This Method of Operation was prepared from Issue 55 of Drawing ST-51001-01

METHOD OF OPERATION

Sender Circuit - Subscriber's - Arranged for Sender Units - 3 Digit Office Code - Panel System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is for use in controlling the establishment of a connection through mechanical selectors under direct control of a machine switching subscriber.

2. WORKING LIMITS

2.1 The use of this circuit is limited by the working limits of the (L), (STP), (TC) and (CFL) relays in regard to external loop and leak resistances as follows:

2.11 Maximum external subscriber's line loop including subset - 900 ohms.

2.12 Minimum external subscriber's line leak resistance - 10,000 ohms.

2.13 Maximum external fundamental circuit loop to office, incoming and final selectors - 2400 ohms.

2.14 Maximum external fundamental circuit loop to direct R.C.I. offices, tandem sender circuits and operator's incoming trunks - 3685 ohms.

2.15 Maximum external fundamental circuit loop to tandem R.C.I. points - 4685 ohms.

2.16 Minimum external fundamental circuit leak - 30,000 ohms.

2.17 External fundamental circuit loop shall not include more than 20 miles of 19 gauge cable.

2.18 On all R.C.I. class calls, the total external trunk loop from the originating office to the R.C.I. office including relay in two-wire office selector, if used, shall be maintained at a minimum of 900 ohms.

2.19 On "Recording Operator" routes the beyond office compensating resistance shall be 900 ohms.

OPERATION

3. PRINCIPAL FUNCTIONS

3.01 This sender is arranged to work with either coin or non-coin subscribers' lines. It is selected by a district selector upon the origination of a call by the removal of the receiver from the switchhook at a machine switching station. Its functions are as follows:-

3.0101 To receive and register the pulses from the calling station's dial for the office code and numerical digits.

3.0102 To translate these pulses from the decimal system as dialed into the proper settings on the registers and translator for making the selections necessary on the panel type selectors for the selection of an outgoing trunk.

3.0103 To set up by means of the class register, the circuit conditions necessary for completing the call to the particular class of office in which the called station terminates, for example a manual or a machine switching office.

3.0104 To control the selections on the various selectors as required to complete the connection.

3.0105 To translate the register settings into the proper pulses to set up the required number on the call indicator if the called station is in a manual office.

3.0106 To collect the coin on completed calls from coin box stations or to return the coin if the call is not completed or if the call is free service. This feature is accomplished in conjunction with the associated coin circuit.

3.0107 To give a suitable alarm after a predetermined length of time in case the completion of call is blocked at any point in its progress.

3.0108 To set up a release condition in the sender and the district selector in case the call is abandoned by the calling subscriber during the time selections are being made.

3.0109 To restore to normal in case an "all paths busy" condition is encountered.

3.0110 To give a signal to the sender monitor in case the call is blocked due to improper dialing or failure to deposit a coin or failure of the equipment during the time selections are being made.

4. CONNECTING CIRCUITS

This circuit will function with:

4.1 Associated line finder and district selector circuit.

4.2 Associated coin and non-coin circuit.

4.3 Any standard three-wire office selector.

4.4 Any standard incoming selector.

4.5 Any standard final selector.

4.6 Any standard R.C.I. trunk circuit.

4.7 Any standard trunk to an operator's position.

4.8 Any standard two-wire office selector except for operator class of call for which the sender is not arranged to give or receive the final heavy pulse to advance the office switch.

DESCRIPTION OF OPERATION

5. FUNCTIONS OF VARIOUS CIRCUITS OF THE SENDER

The sender is made up of the following divisions:

5.1 Class Circuit

By means of which the class of call to be made is determined. The setting taken by the class switch under control of the translator causes the sender to add or to omit certain of its operations as required for the completion of the connection.

5.2 Sender and Translator Control Circuit

Controls the connection of the sender to a district selector; controls the closure of the fundamental circuit during selections

and controls the disconnections of the sender. The office code dial pulses take settings corresponding to the number of pulses dialed. The setting of the office code register gives information to the sender for selecting a trunk to the office containing the called station. That is, the setting of the office code registers permits the associated translator circuit to set up the necessary register relays for controlling the proper brush and group selections on the district and office selector frames for choosing an outgoing trunk to the called office. The numerical and station dial pulses take settings corresponding to the number of pulses dialed. The setting of the numerical registers controls incoming and final selections or controls the R.C.I. pulses depending upon the class of office in which the called station is located.

5.3 Sender Circuit

Consisting of the stepping relay and counting relays for controlling district, office, incoming and final selections. The counting relays to be used for district and office selections are determined by cross-connections from the district brush, district group, office brush and office group arcs of the translator which in turn is set by the office code registers. The counting relays to be used for incoming brush, incoming group, final brush, final tens and final units and if required, station designations, are determined by wiring from the numerical and stations register arcs of the sender and translator control circuit as set up by the numerical and stations digits from the calling subscriber's dial.

5.4 Routine Switch

Is primarily for the purpose of routing the various operator class of calls without the use of the translator and associated register relays.

5.5 Compensating Resistance Switch

By means of which the fundamental circuit loop resistance is maintained at 1200 ohms. This switch makes up the difference between the external resistance and 1200 ohms. The route and compensating resistance switches are set under control of the translator and register relays.

5.6 R.C.I. Impulser Circuit

The impulser sequence switch sends out to the control circuit of the call indicator equipment at the manual office a series of pulses, the sequence of which is under control of the sender

numerical registers, to operate the call indicator lamp relays that cause the number of the called subscribers to be displayed before an operator.

6. INDEX

REGULAR CALL TO A FULL MECHANICAL OFFICE - USING OFFICE SELECTOR - COIN

7. SENDER SELECTED

When the sender selector of a line finder district finds an idle sender, ground is connected to lead (TST), operating the (T) relay. The (T) relay operated, (a) locks over lead (TST), (b) starts the associated time measure circuit, (c) operates the (SB) relay, (d) connects

ground to the (SC) lead thru the (SC-2) relay, (c) connects ground to the armature spring of the (L-1) relay. The (SB) relay operated, (a) closes a circuit to the sender busy lamp and closes the "All Senders Busy Register Circuit", (b) opens the operating circuit for the (T) relay which, however, is held operated through its make contact to the (TST) lead, (c) closes the operating circuit of the (T-1) relay. Under this condition the (T-1) relay winding is short-circuited and does not operate, and (d) connects battery to the counting relays.

8. DIAL TONE

(R-2) (1) After the calling line has been found by the line finder and with the sender selected, the district advances, connecting the (T) and (R) leads through to the (BAL) coil and (L) relay, operating the (L) relay. The district, in advancing, operates the (SC-2) relay, from battery over lead (SC). The (SC-2) relay operated, locks to battery through 500 ohms resistance until the (R-2) switch breaks position 4. The (L) relay operated, operates the (RLS) relay. The (RLS) relay operated, closes a circuit from ground through the (RC-1) brush and normal terminal 25 ohm winding of (BAL) coil to the tone lead. A tone is thus induced in the inner winding of the repeating coil which is transmitted back to the calling station as an audible indication that the office apparatus is ready for the operation of the dial. The outer winding of the (L) relay is connected in series with the 0.5 mf condenser to increase the speed of the relay. The (RLS) and (SC-2) relay operated, steps the (TM) selector to terminal 6 in case of GG wiring or to terminal 2 in case of FF wiring. With the TM selector on terminal 2 to 10 the ON circuit is grounded.

Note 1 The designations (R-1), (R-2), (R-3), (R-4), (R-5) and (R-6) when used as suffixes to the literal designations of cams indicate that the cam is on that particular switch. Example:- Cam J (R-1) indicates that cam J is on the (R-1) switch.

Note 2 The positions of the various switches are shown at the beginning of all paragraphs which contain circuits passing through cams. Example: (R-1) (3), (R-2) (5), (R-4) (7) indicates that switches (R-1), (R-2) and (R-4) are in positions 3, 5 and 7 respectively.

9. SETTING OFFICE REGISTERS

The calling party dials a number consisting of three digits (letters) and four digits (numbers) causing the (L) relay to alternately release and reoperate. The (L) relay releases for each break of the dial contacts. The first impulse releases the (L) relay, operating the (L-1) and

(RA) relays and the (A) register magnet. This circuit is from ground at the normal (DWC) relay, normal (L) relay, operated (RLS) relay, windings of the (RA) relay, normal (RC-5) arc, normal (PP) relay, dividing beyond this point into two paths, one through the (A) register (STP) magnet 52.5 ohms to battery, and the other through the interrupter spring of the (A) register (STP) magnet, normal (RC-6) arc, winding of the (L-1) relay, normal (PP) relay to battery. The (RLS) relay is slow in releasing and remains operated during the complete dialing period for all digits. The (L-1) relay is fast in operating and operates upon each release of the (L) relay. The (L-1) relay operated locks until its locking circuit is opened by the operation of the (A) register magnet. Its function is to aid in holding operated the (RLS) relay and to reinforce the impulses from the (L) relay by the closure of a circuit from ground, (T) relay operated, through its make contact. This ground reinforces the ground on the armature of the (L) relay thus insuring the positive operation of the various register magnets, if for any reason the impulses from the (L) relay are of insufficient duration to completely operate the register magnet. The (RA) relay operated, operates the (ON) relay and energises the (RC) magnet. The (ON) relay operated, performs no useful function at this time. The (RA) relay is slow in releasing and remains operated during the impulse period of each digit dialed.

10. SETTING ("A") REGISTER

The (A) register magnet operated, opens the locking circuit of the (L-1) relay which releases. With the (L-1) relay released and the (L) relay operated on the next dial pulse, ground is disconnected from the winding of the (A) register magnet which releases. The A register magnet released, steps its brush assembly to terminal 1. For each impulse received from the station dialed, the above cycle of operation if repeated, thus stepping the brush assembly of the (A) register to the terminal corresponding to the (A) digit of the office code dialed.

Note The number "one" (1) is not used as a digit in the office code thus two or more impulses are received from the first digit dialed. The brush assembly of the A register therefore does not step on terminal 1 except as described under preliminary impulse.

