC) when the "B" position is occupied and thereby closure of the H lead to permit selection of the position and opening of the "A" lead to the "A" position telephone circuit to prevent interference.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

This circuit is the "B" operator's position circuit, and may be used to complete calls to a panel office, a local crossbar office No. 1 (single office unit) or two or more local crossbar offices No. 1 (multi-office unit). When a panel link or a terminating sender for a crossbar single office unit seizes this circuit a double order tone is given to the originating and "B" operators. When a terminating sender for a crossbar multi-office unit seizes this circuit a single order tone is given the originating and B operators as an indication that the originating operator should pass the office name and number and that the B operator should receive the office name and number and that the office key must be depressed in addition to the numerical keys.

2. WORKING LIMITS

- 2.1 None.

3. FUNCTIONS

- 3.01 To test busy to hunting panel links or crossbar terminating "B" senders when the position is not occupied by an operator.

- 3.02 To test idle and to permit seizure by a panel link or crossbar terminating "B" sender when the position is occupied by an operator, in which case her telephone set is plugged into the jack.

- 3.03 To test busy to other hunting panel links or crossbar terminating "B" senders when the position has been seized.

- 3.04 To cause a green lamp to flash as a signal to the operator that her position has been seized.

- 3.05 To transmit a double order tone to the originating operator for calls to a panel office or to crossbar single office unit.

- 3.06 To transmit a single order tone to the originating operator on calls to a crossbar multi-office unit when combined incoming trunk groups are used.

- 3.07 To permit the "B" operator to hear the order tones.

- 3.08 To cause the display of a steady green lamp as a signal to the "B" operator that the order tones have been transmitted.

- 3.09 When the position is first seized, to cause the display of a steady white lamp as a signal that a sender has not been attached.

- 3.10 To cause the white lamp to be extinguished when the sender is attached.

- 3.11 To permit conversation between the originating and "B" operators.

- 3.12 To provide means for recording the depression of the office key in the crossbar terminating "B" sender.

3.13 To permit keying up the number on the numerical keys which is registered by the sender when attached.

3.14 To cause a white lamp to flash when the "B" operator attempts to set up a number before the sender is attached.

3.15 To display a steady white lamp after the (RS) key has been depressed until the sender is again attached.

3.16 To display a steady red lamp when provided as an indication to the "B" operator she must receive an office code and depress the office key.

3.17 To enable the "B" operator, in case of a wrong registration, to wipe out a partially registered call without disconnecting the sender.

3.18 To provide means for the "B" operator to disconnect in case of a trouble in an associated circuit.

3.19 To provide means for registering the number of calls handled by the "B" operator.

3.20 To prevent a panel link circuit or a crossbar terminating "B" sender from hunting a position when all positions are busy.

3.21 To provide means for ringing a night alarm bell when a call comes in and all positions are vacated.

3.22 To provide means for monitoring on the position.

3.23 To provide means for testing the position circuit by means of the sender and position test circuit.

3.24 To provide for giving the originating operator a reorder signal in case the position is abandoned just as a call is received.

3.25 To close a pair of leads to the calls waiting signal circuit when the position is occupied.

3.26 Provides means when Fig. 22 is provided to isolate 4 key from 5 key calls and vice versa.

3.27 Provides means by the use of Figs. 23 and 25 or 26 and 27 to cut in the operators transmitter for Day Talk or Night Talk.

3.28 Provides means when Fig. 22 is provided and the position is handling both 4 key and 5 key calls to make the position look like a half position to each of its respective calls waiting positions.

3.29 Provides means when the (4K) key is operated to make the position look like a whole position to the calls waiting signal circuit associated with 4 key "B" senders and position finders and panel link circuits and to make it look unoccupied to the calls waiting signal circuit associated with "B" sender and position finder circuits arranged for 5 key calls. The above operation is reversed when the (5K) key is operated.

3.30 Provides means for giving the originating operator a reorder signal if a 4 key call comes in just as the (5K) key is thrown, or if a 5 key call comes in just as the (4K) key is thrown.

3.31 Provides for use in an "A" position arranged for both "A" switchboard and call distributing "B" operation.

3.32 Provides for operation from an adjacent "A" switchboard position.

3.33 Provides means to properly control the position busy and NA circuit under various conditions when the position grouping key is operated to the 4K or 5K position.

