

THIS APPENDIX WAS PREPARED FROM ISSUE 31 OF DRAWING ES-226378

METHOD OF OPERATION

Panel System - District Selector - For Coin Lines, with Message Register -
If Specified, Battery Grounded at End - For Panel Linefinder.

In paragraph 2.1 change second sentence to read: - "For subscriber's supervision the maximum external loop is 1500 ohms."

In paragraph 3.1 change "idle sender selector." to read "idle sender."

Change paragraph 4.1 to read, "A subscribers sender circuit, start circuit and incoming circuit, of line finder sender selector type, and a district release circuit."

In paragraph 11 at the end of the last sentence change "through cams H and C" to read, "through cams H and G."

In paragraph 12 change portion of line 17 which reads "(C) closes the sender control," to read "(C) operates the (CI-1) relay which closes the sender control," and change portion of line 20 which reads "relay in the sender." to read, "relay in the sender over the "FT" lead."

In paragraph 15.3 change portion of line which reads "from the commutator feed bar, (G) releasing the UP magnet" to read, "from the commutator feed bar, (C) releasing the UP magnet."

In beginning of paragraph 28 change "Should the calling subscriber ---" to read, "When "M" wiring is furnished should the calling subscriber ---"
Add the following to paragraph 28,

When "V" or "Y" wiring is furnished, if the calling subscriber fails to disconnect, ground from the back contact of the (CS) relay causes the district release circuit to function and connect this ground to lead 2, operating the "F" relay, which releases the (DC) and (D) relays, causing the district to restore to normal, in the case of "V" wiring for dial tone first lines, or operating the (L) relay and causing the district to advance to overflow position 15 and give the subscriber overflow tone in the case of "Y" wiring for coin first lines. In this case, the selector time alarm operates in position 15, and when the subscriber hangs up, the coin is collected and the district is restored to normal as covered in paragraphs 20, 21, 23, 25 and 27.

Add paragraph 36 which reads:
36. SELECTOR GROUP REGISTER

With "Z" wiring, when the district switch passes thru position 7-1/2, with relay (SL) operated, and relay (F) released, ground is connected to the selector group register which operates and registers

the number of calls handled by the group of districts. The register is not operated for calls abandoned before position 7-1/2 is reached - that is, with relay (SL) released or relay (F) operated in position 7-1/2. Without "Z" wiring, the register operates from a direct ground in position 16-1/2, thereby registering each time the district switch is rotated, regardless of when disconnection occurs.

In paragraph 3.1 change second sentence to read: - "For subscriber's supervision the maximum external loop is 1800 ohms."
In paragraph 3.1 change "idle sender selector." to read "idle sender."
Change paragraph 3.1 to read, "A subscriber sender circuit, start circuit and incoming circuit of line finder sender selector type, and a district release circuit."
In paragraph 11 at the end of the last sentence change "through ohms H and C" to read, "through ohms H and C."
In paragraph 12 change portion of line IV which reads "(C) closes the sender control," to read "(C) operates the (C1-1) relay which closes the sender control," and change portion of line 20 which reads "relay in the sender," to read, "relay in the sender over the 'RT' lead."
In paragraph 13.3 change portion of line which reads "from the contactor lead bar, (C) releasing the UP magnet" to read, "from the contactor lead bar, (C) releasing the UP magnet."
In beginning of paragraph 23 change "Should the calling subscriber to read, "When 'M' wiring is furnished should the calling subscriber - - -" Add the following to paragraph 23,

When "V" or "Y" wiring is furnished, if the calling subscriber fails to disconnect, ground from the back contact of the (C2) relay causes the district release circuit to function and connect this ground to lead 2, operating the "Y" relay, which releases the (D2) and (D) relays, causing the district to restore to normal, in the case of "V" wiring for dial tone first lines, or operating the (L) relay and causing the district to advance to overflow position 15 and give the subscriber overflow tone in the case of "Y" wiring for coin first lines. In this case, the selector time alarm operates in position 15, and when the subscriber hangs up, the coin is collected and the district is restored to normal as covered in paragraphs

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With "E" wiring, when the district switch passes thru position 7-1/2, with relay (SL) operated, and relay (F) released, ground is connected to the selector group register which operates and registers

This Method of Operation was Prepared from Issue 25 of Drawing ES-226378

METHOD OF OPERATION

DISTRICT SELECTOR

For Coin Line with Message Register if Specified, Battery Grounded at End For
Panel Line Finder - Panel System

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is arranged to find the calling subscriber's line and connect it with the various switching apparatus necessary to complete a call.