11. DISCONNECTING DIAL TONE

At the completion of the series of impulses corresponding to the first digit of the office code dialed, the (RA) relay releases, opening the circuit through the (RC) magnet and the (ON) relay, which release. The (RC) magnet released, steps its brush assembly to terminal. As the (RC-1) brush steps from its normal terminal, the circuit through

the 25 ohm winding of the (BAL) coil is opened, disconnecting the dial tone from the calling station.

12. SETTING ("B") REGISTER

With the brush assembly of the (RC) switch on terminal 1, the sender is ready to receive the impulses corresponding to the second digit of the office code dialed. The (L) relay again responding to the impulses of the station dial, operates (L-1) and (RA) relays and (B) register magnet which steps its brush assembly. The (L-1) and (RA) relays operated, function as described in paragraph 9. When the impulses corresponding to the second digit cease, the (RA) relay releases, in turn releasing the (ON) relay and (RC) magnet which steps its brush assembly to terminal 2.

13. SETTING REMAILING REGISTERS

With the brush assembly of the (RC) switch on terminal 2, the (ST) relay operates. Circuit:- Battery, inner winding of (ST) relay, (Z) relay normal, terminal 2 and (RC-1) brush, (RLS) relay operated to ground. The (ST) relay operated, locks under control of the (RLS) relay. The function of the operated (ST) relay is described in paragraph 15. In a similar manner the (C), (TH), (H), (T), (U) and (SH) (when used) registers are set in accordance with the impulse of the digits dialed, the brush assembly of the (RC) switch stepping one terminal after each register is set, thus stepping the (RC) brush assembly on terminal 7 (or 8). The brush assembly of the (RC) switch remains on terminal 7 until the (R-1) switch makes position 9.

14. TM SWITCH OPERATES MECHANICAL A.B.X. CLASS

With the brush assembly of the RC switch on terminal 7, the (TM) magnet operates, under control of the interrupter, stepping the brush assembly of the TM switch one terminal until terminal 10 is reached in case of G wiring or to terminal 6 in case of FF wiring. When the RC selector advances to terminal 10 a circuit is closed to advance the TM selector to terminal 7 in case of FF wiring.

15. TRANSLATION - (R-1) (1)

The (ST) relay operated, operates the (TC) relay. The (TC) relay operated, advances the (R-1) switch to position 2. As the (R-1) switch advances from position 1, the (TC) relay locks through its windings in series under control of the (TS) relay, the operating circuit being opened at cam G (R-1).

16. TRANSLATOR ELEVATOR OPERATES - (R-1) (2)

The (SC) and (ON-2) relays now operate from ground on cam O (R-1). The (ON-2) relay performs no useful function at this time. Its function is described in Registers and Switches Off Normal. The (SC) relay operated prepares the circuit for operating the (SC-1) relay. The (UP) magnet also operates through cam H.

17. SELECTION OF ELEVATOR WHEN TWO TRANSLATORS ARE USED

When two elevators are used, the (E) relay determines which elevator is to be used. The (E) relay is under control of the (A-2) brush. When the (E) relay operates, it locks to off normal ground and operates the (UP) magnet of the second translator.

18. BRUSH HUNTING - (R-1) (2)

Cross-connections are made as specified for each installation, from the A and B selector registers to the hunting bank of the translator, so that one of the five terminals (5, 7, 9, 11 and 13) and one of the terminals 15, 23, 31, 39 and 47 will be grounded for translator brush and group selections respectively. When the hunting brush on the translator selector connects with the grounded terminal, the (TS) relay operates. The (TS) relay operated, releases the (TC) relay which opens the circuit through the (UP) magnet thus stopping the upward movement of the translator and selecting the proper brush advancing the (R-1) switch to position 3. As the (R-1) switch advances from position 2-1/4, the (TS) relay releases.

19. AWAITING (TC) RELAY - (R-1) (3)

As the (R-1) switch makes position 3, the (TM) magnet operates to ground on cam I (R-1). In position 3, the (TC) relay reoperates, locks and advances the (R-1) switch to position 4.

20. GROUP HUNTING - (R-1) (4)

As the (R-1) switch makes position 4, the (UP) magnet again operates causing the translator selector to move upward for group hunting. As the translator selector moves upward for group hunting, the selected pair of brushes is tripped. When the translator hunting brush connects with a grounded terminal the (TS) relay operates. The (TS) relay operated, releases the (TC) relay which releases the (UP) magnet, stopping the upward movement of the translator selector. The (TC) relay released also advances the (R-1) switch to position 5. As the (R-1) switch advances from position 4-1/4, the (TS) relay releases.

21. TERMINAL HUNTING - (R-1) (6)

With the (R-1) switch in position 5 and the (S) relay normal, the (TC) relay reoperates, locks and advances the (R-1) switch to position 6. As the (R-1) switch enters position 6, the (UP) magnet reoperates, causing the translator selector to move upward for terminal selection. Certain terminals (16 to 22 inclusive) of the hunting bank are multipled respectively to certain other terminals (24 to 30, 32 to 38, 40 to 46, 48 to 54) and connected to terminals 3 to 9 of arc (C-2) inclusive. For each call, one of these terminals is grounded depending upon the setting taken by the C register. When the hunting brush on the translator selector connects with the grounded terminals, the (TS) relay operates. The (TS) relay operated, releases the (TC) relay which releases the (UP) magnet stopping the upward movement of the translator selector, and advances the (R-1) switch to position 7. As the (R-1) switch advances from position 6-1/4, the (TS) relay releases. The (R-1) switch is advanced to position 8 by cam A.

22. AWAITING COMPLETION OF OFFICE CODE REGISTRATION (R-1) (5)

If the third digit of the office code has not been dialed when the (R-1) switch reaches position 4-3/4, the (S) relay operates. The (S) relay operated, opens the tip side of the fundamental circuit and the operating circuit for the (TC) relay thus preventing the (R-1) switch from advancing and terminal selection from taking place. When all the impulses for the third digit of the office code have been received and the C register set, the brush assembly of the (RC) switch steps to terminal 3, releasing the (S) relay.

23. PULSE COUNT AND REGISTRATION (R-1) (8), (R-2) (1)

As the (R-1) switch enters position 7, the (P) and (P-1) relays operate to ground on cam J (R-1). With the (R-1) switch in position 8, the (STP) relay operates. Circuit:- Battery on the timing drum of the pulse machine, timing lead, cam F 18-AE resistances, winding of (STP) relay, (BO) and (SC-1) relays normal, 18-AC resistance, ground. The (STP) relay operates in unison with and under control of battery impulses from the timing drum of the pulse machine. The (STP) relay operated, operates counting relay (6). Circuit:- Ground, cam J and I (R-2), (STP) relay operated, cam H, (CW) relay normal, (P-1) relay operated, winding of counting relay (6), (SB) relay operated, battery.

24. PULSE COUNT TIMING - (R-1), (8), (R-2) (1)

Counting relay (6) operated, connects its windings in series with the winding of counting relay (6') to ground on cam H (R-1). Counting relay (6'), however, does not operate at this time due to ground being

connected to both sides of its winding. When the (STP) relay releases at the end of the first impulse, ground is disconnected from one winding terminal of relay (6'), permitting it to operate. Counting relay (6') operated, transfers the pulsing circuit through its make contact to the 5 sets of counting relays which operate on the second impulse. Upon each operation and release of the (STP) relay, one set of counting relays is operated and locked. When the (STP) relay operates the seventh time, counting relay (0) operates. Counting relay (0) operated, connects its winding in series with the windings of the (BO) and (FO') relays in parallel to ground on cam M (M-1). The (BO) and (FO') relays, however, do not operate at this time due to ground being connected to both sides of their windings. When the (STP) relay releases at the end of the seventh impulse, ground is disconnected from one winding terminal of the (BO) and (FO') relays, thus permitting both relays to operate in series with the (0) relay. All counting relays when operated at this time lock to ground on cam N. The (BO) relay operated, opens the pulsing circuit through the (STP) relay, thus ending pulse count timing.

25. SEVEN IMPULSES REQUIRED

Seven impulses are required from the timing drum of the pulse machine to set up the counting relays for the pulse count, thus necessitating slightly over one revolution of the pulse machine for this count. After the seventh impulse is received, the timing load circuit is opened at the break contact of the (BO) relay, at which time all register relays will have been set.

26. SETTING REGISTER RELAYS

The (P) and (P-1) relays operated, complete the closure of the six impulsing paths over leads (TS), (OG), (DG), (OB), (DB) and (CL) between the translator pulse machine commutator and the (A) control relays. During the interval, the counting relays are being operated and locked, the (A) control relays operate on impulses from the sending drums of the pulse machine, in turn operating the (B) control relays. The (B) control relays operate in synchronism with the battery impulses from the sender drums of the pulse machine. At the same time that these control relays operate and close, the six pulsing paths from the receiving drums over leads (RL-1), (RL-2), (RL-3), (RL-4), (RL-5) and (RL-6), the required combination of register relays in each group is operated by battery impulses sent over the receiving leads. The operation of the proper register relays for each call depends upon the prearranged cross-connection scheme between the sending drums and the terminals of the translator banks.

27. METHOD OF SETTING THE VARIOUS COMBINATIONS (R-1) (S)

Certain combinations of register relays in groups 1, 2, 3, 4, 5 and 6 are operated for each call. Example: The (CL-A) control relay operates and releases in synchronism with the battery impulses transmitted through one of the six sending leads during one revolution of the pulse machine. For each operation of the (CL-A) relay, the (CL-B) relay operates. This relay operated, closes the six leads from the receiving drums of the pulse machine, through to the windings of the (CL-1), (CL-2), (CL-3), (CL-4), (CN-5) and (SKO-6) relays. During the time that these leads are closed, any relay receiving an impulse from the receiving drums, operates and locks. Thus it is obvious that, by the arrangement of the cross-connections to the various receiving drums any combination of class relays may be set. The setting of the register relays of the other group is made in a similar manner. All operated register relays look to battery on cam E (R-1).

