PANEL SYSTEM
INCOMING SELECTOR CIRCUIT
FROM CENTRAL A SWITCHBOARD
NO TEST
GROUND CUT OFF RELAY OFFICE

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The J4 Cam is shown cut in positions 1 to 11 instead of in positions 1 and 11.

All other headings, no change.

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DEPT. 3040-NL-CGM-P1

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CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-20744-01
Issue 1
Dwg. Issue 1

PANEL SYSTEM
INCOMING SELECTOR CIRCUIT
FROM CENTRAL "A" SWITCHBOARD
NO TEST
GROUND CUT OFF RELAY OFFICE

1. PURPOSE OF CIRCUIT

1.1 This circuit is designed to permit a panel A operator to verify the busy condition of a panel subscriber's line which may be located in a distant building.

2. WORKING LIMITS

2.1 The external circuit loop for selections shall not exceed 1830 ohms resistance and shall not include more than 14 miles of cable.

2.2 The external circuit loop for supervision shall not exceed 7200 ohms resistance.

2.3 The insulation resistance shall be minimum 30,000 ohms.

3. FUNCTIONS

3.01 Recognizes Selection

3.02 Makes Brush Selection

3.03 Trips Selected Brush

3.04 Makes Group Selection

3.05 Selects and centers the multiple brushes on the terminals of the first idle trunk.

3.06 Immediately makes the seized terminal busy by placing a ground on the sleeve terminal.

3.07 Recognizes the completion of final selections and signals this condition back to the sender by reversing battery and ground to the trunk.

3.08 Charges the cable capacity prior to advancing to trunk closure position.

3.09 Arranged to place a busy condition on the trunk when associated with a final selector that awaits the called subscriber's release before disconnect.

3.10 Operates the peg count register for each revolution of the switch.

3.11 In connection with other selectors in the same group, this circuit is arranged to operate the all trunks busy register.

3.12 Arranged to release the up drive magnet when this circuit reaches the overflow or tell-tale terminals.

3.13 When this circuit reaches tell-tale terminals, a premature reversal of battery and ground is given to the sender the same as on an overflow condition.

3.14 Arranged to restore to normal if the switch is moved off normal manually.

3.15 Arranged to cause the final selector to seize a busy subscriber's line.

4. CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon is to be followed.

4.1 Outgoing trunk circuit SD-21179-01.

4.2 Final Selector Circuit ES-207389 or ES-239664.

4.3 Miscellaneous Register Circuit SD-20141-01.

4.4 Blank Incoming Trunk Circuit ES-240037.

DESCRIPTION OF OPERATION

5. SEIZURE

When this circuit is selected and the associated sender closes the fundamental circuit for incoming brush selections, the incoming L relay and sender ST relay are operated. The L relay operated, operates the T relay which locks and advances the sequence switch to position. 2

6. BRUSH SELECTION

In position 2 with the L and T relays operated, the updrive magnet is energized and the brush rod moves upward for brush selection. During the upward travel of the brush rod, the "A" commutator causes ground impulses to be connected to the tip of the fundamental circuit which holds the L relay operated, but short-circuits the stepping relay in the sender, causing a predetermined number of counting relays to operate. When the sender has been satisfied, the fundamental circuit is opened in the sender and the L relay releases, in turn releasing the

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T relay, stopping the updrive and advancing the switch to position 3.

7. GROUP SELECTION

In position 3 the trip magnet operates, ready to trip the selector brush on the next upward movement of the brush rod. The fundamental circuit is closed again operating relay L which in turn operates and locks relay T. Relay T operated advances the switch to position 4. The B commutator is connected to the tip side of the fundamental circuit, the C commutator is connected to the S winding of the T relay and the updrive magnet is again energized. The selected multiple brush is tripped and the elevator rod moves upward in position 4. The T relay is held both from the contact of the L relay under control of the sender and by the C commutator. During the upward travel of the brush rod the B commutator causes ground pulses to be connected to the tip of the fundamental circuit which holds the L relay operated, but short-circuits the stepping relay in the sender causing a predetermined number of counting relays in the sender to operate. As soon as the sender has been satisfied the fundamental circuit is opened, the L relay releases and removes its control over the T relay. The C commutator prevents the release of the T relay until the elevator rod has traveled high enough for the locking panel to engage the rack when the updrive releases. When the C commutator circuit is broken, the T relay releases, stops the updrive and advances the switch to position 5.