2. WORKING LIMITS

2.1 This circuit has an external circuit loop resistance of 5600 ohms maximum. For trunk supervision the maximum external loop is 900.

OPERATION

3. PRINCIPAL FUNCTIONS

The principal functions of this circuit are:

- 3.1 To find the proper line and start the sender hunting for an idle sender selector.
- 3.2 To establish talking connection.
- 3.3 To supply talking battery to the calling station.
- 3.4 To select an idle sender.
- 3.5 To connect battery for the operation of the message register in the line circuit on a charged call.
- 3.6 To connect a busy tone to the calling station, if required.
- 3.7 To collect or return the coin.

4. CONNECTING CIRCUIT

This district selector circuit will function with:

- 4.1 A standard subscribers sender circuit, a standard line circuit, start circuit and standard incoming circuit.

DESCRIPTION OF OPERATION

5. INITIAL OPERATION

When the receiver at the calling station is removed from the switch-hook, various relays in the line circuit operate and connect battery to the H terminal of the line at the finder multiple bank. When ground is connected to the ST lead the (IF) relay operates, and (a) locks through its windings in series to ground on the make contact of the (H) relay, (b) closes a circuit over lead Y operating the (GA) relay in the starting circuit, (c) operates the UP magnet, causing the line finder selector to travel upward and hunt for the terminal of the calling line, to which battery is connected, (d) closes a circuit for operating the (CI) relay.

6. FINDING A SENDER

As the line finder selector starts upward, hunting for the calling line, a circuit is closed through the M commutator slightly after the brushes of the selector move off-normal. Ground on the M commutator brush and segment, operates the line finder (E) relay. The (E) relay operated, (a) operates the (ID) relay, (b) closes a circuit from ground on the upper inner contact of cam I, make contact of the (E) relay, to battery through the inner winding of the (D) relay, operating the (D) relay, (c) opens the operating circuit of the (CI) relay, thus permitting the relay to release if the test brush of the sender selector is making contact with the test terminal of an idle sender. If the test brush of the sender selector is making contact with the test terminal of the busy sender, the (CI) relay locks through its outer winding, the lower contacts of cam S, make contact of the relay to ground on the test brush of the sender selector. With the (CI) relay held operated, the operation of the line finder (E) relay also closes a circuit operating the (F) relay in the line finder circuit and the sender selector (STP) magnet. This circuit is traced from battery through the 1000 ohm winding of the (F) relay and through the windings and break contact of the STP magnet, make contacts of the (CI) and (E) relays to ground on cam H, thereby stepping the sender selector brushes one step on its back stroke. If the next sender circuit is idle the (CI) relay releases, in turn stopping the selector, but if the next terminal is busy, the (CI) relay remains operated and the sender selector continues to step until an idle sender terminal is found. When the (CI) relay releases, the test terminal of the selected sender is immediately made busy to all hunting sender selectors by ground connected to the test brush from cam H, through the make contact of the (E) relay and the break contact of the (CI) relay. This busy ground is connected until the switch advances from position 1 1/4. The operation of the (F) relay opens the tip and ring leads between the line finder commutator and the district circuit, and prevents the district (L) relay from operating and advancing the

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district switch from normal, should the line finder selector connect to the terminals of the calling line before the sender selector finds an idle sender.

7. MAKING DISTRICT BUSY

The (MB) relay operated (a) locks from ground on the armature and outer make contact of the (STA) relay in the START circuit, lead X, make contact, and through the outer winding of the (MB) relay, to battery on the break contact and armature of the (SL) relay, so that the (MB) relay will not release should the selector return to normal while another call is going through, (b) closes a circuit from ground through the make contact of the (LF) and (MB) relays, to battery through the 800 ohm winding of the (F) relay, which operates if the relay was not previously operated, (c) connects ground on its armature to the series circuit through the (MB) relays of the other selectors in the same group, thus permitting the operation, over lead CH of the (CA) or (CB) relay in the starting circuit, when all line finder selectors in the group are off-normal, (d) opens the circuit over lead Y, to prevent the (CA) relay from reoperating, (e) transfers the ST lead to the next line finder, which, if busy, transfers the call over the ST lead in the same manner until an idle line finder is reached.