4. CONNECTING CIRCUITS

4.01 Call distributing "B" trip, start and link circuits, SD-21105-01.

4.02 Crossbar "B" switchboard sender and position finder circuit, SD-25382-01 and SD-96285-01.

4.03 Call distributing "B" position busy and night alarm circuit, SD-21139-01.

4.04 Call distributing "B" key monitoring circuit, SD-21648-01.

4.05 "A" switchboard key monitoring circuit, SD-96118-01.

4.06 "A" switchboard answering jack circuit, SD-90467-01.

4.07 Miscellaneous register circuit, SD-21537-01.

4.08 Miscellaneous interrupter circuit, SD-21666-01.

4.09 Telephone circuit for combined key listening and call distributing "B" position, SD-21604-01 and SD-21652-01.

4.10 Telephone circuit for combined "A" and call distributing "B" position, SD-96159-01.

4.11 "A" and "B" group circuit, SD-21657-01.

- 4.12 "B" sender and position automatic test circuit, SD-21107-01.
- 4.13 Monitoring jack circuit, SD-90564-01.
- 4.14 Combined key set and transfer circuit, SD-21709-01.
- 4.15 Calls waiting signal circuit, SD-21758-01.
- 4.16 "A" position key set circuit, SD-96133-01.

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 When Employed at a Call Distributing "B" Position

When the "B" position is occupied and the plug of the operator's telephone set is inserted in the jack, the (TR) relay shown in Figures 3, 8, 23 or 26 will operate. Operation of this relay will provide closure of battery to lead B to Figure 1 or 28 which will connect thru the 270 ohm resistance (A) to the H lead tested by the "B" link or crossbar "R" sender circuits. The position is now in a condition for selection by the hunting link or sender and when the position is seized, low resistance ground thru the test relay in the hunting circuit will cause the position to test busy to other hunting links or senders. The operation of the test relay in the link or sender circuit will then cause connection of battery and ground from the panel incoming selector or from the crossbar sender to the "T" and "R" leads respectively, shown in Figure 1 or 28. Operation of the (TR) relay in the telephone circuit will also cause, (a) closure of a pair of leads to the calls waiting signal circuit either directly when associated with one signal circuit or thru operation of the (CW) relay when associated with more than one signal circuit, (b) with "Q" and "G" wiring, connects ground to the "AB" lead to the position busy and night alarm circuit, (c) disconnects ground from the "R" lead to the "B" link or sender if "K" wiring is used, (d) grounds the NA lead to position busy and night alarm circuit direct with "G" wiring or thru Figure 22 with "AI" wiring and (e) when "R" wiring is provided to Figure 21 causes operation of relay (R01) in that figure. Operation of this relay causes (a) disconnection of ground from the "R" lead, (b) operation of relay (R02) and (c) closure thru of the R lead to lead "D" to telephone circuit. Operation of relay (R02) (a) opens the circuit in part for grounding the "R" lead and (b) grounds the "AB" lead to the position

busy and night alarm circuit thru "G" wiring.

5.2 When provision is made for the operation of this circuit from an adjacent "A" position, figure 29 and "F" and "AP" wiring is used. Under this condition when the "B" position is occupied operation of the position circuit (TR) relay will cause operation of relay (HC) thereby closing the "H" lead and opening the "A" lead to the "A" position telephone circuit to prevent interference. Other operation is as described in par. 5.1.

5.3 When figure 29 and F and "AP" wiring is provided as above noted, the "B" position is vacated and the "B" calls are being handled from an adjacent "A" position using the "B" position keyset, the position will operate in the following manner. The "H" lead is not closed thru the 270 ohm (A) resistance to battery until the transfer key at the "A" position has been operated. A waiting call is indicated to the operator by lighting of the (CD) position lamp. When the transfer key is operated the operator's telephone circuit is connected to this circuit and battery is connected to lead "B" and therefore to the (A) resistance. Closure thru of the H lead provides the proper condition for selection of the position circuit by a hunting link or sender. When seizure of the position occurs, ground thru the test relay in the selecting circuit is connected to the H lead providing a busy condition to other hunting links or senders. Closure of battery and ground then occurs over leads "T" and "R" from the panel incoming selector or the "B" sender circuit causing operation of the (T) relay in this circuit.

