

This M. of O. was prepared from Issue 18 of T-431575.

METHOD OF OPERATION
SELECTOR CIRCUIT CORDLESS

Incoming from Long Distance--Arranged for Coin Collect
and ground potential less than 8 volts Four party semi-
selective ringing-Panel Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used at a cordless "B" board to establish signalling and talking connections for calls incoming from long distance offices.

2. WORKING LIMITS

- 2.1 This circuit has a maximum external trunk loop resistance of 2000 ohms and a subscribers loop resistance of 900 ohms maximum.

OPERATION

3. PRINCIPAL FUNCTIONS

- 3.1 Give a steady visible guard signal when toll operator inserts the plug of a toll cord into the jack.
- 3.2 Gives a flickering busy signal while selection is in progress.
- 3.3 Gives a steady busy signal when selection is completed.
- 3.4 Selects the proper idle final selector.
- 3.5 Signals the called subscriber.
- 3.6 Establishes the talking connection.
- 3.7 Gives a flickering guard signal when all paths are busy.
- 3.8 Gives a flashing guard and busy signal when toll operator disconnects.
- 3.9 Returns to normal.

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4. CONNECTING CIRCUITS

- 4.1 This circuit functions with final selectors and coin collect circuits, and is associated, thru an allotter circuit, with cordless sender selector and sender circuits.

DESCRIPTION OF OPERATION

5. TOLL CORD INSERTED BEFORE ASSIGNMENT

If the plug of the long distance cord is inserted in the outgoing trunk jack before the assignment key has been depressed, the (A) relay operates thru the bridge in the cord circuit. The (A) relay is made slow in releasing to prevent its release from a condenser discharge or inductive surge. The (A) relay operated, operates the (L), and the (S-1) relays. The (S-1) relay operated disconnects battery and ground from the tip and ring of the trunk and closes a circuit locking the (A) relay. The (L) relay operated, lights the guard lamp (WH) and connects ground to the HTG lead as a temporary busy condition.

6. TOLL CORD INSERTED AFTER ASSIGNMENT

If the assignment key is depressed before the plug of the long distance cord is inserted in the jack, the peg count register operates and the R magnet advances the switch to position 2. In position 2, the (white) guard lamp lights steadily and ground is connected to the holding lead (HOLD), the fundamental lead (FUND), and the start (ST) lead. Ground on the start lead advances the associated sender selector and trunk finder which connect ground to the advance lead (ADV). Ground on the advance lead is closed thru the R magnet, advancing the switch to position 3. In position 3, the white lamp is extinguished and the Busy (green) lamp flashes rapidly. As the switch enters position 3, ground is connected to the hunting (HTG) lead. As the associated sender advances, ground from the Fund. lead is connected thru the inner winding of the (L) relay, which operates. The (L) relay operated, (a) locks from battery thru its 800 ohm winding, to ground on cam I, (b) connects ground to the hunting lead from its armature, and (c) closes a circuit thru the R magnet, advancing the switch to position 4, the A cam advancing it to position 5. As the switch enters position 4, the (L) relay locks in a circuit thru its 1200 ohm winding, to ground on the fundamental lead.

7. BRUSH SELECTION

With the switch in position 5, and the (L) relay locked, a circuit is closed thru the UP magnet, causing the selector to move upward for brush selection. As the selector moves upward in position 5, carrying the commutator brushes over the commutator segments, the A segment and brush intermittently connect ground to the tip side of the fundamental circuit, holding the (L) relay operated, but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its reoperation until the proper brush has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay. The (L) relay released, opens the circuit thru the UP magnet, stopping the upward movement of the selector, and closes a circuit thru the R magnet advancing the switch to position 6.

8. GROUP SELECTION

In position 6, a circuit is closed thru the TRIP magnet which operates. In position 6, the (L) relay again operates over the fundamental circuit, advancing the switch to position 7 for group selection. In position 7, the circuit thru the UP magnet is again closed moving the selector upward for group selection. The trip magnet being operated in position 6 to 8, the previously selected brush is tripped as the selector moves upward in position 7. As the selector moves upward carrying the brushes over the commutator segment, the B commutator brush and segment intermittently connect ground to the tip side of the fundamental circuit, holding the (L) relay operated, but successively short-circuiting, the stepping relay in the associated sender circuit, thus releasing and permitting its reoperation. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay. The (L) relay released, opens the circuit thru the UP magnet thus stopping the brushes at the selected group and closes a circuit thru the R magnet, advancing the switch to position 8. In position 8, a circuit is closed thru the outer winding of the (L) relay which operates and advances the switch to position 9 for trunk hunting.