8. RELEASING THE TRIP AND START CIRCUITS

As the line finder selector continues upward, at the end of the tripping zone, the K brush makes contact with K commutator and thus connects ground to the K lead. This ground short-circuits and releases various relays in the trip and start circuits. The trip and start circuits are thus released and the circuit over lead X is opened but the (MB) relay will not release as it is held operated through its operating winding.

9. FINDING THE CALLING LINE

When the selector brushes make contact with the terminals associated with the calling line, the (H) relay operates from battery in the trip circuit, over lead H, to the H multiple terminal and brush, outer contacts of cam W, winding of the (H) relay to ground on the break contact and armature of the (DS) relay. With the (H) relay operated, a 50 ohm non-inductive shunt is connected to its winding, to ground on its armature for the purpose of increasing the amount of current through the 500 ohm winding of the (O) relay, in the trip circuit thus speeding its operation. This is necessary on account of the very short time period during which the H brush makes contact with the H terminal before the circuit over the H lead is opened by the overthrow of the selector. The (H) relay operated, opens the circuit which holds the (LF) relay operated, but (LF) relay does not release immediately on account of a circuit being closed from ground on the C commutator brush and segment, to

battery through both windings of the (LF) relay in series. The (LF) relay is thus held operated until the brushes are centered on the terminals of the calling line. When the circuit through the C commutator segment is opened, the (LF) relay releases and (a) opens the circuit through the UP magnet, which stops the selector brushes on the terminals of the calling line, (b) opens the circuit through the 800 ohm winding of the (F) relay so that when the circuit through its 1000 ohm winding is opened, by the release of the (CI) relay when the district sender selector seizes an idle sender, the (F) relay releases, (c) closes a circuit operating the (SL) relay. This circuit is traced from ground on the M commutator, break contact of the (LF) relay, make contact of the (E) relay, winding of the (SL) relay, cam T, make contact of the (D) relay to battery on the break contact of the (DS) relay.

10. THE ADJUSTMENT OF THE "C" COMMUTATOR BRUSH

The adjustment of the "C" commutator brush, with relation to the tripped "H" multiple brush, is such that it does not break contact with the "C" commutator segment until slightly after the holding circuit through both windings of the (LF) relay is opened by the operation of the (H) relay when the H brush makes contact with the H terminals to which battery is connected. The UP magnet, therefore remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the line terminals, allowing the locking pawl to enter the notch on the rack attached to the brush support rod. At this time, the holding circuit through both windings of the (LF) relay is opened at the "C" commutator, releasing the relay. The (LF) relay released, releases the UP magnet. The selector then drops into place, thus centering the brushes on the line terminals.

11. ADVANCING SWITCH TO POSITION 2

The (SL) relay operated closes a circuit which operates the (L) and (CH) relays. This circuit is traced from ground on the N commutator brush and segment, through the break contact of the (F) relay, make contact of the (SL) relay, cam O, to battery through the 600 ohm winding of the (CH) relay. The same ground is also connected through cam R to battery through the 800 ohm winding of the district L relay. The (CH) relay operated, closes a circuit from ground on cam H, break contact of the (CS) relay, make contact of the (CH) relay to battery through the selector time alarm circuit not shown, which performs no useful function at this time. The (L) relay operated, closes a circuit advancing the district switch to position 2. This circuit is traced from battery through the R magnet, cam B, make contact of the (L) relay, to ground through cam M. As the switch advances from position 1, the circuits through the (L) and (CH) relays are opened, releasing the relays and disconnecting the selector time alarm circuit, in position 1-1/2 to 2, the associated sender is held busy by ground through cams H, and G.