5.4 When Employed at a Combined "A" and Call Distributing "B" Position

Battery is not connected thru the (A) resistance to the H lead until the transfer key at the position has been operated. A waiting call is indicated to the operator by the lighting of the (CD) position lamp. After the transfer key is thrown, the operators telephone circuit is connected to this circuit and battery is closed to the "B" lead. When a separate key set key is employed with the "B" position this battery is connected directly to the (A) resistance. In the case of a combined key set key, the battery on the "B" lead operates relays in the transfer circuit which connects battery to the (A) resistance. Battery thru the (A) resistance to the H lead places the position in a condition to be seized by a hunting link or sender. When the position has been seized, ground thru the (DT) relay in the link or sender

is connected to the "H" lead making the position test busy to other links or senders. Battery and ground from the incoming repeating coil or from the "B" sender over leads "T" and "R" operates the (T) relay.

6. ORDER TONES AND NUMBER PASSED

6.1 Panel and Crossbar Single Office Operation Fig. A

The (T) relay operated closes the "R" lead, lights the (S) lamp, connects battery to the "K2" lead, operates the (TA) and in turn (TAL) relays and connects battery to the key circuit direct or by operation of relay (TAL).

Fig. 1 - "H" Wiring

The (TA) relay operated disconnects battery from the "H" lead, connects the key set to the "K1" lead, connects battery to the (LK) lamp and closes the tone circuit through the P winding of the (T) 103B repeating coil to ground through the back contacts of the (TB) and (TD) relays.

Fig. 1 - "J" and "BA" Wiring and Apparatus

The (TA) relay operated disconnects battery from the "H" lead, connects battery to the (LK) lamp, closes the tone circuit through the "P" winding of the (T) 103B repeat coil to ground through the back contacts of the (TB) and (TD) relays and operates the (TAL) relay. The (TAL) relay operated connects the key set to the "K1" lead and removes the short circuit from the operator's telephone leads.

The closure of the tone lead thru the (T) repeat coil causes a tone to be induced in the "S" winding of the 103B repeat coil which is connected to the tip and ring conductors and is transmitted over the trunk to the originating operator. A part of the tone also passes through the (TA) and (TB) condensers and is heard by the "B" operator. The (TA) relay operated also closes a circuit for operating the slow operate (TB) relay. Since the circuit through the "P" winding of the (T) repeat coil passes through the back contact of the (TB) relay the tone is, therefore, connected to the trunk for an interval equal only to the operate time of the (TB) relay. The (TB) relay operated disconnects the tone and closes the circuit for operating the (TC) relay which operates and again closes the tone circuit. The (TC) relay also closes the circuit for operating the (TD) relay. The tone is again connected to the trunk for the operate time of the (TD) relay.

The (TD) relay operated opens the tone circuit and closes a circuit for operating the (TE) relay. The (TE) relay operates and locks, and opens the circuit through the "S" winding of the repeat coil, closes a talking circuit to the operator's telephone set, causes a steady green (LK) lamp to be displayed and opens the operating circuit for the (TB) relay which releases, in turn releasing the (TC) relay which allows the (TD) relay to release. The order tones have been transmitted and the number can be passed.

Fig. 1 - "BB" Wiring and Apparatus

When "BB" wiring and apparatus is used the circuit functions as explained in the previous paragraph except that the circuit for operating the (TB) relay is not closed until the short circuit is removed from the operator's telephone set. This is accomplished by the operation of the (TAL) relay "BB" apparatus and insures the "B" operator receiving the full double order tone. The (TAL) relay operated (a) connects the key set to the "K1" lead, (b) removes the short circuit from the operator's telephone leads and, (c) operates the (TB) relay.

Fig. 1 - "BF" Wiring and Apparatus

When "BF" wiring and apparatus are provided, the circuit functions as explained for "J" wiring except as follows. Operation of relay (TAL) (a) disconnects the charging short circuit from condensers (TA) and (TB) and closes thru the operator telephone leads, (b) as with "BB" wiring operates relay (TB) which insures the "B" operator hearing the entire double order tone and (c) closes the circuit from "B" battery over lead J to the key set.

Fig. 28

When Fig. 28 is provided, the (TA) relay operated, disconnects battery from the H lead, connects battery to the (LK) lamp, disconnects the charging short circuit from condensers (TA) and (TB), closes the T and R leads thru from the operator's telephone circuit to contacts of the (TE) relay, and operates the (TAL) relay. The (TAL) relay operated, connects the key set to the K1 lead, closes the tone circuit thru the P winding of the (T) 103B repeating coil, to ground thru the back contacts of the (TB) and (TD) relays, and closes "B" battery over lead "J" to the key set.

From this point on, the circuit functions as explained above for Fig. 1, "J" wiring and apparatus, except that the (TAL) relay instead of the (TA) relay, closes the circuit for operating the (TB) relay.