28. CIRCUIT PREPARATION FOR THE VARIOUS SELECTIONS - (R-1) (S)

The operation of the (FO') relay at the end of the pulse count timing period, operates the (CL) relay through the (P) relay operated. The (SL) relay operated, operates the (CS) and (GS) relays, from the off-normal ground. The (CS) and (GS) relays operated, lock to ground on cam J (R-1). The (CS) relay operated, release the (P) and (P-1) relays. The (P) and (P-1) relays released, open the six pulsing paths to the register control relays, and opens the operating circuit for the (CL) relay. The (GS) relay operated, closes the circuit to the armature of the (CL-1), (CL-2), (CL-3) and (CL-4) relays to advance the class sequence switch, and connects ground to the armatures of the (CR), (ZN), (R) and (SD) register relays, the function of which is described hereinafter under the various selections.

29. CLASS SELECTION - (R-1) (S)

Assuming the (CL-3) and (CL-4) relays operated, the (R-3) switch is advanced from any position in which it may have been left from the previous call to position 4 for the call being described. The (CL) relay always operates whenever the (R-3) magnet is energised.

30. ROUTE AND COMPENSATING RESISTANCE SELECTION

The (R-4) and (R-5) switches are set in a manner similar to the (R-3) switch. The (R-4) switch is advanced (if necessary) from normal to a position as determined by the setting of the R relays from ground on relay (GS) operated. The (R) relay operates in parallel with the (R-4) magnet. For this call, the (R-4) switch remains in position 1. The (R)

and (CL) relays are operated during the setting of the (R-3) and (R-4) switches so that the (R-1) switch will not advance from position 8 until the class and route switches are set. The (R-5) switch is set as determined by the (CR-) relays. The (CR) relay operates in parallel with the (R-5) magnet so that in case the (R-5) switch is not set, when the (R-2) switch enters position 5, the (S) relay operates. The (S) relay, operated, opens the fundamental circuit thus preventing office test until the (CR) relay releases. Assume for this call that the (R-5) switch is set in position 2.

31. RETURNING TRANSLATOR TO NORMAL - (R-1) (8)

With the (R-3) and (R-4) switches set, the (CL) and (R) relays release, advancing the (R-1) switch to position 9. As the (R-1) switch enters position 9, the (DD) relay operates to ground on cam I (R-1). The (DD) relay operated, operates the (DOWN) drive magnet returning the translator elevator to normal. When the translator elevator reaches normal, ground on the (Y) commutator short-circuits the inductive winding of the (DD) relay which releases, in turn releasing the (DOWN) magnet.

32. ADVANCING (R-2) SWITCH AND (TM) SELECTOR - MECHANICAL DIRECT CLASS - (R-1) (9), (R-2) (1)

As the (R-1) switch enters position 8-3/4 to 9, the (SON) relay operates through the operated (DB), (OB), (DG), (OG) and (TS) relays to ground on cam N (R-1). The (SON) relay operated locks to the off normal ground and advances the (R-2) switch to position2 from the operating ground of the (SON) relays. Also in position 9, the (TM) selector is stepped to terminal 10, in case of GG wiring or terminal 6 in the case of FF wiring, from ground on cam M (R-1), through cam U (R-3) and arc (TM-3).

33. ADVANCING (RC) SELECTOR - (R-1) (9), (R-3) (4), TM (10), RC (7)

With the brush assembly of the (TM) switch on terminal 10, the (RC) magnet operates and steps its brush assembly to terminal 8'. Circuit:- Battery, 44-B resistance, winding on (ON) relay, winding and break contact of (RC) magnet, (RC-2) brush and terminal 7, cam O (R-3), cam W (R-1), terminal 10 and (TM-6) brush ground. The (ON) relay also operates in this circuit but performs no useful function at this time. The brush assembly of the (RC) switch is now stepped to terminal 9 and then to terminal 0 from ground on cam S (R-3).

34. DISTRICT SELECTIONS - (R-1) (9), (R-2) (2), (R-4) (1)

The register relays having been set and the (R-2) switch advanced to position 2, the fundamental circuit is closed for district brush selection, operating the (STP) relay. Circuit: Battery, district line

relay, lead (FT), (S) relay normal, cam U (R-1), cam C (R-2), 54 ohm winding of (OFL) relay, winding of the (STP) relay, (BO) and (SC-1) relays normal, 18-AC resistance (500 ohms), ground. The (STP) relay operated, operates counting relay (1) as determined by the setting of the (DB) relays (Assuming district brush 1 to be selected). Circuit:- Ground, cam I (R-2), (STP) relay operated, cam H, (OV) relay normal, cam R (R-1), cams N and M (R-2), cam F (R-4), contacts of the (DB) relays, counting relay (1') normal, winding of counting relay (1), (SB) relay operated, battery.

35. DISTRICT BRUSH SELECTION

As the district brush 1 is to be selected, the district "A" commutator need only apply two ground impulses to the tip side of the fundamental circuit to satisfy the sender. The first impulse from the district "A" commutator short circuits and releases the (STP) relay, thus allowing counting relay (1') to operate in series with counting relay (1). Counting relay (1') operated, transfers the pulsing circuit to counting relay (0). When the district "A" commutator ground is disconnected from the tip side of the fundamental circuit, the (STP) relay reoperates, operating counting relay (0). As the district "A" commutator brush again makes contact with its commutator segment, the (STP) relay releases thus removing the short circuit from the windings of the (BO) and (FO') relays, which operate in parallel and in series with counting relay (0). All counting relays when operated lock to ground on cam I (R-2). The (BC) relay operated, opens the fundamental circuit thus completing district brush selection. The (FO') relay operated, advances the (R-2) switch to position 3. The A cam advances it to position 4. As the (R-2) switch advances from position 2, the counting relays release.

36. DISTRICT GROUP SELECTION - (R-1) (9), (R-2) (4) (R-4) (1)

The fundamental circuit is closed for district group selection. District group selection is made in the same manner as district brush selection except that the setting of the (DG) relays determines which counting relays are used. When sufficient impulses have been sent back from the district circuit, the (BO) and (FO') relays operate, opening the fundamental circuit and advancing the (R-2) switch to position 5, the A cam advancing it to position 6.

37. ADVANCING THE DISTRICT - (R-2) (4)

The (SC-2) relay releases as the (R-2) switch advances from position 4. The (SC-2) relay released, connects ground on the off-normal lead, through its 500 ohm non-inductive winding to lead (SC), advancing the district switch, and operates the (SC-1) relay.

38. OFFICE TEST - (R-1) (9), (R-2) (6), (R-5) (2)

When the district selector seizes an office selector, the fundamental circuit is closed operating the (TG) relay. Circuit: Battery, office selector line relay, lead (FT), (S) relay normal, cam U (R-1) cam C (R-2), 54 ohm winding of (OFL) relay, winding of (STP) relay, (BO) relay normal, 6400 ohm winding of (OFL) relay, winding of (TG) relay, cam Y (R-2) compensating resistance, cam H (R-5), cam R (R-2), cam X (R-1), (ADV) relay normal, lead (FR), to ground in the office selector circuit.

39. SELECTED TRUNK OFF NORMAL

The (TG) relay does not operate if the selected trunk is seized while it is returning to normal from its talking position. It does operate, however, in the above circuit from battery in the office selector when the conditions found on the tip and ring of the office trunk, when seized, represent its normal condition. The (TG) relay operated, operates the (TG-2) relay which in turn operates the (TG-1) relay. The (TG-1) relay operated, advances the (R-2) switch to position 7, the A cam advancing it to position 8. As the (R-2) switch enters position 7, the (TG) relay and the 6400 ohm winding of the (OFL) relay are short-circuited at the inner contacts of cam Y (R-2) releasing the (TG) relay and permitting the (L) (office) and (STP) relay to operate. The (TG) relay released, releases the (TG-2) and (TG-1) relays.

40. OFFICE SELECTION - (R-1) (9), (R-2) (8), (R-4) (1) (R-5) (2)

Office selections are made in the same manner as district brush selection. The (STP) relay operates over the fundamental circuit. The counting relays operated under control of the (STP) and (DB) or (DG) relays. When sufficient impulses have been sent back to satisfy the sender, the (BO) and (FO') relays operate, opening the fundamental circuit and advancing the (R-2) switch to position 9 and 11, the A cam advancing it to position 10 and 12.

41. SPLITTING COUNTING RELAYS - (R-1) (9), (R-2) (4) (R-4) (1)

In both district and office group selections, counting relays (9) to (5) are operated between counting relays (1) and (0) when the group required is above 5. Under this condition, cams V and W (R-2) and register relays (DG-4) and (OG-4) are used. When the group selection is under 5, the operating circuit for (0) relay is through the (DG-4) or (OG-4) relay normal. When the group selection is 5 or above, the 9 relay operates after the (1') relay through the (DG-4) or (OG-4) relay operated. The (0) relay then operated after the (5') relay, operates also through the (DG-4) or (OG-4) relay operated.

42. INCOMING TRUNK TEST - (R-1) (9), (R-2) (12), (R-5) (2)

With the (R-2) switch in position 12, the selected incoming trunk is tested. When the incoming selector is seized by the district or office selector, the (TG), (OFL) and (STP) relays are bridged across the fundamental circuit, operating the (TG) relay as for office test. The (TG) relay operated, operates the (TG-2) relay which in turn operates the (TG-1) relay. The (TG-1) relay operated, advances the (R-2) switch to position 13; the A cam advancing it to position 14. As the (R-2) switch advances from position 12, the (TG), (TG-2) and (TG-1) relays release.

43. INCOMING TRUNK OFF NORMAL - (R-1) (9), (R-2) (12), (R-5) (2)

If the (TG) relay should be bridged across an inter-office incoming trunk whose switch has not advanced from its talking position although released by either the district or office selector, battery (24 volt) and ground are connected to the tip and ring of the fundamental circuit respectively, through the windings of the incoming (A) relay. Under this condition, the (TG) relay being marginal does not operate. The (R-2) switch therefore is not advanced from position 12 until the incoming switch returns to normal, at which time battery (48 volt) is connected to the tip side through the incoming line relay, and ground to the ring side of the fundamental circuit.

