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METHOD OF OPERATION

District Selector Circuit - Line Circuit - Trip Circuit - Starting Circuit - Time Alarm Circuit and Line Finder Circuit for Flat or Ind. Message Rate Line - Panel Machine Switching System.

A, B and C wiring were added the functions of which are as follows:

"A" wiring includes the original arrangement, before "B" and "C" wiring were added.

"B" wiring includes an arrangement for returning the line finder from tell-tale and prevents simultaneous up and down drive trouble. With "B" wiring the (DS) relay is under control of the (LF) relay instead of being wired direct to the M segment so that it cannot operate and connect on the DOWN drive when the (LF) relay is operated. Also the (H) relay armature is wired to the N segment ground. The (LF) relay contact controlling the up magnet is wired direct to ground instead of through the N segment and the make contact of the (F) relay formerly wired to the tell-tale circuit is wired over leads 6 and 11 to the H lead at overflow and thereby insures the release of the trip circuit, with the above wiring changes when the line finder goes to tell tale without tripping a brush, the (LF) relay releases as the N and C segments are opened, thus releasing the UP-drive magnet and the (F) relay as soon as the sender is found. The release of the (F) relay operates the (DS) relay which locks and insures the return of the line finder elevator.

"C" wiring provides for eliminating the simultaneous operation of the UP and DOWN drive magnets only.

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METHOD OF OPERATION

District Selector Circuit - Line Circuit, Trip Circuit, Starting Circuit - Time Alarm Circuit and Line Finder Circuit For Flat or Ind. Message Rate Lines - Panel Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is arranged to Route calls, start Line Finders, Find Calling Subscribers Line, and connect it with various switching apparatus necessary to Complete a call.

2. WORKING LIMITS

2.1 This circuit has Maximum external trunk supervisory loop range of 5010 ohms. It is also used with subscribers loops of 900 ohm maximum and a minimum leak of 10,000 ohms.

2.2 This circuit has a maximum external loop resistance of 750 ohms and a minimum leak of 10,000 ohms with individual coin lines.

OPERATION

3. PRINCIPAL FUNCTIONS

3.1 Cause Starting Circuit Function.

3.2 Route Calls.

3.3 Find Calling Line.

3.4 Start Sender Selector.

3.5 Establish Talking Connection.

3.6 Provide Timing Alarm Feature.

4. CONNECTING CIRCUITS

4.1 Any Standard Incoming Circuit.

DESCRIPTION OF OPERATION

5. LINE AND TRIP CIRCUIT

5.1 Originating A Call

The operation of a call originating in the first ten lines of a group is as follows:- When the receiver at the calling station is removed from the switchhook, the (L) relay in the line circuit operates, through the 200 ohm resistance, winding of the (L) relay, contact of the (CO) relay, over the ring side of the subscriber's loop, back over the tip side to ground on the armature of the (CO) relay. The line relay (L) operated connects battery to the H terminal of the line and operates the (BA) relay through its inner winding. The (BA) relay operated, operates the (TR) relay from ground on the armature of the (BA) relay, break contact of the (K) relay, 700 ohm winding of the (TR) relay, to battery over the TR lead. The (TR) relay operated, (a) operates the two trip magnets, (b) opens the locking series circuit through the (TR) relays in the other bank groups and (c) locks through its 600 ohm winding to battery on terminal 1 and brush of the G group distributor selector in series with the (STA) relay in the start circuit.

5.2 STARTING A LINE FINDER

When the (STA) relay in the start circuit operates it starts a line finder hunting for the calling line. Each TRIP magnet operates its trip rod, thus tripping the corresponding group brushes of the associated selectors on its respective side of the frame. Ground on the K lead operates the (K) relay which, (a) Locks to ground on the armature of the (BA) relay under control of the (O) relay, (b) Opens the circuit through the 700 ohm winding of the (TR) relay, thus preventing another line finder selector from being started by this call (c) closes a circuit from the 1500 ohm winding of the (O) relay, but the (O) relay does not operate at this time on account of insufficient amount of current through the winding. As the line finder selector moves upward and at the end of the tripping tone, ground on the K commutator brush and segment, short circuits the 600 ohm winding of the (TR) relay. The (TR) relay released, closes the locking series circuit through the (TR) relay in the other groups and opens the circuit through the two trip magnets, which release.