6.2 Crossbar Multi-Office Operation, Fig. B

When a "B" position only handles calls for multi-office operation, Fig. B is furnished and the circuit functions as follows. When the position is seized by a "B" sender and battery and ground is connected to the "T" and "R" leads, the (T) relay operates thru its P1 and P2 windings series aiding. The (T) relay operated (a) closes the "R" lead (b) lights the (S) lamp, (c) connects battery to the "K2" lead and (d) operates the (TA) relay and with "BC" wiring connects battery to the key set.

Fig. 1 - "H" Wiring

The (TA) relay operated (a) operates the (TD1) relay (B) disconnects battery from the "H" lead, (c) connects the key set to the "K1" lead (d) connects battery to the (LK) lamp and (e) closes the tone circuit thru the P winding of the (T) 103B repeating coil thru the make contacts of the (TD1) relay.

Fig. 1 - "J" and "BA" Wiring

The (TA) relay operated (a) operates the (TD1) relay, (b) disconnects battery from the "H" lead, (c) operates the (TA1) relay, (d) connects tone thru the P winding of the (T) 103B repeating coil thru the make contacts of the (TD1) relay. Disconnecting battery from the "H" lead makes the position test busy to other crossbar terminating "B" senders. The (TA1) relay operated (a) connects the key set to the "K1" lead and (B) removes the short circuit from the operator's telephone leads.

The closure of the tone lead thru the (T) repeating coil causes a tone to be induced thru the S winding of the (T) repeating coil, over the "T" and "R" leads to the distant operator. A part of the tone passes thru the (TA) and (TB) condensers and is heard by the "B" operator. This tone closure is maintained until the (TD1) relay releases as explained later, thus giving both the distant and B operators a long single tone as an indication the office name in addition to the numerical number must be passed by the distant operator. The (TA) relay operated also operates the (TB) relay which in turn operates the (TC) and (TD) relays in cascade. The (TD) relay operated (a) releases the (TD1) relay and (b) closes the circuit for operating the (TE) relay. The (TD1) relay released opens the tone circuit from the (T) repeating coil. The (TE) relay operated (a) locks under control of the (TA) relay, (b) opens the operating path for the (TB) relay which releases, (c) closes the talking circuit to the telephone set, (d) disconnects the "S" winding of the (T) repeating

coil from the T and R leads, (e) opens ground from the "P" winding of the (T) repeating coil and (f) lights the (LK) lamp as an indication the order tone has been transmitted. The desired office and the numerical number is now passed by the distant operator to the "B" operator. The "B" operator then depresses the corresponding office key, which either connects battery or ground thru each winding of the (T) relay, over the "T" and "R" leads into the sender, operating the proper office relay in the sender.

When "BF" wiring is used the operation is as described for "J" wiring except that operation of relay (TA1) closes thru the operator's tel. circuit and closes "B" battery to the key set.

Fig. 28

When Fig. 28 is provided, the (TA) relay operated, disconnects battery from the H lead, connects battery to the (LK) lamp, disconnects the charging short circuit from condensers (TA) and (TB), closes the T and R leads thru from the operator's telephone circuit to contacts of the (TE) relay, and operates the (TA1) relay. The (TA1) relay operated, connects the key set to the K1 lead, operates the (TD1) relay, connects tone thru the P winding of the (T) 103B repeating coil thru the make contacts of the (TD1) relay, and closes B battery to the key set.

From this point on, the circuit functions as explained above for Fig. 1, "J" wiring, except that the (TA1) relay instead of the (TA) relay, closes the circuit for operating the (TB) relay, and the (TE) relay locks under control of the (TA1) instead of the (TA) relay.

6.3 Panel Office, Crossbar Single Office and Crossbar Multi-Office Operation, Fig. C

6.31 Panel or Crossbar Single Office Operation

Fig. 1

For a call to be completed in a panel or a crossbar single office the position is seized and the (T) relay operates as previously explained. The (T) relay operates the (TA) relay which in turn operates the (TD1) and (TA1) relays. The (TA1) relay operated, operates relay (TB) and with "BF" wiring also closes the telephone circuit and battery to the key set. The (TA) relay also closes the tone circuit thru the "P" winding of the (T) repeating coil which induces tone into the "S" winding and over the "T" and "R" leads to the distant operator and back thru the (TA) and (TB) condensers to the "B" operator.