8. TRUNK HUNTING

In position 5 the T relay operates thru its primary winding in series with the tertiary winding. The T relay operated, connects its secondary winding to the sleeve in positions 5/7 and advances the switch to position 6. If the final trunk is idle, the T relay releases as soon as the switch advances out of position 5 and immediately connects ground to the sleeve terminal thru its back contact in positions 5/7. With the switch in position 6 and the T relay released, the switch advances to position 7. The L relay then operates and advances the switch to position 8. Busy ground is connected directly to the sleeve terminal of the selected trunk in positions 6-3/4/12. The C commutator is connected to the primary winding of the T relay in position 6 but ground is not connected to this commutator unless the T relay is operated. The C commutator has no function when the first trunk of the group is idle. If the first trunk of a group is found busy, the T relay is locked thru its secondary winding to the grounded sleeve terminal of the busy final. The primary winding is connected to the C commutator and the updrive magnet is energized under control of the operated T relay. The T relay holds and the elevator rod travels upward until an idle terminal is reached after which the circuit is opened thru the secondary winding of the T relay. The C commutator opens the circuit to the primary winding of the T relay when the elevator rod has traveled high enough to insure proper centering. The T relay then releases and opens the circuit to the updrive magnet and advances the switch to position 7, which in turn operates the D relay. The L relay then operates and advances the switch to position 8.

9. SELECTIONS BEYOND

In position 7-1/2/8 the L relay holds to ground on the ring lead from the final selector. In position 8 the tip of the fundamental is closed thru from the sender to the final selector and ground at the N cam completes the fundamental circuit.

10. NO TEST OPERATION

In position 8 the (NT) resistance to battery is connected to the ring lead to the final selector and when the final advances at the completion of selections this battery condition causes operation of the final (PBX) relay thereby causing the final to seize the called line regardless of whether the line is busy or idle.

11. INCOMING ADVANCE

When final selections are completed, the final selector removes the ground from the ring lead and releases the L relay which in turn advances the switch to position 9. In position 9 the L relay is connected to the ring side and ground is connected to the tip side of the fundamental circuit so that when the sender closes the fundamental circuit, the incoming L relay operates. The L relay operated operates the T relay which locks and in turn releases the D relay. The D relay is slow release to allow sufficient time for the sender relays to operate. The D relay released advances the switch to position 10 and the A cam then advances the switch to position 11.

12. CHARGING OF CABLE CAPACITY AND TRUNK CLOSURE

In positions 10/10-1/4 battery thru the 750 ohm winding of the T relay is supplied to the tip and direct ground to the ring to charge the cable capacity before the application of the A relay for the trunk closure test. As the switch passes position 10-1/2, battery and ground thru the A relay and retardation coil is applied to the fundamental tip and ring respectively to await trunk closure in the

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sender circuit. When the sender closes the fundamental for trunk closure, the A relay operates and in turn operates the D relay. The D relay operates the T relay thru its primary and tertiary windings. The T relay operated, locks and advances the switch to position 12. As the switch leaves position 11 the ground for the A relay is supplied from the operated contact of the D relay.

13. LISTENING

With the switch in position 12, the tip and ring of the trunk are closed thru from the cord circuit to the final. Condensers (T) and (R) are provided to prevent interference with a conversation in progress on a busy connection on which the operator is listening.