5.3 Releasing The Trip Circuit

When the selector brushes make contact with the terminals associated with the calling line, battery on the H terminal operates the (O) relay. The (O) relay operated, opens the locking circuit of the (K) relay but the (K) relay is very slow in releasing and holds the (O) relay operated through the 1500 ohm winding in order to permit the (BA) relay to release before the (O) relay, otherwise another line finder may be started by this call. When the line has been found the district functions and connects battery to lead S, operating the (CO) relay. The (CO) relay operated, releases the line, (L) relay which in turn releases the (BA) relay thus opening a circuit, releasing the (O) relay. Another call may now start within this same group of ten lines if the starting circuit is ready for the call. The operation for a call originating in the last ten lines of a group of twenty, will be similar to that already described for the first ten lines except that the (BA-1), (K-1), (O-1) and (TR-1) relays are involved instead of the (BA), (O), (TR) and (K) relays.

5.4 Simultaneous Calls

If there is a simultaneous call in both the first and last ten lines of a group of twenty lines, the relays of both sub-groups will operate as already described, starting two line finder selectors in different sub-group at the same time. In this case, the line windings of the (O) and (O-1) relays are connected together through the make contacts of the (BA) and (BA-1) relays. The (O) and (O-1) relays will therefore operate in parallel when the H brush of either or both line finder selectors make contact with the H terminals of the calling line.

5.5 Message Register

On message register calls, a message register operates on battery over lead H.

5.6 Terminating Calls

When the final selector connects to the tip, ring and sleeve terminals of an idle line at the final multiple, battery through a resistance in the final circuit is connected over the S lead to ground through both windings of the (CO) relay (on individual lines or the last line of a group of consecutive lines) or through the 100 ohm winding of the (CO) relay on an intermediate line of a group of

consecutive lines. The (CO) relay operated, disconnects the (L) relay battery bridge from across the tip and ring of the line. When the final selector returns to normal, the circuit through the winding of the (CO) relay is opened, releasing the relay and restoring the circuit to normal.

6. STARTING CIRCUIT

6.1 Originating Call

When the receiver at the calling station is removed from the switchhook, various relays in the line and trip circuits operate, operating the (ST-A) relay from ground over lead I, terminal 1 and brush of the G group distributor selector, break contacts of the (C), (CA) and (SB) relays to battery through the 18-BH resistance in parallel with the winding of the (ST-A) relay. The (ST-A) relay operated, (a) operates the STP-G magnet, which remains operated until the (ST-A) relay releases, (b) short circuits the 500 ohm winding of the (CA) relay, preventing it from operating and starting a line finder in sub-group "B", while a call is going through, (c) connects ground to lead K and (d) closes a circuit over lead ST, thus starting a line finder hunting for the calling line.

6.2 Starting Line Finder

As the line finder starts upward a circuit is closed over lead Y operating the (GA) relay. The (GA) relay operated, removes ground from lead ST, locks to ground on the armature of the (ST-A) relay and closes a circuit operating the STP-A magnet. This circuit is traced from ground on the make contact of the (ST-A) relay, make contact of the (GA) relay, terminal and brush of the A-3 arc of the A selector, to battery through the winding of the STP-A magnet. The STP-A magnet remains operated until the release of the (ST-A) relay. Ground is also connected to lead CH operating the (CA) or (CB) relay when all line finder selectors in a group are off normal. As the line finder continues upward ground is momentarily connected to lead K, thus releasing a relay in the trip circuit but holding the (STA) relay operated. When the ground is disconnected from lead K, the (ST-A) relay releases and (a) opens the locking circuit through the (GA) relay, which releases, (b) opens the circuit over lead X, (c) opens the circuit through the STP-G magnet, which releases and steps the brushes of the G group distributor selector to the next terminals, (d) opens the circuit through the STP-A magnet, which releases and steps the brushes of the A group distributor selector to the next terminals, (e) removes the short circuit from the 500 ohm winding of the (CA) relay, but the (CA) relay will not operate unless all selectors in the group are busy.

6.3 Emergency Release of Start Circuit

If either the (ST-A) or the (ST-B) relay remains operated, due to the failure of the (TR) or (TR-1) relay in the trip circuit to be shunted out and released, the (KF) relay operates as soon as the interrupter contacts I, III and V close, and locks under control of the (ST-A) or (ST-B) relay. If it remains locked for two seconds, interrupter contacts II and IV close and connect ground to either the (TR) or (TR-1) relay in the trip circuit, (depending upon whether the call is through the "A" or "B" sub-group), releasing the (TR) or (TR-1) relay. When ground is removed by the opening of the interrupter contacts II or IV, the (ST-A) or the (ST-B) relay releases, releasing the (KF) relay and restoring the circuit to normal.

6.4 Start Circuit Alarm

The closure of the interrupter contact VI, which occurs at the same time contacts II and IV are closed, while the (KF) relay is operated, operates the (KA) relay. The (KA) relay operated, (a) locks under control of a key at the trouble desk, (b) lights a lamp at the trouble desk, individual to the line finder frame, and operates an alarm. The operation of the key releases the (KA) relay, extinguishing the lamp and silencing the alarm. The operation for a call originating in the last 10 lines of a group of 20 will be similar to that already described for the first 10 lines, except that the (ST-B) and (GB) relays are involved instead of the (ST-A) and (GA) relays.