44. ADVANCING THE (R-2) SWITCH - (R-1) (9), (R-2) (14) (R-5) (4)

As the (R-2) switch enters position 14, the (CI) relay operates to ground on cam K (R-2). The (CI) relay operated, advances the (R-2) switch to position 15. The A cam advances it to position 16. As the switch advances from position 14, the (CI) and (RB) relays release. As the (R-2) switch enters position 15, the (TG) and (OFL) relays are short-circuited at cam Y (R-2) releasing the (TG) relay and allowing the (STP) and the incoming (L) relays to operate. The (TG) relay released, releases the (TG-1) and (TG-2) relays.

45. RELEASING REGISTER RELAYS - (R-1) (9), (R-2) (15)

As the (R-2) switch enters position 15, the (R-1) switch is advanced to position 10 from ground on cam J (R-2). The A cam advances the (R-2) switch to position 12. As the (R-1) switch advances from position 11, the (GS), (SD-4), (SD-5), (TO-6), (SKO-6), (DG-4) and (OG-4) relays release. In position 12 of the (R-1) switch, the (ITT) relay operates and locks under control of the (R-2) switch. The (IPT) relay operated functions only in case of incoming toll-tale conditions.

46. INCOMING BRUSH SELECTION - (R-1) (12), (R-2) (16), (R-5) (2)

With the (STP) relay operated as the (R-2) switch enters position 16, incoming brush selection takes place. The counting relays operate under control of the (TH) register setting. When sufficient impulses have been sent back from the incoming selector to satisfy the sender, the (BO) and (FO') relays operate, opening the fundamental circuit and advancing the (R-2) switch to position 17, through cam F (R-2) and the A cam advancing it to position 18. As the (R-2) switch passes through position 17, the (STP) and (CI) relays operate soaking the (STP) relay so as to insure speed in releasing the relay. The (CI) relay performs no useful function at this time.

47. INCOMING GROUP SELECTION

In position 18, incoming group selection is made. The counting relays are under control of the (TH) register switch and (IG) relay. When the sender circuit is satisfied for incoming group selection, the (BO) and (FO') relays operate. The (BO) relay opens the fundamental circuit. The (FO') relay operated advances the (R-1) switch to position 13. The advance of the (R-2) switch after each selection releases the operated counting relays. If the hundred digit of the called number is between 5 and 9 inclusive, the (IG) relay operates, causing an odd numbered group in the incoming frame to be selected.

48. ADVANCING THE (R-2) SWITCH - (R-1) (13), (R-2) (18)

When the (R-1) switch enters position 13, the (R-2) switch advances to position 1 through cam P (R-1) and cam J (R-2) to ground. The (R-2) switch advances to position 2 of its second revolution over the same circuit used in the first revolution.

49. FINAL BRUSH SELECTION - (R-1) (13) (R-2) (2), (R-3) (4), (R-5) (2)

The fundamental circuit is now closed for final brush selection operating the (STP) relay. The counting relays are operated under control of the (H) register switch (Brush H-2). When sufficient impulses have been sent back to satisfy the sender, the (BO) and (FO') operate. The (BO) relay operated, opens the fundamental circuit completing final brush selection. The (FO') relay operated advances the (R-2) switch to position 3, the A cam advancing it to position 4. As the (R-2) switch advances from position 2, the counting relays release. In a similar manner final tens selection is made and the (R-2) switch is advanced to position 5 and 6 by the (FO) relay and A cam.

50. AWAITING TENS DIGIT REGISTRATION - (R-1) (13), (R-2) (4)

If the tens digit has not been dialed, the (T) register being in normal when the (R-2) switch reaches position 3, the (S) relay operates. Circuit: - Battery, tertiary and primary windings of (S) relay in series, cam T (R-1), cam E (R-2), terminal 5 and (RC-1) brush, (RLS) relay operated, ground. The (S) relay operated, opens the tip side of the fundamental circuit thus preventing final tens selection. After the (T) register has been set, the brush assembly of the (RC) switch is stepped to terminal 6 releasing the (S) relay, thereby allowing final tens selection to be made.

51. FINAL UNITS DELAY - (R-1) (13), (R-2) (6)

The sender circuit will not make final units selection until the time measure circuit has tested for the presence of a coin deposited. As the (R-2) switch enters position 6, the (S) relay operates to ground in the time measure circuit (the time measure circuit is still testing for a coin or a coin has not been deposited). The (S) relay operated, opens the tip side of the fundamental circuit, preventing final units selection until a coin has been deposited. When a coin is deposited, ground in the time measure circuit is removed releasing the (S) relay and allowing final units selection to take place.

52. FINAL UNITS SELECTION - (R-1) (13), (R-2) (6), (R-3) (4), (R-5) (5)

The fundamental circuit is now closed over leads (FT) and (FR) for final units selection operating the (STP) relay. The counting relays operate under control of the setting of the (U) register. When sufficient impulses have been sent back from the (U) commutator, the (BO) and (FO') relays operate. The (BO) relay operated, opens the fundamental circuit completing the final units selection. The (FO') relay operated, advances the (R-2 switch to position 7, through cam B. The A cam advances the switch to position 8.

53. AWAITING UNITS REGISTRATION - (R-1) (13), (R-2) (6)

Should the (R-2) switch reach position 6 before the impulses for the units digits have not been received from the station dial and the (U) register is not set. The (S) relay operates through terminal 6 and (RC-1) brush, (RLS) relay operated, ground. The (S) relay operated, opens the tip side of the fundamental circuit, thus preventing final units selection from taking place. After all the impulses have been received and the (U) register set, the brush assembly of the (RC) switch is stepped to terminal 7, releasing the (S) relay. The (S) relay released, allows final units selection to be made.

54. SKIPPING AUTOMATIC BRANCH SELECTIONS - (R-1) (13), (R-2) (8), (R-3) (4)

As there are no automatic branch exchange selections in this call, the (R-2) switch advances directly from position 8 to position 14, skipping stations selections. The (FO') relay operated, at the end of final units selections locks through cam F (R-2), cam M (R3) and cam M (R-1), to ground. The (FO') relay operated, advances the (R-2) switch to positions 9, 11 and 13. The A cam advances the (R-2) switch to positions 10, 12 and 14. As the (R-2) switch advances from position 12, the counting relays release.

55. RESETTING THE REGISTERS - (R-1) (13), (R-2) (14), (R-3) (4)

With the (R-2) switch in position 14, the (CI) relay operates to ground on cam K (R-1). The (CI) relay operated, advances the (R-1) switch to position 14. As the (R-1) switch enters position 14, the (RR) relay operates to ground on cam L (R-1). The operation of the (RR) relay steps the brush assemblies of the (C), (TH) and (U) registers to their next normal terminal and prevents the resetting of the (RC) switch. When the (C), (TH) and (U) registers are resting on the N terminal, the (B), (H) and (SH) registers are advanced to normal in turn resetting the (A) and (T) registers. With the (R-1) switch in position 14, the (R-2) switch advances to position 15. The A cam advances the (R-2) switch to position 16. As the (R-2) switch advances from position 14, the (CI) and (RB) relays release.

56. INCOMING ADVANCE - (R-1) (14), (R-2) (16), (R-5) (2)

When the final advances after units selection, it releases the (L) relay in the incoming trunk. The incoming advances, connecting reverse battery to the fundamental circuit and awaits the sender. The (OFL) and (STP) relays now operate on reversed battery and ground from the incoming selector. The (OFL) relay operated, operates the (OFL-1) and (IA) relays. The function of the (OFL-1) relay is to insure positive operation of the (IA) relay. Should the (OFL) relay release immediately after operating, the (OFL-1) relay operates, but the (IA) relay may not. The (OFL-1) relay is fast in operating and, when operated, locks and operates the (IA) relay. The (IA) relay operated, locks to ground on the off-normal lead. The (STP) relay operated, operates counting relay (O). Circuit: - Battery (SB) relay operated, winding of (O) relay, cam W (R-2), (IA) relay, operated, cams O and P (R-2), cam X (R-3), cam R (R-1), (CV) relay normal, cam H-(R-2), (STP) relay operated, cam I (R-2), ground. The incoming line relay operates in series with the (STP) and (OFL) relays over the fundamental circuit, advancing its switch to awaiting trunk closure position, releasing the (OFL) and (STP) relays. With the (STP) relay released and the (IA) relay operated, the (BO) and (FO') relays

operate in series with the (C) relay. The (FO') relay operated, operates the (ADV) and (ADV-1) relays. Circuit: - Ground, (FO') relay operated, (OOV) and (ITT) relays normal, (IA) relay operated, continuity contact of (ADV) relay, winding of (ADV) and (ADV-1) relays, battery.

57. DISTRICT ADVANCE - (R-1) (14)

The (ADV) and (ADV-1) relays operated, lock to the off-normal ground. The (ADV) relay operated, opens the ring side of the fundamental circuit. The (ADV-1) relay operated, removes the short circuit from the 17,500 ohm winding of the (SC) relay, and opens the circuit through its 2000 ohm winding. The (SC) relay thus remains operated through its 17,500 ohm winding. The removing of the short circuit from the 17,500 ohm winding of the (SC) relay, releases the (CH) relay in the district, advancing the district switch out of its "selection beyond" position. The district switch in advancing, opens the (T) and (R) pulsing leads, releasing the (L) relay, which in turn releases the (RLS) relay and also disconnects battery from lead (SC), releasing the (SC) relay. The (SC) relay released, releases the (SC-1) relay. The (RLS) relay released, releases the (ST) relay. The (ADV-1) relay operated, advances the (R-2) switch to position 17. As the (R-2) switch advances from position 16, the (O), (FO') and (BO) relays release. Cam A advances the (R-2) switch to position 18.

58. STEPPING RELAY SOAK

As the (R-2) switch passes through position 17, a circuit is closed to soak (STP) relay in the proper direction for talking selection. As the (R-2) switch advances from position 17, the (STP) and (CI) relays release.

59. TALKING SELECTION - (R-1) (14), (R-2) (18)

The (STP) relay operates. Circuit: - Battery, district of line relay, (FT) lead, (S) relay normal, cam U (R-1), cam C (R-2), 54 ohm winding of (FL) relay, winding of (STP) relay, (BO) and (SC-1) relays normal, 18-AC resistance (500 ohms), ground. The (STP) relay operated, operates counting relay (O) under control of the (TS) relays. As the district switch advances, the (STP) relay is short-circuited and releases. The (STP) relay released, operates the (BO) and (FO') relays which lock to ground on cam I. The (BO) relay operated, opens the fundamental circuit, thus stepping the district in the proper talking positions. The (FO') relay operated, advances the (R-1) switch to position 15.