The (TB) relay operated (a) operates the (TBL) relay and (b) disconnects tone from the "P" winding of the repeating coil. The (TBL) relay operated (a) locks under control of the (TA) relay, (b) disconnects battery from the H lead, (c) connects battery to the (LK) lamp which flashes under control of the (FLI) interrupter as an indication to the operator that her position has been seized if for any reason the (TE) relay fails to operate, (d) disconnects the (OC) relay from the "K2" lead, (e) closes the operating path for the (TC) relay and (f) closes the "K2" lead to the key set. The (TC) relay operated (a) again closes the tone to the P winding of the (T) repeating coil and (b) operates the (TD) relay. The (TD) relay operated opens the tone from the (T) repeating coil thus completing the double order tone to the distant and "B" operators, releases the (TDL) relay and operates the (TE) relay. The (TE) relay closes the talking circuit to the "B" operator, causes the (LK) lamp to burn steadily and the circuit to function as previously described. Upon hearing a double order tone the "B" operator is informed that she is not to receive the office name from the distant operator and that she is not to depress an office code key but merely write up the number on her numerical keys.

Fig. 28

When Fig. 28 is used, the (T) relay operates, when the position is seized and operates the (TA) relay, which in turn (a) operates the (TAL) relay, (b) disconnects the charging short circuit from condensers (TA) and (TB) and (c) closes the T and R leads from the operator's telephone circuit to contacts of the (TE) relay. The (TAL) relay operated, operates the (TDL) and (TB) relays, closes the tone circuit thru the "P" winding of the (T) repeating coil, and closes battery to the key set.

From this point on, the circuit functions as described in the preceding paragraph for Fig. 1.

6.32 Crossbar Multi-Office Operation - Combined Incoming Trunk Groups

Fig. 1 or 28

For a call to one of two offices in a multi-office unit, the terminating sender grounds the "K2" lead at the time the position is seized operating the (OC) relay. The (OC) relay operated (a) locks to the (TA) relay, (b) opens in part the operating path for the (TE) relay and together with the (TDL) relay operated changes the

double order tone to a long single order tone as an indication the "B" operator must receive an office name in addition to the number. The (OC) relay operated also lights the (OC) lamp as an additional indication she is handling a multi-office call. The (TA), (TAL), (TB), (TBL), (TC), (TD) and (TE) relays function as previously described.

The (TBL) relay operated disconnects the (OC) relay from the "K2" lead and closes this lead to the key set. Upon receiving the order from the distant operator, the operator depresses the proper (OC) key which either connects battery or ground thru each winding of the (T) relay over the "T" and "R" leads into the sender which operates the proper office relay in the sender. The (T) relay remains operated so long as the (OC) key is held depressed. The "B" operator then completes the call by writing up the number on the numerical keys.

7. REGISTRATION OF NUMBER

When the sender is connected, battery over the "K1" and "K2" leads causes the sender to function and connect 840 ohm battery to the "K3" lead. This operates the (SA) relay which locks and operates the (SAL) relay. This relay locks under control of the (RS) key, opens the operating circuit for the (SA) and operates the (SA2) relay. The (SA2) relay operated disconnects the battery from the "K1" and "K2" leads which causes the sender to function and disconnect the 840 ohm battery from the "K3" lead which releases the (SA) relay. The (SA) relay released, connects the "K3" lead through the "P" winding of the (PC) relay to the numerical keys and extinguishes the (S) lamp as a signal that the sender is attached and ready for recording the numerical key depression. The number can now be set up, on the numerical keys, which will be registered by the sender. The depression of the keys in setting up the number connects battery through either all or parts of the (B), (C), (E), and (D) resistances to the "K3", "K2" or "K1" leads respectively as shown in note 105. The connection of resistance battery to these leads causes certain combinations of relays in the sender to operate and lock, thereby registering the number.

8. SENDER RESET

If after setting up a series of digits the "B" operator finds that she has made a mistake but has not depressed the last digit of the number, she can depress the (RS) key which will cause any register relays that may have been operated in the sender to release and then the correct number can be set up. The depression of the (RS) key releases the

(SA1) relay. The (SA1) relay releases the (SA2) relay which relights the (S) lamp and again connects battery to the "K1" and "K2" leads which will cause the sender to function to release any register relays that may have been operated and to again prepare for registration and to connect battery through 840 ohms to the "K3" lead. This will cause the position circuit to function and prepare for again recording the number as described under "Registration of Number."