6.5 All Selections In One Sub-Group Busy

If all the selectors in sub-group A, for example, are busy, the (CA) relay operates in a circuit from ground over lead CH, 500 ohm winding of the (CA) relay, to battery through the 600 ohm resistance C. The (CA) relay operated, transfers the circuit over lead 1 from the winding of the ST-A relay, to battery through the winding of the SA relay and the break contact of the SB relay. When a call is now received, the SA relay operates, in turn operating the (ST-B) relay. This circuit is traced from battery through the winding of the (STB) relay, make contact of the SA relay, 600 ohm resistance B, to ground on the armature of the (CH) relay. The (ST-B) relay operated, operates a relay in the district thus starting a selector in the "B" sub-group hunting for the calling line and closes a locking circuit through the 1000 ohm winding and make contact of the CA relay. This is to prevent the release of the (CA) relay should a selector become available in the "A" sub-group while a call is going through the "B" sub-group.

If all selectors in sub-group "B" are busy, the operation is similar except that the (CB) (SB) and (ST-A) relays now operate. The (ST-A) relay operated, starts a selector in the "A" sub-group hunting, as explained before.

6.6 All Selectors In Both Sub-Groups Busy

If all selectors in both sub-groups are busy, both the (CA) and (CB) relays are operated. Should a call be received in either sub-group under these conditions, the corresponding (SA) or (SB) relay operates, but neither the (ST-B) nor (ST-A) relay operates, as the circuits to ground on the armature of the (CA) and (CB) relays are open. When a call is received in the "A" or "B" sub-group while all selectors are busy, the special message register in the starting circuit operates through the make contact of the (SA) relay to ground on the armature of the (CB) relay, if the call is in sub-group "A", or through the make contact of the (SB) relay to ground on the armature of the (CA) relay, if the call is in sub-group "B". The message register thus indicates the number of calls which were originated while all the line finder selectors were busy.

6.7 Testing Line Finder Selector

This circuit, which is shown associated with the starting circuit, enables the testing of any particular line finder selector at any time. The test line used with the test box circuit for making the test is the first or bottom line of the bottom bank in both the "A" and "B" sub-groups, the first line terminal in both sub-groups being connected together. When the plug (shown on the line finder circuit) is inserted in the test jack of the line finder under test, the ST and ST-1 leads are connected together and the circuit that supplied battery to the ST lead is transferred to lead Z. When the plug of the test box cord is inserted in the test jack, the (A) relay operates from ground on the sleeve of the test box cord. The (A) relay operated opens the circuit to the (TR & TR-) relays and operates the (B) relay. The (B) relay is slow in operating to prevent a call which has just reached the (ST-A) or (ST-B) relay from being interrupted. The B relay operated, (a) locks to battery on its make contact (b) operates the (C) and (C-1) relays and (c) closes the ring side of the loop through the test box, which operates the (L) relay associated with the test line. The (C) relay operated (a) transfers the circuit for operating the (ST-A) relay from the G distributor selector bank, (b) opens the normal ST lead (c) connects

ground to lead Z, (d) opens the operating circuit for the (ST-B) relay, which would otherwise operate and lock on a call within the last 10 lines in the group. The (CI) relay operated (a) closes a circuit to the (TR) (TR-1) relays over the TR lead from battery on the armature of the STP-G magnet, (b) connects the K lead of sub-group "A" with the K lead of sub-group B, thus connecting the K commutator segments of all the selectors of both sub-groups together, (c) connects the Y lead of sub-group "A" with the Y lead of sub-group "B" so that the (GA) relay will be operated by a selector in either sub-group. When the (L) relay in the test line operates, the trip circuit functions and connects ground through the (TR) relay in trip circuit, make contact of the (CI) relay, break contact of the (STA) and (STB) relays to battery on the contact of the STP-G magnet, operating the relay in the trip circuit. When the (TR) relay in the trip circuit operates, it locks over make contact of the (C) relay, break contacts of the (CA) and (SB) relays to battery through the winding of the (ST-A) relay in parallel with the 18-BH resistance, operating the (ST-A) relay. The (ST-A) relay operated, operates the STP-G magnet which remains operated until the (ST-A) relay releases, (b) short-circuits the 500 ohm winding of the (CA) relay (c) connects ground to lead K, (d) operates the D relay and (e) closes a circuit from ground through the break contact of the (GA) relay, make contact of the (C) relay over lead Z to battery through a relay in the district thus causing the line finder to start hunting for the calling line. The (D) relay operated, locks to ground on the armature of the (A) relay. When the (ST-A) relay releases, the (E) relay operates from ground on the left inner armature of the (ST-A) relay, make contact of the (D) relay, to battery through the break contact and winding of the (E) relay. The (E) relay operated, (a) locks to ground on the armature of the (A) relay, (b) releases the (C) and (C1) relays, thereby restoring the starting circuit to normal, (c) closes the circuit from battery on the armature of the STP-G magnet, which was opened by the operation of the (A) relay and later closed by the operation of the (C1) relay, through to the (TR) and (TR-1) lead. When the plug of the test box cord is removed from the test jack, the A relay is released, releasing the (B), (D) and (E) relays, thereby restoring the test circuit to normal.