12. COMPLETING FUNDAMENTAL CIRCUIT

With the switch in position 2, the tip and ring leads are closed from the calling line to the tip and ring leads of the associated sender circuit, thus permitting the dialing tone to be transmitted back over the dialing circuit from the associated sender, as an indication that the apparatus is ready to receive the call by the operation of the station dial. The tip side of the dialing circuit is closed from the tip of the line, through the break contact of the (F) relay, cam P, to the tip brush of the sender selector. The ring side of the dialing circuit is closed from the ring lead of the line, through the break contact of the (F) relay, winding of the (DC) relay, cam Q to the R brush of the sender selector. In position 2, the (CI) relay operates through its outer winding to ground on cam S, and remains operated until the switch advances from position 10. The (CI) relay operated, (a) connects ground through the inner contacts of cam S, to the test brush of the sender selector, thus making the associated sender test busy after the switch advances from position 2, (b) closes the tip side of the fundamental circuit through to the sender, (c) closes the sender control (SC lead) through cams V and U, to battery through the outer winding of the (D) relay. After the sender functions, the fundamental circuit is established for the operation of the district (L) relay and the stepping relay in the sender. This circuit is traced from ground in the sender circuit, through the FT brush, make contact of the (CI) relay, cam L, to battery through the 1200 ohm winding of the (L) relay, which operates. The (L) relay operated, locks through its 1200 ohm winding and make contact through cam L, and the same ground over the FT lead and advances the switch to position 3 from ground on cam M. The 600 ohm winding of the (CH) relay is also connected through cam U, in parallel with the winding of the (D) relay. Should the (CH) relay operate at this time due to a high resistance ground in the sender circuit, no useful function will be performed.

13. DISTRICT BRUSH SELECTION

With the switch in position 3, the UP magnet is operated for brush selection over a circuit traced from battery through the windings of the magnet, cam C, make contact of the (L) relay, to ground on cam M. As the selector moves upward in position 3, carrying the commutator brushes over the commutator segments, the A segment and brush intermittently connects ground to the tip side of the fundamental circuit through cams K and L, 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 through the UP magnet, thereby stopping the upward movement of the selector and advances the switch to position 4. This circuit is traced from

ground through cam M, break contact of the (L) relay, cam B, to battery through the R magnet. When two digit senders are used with this circuit, the advance of the sender replaces the high resistance on the SC lead with a 500 ohm ground, thus insuring the operation of the (CH) relay. In position 4, the trip magnet (TM) is operated from ground through cam S, and the (L) relay is operated and locked to ground on the fundamental circuit previously described, advancing the switch to position 5.

14. DISTRICT GROUP SELECTION

With the switch in position 5, the UP magnet is reoperated and the trip magnet being operated, causes the previously selected set of brushes to trip when the selector starts upward as the set of brushes trip the finger which was previously operated by the trip magnet. As the selector moves upward for group selection, carrying the brushes over the commutator segments, the B segment and brush intermittently connects ground to the tip side of the fundamental circuit through cam L holding the district (L) relay operated, but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its operation until the proper group has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay which in turn opens the circuit through the UP magnet and advances the switch to position 6. When three digit senders are used with this circuit, the advance of the sender replaces the high resistance ground on the SC lead with a 500 ohm ground, thus insuring the operation of the (CH) relay. With the switch in position 6, a circuit is closed from ground on the line finder N commutator, brush and segment, through the break contact of the (F) relay, make contact of the (SL) relay, inner contacts of cam O, cam R, to battery through the 800 ohm winding of the (L) relay, operating the relay. The (L) relay operated, advances the switch to position 7, in a circuit from battery through the R magnet, cam B, make contact of the (L) relay, cam M, make contacts of the (D) relay, to ground.

15. TRUNK HUNTING

15.1 With First Trunk Idle

Should the first trunk in the group in which the selector is hunting be idle, the (L) relay releases as the switch leaves position 6 1/4. When the switch enters position 6 1/2, ground is connected to the sleeve of the selected trunk through cam M, break contact of the (L) relay, cam E, as a busy condition until the switch advances to position 7 3/4.

15.2 With First Trunk Busy

Should the first trunk in the group in which the selector is hunting be busy, the (L) relay is held operated in a circuit

from battery through its inner winding and make contact, cam E to ground on the sleeve terminal of the busy trunk. With the switch in position 7, the UP magnet is reoperated from ground on cam M, under control of the (L) relay, and the selector travels upward until an idle trunk is found. When the idle trunk is found, the locking circuit through the inner winding of the (L) relay is opened but the relay does not release immediately, due to a circuit being closed from battery through its outer winding, cam R to ground through the C commutator brush and segment. When the brushes are centered on the trunk terminals, the circuit through the C commutator segment is opened and the (L) relay releases and opens the circuit through the UP magnet, which stops the selector brushes on the terminals of the selected trunk. The (L) relay released, also advances the switch to position 8.

15.3 "C" Commutator

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, until slightly after the holding circuit through 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, therefore, 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 through the outer winding of the (L) relay is opened, at the "C" commutator, releasing the relay which disconnects ground from the commutator feed bar, (G) releasing the UP magnet. The selector then drops into place thus centering the brushes on the trunk terminal. During trunk hunting, in position 7 only, the commutator feed ground is supplied from ground on cam M 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.