9. TRUNK HUNTING

If the first trunk of the group is idle as the switch enters position 9, the (L) relay releases, placing ground on the sleeve terminal of the selected final as a busy condition. This busy circuit is traced from ground on the upper outer contacts of cam H and O, break contact of the (L) relay, outer contacts of cam I, to the sleeve terminal of the selected trunk. Should the first trunk of the group be busy, however, the

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(L) relay is held operated thru its 1200 ohm winding, to ground on the sleeve terminal of the busy trunk. With the (L) relay held operated, the UP magnet remains operated and causes the selector to move upward until an idle trunk is found. When the idle trunk is found the circuit thru the 1200 ohm winding of the (L) relay is opened, but the (L) relay does not release immediately due to a circuit being closed from ground on the C commutator brush and segment, thru the 800 ohm winding of the (L) relay. The UP magnet therefore remains operated and the selector continues to move upward until the circuit thru the C commutator is opened.

10. "C" COMMUTATOR NOTE

The adjustment of the "C" commutator brush with relation to the tripped sleeve multiple brush, is such, that it does not break contact with the C commutator segment until slightly after the holding circuit thru the inner winding of the (L) relay is opened, by the sleeve brush leaving the busy terminal and making contact with the sleeve terminal of the idle trunk. The UP magnet, remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the trunk terminals, allowing the locking pawl to enter the notch on the rack attached to the brush support rod. At this time the holding circuit thru the outer winding of the (L) relay is opened at the C commutator, releasing the relay. The (L) relay released, disconnects ground from the commutator feed bar (G) and releases the UP magnet. The selector then drops into place, thus centering the brushes on the trunk terminals. During trunk hunting (in position 9 only) the commutator feed ground is supplied thru cam L, from ground on cam S under control of the (L) relay. This is to prevent the reoperation of the (L) relay by the closing of a circuit between the C commutator brush and segment, on the overthrow of the selector, or as it drops into place.

11. SELECTION BEYOND

The release of the (L) relay, opens the circuit thru the UP magnet and advances the switch to position 10, the A cam advancing it to position 11. From position 10 to 16-1/4, the selected trunk is held busy to all other hunting selectors by ground connected to the sleeve terminal of the trunk, thru the upper contacts of cam I. In position 11, the fundamental circuit is closed for selection beyond. When selection beyond has been completed, ground from the associated sender circuit is connected to the advance lead (ADV) to battery thru the R magnet, advancing the switch to position 12. In position 12 the white

and green lamps light steadily to ground on cam S, the green lamp changing from a flashing to a steady lamp as the switch leaves position 11.

12. TRUNK CLOSURE

When the plug of the long distance cord is inserted in the jack of the assigned trunk, a circuit is closed operating the (A) relay. The (A) relay operated, operates the (S-1) relay. The (S-1) relay operated, disconnects battery and ground from the trunk, thus preventing the long distance cord supervisory lamp from lighting, and holds the (A) relay operated. As the switch enters position 12 with the (A) relay operated, a circuit is closed operating the (L) relay thru its inner winding. The (L) relay operated, advances the switch to position 13, the A cam advancing it to position 14. With the switch to position 14, the white lamp is extinguished and the green lamp remains lighted. When the switch leaves position 12, the (S-1) relay releases, connecting battery and ground to the long distance supervisory relay which operates, lighting the long distance cord supervisory lamp as a ringing signal. The A relay is held operated thru the bridge in the long distance cord circuit.

13. RINGING

13.1 ONE-RING STATIONS

If the number called is reached by final trunks located in either the first or third group in the incoming frame, the circuit thru the P commutator is open, therefore, the (P) relay does not operate and the switch remains in position 14 during the ringing period. When ringing current is connected to the trunk in the long distance office, with the switch in position 14, the (R-2) relay operates. The (R-2) operated, operates the (RC) relay. The (R-2) relay operated, also closes a circuit thru the inner winding of the (S-1) relay, which operates during the LD ringing period. The (S-1) relay operated, disconnects battery and ground from the tip and ring of the trunk and holds the (A) relay operated. The (RC) relay operated, (a) locks in a circuit from ground on its armature to battery on the armature of the (R-1) relay, (b) closes a circuit operating the (PU) relay. The (PU) relay operated, (a) operates the (R-1) relay, (b) locks thru the continuity contacts to ground on the armature of the (R) relay, and (c) connects one ring ringing current to the ring of the trunk. This ringing circuit is closed from one ring ringing current thru cam R winding of the (R) relay, make contacts of the (PU) and (R-1) relays, lower contact of cam G, over the ring of the trunk, to ground thru the