9. PREMATURE NUMERICAL KEY DEPRESSION

In case a numerical key is depressed after the position has been seized but before the sender circuit is ready for recording the number, battery from the depressed numerical key will be connected through the (B) resistance, either front contact of (SA) and (SA1) relays or back contact of (SA1) or (SA2) relay to the "P" winding of the (PK) relay which operates and locks. The (PK) relay operated opens the operating circuit for the (SA) relay and causes the (S) lamp to flash as a signal to the "B" operator. The "B" operator then depresses the (RS) key which releases the (PK) relay again closing the operating circuit for the (SA) relay and displays the steady (S) lamp. When the sender circuit is attached the (SA), (SA1), and (SA2) relays operate and the position circuit prepares for setting up the number as described under "Registration of Number."

10. POSITION DISCONNECT

In case of a trouble in the link circuit or sender circuit which prevents the progress of the call, the position circuit would be held and the operator unable to handle other calls. In such cases she will depress the (PD) key. If the (T) relay failed to operate the (PD) relay would operate to battery in the link circuit over the "K1" lead and cause the (LK) lamp to flash. Depression of the (PD) key at this time would cause release of the (PD) relay extinguishing the flashing lamp and would by closure of ground through the back contact of the (TA) or (TA1) relay to the K1 lead cause the panel link or cross-bar sender circuit to function and disconnect the position circuit. If the (T) relay has operated the depression of the (PD) key connects ground to the "R" lead, opens the ring lead to the "B" operator's telephone circuit and removes battery from "H" lead. This will cause the link or sender to function and dismiss the position circuit. When the (PD) key is released battery is again connected to the "H" lead and the position can be selected by a hunting link or sender.

11. PEG COUNT

When it is desired to take a count of the number of calls handled by the "B" operator the locking key in the miscellaneous register circuit is depressed which connects battery through a message register to the "M" lead. When a call has progressed to the point where the operator has depressed one numerical key the (PC) relay operates, locks and connects ground to the "M" lead. This causes the message register to operate, a record of the number of calls handled by the operator is thereby obtained.

12. ALL POSITIONS BUSY

When all positions are busy or vacant, ground is removed from the "AB" lead to the positions busy and night alarm circuit. This causes this circuit to function and prevent any link circuit from hunting a position circuit.

13. NIGHT ALARM

When all positions are vacant in which case all (TR) relays are released, ground is disconnected from the NA lead to the positions busy and night alarm circuit. This allows a relay in that circuit to release and should a call come in a night alarm bell will ring as a signal that the call is waiting.

14. KEY MONITORING

When key monitoring is desired, figure 2 is furnished and when the plug of the key monitoring circuit is inserted into the (KM) jack, M or N wiring, the (M1), (M2) and (M3) relays will operate. "L" wiring is used when the circuit is used at a comb. "A" & "B" pos. when a single monitoring jack is used to monitor on both "A" & "B" service. When L wiring is used the (MJ) relay operates when the plug of the key mon. circuit is inserted into the (KM) jack in turn operating (M1), (M2) and (M3) relays. These relays operated connect the "K1", "ON", "K1'", "PD", "K3'", "K3", "ST", "K2'", "K2", "LL" and "SL" leads through to the key monitoring circuit. A set of relays in the key monitoring circuit similar to the register relays in the sender are connected to the "K" leads and when the "B" operator depresses the numerical keys in the position circuit operating the sender relays the relays in the key monitoring circuit are also operated. These relays operated, lock and light lamps which are numbered to correspond with the number of the depressed key. A record of the key depressions is therefore recorded before the monitoring operator. The "SL" and "LL" leads are multiples of the (S) and

(LK) lamp leads and connect to similar lamps in the key monitoring circuit. In this way an indication is given the monitoring operator when the (S) and (LK) lamps are lighted and extinguished. The "PD" lead connects to a relay in the key monitoring circuit which operates when the (PD) key is depressed. This relay operated locks and lights a lamp as an indication to the monitoring operator that the (PD) key has been depressed. A record of the depressions of the (RS) key is given the monitoring operator due to the operation of the (RR) relay in the key monitoring circuit when battery is connected to the "K1" and "K2" leads from the depressed (RS) key. The "3T" lead is used to prevent the disturbance of relays already set up in the key monitoring circuit by the handling of another call by the "B" operator before the monitoring operator has wiped out the previous record. The monitoring operator observes the transmission of the order tones and the number over the "T" and "R" leads which completes her record, of the functions of the "B" operator in handling the call. When the "B" operator depresses an (OC) key, ground is connected over one of leads designated one to six in Fig. 17 which operates and locks a relay in the key monitor circuit and lights the associated office lamp.