16. SELECTION BEYOND

As the switch advances to 7 3/4, ground through cam E is connected to the sleeve of the selector trunk as a busy condition. With the switch in position 8, a circuit is closed from ground on the armature and make contact of the (CH) relay, through cam O, cam R to battery through the outer winding of the (L) relay, which operates advancing the switch to position 9. In position 9, the tip and ring sides of the outgoing fundamental circuit are closed through the tip and ring terminals of the selected trunk for selection beyond, through the UP

and FR brushes of the sender selector and cams F and G respectively. After the selection beyond has been completed, ground in the sender is removed from the SC lead, releasing the (CH) relay, in turn releasing the (L) relay. The (L) relay released, advances the switch to position 10. As the switch leaves position 9 1/2, the dialing circuit is opened at cams P and Q and, in position 9 3/4, the tip and ring leads from the line finder are closed through cams P and Q respectively to 24 volts battery and ground in the district, holding the (DC) relay operated, under control of the station switchhook. With the (DC) relay operated, a locking circuit is closed for the (D) relay after a switch advances from position 10. This circuit is traced from battery through the inner winding of the (D) relay, make contact of the (DC) relay, make contact of the (D) relay to ground. The (D) relay (178-AK) is made slow in releasing in order that the connection may not be lost if the switchhook at the called station is momentarily depressed.

17. TALKING SELECTION

With the switch in position 10, the sender circuit functions and connects ground to the FT lead, causing the (L) relay to operate and lock through its inner winding over the tip of the fundamental circuit previously described. The (L) relay operated, advances the switch to the talking selection position until the (L) relay is released by the operation of the sender circuit. As the switch advances, ground is intermittently connected to the tip side of the fundamental circuit, through cam E, holding the (L) relay operated, but successively short-circuiting and permitting the reoperation of the stepping relay in the sender circuit. 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 through the R magnet, stopping the switch in position 11, 12 or 13 depending upon the class of call. As the switch leaves position 10, the holding circuit of the (CI) relay is transferred from ground on cam S to ground on cam E under the control of the (L) relay. This circuit is traced from battery through the inner winding of the (CI) relay, inner contacts of cam U, make contact of the (OI-1) relay, cam V, make contact of the (L) relay to ground through cam E. The release of the (L) relay opens the holding circuit through the (CI) relay, disconnecting the sender from the district circuit.

18. CALLED PARTY ANSWERS

When the receiver at the called station is removed from the switchhook, with the switch in position 11 or 12, reversed battery and ground from the incoming circuit operates the (CS) relay. The (CS) relay operated, closes a circuit from ground on cam I, through the make contact of cam N, winding of the (I) relay, to battery through the #3 contact of the interrupter. When the interrupter contact closes, the I relay operates and locks on the same ground through its make contact. When the #4 contact of the interrupter closes, the operation of the (I) relay closes

a circuit from ground on the interrupter contact to battery through the 600 ohm winding of the (CH) relay, operating the relay. The (CH) relay operated, locks through its winding, cam O, to ground on its make contact and armature. The interrupter is so connected in the circuit that the operation of the (CH) relay is delayed for at least two seconds after (CS) relay operates. This delay is to prevent the false operation of the (CH) relay should the (CS) relay operate momentarily before the called party answers due to any line disturbances.

19. OPERATOR ANSWERS

The switch advances to position 13, as described above and when the operator inserts the plug of an answering cord in the answering jack of the trunk, the (CS) relay operates on reverse battery and ground, over the trunk. The (CS) relay operated, closes a circuit from ground on cam I, through cam R, to battery through the outer winding of the (L) relay, which operates and advances the switch to position 14. With the switch in position 14, the repeating coil and battery are disconnected and the T and R leads are connected directly to the T and R brushes of the selector through cam P and Q, respectively. As the switch enters position 13 1/2, the (L) relay locks in a circuit from ground over lead S of the selected trunk, through cam E, to battery through the make contact and inner winding of the (L) relay, and in position 14, the locking circuit through the inner winding of the (D) relay is transferred from the contacts of the (DC) relay to the contacts of cam J. In position 14, a checking tone circuit is closed over the sleeve of the operator's trunk, cam E, make contact of the (L) relay, cam V and cam Y, 2 mf condenser, cam X, the S brush and terminal at the line finder bank, to ground through the winding of the (CO) relay in the line circuit for number checking.