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ringers in the sub-station set. The (R-1) relay operated releases the (RC) relay, and closes a circuit for transmitting an audible ringing tone to the long distance operator. This circuit is traced from ringing current thru the make contact of the (R-1) relay, .02 mf condenser, windings of the repeating coil, inner winding of the (S) relay, to battery.

13.2 "P" COMMUTATOR NOTE

The switch has two ringing positions namely 14 and 16. In position 14, one ring ringing current is connected to the ring brush of the selector and in position 16, two ring ringing current is connected to the ring brush. Stations which are rung with one ring ringing current are assigned numbers which are reached thru final trunks terminating in either the first or third group on the incoming frame. Stations which are rung with two ring current are assigned numbers which are reached thru final trunks terminating in either the second or fourth group on the incoming frame. The ringing of stations on the tip side of the line is cared for by a cross connecting and reversing scheme at the distributing frame. The switch stops in position 14, when the selector is on a final trunk so located that the circuit thru the P commutator brush and segment is opened, but it advances to position 16 when the selector is on a trunk so located that the circuit thru the P commutator is closed.

13.3 TWO RING STATIONS

On calls for a two ring station the selected final trunk is located so that ground is closed thru the P commutator as the switch enters position 13, operating the (P) relay. The (P) relay operated, advances the switch to position 15, the A cam advancing it to position 16. As the switch leaves position 14-1/4, the (P) relay releases. The switch waits in position 16 for the pick-up interrupter in order to get the full two ring code when the (PU) relay operates. When the ringing current at the long distance office is connected to the trunk, the (R-2) relay operates and functions as previously described. The (RC) relay operated, operates the (PU) relay. The (PU) relay operated, closes a circuit operating the (R-1) relay. The (R-1) relay operated opens the holding circuit thru the (RC) relay which releases, and connects the two ring ringing current to the called line. This circuit is traced from the ring ringing current thru the lower contact of the R, winding of the (R) relay, make contacts

of the (PU) and (R-1) relays, cam G, over the ring side of the final trunk and called line to ground thru the sub-station ringing set.

13.4 RINGING P.B.X. AND DIRECT LINES

The circuit functions for P.B.X. and direct line ringing the same as described in paragraph 13.1 for one ring ringing, the (S) and (RC-1) relays operating when the call is answered by either the P.B.X. operator, or when the receiver is removed from the switchhook at the called station.

13.5 RRINGING P.B.X.

When ringing current is connected to the trunk at the long distance office to recall a P.B.X. the (R-2) relay operates. As the (RC-1) relay is operated at this time, the operation of the (R-2) relay closes a circuit thru the winding of the (R-1) relay which operates. The operation of the (R-1) relay connects continuous ringing current to the trunk. The operation of the (R-1) relay also closes a circuit holding the (S-1) and (RC-1) relays operated.

14. CALLED PARTY ANSWERS

When the receiver at the called station is removed from the switchhook, the (R) relay operates to ground thru the make contact of the (PU) and (R-1) relays due to the increased amount of current closed thru the switchhook contacts. The (R) relay is not necessarily slow acting but is designed to be less responsive to alternating than to direct current. The operation of the (R) relay releases the (PU) relay which in turn releases the (R-1) relay. The release of the (R-1) relay closes the tip and ring of the final trunk thru to the windings of the repeating coil, and the winding of the (S) relay, which operates. The operation of the (S) relay (a) closes a circuit thru the outer winding of the (S-1) relay, which operates and (b) closes a circuit operating the (RC-1) relay. The (RC-1) relay is made slow in releasing to prevent its release during the interval that its holding circuit is being transferred from the make contact of the (R-1) relay to the make contact of the (S) relay on a recall to a P.B.X. The operation of the (S-1) relay disconnects battery and ground from the tip and ring of the circuit, extinguishing the supervisory lamp in the long distance cord circuit. The operation of the (RC-1) relay performs no useful function at this time. This feature is explained under P.B.X. ringing in paragraph 13.5.