15. TESTING THE POSITION CIRCUIT

The "T", "R", "K1", "K2", "K3" and "H" leads to the link circuit are multipled to the sender and position test circuit to provide means for testing the position circuit to determine whether or not it functions properly. When the position circuit is idle it can be selected by the test circuit which can then test all its functions.

16. POSITION ABANDONED

16.1 "E" and "K" and "AO" Wiring

When the telephone set is removed from the jacks or when the transfer key is restored to normal, battery and ground is removed from the position circuit which makes the position test busy to hunting links. In case a call was received just prior to the removal of battery and ground, ground on the ring lead will cause a relay in the link circuit to operate which will in turn cause a reorder signal to be given back over the incoming trunk to the originating operator flashing her supervisory lamp as an indication to remove the cord from the jack and reoriginate the call.

16.2 Position Abandoned "R" Wiring

When the telephone set is removed from the jacks at the "B" position the

(TR) relay releases in turn releasing the (R01) relay and which in turn releases the (R02) relay. The (TR) relay released connects ground to the "R" lead toward the panel link or "B" sender circuit for the release time of the (R01) relay. When the (R01) relay releases this ground is removed from the "R" lead and when the (R02) relay releases ground is again connected to the "R" lead thus completing 2 impulses of ground which is required to function the reorder relay in the "B" sender arranged for 5 key operation.

16.3 Position Abandoned "F" and "AO" Wiring

"F" and "AO" wiring is provided when this position circuit is associated with a combination "A" and "B" position or a combined call distributing and key listening "B" position. When the operator restores the transfer key to the normal position, the "H" lead is immediately opened to prevent the seizure of this position circuit. In case a call was received just prior to the opening of the "H" lead and the (T) relay operates, battery closure thru the contacts of the "T" relay will hold a relay at the combination position and prevent the position transfer until the call is disposed of. This feature is to eliminate reorders which are caused by a call seizing the position just before the transfer key is restored to normal.

16.4 "F" and "AP" Wiring and Fig. 29

When it is desired to provide for the use of this circuit with an adjacent "A" position not arranged for combined A and B operation but equipped with a telephone circuit arranged to transfer to or from a call distributing "B" position, "F" and "AP" wiring and Fig. 29 should be provided. Under this condition when the "B" position is not occupied and the operator at the adjacent "A" position finishes handling an incoming "B" call and expects to next use the regular A cord circuits, the transfer key in the "A" position is restored to the normal position. This operation immediately opens the "H" lead to prevent seizure of this position circuit. Should the position circuit be seized just prior to restoration of the transfer key and the (T) relay operates, battery closure thru contacts of the (T) relay will hold operated a relay in the "A" position circuit and thereby prevent transfer of the telephone circuit until the incoming "B" call is disposed of. This feature is to prevent reorder signals being given should seizure of the position occur at this time.

17. CALLS WAITING SIGNAL

The white (CW) lamp is lighted by the calls waiting signal circuit when the number of call distributing calls waiting to be answered is such as to cause undue delay in answering the originating operators.

18. THE VARISTOR

The resistance of the varistor becomes less as the voltage across its terminals is increased. This characteristic of the varistor when placed in multiple with the receiver causes a greater reduction in the volume of tone from the receiver 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.

19. OFFICE GROUPING KEY FIG. 22

19.1 4 Key and 5 Key Calls

When Fig. 22 is provided and the (4K) and (5K) key is normal and the "B" position is occupied, it is receptive to receiving both 4 key and 5 key calls. Under this condition when a call is being handled in the position, ground is disconnected from the "M1" lead thru contacts on the (4K) and (5K) relays to the "HC" lead toward the position busy and NA circuit. When grounds are disconnected from all other "M1" leads, the position busy and NA circuit functions to stop sender and panel links from hunting until a position is available to handle the call. So long as the position is occupied and the grouping key is normal ground will be connected from the "M1" lead to the NAC lead into the position busy and NA circuit to prevent that circuit from ringing the (NA) bell.