20. DISCONNECTION - REGULAR CALLS

When the receiver at the calling station is replaced on the switch-hook, the (DC) relay releases, in turn releasing the (D) relay. The (D) relay released, closes a circuit to battery through the R magnet, advancing the switch to position 16.

21. SELECTING ANOTHER SENDER

On Message Register and Coin District Circuits, the (CI) and (CI-1) relays operate while the switch is passing through positions 14 3/4 to 15 1/2 and another sender is selected in a manner similar to that described in paragraph 6 except that the (CI) relay operates in a circuit from battery through its inner winding make contact of the (E) relay to ground on cam I. The ground to hold the Test terminal of the sender busy after the release of the (CI) relay is connected through cam H until the switch advances from position 16 1/2 and through cams C and M and relays (L) and (D) until the switch enters position 17. When an

idle sender is found the (CI) relay releases and operates the (L) relay. If the call has been completed, the (CH) relay will have operated in position 11 or 12, and as the switch enters position 16 a circuit is closed to the Selector Time Alarm Circuit, thus giving an alarm if a sender is not selected in a reasonable length of time. With the switch in position 16, the (D) relay operates and when the (CI) relay releases the (L) relay operates and advances the switch to position 17.

22. MESSAGE REGISTERING

On message register district circuits, with the switch in position 17, a circuit is closed from battery, make contact of the (SL) relay cam T, through the three 18-AN resistance, in parallel, make contact of the (CH) relay H brush and terminal at the line finder bank over lead H, through the break contact of the (L) relay to ground through the message register (MR), operating the message register. During the message registering period, another line finder selector hunting over the line terminals in the same group will not stop its brush on the multiple terminals of this line at this time on account of its H relay being shunted by the 5 ohm message register, while the H brush of the hunting selector is passing over the H terminal of the line.

23. COLLECTING THE COIN

With another sender selected as described in paragraph 21 and with the switch in position 17, the (CI) relay operates in the same manner as previously described. The (CI) relay operated, operates the (CI-1) relay. When the switch stopped in position 11 or 12 for talking, the (CS) relay operated when the receiver was removed from the switchhook at the called station and in turn closed a circuit operating the (CH) relay. The CH relay operated, locks and remains locked until the switch leaves position 17 1/4. With the (CH) relay operated and the switch in position 17, ground is connected to the FR lead, causing the sender to function and connect the coin collect battery to the T and R leads of the sender circuit, inner contacts of cams P and Q over the T and R leads to the subscriber's station.

24. RETURNING THE COIN ON UNCOMPLETED CALLS

If the receiver was not removed from the switchhook at the called station, the (CH) relay does not operate, therefore ground is not connected to the FR lead of the sender, but the sender functions and connects "coin return" battery over the T and R leads of the sender, to the subscriber's station, returning the coin. With the switch in position 17, the (D) relay releases differentially due to a circuit being closed from battery through its outer winding, upper outer and lower inner contacts of cam U, make contact of the (CI-1) relay, lower contacts of cam V, to ground in the sender circuit over the SO lead.

25. RETURNING THE COIN ON NO CHARGE CALLS

When the switch stops in position 13 or 14 for talking selection, the (CH) relay does not operate, since the call is to an operator, and therefore the coin is returned in the same manner as previously described.

26. RESTORING THE DISTRICT TO NORMAL

When the coin has been returned or collected, the sender circuit advances and connects ground to (SC) lead causing the (D) relay to release. The (D) relay released, advances the switch to position 18. As the switch enters position 18, a circuit is closed through the DOWN magnet, from ground on the break contact of the (D) relay, upper contacts of cam D to battery, causing district selector to return to normal.

27. RESTORING THE LINE FINDER SELECTOR TO NORMAL

With the switch in position 18, another circuit is closed from ground on the M commutator, outer winding of the (DS) relay, inner contacts of cam N, break contact of the (D) relay to battery on the break contact of the (DS) relay, operating the (DS) relay. The (DS) relay operated, locks directly to the same battery through its make contact and closes a circuit energizing the line finder selector DOWN magnet, restoring the line finder selector to normal. As the switch advances from position 17 1/4 the (SL) relay releases and disconnects battery from the S lead of the line allowing the (CO) relay in the line circuit to release. The (DS) relay operated also closes a circuit operating the (F) relay. When the selector returns to normal, the circuit through the M commutator segment is opened, releasing the (E), (DS), (MB) and (F) relays, restoring the circuit to normal. When the district selector returns to normal, a circuit is closed from ground on its Y commutator to battery through the R magnet, advancing the switch to position 1 or normal.