60. REGULAR DISCONNECTION - (R-1) (18), (R-2) (18)

As the (R-1) switch advances from position 14, the locking circuits for the operated register relays, and for the (CS) relay are opened at cams E and J (R-1) respectively, releasing the relays. As the (R-1) switch enters position 15, the (R-2) switch is advanced to normal through cam P (R-1) and cam J (R-2) to ground. As the district switch advances to its talking position, ground is disconnected, from lead (TST), removing the short circuit from the (T-1) relay. The (T-1) relay operates from battery on the (SB) relay to ground on the SB relay. The (T-1) relay operated, (a) releases the (T) relay, (b) locks under control of the (SB) relay and (c) connects ground through its 80 ohm winding to lead (TST) thus making the sender test busy to hunting sender selectors. With the (T) relay released, the (SB) relay locks to ground through the continuity contact of the (T) relay. The (T) relay released, steps the (TM) switch to normal. The (TM) switch in normal, advances the (R-1) switch to position 18, and releases the (MS) relay.

61. (R-1) SWITCH RETURNS TO NORMAL - (R-1) (18)

With the (DD) relay released, the (R-1) switch is advanced to normal. As the (R-1) switch advances from position 18, the (ADV), (ADV-1), (SON), (ON-2), (OFL-1), (IA), (SB), (RR) and (E) relays release. The (RR) relay released, steps the (RC) switch to the (N) terminal and at the same time operates the (ON-1) relay. The (ON-1) relay operated, holds the (SB) relay operated or if the (SB) relay has released it reoperates. When the (RC) switch steps to the (N) terminal, the (ON-1) and (SB) relays release. The (R-3) and (R-5) switches, however, do not return to normal. The (SB) relay released, releases the (T-1) relay disconnecting the ground from the (TST) lead, which restores the circuit to normal.

62. RESETTING OFF NORMAL REGISTERS

If the (R-1) switch has been returned to normal before the registers are reset, the (RR) relay then releases. The registers are now reset from ground at the normal (T) relay through the (N) terminal of arc TM-2, (ON-1) relay and cam O or Q (R-1). The (ON-1) relay operates, locking or reoperating the (SB) relay holding this circuit busy to hunting selectors. When the (A), (B) and (C) registers are reset, the (RC) register is stepped to terminal (N). With all the registers reset, the (ON-1) relay releases, in turn releasing the (SB) relay. The (SB) relay releases, the (T-1) relay, returning the circuit to normal.

63. SENDER RESELECTED FOR COIN COLLECT OR REFUND

When the receiver at the calling station is replaced on the switchhook, the district advances and reselects an idle sender for the purpose

of collecting or refunding the coin. The (T) and (SB) relays operate as before. After the coin has been collected or refunded by the associated coin and time measure alarm circuit, the district advances, releasing the sender and restoring the circuit to normal.

64. DISCONNECTION BEFORE DIALING IS COMPLETED

Should the receiver at the calling station be replaced on the switchhook before dialing has been completed, the (L) relay releases, releasing the (RLS) relay. The release of the (L) and (RLS) relays, operates the (DWO-1) relay. The (DWO-1) relay operated, (a) locks to off normal ground, (b) opens the operating circuit of the (SCN) relay, (c) operates the (DWO) relay, (d) opens the heavy impulse circuit so nothing but light RCI impulses will be sent out. The (DWO) relay operated, (a) closes the (FT) lead around the break contact of the (S) relay, (b) opens the (DWO-1) relays operating circuit, (c) opens the units selection pulsing lead and (d) causes the coin and time measure alarm cabinet to refund the coin.

65. WHEN THE DISTRICT HAS NOT REACHED POSITION 6

If the district has not reached position 6, it will not be advanced until after the coin has been refunded. The coin and time measure circuit functions after coin refund, releasing the (D) relay in the district and restoring the district selector to normal. The sender is then restored to normal as described under Regular Disconnection.

66. WHEN THE DISTRICT HAS PASSED POSITION 6

If the district has passed position 6 "awaiting relays returned on W.O.", the various selections will be made, depending upon the number of numerical digits dialed. With the fundamental circuit closed, selections will be stopped by the counting relay circuit being opened at the particular numerical register which has not moved off-normal. Under this condition, the incoming or final selector travels to tell-tale and reverse battery is connected to the fundamental circuit operating the (OFL) relay. The (OFL) relay operates the (OFL-1) and (OV) relays. The (OV) relay operates, operates the (IA) relay. The (OV) and (IA) relays lock to ground on cam J (R-1). The (ITT) relay which operated in position 12 of the (R-1) switch is locked to ground on cam J (R-1) until the (R-2) switch enters position 6 of its second revolution when its winding is short-circuited, releasing it. With the (ITT) and (IA) relays operated, the (BC), (FO') and (O) relays operate and lock. The (FO') relay operated with the aid of cam A advances the (R-2) switch to position 14 of the second revolution and (R-1) switch to position 14. As the (R-2) switch enters position 12, the (OOV) relay operates through cam T.

(CFL-1) relay operated, to the off-normal ground. As the (R-2) switch leaves position 12, the (BO), (FO') and (O) relays are released. If the coin has been returned when the (R-2) switches reaches position 14, the (ADV) and (ADV-1) relays operate, advancing the district selector. Circuit: - Battery, winding (ADV-1) relay, thru the time measure circuit, in parallel with winding of (ADV) relay, (ADV) relay normal. (IA) relay operated, (ITT) relay normal, (CTV) relay operated, cam K (R-2), ground. Talking selection is made, at the completion of which the (BO and (FO') relays operate. The (BO) relay operates, opens the tip side of the fundamental circuit, stopping the district in a talking position. With the district in a talking position, ground is removed from the (TST) lead, releasing the sender as described under call 1.

67. DISCONNECTION AFTER DIALING IS COMPLETED

If all the numerical digits have been dialed, district, office, incoming and final selections are made in the regular manner. Units selection is cancelled by the operation of the (DWO) relay. The (DWO) relay operates as described in paragraph 64, opening the counting relay circuit, causing the final selector to travel to tell-tale. The circuit functions from this point as described in the preceding paragraph.

68. REGULAR CALL TO A FULL MECHANICAL OFFICE USING OFFICE SELECTOR - NON COIN

For this class of call, this sender circuit connects with a non-coin time measure alarm circuit. The circuit functions as described for Regular Call-Coin except that the final units selection does not wait on the time measure circuit to test for a coin. The sender is not reselected to collect or refund the coin.

69. DIRECT MECHANICAL CALL WITHOUT THE USE OF OFFICE SELECTOR

When office selections are skipped, the sender functions as described under Regular Call as far as, and including district group selection. The (SKO-6) register relay is operated for this class of call and holds the (BO) and (FO') relays operated, upon completion of district group selection. Ground on the armature of the (FO') relay and the A cam advances the (R-2) switch from position 4 to position 11. As the (R-2) switch leaves position 10, the counting relays release, and the A cam advances the switch to position 12, skipping office test, office brush and office group selections. The sender functions as previously described, completing the call.

70. DIRECT MECHANICAL CALL TO A.B.X.

On calls to A.B.X. stations, the calling subscriber dials the A.B.X. station number in addition to the office code and call number.

The station selectors are set in the same manner as the office and numerical selectors described under Regular Call. The translator frame cross-connections in this case are such as to operate class register relays (CL-1), (CL-3) and (CL-4). These relays operated, cause the (R-3) switch to advance from any position in which it may have been set from the previous call to position 12. The (RC) switch is stepped from terminal 7 to terminal 10 under control of the (RA) relay. After final units selection has been made and the (R-2) switch is in position 8, (second revolution, the fundamental circuit is opened by the operation of the (S) relay, if the A.B.X. number has not been dialed. When all is opened by the operation of the (S) relay, if the A.B.X. number has not been dialed. When all A.B.X. registers are set, the fundamental circuit is closed through to the distant A.B.X. which controls the operating of the (STP relay, until the sender is satisfied. Ground is connected to the counting relays through the brushes and terminals of arc (SH-2), (ST-2) and (SU-2), through cam O (R-2). After each selection, the operation of the (FO') relay advances the (R-2) switch to the next position. Otherwise the circuit functions as described under "Regular Call".

71. CALL TO ZERO OPERATOR - NON COIN

To call the zero operator, the calling party dials zero. The (T), (SB) and (SC-2) relays operate and function as described in paragraph 7. The (L) relay operated, operates the (RLS), (RA) and (L-1) relays which function as described in paragraph 9. The brush assembly of the (A) selector is advanced to terminal 10 as ten impulses will be received from the station dial. The (B) and (C) registers and numerical selectors, the register relays and the (R-1) switch remain normal. After all the impulses have been received from the station dial, the (RA) relay releases, stepping the (RC) switch to terminal 1.

72. ZERO RELAYS OPERATE - (R-1) (1), (R-4) (1), RC (1)

With the brush assembly of the (A) selector on terminal 10, the (Z) and (Z-1) relays operate. Circuit: - Battery windings (Z) and (Z-1) relays, terminal 10 and (A-6) brush, cam E (R-4), cam I (R-1), ground. The (Z) and (Z-1) relays operated lock to ground through the make contacts of the (Z) and (T) relays. The (Z-1) relay operated, (a) advances the (R-4) switch to position 3 and operates the (R) relay, (b) operates the (CL) relay, and advances the (R-3) switch to position 13, and (c) opens the circuit through its break contact, thereby preventing the (R-4) switch from advancing from position 3. If the (Z2) relay is furnished, it operates when the (Z1) relay operates and advances the route switch

(R4) and opens the (CT-4) relay circuit. The (RC) switch steps from terminal 1 to terminal 10. Circuit: - Battery, winding (ON) relay, winding and break contact (RC) selector magnet, terminals 1, 2, 3, 4, 5, 6, 7, 8, 9 and (RC-3) brush, terminal 10 and (A-2) brush, (RA) relay normal to ground. With the (R-4) switch in position 3 and the (CL relay normal, the (SON) relay operates. The (SON) relay operated locks to the off-normal ground and advances the (R-2) switch to position 2. As the (R-2) switch enters position 2, the (SC) and (ON-2) relays operate. The (SC) relay operated, operates the (SC-1) relay.