7. SELECTOR START WIRE ARRANGEMENT

7.1 Line Finder Distributor

The distributing selectors, A and B, are used for distributing calls uniformly to the line-finder selectors in sub-groups "A" and "B" respectively.

7.2 Less Than 40 Selectors For 400 Lines

When the number of line-finder selectors for a group does not exceed 40 selectors for each 400 lines, the starting circuit shall be equipped with two 200-R distributor selectors. Figure 1 shows these selectors wired and equipped for 16 line-finder selectors for each sub-group. When the operation of the (ST-A) relay in the starting circuit connects ground on the START (ST) lead, the LF relay (not shown) that operates, depends upon the terminal on which the (A) A bridging brush is resting. Assume the (A)A brush is resting on terminal #1 in the regular start circuit of sub-group "A". In this case, if the first selector is not busy, the associated LF relay (not shown) operates and starts a line-finder hunting for the calling line. If the first selector is busy, the associated MB relay will be operated and the circuit through the LF relay will be opened. In this case, the LF relay, associated with the next idle selector will operate. Assuming this to be the tenth selector, the circuit is then closed from ground on the (ST-A) relay (not shown) through the break contacts of the (GA) and (C) relays, the (A)A bridging brush and terminal #1 of the (A)A arc of the distributor selector, the ST lead, make contact of the first MB relay, the series make contacts of the succeeding operated MB relays, break contact of the tenth MB relay to battery through the inner winding of the LF relay (not shown) which operates. The operation of the (GA) relay operates the STP-A magnet from ground on the armature of the ST-A relay through terminal #1 and the (A)C brush to battery through the winding of the magnet, so that when the (GA) relay releases on the completion of a call, the STP-A magnet releases, in turn stepping the selector brushes one step and giving the next selector the preference. When the brushes of the distributor selector advance from the terminals of the last line-finder selector terminal 16, the selector is advanced over the spare terminals to the first terminal from ground on the strapped spare terminals through the (A)B brush. While the selector is advancing over the spare terminals, a call at this time will be routed to the first selector through the (A)A brush and strapped spare terminals by the strap from terminal 22 to terminal 1 on the (A)A arc.

7.3 More Than 40 Selectors For 400 Lines

When the number of line-finder selectors for a group exceeds 40 selectors for each 400 lines, the starting circuit shall be equipped with two 200-P distributor selectors. Figure 2 shows the selectors wired and equipped for 26 line-finder selectors for each sub-group. It will be noted that the ST leads from the first 15 line-finder selectors of each sub-group are connected in their respective

order to the first 15 terminals of the (A)A and (B)A arcs, and the ST leads of the last 11 line-finder selectors of each sub-group are connected in their respective order to the first 11 terminals of the (A)D and (B)D arcs. It will also be noted that the brushes of the first three arcs of each selector are in the opposite position from the brushes of the last three arcs so that only three brushes of a selector will be making contact with terminals at the same time, the other three brushes being open at that time. On a regular call in sub-group "A", the circuit functions as described for Figure 1, until the first three brushes of the A distributor advance from terminals 22. At this time, the first three brushes are open, and the last three brushes are now resting on the first terminal of the (A)D, (A)E) and (A)F arcs. The next call in this sub-group will then start #16 selector, if idle, hunting for the calling line. Assume that the last three brushes are resting on terminal 11 of the associated arcs, and the 26th line-finder selector is idle. The operation of the (ST-A) relay in the starting circuit closes a circuit from ground on its armature, break contacts of the (GA) and (C) relays. (A)D brush and terminal 11, over the ST lead through the break contact of the (MB) relay of the last or 26th line-finder selector in the sub-group to the associated LF relay. The operation of the (GA) relay operates the STP-A magnet through the (A)F brush and terminal 11. The release of the (ST-A) relay releases the STP-A magnet advancing the brushes to the next or terminal 12. Ground on spare terminals 12 to 22 through the (A)E brush advances the brushes of the selector until the first three brushes are resting on the first terminal of the (A)A, (A)B and (A)C arcs. While the selector is advanced over the spare terminals, a call at this time will be routed to the first selector through the (A)D brush and strapped spare terminals by the strap to terminal #1 of the (A)A arc. The number of line-finder selectors for a sub-group may thus be changed by changing the necessary strapping on the selector arcs. The operation for the emergency selector for sub-group "A", and the regular and emergency selectors for sub-group "B" are similar to the above.