19.2 (4K) Key Operated

If it is desired to handle 4 key calls only, the (4K) key is operated which operates the (4K) relay. The (4K) relay operated (a) opens the "T", "R" and "H" leads toward the "B" senders arranged for 5 key operation so that these senders cannot connect to this position, (b) disconnects ground from the "NAC" and "HC" leads toward the position busy and NA circuit to make the position appear vacated to 5 key senders and position finders, (c) closes

ground to the "H4" and "NA4" leads toward the position busy and night alarm circuit to inform that circuit the position is only handling 4 key calls. After the position is seized by an incoming call ground is disconnected from the H4 lead, which, if this position is the last position available for handling other 4 key calls that may be waiting, stops the position hunt of panel links and 4 key senders, (d) grounds the "NA4" lead, (e) releases the (R01) relay, (f) opens the "A" and "L" leads toward the 5 key calls waiting signal circuit which makes the position appear vacated to that circuit, (g) closes the "A" lead to the "E" lead of 4 key calls waiting circuit making the position appear as a whole position instead of a half position and (h) connects ground to the "T" lead of the 5 key sender. The release of the (R01) relay (a) opens ground from the "T" lead toward the 5 key sender and (b) releases the (R02) relay. The (R02) relay again connects ground to the "T" lead toward the 5 key sender, which if it has a call locked in when the (4K) key is operated, routes the call to overflow.

19.3 (5K) Key Operated

When the (5K) key is operated the (5K) relay operates and the position only handles calls from 5 key senders the same as explained for 4 key calls except that the (R01) and (R02) relays do not release and that ground is connected to the "T" lead of 4 key senders and panel links to route a call that may be locked in due to the position being seized at the time the (5K) relay operates, to reorder. Also the position appears vacated to 4 key senders and panel links and the half position indication is changed to a full position indication to calls waiting signal associated with 5 key senders.

20. TRANSMITTER CUT IN

When Figs. 23 and 25 or Figs. 26 and 27 are used, the N talk or D talk key must be operated to connect the "B" operators transmitter for conversation with the distant operator. The N talk key is locking and is generally used during the night when light loads are prevalent. The D talk key is non-locking and when operated releases the N talk key. Either key operates the (TRC) relay which connects the transmitter into the telephone circuit.

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17. CALLS WAITING SIGNAL

The white (CW) lamp is lighted by the calls waiting signal circuit when the number of call distributing calls waiting to be answered is such as to cause undue delay in answering the originating operators.

18. THE VARIATOR

The resistance of the variator becomes less as the voltage across its terminals is increased. This character- istic of the variator when placed in multiple with the receiver causes a greater reduction in the volume of tone from the receiver when the volume is loud than when the volume is normal. In this way the intensity of clicks and sound volume are reduced without appreci- ably affecting the volume of normal transmission.

19. OFFICE GROUPING KEY VIB. 22

19.1 4 Key and 5 Key Calls

When Fig. 22 is provided and the (4K) and (5K) key is normal and the "B" position is occupied, it is receptive to receiving both 4 key and 5 key calls. Under this condition when a call is be- ing handled in the position, ground is disconnected from the "M" lead thru contacts on the (4K) and (5K) relays to the "H" lead toward the position play and NA circuit. When grounds are disconnected from all other "M" leads, the position busy and NA circuit func- tions to stop sender and panel links from hunting until a position is avail- able to handle the call. So long as the position is occupied and the group- ing key is normal ground will be con- nected from the "M" lead to the NAQ lead into the position busy and NA cir- cuit to prevent that circuit from ring- ing the (NA) bell.

19.2 (4K) Key Operated

If it is desired to handle 4 key calls only, the (4K) key is operated which operates the (4K) relay. The (4K) relay operated (a) opens the "T" lead toward the "B" senders and "H" leads toward the "B" key operation so that these senders cannot connect to this position. (b) disconnects ground from the "NAQ" and "H" leads toward the position busy and NA circuit to make the position appear vacated to 5 key senders and position finders. (c) closes

19.3 (5K) Key Operated

When the (5K) key is operated the (5K) relay operates and the position only handles calls from 5 key senders the same as explained for 4 key calls except that the (RO1) and (RO2) relays do not release and that ground is con- nected to the "T" lead of 4 key senders and panel links to route a call that may be locked in due to the position being seized at the time the (5K) relay operated, to recorder. Also the posi- tion appears vacated to 4 key senders and panel links and the half position indication is changed to a full posi- tion indication to calls waiting signal associated with 5 key senders.

20. TRANSMITTER CUT IN

When Figs. 23 and 25 or Figs. 26 and 27 are used, the N talk or D talk key must be operated to connect the "B" op- erator transmitter for conversation with the distant operator. The N talk key is locked and is generally used during the night when light loads are prevalent. The D talk key is non-looking and when operated releases the N talk key. Either key operates the (TRC) relay which connects the transmitter into the telephone circuit.

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