73. (R-5) SWITCH ADVANCED TO POSITION 1 - (R-3) (13), (R-4) (3)

The (R-5) switch is now advanced from any position in which it may be to position 1. Circuit: - Battery, winding (R-5) magnet, cams D, E, F or G, cross-connected to cam S (R-4), R relay normal, ground. The circuit functions for district brush, district group, office test, office brush, and office group selections, as described under Regular Call (1), except the counting relay circuit is traced through the upper inner contacts of cams O, L, I and F, (R-4), instead of through the contacts of the register relays. As the (R-1) switch does not move off-normal for this call, the translator circuit and register relays do not function. The connections from these cams to the counting relays are made as required in accordance with position of the trunks to the zero operator at the district and office frames. At the end of office group selection, the (FO') relay operates, and advances the (R-2) switch to position 11, the A cam advancing it to position 12.

74. TRUNK TEST - (R-3) (13), (R-2) (12)

The (TG), (TG-1) and (TG-2) relays operate for trunk test, advancing the (R-2) switch to position 13, the A cam advancing it to position 14. As the (R-2) switch enters position 14, the (ADV) and (ADV-1) relays operate through cam Q, (R-3), cam K, (R-2) to ground. The (ADV) relays operated, lock to the off-normal ground and function as described in paragraph 5.

75. TALKING SELECTION - (R-1) (1)

With the (R-2) switch in position 14, the fundamental circuit is closed operating the (STP) relay and advancing the district for talking selection. The (STP) relay operated, operates the counting relays for talking selection under control of the (Z) relay.

76. SENDER RELEASED

When sufficient impulses have been sent back to satisfy the sender for talking selection, the (FO') relay operates and advances the (R-2)

switch to position 15, the A cam advancing it to position 16. As the district advances to its talking position, ground is disconnected from the (TST) lead, releasing the (T) relay as described in paragraph 60, except the release of the (T) relay, also releases the (Z) and (Z-1) relays. The (SB) relay, however, does not release at this time, but locks through the break contact of the (T) relay, to ground on the (TM-1) brush. The ground through the winding and make contact of the (T-1) relay is thus maintained on the (TST) lead until the (TM) selector returns to normal. The (Z-1) relay released, advances the (R-4) switch to normal and operates the (R) relay.

77. STEPPING RELAY SOAK

The (R) relay operated, advances the (R-3) switch to normal and operates the (CL) relay. The (GS) and (GS) relays also operate, but perform no useful function. As the (R-4) switch reaches normal, the (R) relay releases, in turn releasing the (CL) relay. With the (R-4) switch normal, the (R-2) switch is advanced to position 17, and A cam advancing it to position 18. As the (R-2) switch passes through position 17, the (STP), and (CI) relays operate as in paragraph 58. Ground on cam K (R-1) advances the (R-2) switch to normal. When the (R-2) switch leaves position 18, the (ON-2) relay releases.

78. RESTORING ALL SELECTORS TO NORMAL

The (T) relay released, advances the (TM) selector to normal through the strapped terminals and (TM-2) brush. With the (TM) selector normal, the (A) selector is restored to normal. The (ON-1) relay operates in series with the (A) magnet, grounding the off-normal lead, holding the (SB), (ADV) and (ADV-1) relays operated. With the (A) selector normal, the (RC) switch is returned to normal. As the (RC) selector returns to normal, the (ON-1) relay releases, in turn releasing the (SB), (ADV) and (ADV-1) relays and also disconnects ground from the "time measure and monitoring alarm circuit" restoring it to normal. The (SB) relay releases the (T-1) relay which disconnects ground from the (TST) lead. The (ON-1) relay is made slow in releasing so that the (SB), (ADV) and (ADV-1) relays will not release while the (A) and (RC) selectors are being restored to normal.

79. CALL TO ZERO OPERATOR - COIN

On a call from a mechanical party station to a zero operator where a coin has been deposited, the calling party dials zero, causing the sender circuit to function as described under "Calls to zero Operator Non-Coin". Although the zero operator may have collected or returned the coin, the district, nevertheless, selects a sender as previously described to return a coin. The zero operator may be called from a

mechanical pay station without a coin being deposited, as the associated "Time Measuring and Monitoring Alarm Circuit - Coin", prevents only final units selection in the progress of a call. As the (R-2) switch on a zero operator's call passes through one revolution only, the call will not be interrupted.

80. RESTRICTED ZONE CALL NON-COIN

Should a number be dialed which is located in a restricted zone or outside the area or zone to which the calling subscriber is limited, the circuit functions as described under Regular Call until position 8 of the (R-1) switch is reached. Certain zone relays (ZN) are operated on impulses from the pulse machine and lock. The (ZN) relays operated, operate the (Z) and (Z-1) relays, and the (Z2) relay if furnished. Circuit:- Battery, windings (Z) and (Z-1) relays, leads (C) and (A), contacts of the (ZN) relays, lead (A), (GS) relay operated, ground. The (Z-1) relay operated, (a) advances the (R-4) switch to position 3 and operates the (R) relay, (b) operates the (CL) relay, and advances the (R-3) switch to position 13, (c) opens the circuit through its break contact, preventing the (R-4) switch from advancing from position 3. The (GS) and (CS) relays lock to ground on cam J (R-1), and the (R-1) switch is advanced to position 9 as described in paragraph 31. The (SON) relay operates and the circuit thereon functions as explained under a Call to Zero Operator (5) with the following exceptions:- The (R-1) switch is returned to normal from position 9 as described under Disconnection in paragraph 60. When the (R-1) switch enters position 1, the (C) selector returns to normal but the (RC) switch does not return to normal until the (B) and (A) selectors have returned to normal. The restoring circuit for the (B) and (A) selector is closed through the terminal of the proceeding arc to ground on (TM-5) brush. The (TH), (H), (T) and (U) selectors are also reset from ground on (TM-5) brush.

81. RESTRICTED ZONE CALL - COIN

On a call from a coin station, the circuit functions in the same manner except that the coin is collected or returned as described under Coin paragraph 79.

82. CALL TO TELEGRAM OPERATOR

On a call from a coin station to a "Telegram Operator", the (TO-6) relay operates on impulses from the pulse machine and routes the call to the Telegram Operator, by operating the (Z) and (Z-1) relays. The coin is collected or returned the same as described in paragraph 79. On non-coin sections the call will go direct to the telegram operator as described under call to 3 digit operator.

83. CALL TO 3 DIGIT OPERATOR

On a call to a 3 digit operator the (T), (SB), and (SC-2) relays operate, the (TM) selector is advanced and dial tone is sent back to the calling station the same as described under Sender Selected paragraphs 7 and 8. Only the office code which consists of three digits, is dialed setting the (A), (B), (C) and (RC) selectors as described under Setting Office Registers. The (R-1) switch is advanced to position 9, and the register relays operated the same as described under Translation, Pulse Count, and Class Selection. At the end of the pulse count the (CL) relay operates, in turn operating the (GS) and (CS) relays. The (GS) and (CS) relays operated, lock to ground through cam J (R-1).

84. TOLL AND LONG DISTANCE OPERATOR CALLED

If a toll operator is called, the (R-6) relay operates, advancing the (R-4) switch to position 4 from ground on the (GS) relay operated. If the long distance operator is called the (R-5) and (R-6) relays operate and advance the (R-4) switch to position 5. In either case, the advance of the (R-4) switch opens the normal operating circuit of the counting relays under control of the register relays and closes a circuit for operating the counting relays through cams C, L, I and F (R-4) in position 5. The (R-3) switch is advanced to position 14, as determined by the (CL-) relays (which operated on impulses from the pulse machine).

85. SELECTION

District brush, district group, office test, office brush and office group selections are made as described under Regular Call, except the operating circuit for the counting relays is closed through the upper outer contacts of cams O, L, I and F (R-4) for a "toll call", or cams P, M, J and G (R-4) for "long distance call". From this point on up to the disconnection, the circuit functions as described under "Call to Zero Operator" except the counting relay circuit for talking selection is closed through the (Z) relay normal and contacts of the (TS-) relays. Disconnection takes place as described under Restricted Zone Call.

86. CALL TO MANUAL STATION VIA DIRECT CALL INDICATOR LESS THAN 10,000 - NON-COIN

On this class of call, the circuit functions for registration, translation, district and office selections and office tests as described under Regular Call. The (R-3) switch is set in position 6 or 15 under control of the (CL-) relays. Assume the (R-5) switch is set in position 5, thus compensating the local office trunk with 1200

ohms, and cutting in no resistance on R.C.I. trunk. The fundamental circuit to the distant R.C.I. office cannot close until the (RC) switch is set in position 10 and the compensating switch has been set, as the (S) relay operates through its secondary winding when the (RC) selector is on terminals 7, 8 and 9. If the compensating switch is in motion, the (GR) relay is operated, in turn operating the (S) relay through its primary winding in positions 5/6 of the (R-2) switch preventing office test until the (R-5) switch is set.

87. LIGHTING ASSIGNMENT LAMP IN MANUAL OFFICE

Upon completion of office group selection, the (R-2) switch is in position 12 and the (R-1) switch in position 9. The (FP) relay operates through cam K (R-3),(CI) relay normal and cam L (R-1) to ground. The (FP) relay operated, locks through cam D (R-6) and cam M (R-1) to ground. The fundamental circuit is closed operating the (STP) and (TG) relays, and the (A) relay in the R.C.I. trunk, thereby causing the assignment lamp associated with the R.C.I. trunk to light. Circuit:- Battery, winding of (A) relay in the distant R.C.I. trunk, tip side of the office and district selectors, lead (FT), (S) relay normal, cam U (R-1) cam C (R-2), primary winding (OFL) relay, winding (STP) relay, (BO) relay normal, cam V (R-3) 18-BJ resistance in parallel with the secondary winding (OFL) relay, cam V (R-2) winding (TG) relay, cam Y (R-2), cams J and K (R-5), cam R (R-2), cam X (R-1), (ADV) relay normal, lead (FR) to ground through the other winding of the (A) relay in the R.C.I. trunk circuit. The (TG) relay operated, operates the (TG-2) relay which in turn operates the (TG-1) relay. The (TG-1) relay operated, (a) locks to ground on cam J (R-2), (b) replaces the circuit through the upper outer and lower inner contacts of cam Y (R-2), which is opened when the switch leaves position 12 and, (c) advances the (R-2) switch to position 13, the A cam advancing it to position 14. With the (R-2) switch in position 14, the (CI) and (RB) relays operate. As the (R-2) switch enters position 13 cam C (R-2) short-circuits the (STP) and (OFL) relays.