28. DELAYED DISCONNECT

Should the calling subscriber fail to replace the receiver on the switchhook, after the called subscriber has disconnected, the release of the (CS) relay, due to the incoming trunk functioning, operates the selector time alarm circuit from ground through cam I, thereby notifying the switchman of the existing conditions.

29. DISCONNECTION TALKING TO OPERATOR

When the plug of the answering cord is in the trunk jack at the incoming end, ground is connected to the sleeve of the trunk to hold the district (L) relay operated. If the plug of the cord is removed from the trunk jack before the receiver at the calling station is replaced on the switchhook, the line relay in the trunk circuit will

operate, thereby holding the ground on the sleeve terminal of the trunk. When the receiver at the calling station is replaced on the switchhook, and the plug of the answering cord is removed from the trunk jack at the incoming end, the (DC) relay releases and ground is disconnected from the sleeve of the trunk, releasing the (L) relay, thus advancing the switch to position 15. As the switch advances from position 14 1/4, the locking circuit through the inner winding of the (D) relay is opened at cam J, releasing the relay. The (D) relay released, advances the district switch to position 16. From this point on, the line finder and district selectors are restored to normal as described in paragraphs 21, 25, 26 and 27.

30. DISCONNECTION ON ABANDONED CALLS

30.1 Disconnection Before Line Finder Selector Finds Frame

Should the calling subscriber replace the receiver on the switchhook before a hunting selector finds the line, the (L) relay in the line circuit releases, removing battery from the H terminals at the multiple bank. The release of the (L) relay releases various relays in the trip circuit but the relays in the start circuit will be operated and the circuit over the ST lead will be closed, thus causing the (LF) relay to operate and start the selector hunting. The selector will therefore travel to the top of the bank and when the H brush of the selector makes contact with the terminal of the H comb. shown on trip circuit at the top of the multiple bank the (H) relay operates. The (H) relay operated, releases the (LF) relay, which in turn releases the (F) relay and opens the circuit through the UP magnet, stopping the selector. The N commutator segment is opened with the selector brushes resting on the "H" comb. terminal to prevent the district switch from advancing from normal when the (F) relay is released. When the (F) relay releases, the (DS) relay operates from ground on the X commutator brush and segment, through its 1000 ohm winding. The (DS) relay operates the DOWN magnet, restoring the selector to normal.

30.2 Positions 2 to 6

If the receiver at the calling station is replaced on the switchhook while the district switch is in position 2 to 6, the dialing circuit is opened at the calling station, causing the sender circuit to function and connect ground to the SC lead, causing the (D) relay to release on account of the increased current flowing through the outer winding of the relay. The (D) relay is connected differentially, but does not release when its inner winding is connected directly to ground and its outer winding connected to ground in series with sufficient resistance. The (D) relay released, operates the (DS) relay, which restores the line finder selector to normal as described in the previous

paragraph. The (D) relay released, also opens the circuit through the SL relay which releases. The SL relay released, disconnects battery from lead S, releasing the CO relay in the line circuit and advances the district switch to position 6. With the district switch in position 6, a circuit is closed from same ground through cam D to battery through the DOWN magnet, operating the district DOWN magnet, restoring the selector to normal. When the selector reaches normal, ground on the Y commutator brush and segment, advances the switch to normal.

30.3 Positions 7 to 10

Should the receiver be replaced on the switchhook while the district switch is in any of these positions, the line finder circuit is restored to normal as previously described. Trunk hunting and selection beyond will take place in the same manner and the advance of the sender circuit advances the switch to position 10. In position 10, the release of the (D) relay advances the switch to position 16. From this point on the district selector and switch are restored to normal as described in paragraphs 21, 25, 26 and 27.

31. TELL-TALE - LINE FINDER

31.1 Brushes Not Tripped

Should the selector travel to the tell-tale position while hunting, due to the multiple brush not being tripped, the (F) relay remains operated through its outer winding. Ground on the X commutator brush and segment is thereby connected to the lead "To tell-tale circuit", giving a visual signal to the attendant. As the N commutator segment is opened at the tell-tale, the district is prevented from advancing from its normal position. The selector in this case is restored to normal manually by the attendant.