14. REGULAR DISCONNECT (Figs. 1 and A)

When the A operator disconnects by removing the plug of the cord circuit from the jack, relay A releases and in turn releases relay D. The D relay released disconnects ground from relay A to prevent its operation until this circuit is restored to normal, and advances the switch to position 13. The A cam then advances the switch to position 14 and 15. Ground on the D relay normal advances the switch to position 16. In position 15-1/2 to 16, the trip magnet is operated to prevent snagging brushes while the elevator rod is returning to normal. In position 16, ground is connected to both the tip and ring to discharge the trunk cable, and the down drive magnet operates to restore the elevator rod to normal. When the elevator rod returns to normal, ground on the "Y" commutator advances the switch to position 17. Ground on the D relay normal advances the switch to position 18 and ground on the T relay normal then advances the switch to position 1.

15. REGULAR DISCONNECT (Figs. 1, B and Z option)

When the A operator disconnects by removing the plug of the cord circuit from the jack relay A releases and in turn releases relay D. Relay D released connects ground to the sleeve of the outgoing trunk as a busy indication to the A operator, and also connects ground to the NT interrupter. When the interrupter contact (F) closes, a circuit is established for operating the (W) relay of the (Z) and (W) combination, closing the windings of the (T1) and (T2) relays to ground. Assuming that the line busy with talking battery connected to the T or R lead, the (T1) or (T2) relay will operate, depending on which side of the trunk is connected to battery. When contact (F) of the interrupter opens, the (Z) relay operates in series with the (W) relay, maintaining the connection of the (T1) or (T2) relay to the trunk. If either of the test relays (T1) or (T2) is operated when contact (B) of the interrupter closes, the (W) relay will be shunted and the (Z) relay will remain operated, maintaining the (T1) and (T2) relays closed to the trunk. When contact (B) of the interrupter opens, the (Z) relay releases and the circuit remains as before. This cycle of operation is repeated as long as the line remains busy. When the called line is restored to normal, the cycle before related repeats, with the exception that the (T1) or (T2) relay fails to operate and the (Z) and (W) relays are not released so that when contact (F) of interrupter (NT) closes the second time in any cycle, ground from the D relay normal, thru the F interrupter contacts thru the Z relay operated contacts advances the switch to position 13. From this point on circuit disconnects as described in the paragraph covering "Regular Disconnect (Figs. 1 and A)".

16. OVERFLOW

If all the trunks in a group test busy while the updrive magnet is energized in trunk hunting position, the elevator rod is driven to the top terminals of a group which are overflow terminals. Ground is never connected to the overflow sleeve terminal; therefore the T relay releases when this terminal is reached, releasing the updrive magnet and advancing the switch to position 7. In position 7 the L relay operates and advances the switch to position 8. In position 8 the D relay operates and holds. Ground on the Z commutator then advances the switch to position 9. In position 9 the L relay and sender relays operate as described for incoming advance on regular calls. The sender, not having completed selections, recognizes this as a premature reversal of battery, and signals an overflow to the A operator. The circuit then returns to normal as described under the paragraph "Regular Disconnect".

17. TELL TALE

If the selector is driven to tell tale in any of the updrive positions, ground on the X commutator advances the switch to position 9. When the sender closes the fundamental circuit, the L relay operates and the circuit restores to normal as described under the paragraph covering "overflow".

18. FINAL TELL TALE

If the associated final selector is driven to tell tale position under conditions where the sender is not satisfied the final selector advances and removes ground from the ring of this circuit releasing the (L) relay advancing the switch to position 9 where reversed battery is closed to the sender. A reversal of the tip and ring potential prior to the completion of units

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selection is recognized by the sender as an overflow condition. The incoming selector then releases as described in the paragraph covering "overflow".

19. SELECTOR GROUP REGISTRATION

As the sequence switch advances thru position 17, ground is connected to lead GR to operate a group register in the miscellaneous register circuit. This register records all of the calls which are completed thru a group of trunks.

20. ALL TRUNKS BUSY REGISTRATION

When the circuit is normal (sequence switch in position 1) ground is connected to the PBR lead to the miscellaneous register circuit. When all circuits in a trunk group are busy they will be in an off normal condition and ground will be removed from the PBR lead and cause a register in the miscellaneous register to operate and record on all trunks busy condition.

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