88. ASSIGNMENT KEY OPERATED

When the assignment key associated with the lighted assignment lamp of the R.C.I. trunk at the terminating call indicator position is operated, battery and ground are disconnected from the fundamental circuit, releasing the (TG) relay. The condenser and resistance bridged across the (TG) relay absorbs the inductive discharge from the (TG) relay and prevents a false pulse. The (TG) relay released, releases the (TG-2) relay which in turn releases the (TG-1) relay. The (TG-1) relay released, operates the (TG) relay. Circuit:- Battery, 1000 ohm winding (TG) relay, cam G (R-1), (CI) relay operated, cam Q, (R-3), (TG-1) relay normal, ground. The (TG) relay operated, with the aid of the A cam advances the (R-6) switch through one complete revolution.

89. REASON FOR (TG-2) BEING SLOW RELEASE RELAY

The (TG-2) relay is made slow in releasing so that the (R-6) switch will not be prematurely advanced from position 1. Should the (TG) relay be bridged across an R.C.I. trunk which has not been disconnected from the line jack, and the switchhook at the station be momentarily depressed, reverse battery and ground are sent back over the tip and ring of the trunk, momentarily releasing the (TG) relay. The (TG) relay released would in turn release the (TG-2) relay if it were not slow in releasing. The (TG-2) relay would in turn release the (TG-1) relay thereby advancing the (R-6) switch. As the (R-6) switch advances, the inpulses necessary to display the called number would be sent to the R.C.I.office and would be lost.

90. SENDING R.C.I. IMPULSES

The continuous advance of the (R-6) switch from position 1 to 1, transmits impulses over the fundamental circuit, operating the proper combination of relays at the terminating R.C.I. office for displaying the called number. The impulses are sent in the following order: Stations, thousands, hundreds, tens and units. Four circuit conditions are established by the rotation of the (R-6) switch for each digit or station designation displayed at the terminating R.C.I. office. For example, to display station designation (W) before the (B) operator at the terminating manual office, the brush of arc (SH-5) will be on terminal 9 and the following four circuit conditions are set up, in the order named by the rotation of the (R-6) switch through position 1 to 4-1/4 inclusive, (a) as the (R-6) switch passes through position 1 to 1-1/4, the fundamental circuit remains open.

91. HEAVY NEGATIVE PULSE - (R-1) (9), (R-2) (14), (R-3) (6), (R-5) (2)

As the (R-6) switch passes through position 1-3/4, to 2-1/4, a low resistance is established to the R.C.I. office, over which the first pulse (heavy negative) is sent. Circuit:- Battery, 52-5 ohm resistance, (DWO-1) relay normal, (TAN) relay normal, cam I (R-6), cam 1 (R-3), (SH-5) brush and terminal 9, cam T (R-6) in parallel with 3500 ohm resistance through the (HR-6) relay normal, through the (FP) relay operated, cam U (R-3), (CI) relay operated, (TG-1) relay normal, compensating resistance, cam R (R-2), cam X (R-1), (ADV) relay normal, lead (FR), over the ring of trunk pulsing relays in the terminating office, back over the tip side of lead (FT), (S) relay normal, cam U (R-1), cam C (R-2), (ADV), (OOV), and (TG-1) relays normal, (CI) relay operated, cam T (R-3), (FP) relay operated, cam V (R-6), ground.

92. FUNDAMENTAL CIRCUIT OPENED

As the (R6) switch passes through positions 2-3/4 to 3-3/4, the fundamental circuit is opened.

93. LIGHT NEGATIVE PULSE

As the (R-6) switch passes through position 3-1/4 to 4-1/4, the fundamental circuit is again closed, sending a light negative impulse. The circuit is the same as described under (b) for a heavy negative pulse, except that the 52.5 ohms resistance is not in parallel with the 3600 ohm resistance, the circuit being open at contact 3 of cam T (R-6). Impulses for the thousands, hundreds, tens and units are sent to the R.C.I. office in a similar manner as the (R-6) switch passes through position 4-3/4 to 8-1/2, 8-3/4 to 12-1/4, 12-3/4 to 15-1/4, and 16-3/4 to 20-1/4 respectively. As the (R-6) switch advances from position 9, the (FP) relay releases, transferring the fundamental circuit from its make contacts to cams H and F (R-6).

94. ADVANCING TWO WIRE OFFICE SELECTOR

As the (R-6) switch enters position 1 and with the (FP) relay normal, the (R-1) switch advances to position 10, the A cam advancing it to position 12. As the switch advances from position 9, the (TC) relay releases. While the (R-1) switch is passing through positions 9-1/2 to 10-1/2, positive battery is applied to the fundamental circuit to advance the distant two wire office selector, if one is used. Circuit:- Battery, 52.5 ohm resistance, cam Y (R-1), cam L (R-3), cam E (R-6), (FP) relay normal, over the fundamental circuit back to ground on cam M (R-1).

95. TALKING SELECTION

With the (R-1) switch in position 12, the (ADV), (ADV-1) and (ITT) relays operate through cam N (R-3) and cam N (R-1) to ground. The (ADV) and (ADV-1) relays operated, function as described in paragraphs 56 and 57, advancing the district selector. The fundamental circuit is closed for talking selection. The counting relays operate under control of the (TS-) relays. When talking selection has been completed, the sender is released. The circuit is restored to normal as described in paragraphs 58 to 63 inclusive.

96. CALL TO MANUAL STATION VIA TANDEM R.C.I. LESS THAN 10,000 NON-COIN

On a call through a tandem office the circuit functions as described for a direct R.C.I. call up to and including office group selections. Upon the completion of office group selection, the (R-2) switch is in position 12 and the (R-1) switch in position 9. The (R-6) switch is advanced to position 17, under control of the (CL-) relays.

97.. TWO REVOLUTIONS OF (R-6) SWITCH - (R-1) (9), (R-2) (12), (R-3) (17)

With the (R-3) switch in position 17, the (TAN) relay operates. Circuit:- Battery, winding of (TAN) relay, cam K (R-3), (CI) relay normal, cam L (R-1), ground. The (TAN) relay operated, operates the (FP) relay. Both relays lock through cam D (R-6) and cam M (R-1) to ground. The (TAN) relay operated also advances the (R-6) switch to position 2. The B cam advances it to position 3. The (TAN) relay causes the three digits of the first revolution of the (R-6) switch to be those registered on the (A), (B) and (C) registers. As the (R-6) switch leaves position 1 of the second revolution, the (TAN) relay releases. With the (R-2) switch in position 12 and the (R-1) switch in position 9, the fundamental circuit is closed to the tandem R.C.I. office, operating the (STP), (TG), (TG-1) and (TG-2) relays, advancing the (R-2) switch to position 14, and operating the (CI) and (RB) relays. When the assignment key of the incoming tandem call indicator position is operated, the (STP), (TG), (TG-1) and (TG-2) relays release. The (TG-1) relay released, operates the (TC) relay which advances the (R-6) switch to position 10, the B cam advancing it to position 1. The (R-6) switch, however, does not stop in position 1 but is advanced a second complete revolution in the same circuit through the (TC) relay operated. As the (R-6) switch leaves position 1 of the second revolution, the (TAN) relay releases.

98. TANDEM OFFICE CODE

Each manual office within the tandem toll district is assigned a tandem office code number of three digits, by means of which the particular office call is identified by the tandem operator. During the first revolution of the (R-6) switch, between positions 8 and 20-1/4, impulses for the three tandem code digits are sent to the tandem office, over the fundamental circuit, in a manner similar to that described for numerical impulses Modification of the four circuit conditions for each digit are made through cams N and O of the (R-6) switch and arcs (A-5), (B-4) and (C-3). During the second revolution of the (R-6) switch, the stations, thousands, hundreds, tens and units impulses are sent over the fundamental circuit and the circuit is returned to normal as described under Direct R.C.I. Call.

99. CALL TO MANUAL OR MECHANICAL OFFICE VIA MECHANICAL TANDEM - LESS THAN 10,000 - NON COIN

On a call through a mechanical tandem office, the circuit functions as described under a tandem relay call indicator call, with the following exceptions:- As a different office code has been dialed, a district and office selector will be selected which will route the

call to a mechanical tandem office. A mechanical tandem trunk will be tested instead of a tandem relay call indicator trunk, operating the (STP) and (TG) relays in series with the distant district line relay. The distant district line relay operated, causes a distant sender to be selected in the tandem office. The circuit through the (STP) and (TG) relays is opened when the distant sender is selected releasing the relays.

100. CALL TO MANUAL STATION VIA DIRECT OR TANDEM CALL INDICATOR MORE THAN 9999 - NON-COIN

For calls in this class the circuit functions as described under call to Direct R.C.I. Office and the (R-3) switch is set by the translator register class relays, in positions 6, 15, or 17. In manual offices having more than 9999 lines, with party lines, there are no party lines having telephone numbers from 1000 to 1099 inclusive nor above 10,000. Lines starting with the number 10 will not be assigned as party lines.

101. WHEN FIRST TWO DIGITS ARE 10

When the first two numerical digits are 10, and if the stations register is moved off-normal by the subscriber's dialing the fifth numerical digit before the (TM) selector reaches position 10, the (STA) relay operates, moving the (R-3) switch from positions for numbers less than 10,000 to the position for numbers greater than 9999. The (STA) relay operated, locks to ground on cam J (R-1), and advances the (R-3) switch to the next position succeeding that in which it is set. The (TM) magnet does not operate at this time due to the high resistance of the winding of the (STA) relay. This changing of the (R-3) switch position in turn changes the order of connection of the (TH), (H), (T), (U) and (SH) selectors to the R.C.I. impulser cams so that instead of sending the station impulses first, the thousands impulses are sent first. Cams E, F, G, H and I (R-3) and (STA) relays operated are used to accomplish this change. You will note that when the (STA) relay releases as the sender is restored to normal, ground through the back contact of the (STA) relay advances the (R-3) switch out of the over 9999 position.