31.2 "S" Wiring

With the circuit connected per "S" wiring, the (LF) relay releases when the line finder reaches tell-tale, due to the N and C segments being open. The release of the (LF) relay releases the UP magnet, and also releases the (F) relay as soon as a sender has been found. The release of the (F) relay operates the (DS) relay which locks, operates the DOWN drive magnet and reoperates the (F) relay, returning the line finder to normal.

31.3 Brushes Tripped

Should the selector travel to the tell-tale position while hunting, with the multiple brush tripped, a circuit is closed

from battery in the trip circuit, terminal of the H comb. at the top of the multiple bank, H multiple brush of the line finder selector, cam W, winding of the (H) relay to ground on the armature of the (DS) relay, operating the H relay. The (H) relay operated, releases the (LF) relay, which in turn releases the (F) relay and UP magnet. The (F) relay released, opens the circuit through the tell-tale alarm and connects ground through the X commutator brush and segment, to battery through the 1000 ohm winding of the (DS) relay, which operates, in turn operating the DOWN magnet restoring the selector to normal. The receiver at the calling station being still removed the switchhook, the relays in the line circuit are still operated and the call goes through as a new call.

"T" WIRING

With the circuit connected per "T" wiring, the operating circuit for relay (DS) is held opened until relay (LF) has released, thus preventing simultaneous operation of the UP and DOWN drive magnet.

33. TELL-TALE DISTRICT SELECTOR

Should the selector travel to the tell-tale position during brush selection, ground on the X commutator is connected through cam B to battery through the R magnet, advancing the switch to position 8. Under this condition ground is disconnected from the SC lead in the sender, releasing the (CH) relay and the district remains in position 8 until it is restored to normal manually. If the district goes to tell-tale during group selection, ground on the X commutator advances the switch to position 8. In position 8, ground on the SC lead holds the (CH) relay operated which, in turn operates the (L) relay, advancing the switch to position 9. The (CH) and (L) relays remain operated and the district remains in position 9 until it is restored to normal manually.

34. OVERFLOW

If all the trunks in the group are busy, the district selector, while trunk hunting in position 7, will travel to the top of the group and rest on the overflow terminal. As the sleeve terminal at overflow is opened, the (L) relay released, in turn advancing the switch to position 8. With the switch in position 8, the (L) relay operates from ground on the armature of the (CH) relay, advancing the switch to position 9. In position 9, a circuit is closed from ground on the Z commutator, brush and segment, through cam K to battery through the R magnet and advancing the switch to position 10. In position 10, a circuit is closed from ground on the Z commutator brush and segment through cam K, to battery through the 1200 ohm winding of the (L) relay, operating the (L) relay. The (L) relay operated, locks through its 1200 ohm winding and make contact to the same ground, through cam L, advancing the switch to position 14. As the switch advances from position 13, the (L) relay releases and in position 14, it advances the switch to position 15. The release of the (L) relay also releases the (CI) relay,

disconnecting the sender from the district circuit. With the switch in position 15, a circuit is closed from the miscellaneous tone circuit over lead O through the 2 mf condenser, cam G, winding of the repeating coil, 2 mf condenser, cam Y, cam V, cam J, make contact of the (D) relay to ground. A tone is therefore induced in the other winding of the repeating coil, thus causing an "all trunks busy" tone to be sent back to the calling subscriber. When the receiver at the calling station is replaced on the switchhook, the (DC) relay releases, opening the locking circuit through the (D) relay, which releases. From this point on, the switch is advanced to position 1 as described for a regular call.

35. "O" COMMUTATOR

The function of the "O" commutator segment is to maintain an idle condition on the multiple overflow terminal so that more than one selector may stop on overflow at one time; otherwise the first selector reaching overflow will make the sleeve multiple terminals busy, thus causing the succeeding selectors to continue upward into the next group of trunks. The O commutator segment is opened at overflow but the S bar is continuous. Both the O and S commutator brushes are permanently strapped together and are wired to the multiple sleeve brush. When the selector is at overflow, the O commutator brush is resting on an open (dead) segment and as the busy ground is fed through the O commutator bar only, this arrangement maintains a non-busy condition on the sleeve terminals. When necessary to combine two or more groups of trunks, the multiple sleeve overflow terminals between the combined groups are made permanently busy by being connected to ground. As the S commutator bar is closed at overflow, the (L) relay is held operated, at this time, and the selector therefore hunts past the "make busy" terminals into the next group.

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