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15. DISCONNECTION

When the receiver at the called station is replaced on the switchhook while the switch is in position 14 or 16 the S relay releases, releasing the (S-1) and (RC-1) relays. The (S-1) relay released, connects battery and ground to the outgoing end of the trunk, lighting the supervisory lamp in the long distance cord circuit as a disconnect signal. When the plug of the long distance cord is removed from the jack, the (A) relay releases, releasing the (L) relay. The (L) relay released, closes a circuit thru the white and green lamps, which flash slowly as a disconnect signal. The (NB) relay, when provided operates in this circuit and in turn operates the Night alarm. The disconnect key is then depressed, closing a circuit thru the R magnet, advancing the switch to position 18. In position 18, a circuit is closed thru the DOWN magnet which operates, restoring the selector to normal. When the selector reaches normal, the switch is advanced to normal in a circuit from ground on the Y commutator brush and segment, thru the R magnet. In position 17-1/2 to 18, the TRIP magnet is operated to prevent the brushes from snagging on the trip fingers as the selector returns to normal.

16. OVERFLOW

Should all the trunks in a group be busy the selector while hunting in position 9, advances to the top of the group and rests on the overflow terminals. As the S terminal is opened at overflow, the circuit thru the (L) relay is opened, releasing the relay. The release of the (L) relay advances the switch to position 10, the A cam advancing it to position 11. In position 11, a circuit is closed from ground on the Z commutator, brush and segment thru the R magnet, advancing the switch to position 12. In position 12, a circuit is closed thru the inner winding of the (L) relay, which operates and advances the switch to position 13, the A cam advancing it to position 14. In position 14, a circuit is closed from ground on the Z commutator, brush and segment, thru the R magnet, advancing the switch to position 17. In position 17 the white lamp flashes rapidly. The disconnect key is then operated, advancing the switch to position 18. In position 18, the DOWN magnet operates returning the selector to normal. When the selector reaches normal, the Y commutator advances the switch to position 1.

17. TELL-TALE

Should the selector travel to the top of the frame during selection, the switch advances to position 10 in a circuit from ground on

the X commutator brush and segment, thru the R magnet, the A cam advancing the switch to position 11. In position 11, the green lamp continues to flash rapidly. The switch remains in position 11 until the disconnect key is depressed. The operation of the disconnect key advances the switch to position 18. From this point on the circuit functions as described in paragraph 15.

18. THE "B" OPERATOR DEPRESSES THE WRONG ASSIGNMENT KEY

If the B operator should depress the wrong assignment key, the switch is advanced to position 2, in which position the white lamp lights steadily. When the operator depresses the assignment key of another trunk, a circuit is closed from ground thru the contact of the second assignment key, thru common strapping to the contacts of the first assignment key depressed, inner contacts of cam K, to battery thru the inner winding of the (L) relay which operates. The (L) relay operated, locks thru its 800 ohm winding thru the R magnet, advancing the switch to position 3. With the switch in position 3, the green lamp flickers. In position 3, a circuit is closed thru the R magnet, advancing the switch to position 4, the A cam advancing it to position 5. When the switch leaves position 3, the circuit thru the (L) relay is opened, releasing the relay. With the (L) relay released and the switch in position 5 a circuit is closed thru the R magnet advancing the switch to position 6. In position 6, a circuit is closed from ground thru the Y commutator brush and segment, cam B, to battery thru the R magnet, advancing the switch to normal.

19. PLUG OF CORD INSERTED IN WRONG TRUNK JACK AT DISTANT OFFICE

When the long distance operator inserts the plugs of a cord in the jack of the wrong trunk, the (A-1) relay operates and closes a circuit thru the 1200 ohm winding of the (L) relay, which operates. The (L) relay operated closes a circuit thru the Guard (white) lamp. The Guard lamp lights and burns steadily and the "B" operator thereupon connects the trunk with the supervisor.

20. COIN COLLECT OR COIN RETURN

When this circuit functions with a coin circuit, a current of 110 volts positive or negative is connected to the tip and ring of the line thru the final circuit, either collecting or returning the coin.

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21. TESTING LEADS

Connections are provided for making the selector available
for use in connection with tests of the incoming selectors and these
leads are designated TA, TB, TC, TD, TM, TR, TS, TT, TU, and TY.

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