8. GROUP DISTRIBUTING ARRANGEMENT

8.1 Wiring of Group Distributor Bank

The wiring of the group distributor arc of the regular "G" distributing selector bank, shown on the regular starting circuit, and of the emergency G distributor selector bank, is shown in detail in the circuit associated with the series circuit through the emergency jack and the contacts of the (TR) and (TR-1) relays for the 15 groups

of a panel line finder frame. For a complete frame of 300 lines, the wiring of the terminals for both arcs of each (G) distributor selector is shown. As a trip circuit is divided into two units, (A) and (B) calls originating in the first 10 lines of a group of 20 lines are connected through trip unit (A) and a terminal and brush of the (G) arc normally having access to the line finders in sub-group (A). Calls originating in the last 10 lines of a group are connected through trip unit (B) and a corresponding terminal and brush of the other arc normally having access to the line finders in sub-group (B). This arrangement permits the distributing of the 15 trip circuit (A) and (B) units to sub-groups (A) and (B), respectively, in the starting circuit, so as to give each group an equal preference, thus preventing any one group from having a permanent preference over the other groups. This is accomplished by the (G) selector being advanced one step to the next group after each call. The series circuit through the contacts of the (TR) and (TR-1) relays permits the passing of a call through a number of idle groups with the same speed as though the call originated on a line within the group having the preference at that time. Should two or more calls start in two or more groups at the same time, the group nearest the one having the preference at that time will be completed first, because of the series locking arrangement of the (TR) or (TR-1) relay holding the relay of this group locked and releasing the other relays.

8.2 Locking Circuit Through (TR) Relays

The (TR) relay in any group locks from ground through its 600 ohm winding and make contact, jack 10, terminal and brush of the associated arc of the (G) selector, to battery in the starting circuit through jack 15. The (TR-1) relay locks through its 600 ohm winding and make contact, jack 12, corresponding terminal and brush of the associated (G) arc, to the starting circuit through jack 16. Jacks 10 and 12 of each group circuit are wired to the selector arc terminals and jacks 9 and 11 loop to the next group circuit, so that though the selector may be giving preference to one group, this group being idle, and a call originates in some other group, a circuit is closed back through the intervening jacks and break contacts of the intervening relays of each group until the terminal which the distributor brush is resting on is reached. Assume a call originates in group 15, and is passing through trip unit (A) and the brushes of the (G) distributor selector arc are resting on the first group terminal, which is terminal 1. The locking circuit for the (TR) relay will

be as follows: Through the 600 ohm winding and make contact of the (TR) relay and jack 10 of group 15, jack 11, break contacts of the (TR-1) and (TR) relays, and jack 10 of group 14 (not shown, through all other groups in the same manner to jack 10 of group 1, terminal 1, and brush of the selector, to jack 15 of the starting circuit. It will be seen that if two calls start at the same time in two different groups causing the (TR) relays in the two groups to operate together, the call originating in the group nearest the one having the preference of the starting circuit will be completed first. For example, if a call started in group 10, trip unit (A), and other in group 15, trip unit (A), the operation of the (TR) relay in the former group would release the (TR) relay in the latter circuit, but remain locked itself. The magnet of the (G) selector is operated by ground in the start circuit and the brushes advance one step on the release of the selector armature when the start circuit releases after each call.

9. LINE FINDER CIRCUIT

9.1 When the receiver at the calling station is removed from the switchhook, various relays in the line trip and start circuits operate, and connect battery to the H terminal of the line at the line finder multiple bank and ground to the ST lead thus operating the LF relay. The LF relay operated, (a) locks to ground on the (H) relay, (b) operates the UP magnet from ground on the M commutator, causing the line finder selector to travel upward and hunt for the terminals of the calling line, to which battery is connected as hereinafter described, (c) closes a circuit from the same ground on the M commutator brush and segment, through the break contact of the (E) relay, to battery through the inner winding of the CI relay in the district circuit.

9.2 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 connects ground to lead Y and operates the (E) relay. The (E) relay operated, operates the (MB) relay and closes a circuit operating the (F) relay. The operation of the (F) relay opens the tip and ring between the line finder commutator and the district circuit and prevents the district (L) relay from operating and advancing the district switch from normal, should the line finder selector connect to the terminals of the line, before the sender selector finds an idle sender.

9.3 The (MB) relay operated, (a) locks to ground on lead X so that it will not release if the selector returns to normal while another call is going through, (b) connects ground on its armature to the series circuit through the (MB) relay of the other selectors in the same group, thus permitting the operation over lead CH of the (CA) or (CB) relays 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 (GA) relay in the start circuit from re-operating, (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 found. As the selector moves upward beyond the tripping zone the K commutator brush makes contact with the K commutator segment thus connecting ground to the K lead which short circuits and releases a relay in the trip circuit. When the K brush passes beyond the K commutator, ground is disconnected from lead K, releasing a relay in the start circuit which in turn disconnects ground from lead X, thus opening the circuit through the (outer) winding of the (MB) relay, but the relay does not release as it is held operated over its operating circuit.

9.4 When the selector brushes make contact with the terminals associated with the calling line, battery on the H terminal operates the (H) relay. With the (H) relay operated, the 50 ohm non-inductive shunt is connected around its winding to ground on the 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 the operation of the relay. The (H) relay operated, opens the circuit which holds the (LF) relay operated, but the (LF) relay does not release immediately on account of a circuit being closed from ground through the C commutator brush and segment, to battery through both windings of the (LF) relay connected in series. The (LF) relay is thus held operated until the brushes are centered on the terminal of the calling line. When the circuit through the C commutator segment is opened, the (LF) relay releases. The (LF) relay released, (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 the 1,000 ohm winding is opened, by the release of the (CI) relay in the district when the district sender selector seized an idle sender, the (F) relay releases, (c) closes a circuit to operate the (SL) relay in the district.

9.5 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 windings of the (LF) relay is opened by the operation of the (H) relay when the H brush makes contact with the H terminal 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.

9.6 Disconnection - Regular Calls

When the receiver at the calling station is replaced on the switchhook, the (DC) relay in the district circuit releases in turn releasing the (D) relay in the district. The (D) relay released closes a circuit operating the (F) relay. The (F) relay operated, disconnects the tip and ring of the trunk and closes a circuit from ground on the N commutator to battery through the district R magnet, advancing the district switch to position 16.

9.7 As the switch advances from position 16 to 18 the circuit through the (D) relay in the district circuit opens releasing the (D) relay, which in turn closes a circuit operating the (DS) relay. This circuit is traced from ground on the M commutator brush and segment, through the 350 ohm winding of the (DS) relay, to battery on the break contact of the (DS) relay. The (DS) relay operated, (a) locks through its make contact and 350 ohm winding to the same ground, (b) closes a circuit through the outer winding of the (F) relay, thus insuring the relay to hold until both the line finder selector and the district selector have returned to normal, (c) operates the line finder DOWN magnet from ground on its armature, which restores the line finder selector to normal. When the line finder selector returns to normal, ground is disconnected from the M commutator brush, releasing the (E) (DS) and (MB) relays. As the switch leaves position 18, the circuit through the DOWN magnet is opened, and after position 18 1/4, the circuit through the outer winding of the (F) relay is opened, releasing the relay and restoring the circuit to normal.

9.8 Disconnection Before Line Finder Selector Finds Line

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 terminal in the multiple bank. Assuming the calling line to be in sub-group "A", the (L) relay in the line circuit releases the (BA) relay in the line circuit. The (TR) relay in the trip circuit having operated, locks on the (SA) relay in the start circuit which operates the (LF) relay and the selector starts 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 at the top of the multiple bank (shown in trip circuit), 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 brush resting on the H comb terminal to prevent the district switch from advancing from normal when the (F) relay is released by the release of the (LF) relay. When the (F) relay releases, the DS relay operates from ground on the X commutator brush and segment through its 1000 ohm winding. When the selector returns to normal, ground is disconnected from the M commutator releasing the (E) (DS) and (F) relays. The (DS) relay, operated, operates the DOWN magnet and restores the selector to normal.

9.9 TESTING LINE FINDER SELECTORS

When the 184 plug is inserted in the test jack the ST and ST-1 leads are connected together. The 1000 ohm winding of the (LF) relay is disconnected from the break contact of the (MB) relay and connected to the make contact of the (C) relay in the starting circuit through the strapped ring and sleeve of the test plug.

9.10 TELL TALE - LINE FINDER SELECTOR

Should the selector travel to the tell tale position while hunting, due to the multiple brushes not being tripped, the (F) relay remains operated through its outer winding. Ground on the X commutator brush and segment is thereby connected to lead "Tell Tale Circuit", giving a visual signal to the attendant. As the N commutator segment is open at 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.

9.11 Should the selector travel to the tell tale position while hunting with the multiple brush tripped, the circuit functions as described in paragraph 12.1. The receiver at the calling station being still removed from the switchhook, the (L) relay in the line circuit and the (BA) relay in the trip circuit are still operated and the call goes through as described under "Originating Calls".

10. LINE FINDER TIME ALARM CIRCUIT

10.1 Line Finder Time Alarm

If a line finder does not find the subscriber's line within 35 seconds after the receiver at the calling station is removed from the switchhook, an alarm is given in the following manner: When the receiver at the calling station is removed from the switchhook, various relays in the line and trip circuits operate and connect battery to winding of the (B) (frame) relay brush and terminal 1 of the START are of the time alarm selector, break contact of the (A) frame relay, to the interrupter contact. When the interrupter contact closes, the (B) relay operates. The (A) (frame) relay does not operate, however, on account of its winding being short circuited by ground on the interrupter. When the interrupter contact opens, the short circuit is removed from the winding of the (A) relay, which now operates in series with the winding and made contact of the (B) relay, to ground on the armature of the (B) relay, thus holding both relays operated. The next operation of the interrupter operates the STP magnet, over a circuit from ground on the make contact of the interrupter, make contact of the (A) relay, terminal 1 and brush of the STEP arc of the selector, to battery through the winding of the STP magnet. When the interrupter contact opens, the STP magnet releases and steps its brushes one step on its back stroke. The selector brushes advance one step for each make and break of the interrupter contact, which is of an interval of 7 seconds, until the fifth terminal of the selector is reached when the circuit through the interrupter is opened. When the fifth terminal of the selector is reached, the BA-1 lamp in the trip circuit lights from battery on the armature of the (A) (frame) relay, terminal 5 and brush of the LAMP arc of the selector, through the make contact of the (BA) relay, BA-1 lamp, to ground through the winding of the B (aisle) relay in the time alarm circuit, which operates. The (B) relay operated, operates the A (aisle) relay. The (A) relay operated, lights the aisle pilot and main or monitoring board lamps through their respective auxiliary alarm circuit. When the source of trouble is removed and the (BA) relay, in the trip circuit has released, in turn releasing both the frame and aisle (A) and (B) relays, extinguishing the aisle and main or monitoring board lamps and silencing the alarm. The release

of the (B) (frame) relay also closes a circuit from ground on its armature, through terminal 5 and the bridging brush of the RETURN arc of the selector to battery through the break contact and winding of the STP magnet, which operates and steps the selector brushes to terminal 6, in which position it awaits the next closure.

10.2 Restoring To Normal

Should the circuit over lead B be opened before the fifth terminal is reached by the selector, the (A) and (B) frame relays release. The (B) relay released, causes the selector to advance to the next normal position, awaiting closure of lead B, as previously described. The operation of the (NL) key steps the selector brushes to the next normal position by way of the STEP bridging brush and 5, 10, 15, or 20 terminal, as the case may be. If the selector has been at normal position 6, 11, or 16, when the (BA) relay operated, the operation would have been the same as described for position 1.

11. DISTRICT SELECTOR CIRCUIT

11.1 Finding A Sender

When the receiver at the calling station is removed from the switchhook, various relays in the line trip, start and line finder circuits operate and start a line finder hunting for the calling line. As the line finder selector starts hunting for the calling line ground is connected, operating the (CI) relay. The (CI) relay operated operates the (STP-SS) magnet thus causing the sender selector to start hunting for an idle sender. When the line finder selector moved off normal a relay operated and (a) operating the (D) relay (b) permitting the (CI) 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, lower contacts of cam S, to ground on the test brush of the sender selector. 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 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, to the break contact of the (CI) relay. This busy ground is connected until the switch advances from position 1-1/4. While the sender selector is hunting for an idle sender, a circuit is closed over lead 11 operating a relay in the finder circuit which 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 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.

11.2 Advancing Switch to Position 2

When the terminals of the calling line have been found and the brushes of the line finder selector have been centered thereon, a circuit is closed from ground through the winding of the (SL) relay, cam T, (D) relay operated, to battery, operating the (SL) relay. The (SL) relay operated (a) connects battery through the 2 #18 Q resistances to lead S thus making the subscribers line test busy at the final frame and operating the cut off relay in the line circuit. (b) opens the circuit to the (MB) relay and (c) closes a circuit from ground on lead 12 operating the (L) and (CH) relays. The (CH) relay operated, closes a circuit from ground on cam I, 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 circuit through the (L) and (CH) relays is 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 cam H, make contact of cam C.

11.3 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 cam P, to the tip brush of the sender selector. The ring side

of the dialing circuit is closed from the ring of the line, through the winding of the (DC) relay, cam Q to 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 to 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 500 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.

11.4 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 winding of the magnet, cam C, make contact of the (L) relay, to ground through 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 [illegible] 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.

11.5 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 selector moves upward for group selection, carrying the brushes over the commutator segments, the B segment brush intermittently connects ground to the tip side of the fundamental circuit through cam L holding the district (L) relay operated, but succesively short circuiting the stepping relay in the assiciated 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 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 lead 12 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.

11.6 Trunk Hunting With 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.

11.7 Trunk Hunting With 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.

11.8 "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 (L) relay which in turn releases 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.

11.9 Selection Beyond

As the switch advances to position 7-3/4, ground through cam E is connected to the sleeve of the selected 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 FT and FR brushes of the sender selector, and cams F and G respectively. After 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 the switch advances from position 10. The (D) relay is made slow in releasing so that the connection will not be lost if the switchhook at the called station is momentarily depressed. 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 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 I to ground on cam E, under the control of the (L) relay. This circuit is traced from battery through the outer winding of the (CI) relay, inner contacts of cam U, make contact of the (CI) 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.

11.10 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 cam N, winding of the (I) relay to battery through the #3 contact of the 149-J 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 500 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 and closes a circuit from battery on its make contact to hold the (BL) relay operated. The 149-J 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.

11.11 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, 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, cams V and W, 2 m.f. condenser, cam X, the S brush and terminal at the line finder bank, to ground through the winding of the CO relay for number checking.

11.12 Disconnection - Regular Calls

When the receiver at the calling station is replaced on the switchhook, the (DC) relay releases, in turn releasing the (D) relay. The (D) relay released, connects ground,

operating a relay in the line finder circuit which disconnects the tip and ring of the trunk from the line and closes a circuit from ground to battery through the R magnet, advancing the switch to position 16.

11.13 Message Registering

On message register district circuits, with the switch in position 16, if the call is to be charged, the (CH) relay will be operated and a circuit will be closed from battery, make contact of the (CH) relay, cam T, through the three 18-AN resistances in parallel over the H lead to operate the message register in the line circuit. When the 149-C interrupter contacts close, a circuit is closed from ground on the make contacts through cam R, to battery through the outer winding of the (L) relay, operating the (L) relay. The (L) relay operated, locks through its inner winding and make contact to ground on cam E. Ground on the 2 make contact of the interrupter is closed through cam Y, make contact of the (L) relay, outer contacts of cam J, to battery through the inner winding of the (D) relay, which operates. The (D) relay operated, advances the switch to position 17, the A cam advancing it to position 18.

11.14 Restoring Line Finder To Normal

As the switch advances from position 16 to 18, the circuits through the (D), (SL), (CH) and (L) relays are opened, releasing the relays, and the battery for operating the message register is disconnected from lead H. The release of the (SL) relay disconnects battery from lead S, releasing the (CO) relay in the line circuit, thus restoring the line circuit to normal. The release of the (D) relay closes a circuit operating a relay in the line finder circuit restoring the line finder selector to normal.

11.15 Restoring District To Normal.

With the district switch in position 18, a circuit is closed from ground through cam D to battery through the district DOWN magnet, which operates and restores the district selector to normal. As the district selector returns to normal, a circuit is closed from ground on the Y commutator brush and segment, cam B, to battery through the R magnet, advancing the switch to position 1 or normal. As the switch leaves position 18, the circuit through the DOWN magnet is opened and in position 18 1/4, the circuit over lead 15 is opened restoring the circuit to normal.

11.16 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.

11.17 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, opens the circuit through the (SL) relay which releases, and closes a circuit, operating a relay in the line finder circuit. When this relay operates ground is connected advancing the district switch to position 16. In position 16 ground on the armature of the (SL) relay through cam D advances the switch to position 17, the A cam advancing it to position 18. In position 16, the (CH) relay being normal, battery is not connected over lead H to operate the message register in the line circuit as the call is not chargeable. From this point on, the line finder and district selectors are restored to normal as described in paragraphs 16, 17, 18 and 19.

11.18 Disconnection on Abandoned Calls - 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 a direct ground, to the SC lead, causing the (D) relay to release on account of the increased current flowing through its outer winding. 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 releases, connects lead 1 to lead 14 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, and advances the district switch in position 6. With the district switch in position 6, a circuit is closed from 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.

11.19 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 releases the (SL) relay. The (D) relay released closes a circuit operating a relay in the line finder circuit which in turn connects ground advancing the switch to position 16. In position 16, ground on the armature of the (SL) relay, advances the switch to position 17, the A cam advancing the switch to position 18. From this point on the district switch is restored to normal as described in paragraph 19.

11.20 Tell-Tale District Selector

Should the selector travel to the tell-tale position during brush selection, ground on the X commutator, brush and segment is connected through to 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.

11.21 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 releases, 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 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, cam L 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 C through the 2 M.F. condenser, cam G, winding of the repeating coil, 2 M.F. condenser cams W, V and J, make contact of the (D) relay to ground on cam I. 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 (DG) 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 in paragraphs 16, 17 and 19.

11.22 "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.

ENG: F.S.G.
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MCR

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