102. TIME ALLOWANCE FOR DIALING FIFTH DIGIT

When the station dial has been operated seven times for three letters and four numericals, the (S) relay operates through (RC-1) brush and terminal 7. The (S) relay operated, opens the fundamental circuit preventing the impulses from being sent to the call indicator position. The same ground used for operating the (S) relay also

advances the (TM) selector to terminal 10 in case of G wiring or terminal 6 in case of FF wiring. A time interval of approximately 4 seconds elapses before the brush assembly reaches terminal 10 or terminal 6, GG or FF wiring respectively to insure sufficient time in case the subscriber dials a number over 9999. When the RC selector is advanced to terminal 0 a circuit is closed which advances the TM selector to terminal 7 in case of FF wiring.

103. CANCELLING TIME ALLOWANCE

In case of calls to manual offices having more than 9999 lines but having no party lines, provision is made to cancel the time allowed the subscriber for dialing the station digit on all calls not beginning with 10 by operating the (SD-4) relay during translation. The (TM selector is then advanced to terminal 10 in case of GG wiring or terminal 6 in case of FF wiring. With the TM selector or terminal 10 or 6 a circuit is closed to advance the RC selector to terminal 0. With the RC selector on terminal 0 in case of FF wiring the TM switch is advanced to terminal 7 as soon as the (T) register is stepped off-normal.

104. CALLS TO OFFICES HAVING LESS THAN 10,000 LINES WITH PARTY LINES

On calls to manual offices having less than 10,000 lines with party lines, the (STA) relay does not operate, thus it is possible to have party lines with numbers beginning with 10. This is accomplished by the operation of the (SD-4) and (SD-5) relays. The circuit for stepping the (TM) selector is opened and it is stepped to terminal 10. In case of G wiring terminal 6 in case of FF wiring under control of the interrupter. When the RC selector reaches terminal 0 the TM selector is advanced to terminal 7 in case of FF wiring.

105. CALLS TO OFFICES HAVING LESS THAN 10,000 LINES WITH NO PARTY LINES

In the case of calls to manual offices having less than 10,000 lines with no party lines the operation of the (STA) relay is prevented, and the time interval is cancelled, by the operation of the (SD-5) relay.

106. NON-STATION R.C.I. CALLS NON-COIN

For R.C.I. calls to individual lines (not requiring station designation) the calling party dials the office code and numerical digits only. The brush assembly of the (SN) selector, therefore, does not advance off normal on this call. Under this condition there will be no modification of the four impulse circuit conditions for the station digit, and the (R-6) switch will send two light negative impulses, to light station lamp 0 at the distant R.C.I. position.

107. CALL INDICATOR CALLS - COIN

On calls to an R.C.I. office from a mechanical pay station the circuit functions the same as described under calls 7, 8, 9, 10 or 11, except that the call is delayed by the operation of the (S) relay in position 12 of the (R-2) switch, until preliminary coin test is completed and the coin is collected or returned the same as described under Regular Call.

MISCELLANEOUS

108. OVERFLOW - DISTRICT SELECTOR

Should the district go to the overflow position during trunk hunting, ground is disconnected from the (TST) lead causing the circuit to function as described under Regular Call - Regular Disconnection.

109. OVERFLOW - OFFICE SELECTOR

Should the office selector go to overflow during trunk hunting, reverse battery is sent back from the office selector over the tip and ring of the fundamental circuit, operating the (TG) and (OFL) relays. The (STP) relay does not operate under this condition. At this time the (R-2) switch is in position 12 and the (R-1) switch is position 9. The (TG) relay operated, operates the (TG-2) relay which in turn operates the (TG-1) relay. The (OFL) relay operated, operates the (OFL-1) and (OOV) relays. The (TG-1) relay operated, advances the (R-2) switch to position 13, the A cam advancing it to position 14. As the (R-2) switch enters position 13, the (OV) relay operates. The (OV) relay operated, locks to ground on cam J (R-1) and operates the (IA) relay. The (IA) relay operated also locks to ground on cam J. With the (IA) and (OOV) relays operated, the (ADV) and (ADV-1) relays operate. As the (R-2) switch enters position 14 the (ADV) and (ADV-1) relays lock to ground on cam J (R-1). The (ADV) and (ADV-1) relays operated, advance the district selector as described in paragraphs 56 and 57. As the district leaves selection beyond position, battery is removed from the (SC) lead, releasing the (SC) relay which releases the (SC-1) relay. The (SC-1) relay released closes the fundamental tip to ground advancing the district for talking selection, and operating the (STP) relay. The (STP) relay operated, operates counting relay (3) through the (OV) and (IA) relays operated. Four impulses are applied to the fundamental circuit by the district advancing through its talking position, operating three sets of counting relays. After the fourth impulse has been sent, the (STP) relay releases, allowing the (BO) and (BO') relays to operate. When the district reaches its overflow position, ground is disconnected from the (TST) lead, disconnecting the sender as described under Regular Call.

110. OVERFLOW - INCOMING SELECTOR - (R-1) (13), (R-2) (2)

Should the incoming selector go to overflow during trunk hunting it advances, connecting reverse battery to the tip and ring of the fundamental circuit, operating the (STP) and (OFL) relays. At this time the (R-2) switch is in position 2 of its second revolution and the (R-1) switch is in position 2 of its second revolution and the (R-1) switch in position 13. The (OFL) relay operated, in turn operates the (OV) and (OFL-1) relays. The (OV) relay operated, (a) locks to the off-normal ground, (b) operates the (IA) relay and (c) transfers through its continuity contacts, the stepping relay pulsing path to cam U operating the (O) counting relays. The incoming advances, opening the fundamental circuit and releasing the (STP) and (OFL) relays. The (STP) relay released removes ground from one side of the windings of the (BO') and (FO') relays which operate in series with the (O) relay. The (FO') relay operated, locks through cam Q to ground on the (IA) relay operated, in positions 2 to 13, and advances the (R-2) switch with the aid of cam A to position 14. From this point the circuit functions as described under Office Selector Overflow.

111. OVERFLOW - TRANSLATOR

Should the brushes of the translator frame go to overflow, the (TL) relay operates, releasing the (UP) magnet. After a certain interval of time has elapsed the "stuck sender" lamp in the "Time Measure and Monitoring Circuit" is lighted as an indication of trouble.

112. REGISTERS OFF-NORMAL (R-1) (1)

Should the brush assembly of any register selectors be advanced off-normal while the sender is idle, the selector will return to normal. Circuit:- Battery, 52.5 ohm resistance winding and break contact of the particular selector magnet, brush and off-normal, terminals of arc 1, normal of the arcs 1 associated with the preceding selectors, lower contacts of cam Q or O (R-1), winding (ON-1) relay, normal terminal and (TM-5) brush, ground. The (ON-1) relay operated, operates the (SB) relay through the (T) relay normal and also causes the associated Time Measure of Monitoring Alarm Circuit to start functioning. The (SB) relay operated, operates the (T-1) relay which connects ground to the (TST) lead through its 80 ohm winding, making the sender test busy until the selectors have returned to normal. When the office selector has returned to normal, the (ON-1) relay releases releasing the (SB) relay and restoring the associated alarm circuit to normal.

The (SB) relay released, releases the (TI) relay which disconnects ground from the (TST) lead. Should the selector not return to normal, the associated alarm circuit, after a certain interval of time has elapsed, closes a circuit lighting a lamp at the monitor position thus indicating a trouble condition.

113. (R-1) SWITCH OFF-NORMAL

Should the (R-1) switch be moved off normal, while the sender is idle it is advanced to position 18 through the normal terminal and brush of arc (TM-1) to ground. With the (R-1) switch in positions 2 to 19, the (SC) and (ON-2) relays operate to ground through the inner contacts of cam C of (R-1) switch. The (SC) relay operated performs nouseful function at this time. The (ON-2) relay operated, operates the (SB) and (MS) relays, which function as described in the preceding paragraph. Ground on the break contact of the (DD) relay advances the (R-1) switch to normal. As the (R-1) switch returns to normal, the (SC) and (ON-2) relays release, in turn releasing the (SB) relay and disconnecting ground from lead (TST) thereby causing the sender to test non-busy.

114. (R-6) SWITCH OFF-NORMAL

Should the (R-6) switch be moved off-normal, it is again returned to normal from ground on cam K (R-1). As the (R-6) switch passes through positions 2 to 20 inclusive, ground on cam E (R-6) operates the (SB) relay and starts the time measure circuit, which functions as described in paragraph 112. When the (R-6) switch returns to normal, the (SB) relay releases and the time measure circuit is restored to normal.

115. (R-4) SWITCH OFF-NORMAL

Should the (R-4) switch be moved off-normal, it is returned to normal from ground on cam K (R-1). As the (R-4) switch enters position 2-1/4, ground through cam W (R-4) operates the (SB) relay and starts the time measure circuit which functions as described when the (R-1) switch moves off-normal. As the (R-4) switch returns to normal, the (SB) relay releases and the time measure circuit is restored to normal.

116. (R-2) SWITCH OFF NORMAL

Should the (R-2) switch be moved off-normal, ground . cam K (R-1) advances the switch to position 17 and from position 18 to normal. The A cam advances it to position 18. As the switch enters position 1-3/4, the (ON-2) relay operates and functions as described in paragraph 113. As the (R-2) switch returns to normal the operated relays are released, returning the circuit to normal.

117. MAKE BUSY

Provision is made to make the sender circuit test busy to the associated sender selectors. When a plug is inserted in the make busy jack, the (MB) relay operates. The (MB) relay operated, connects ground to the (TST) lead, as a busy condition. Should trouble develop in the motor circuit, ground is connected to the winding of (MB) relay which operates and functions as described above.

118. PRELIMINARY IMPULSES

Should a preliminary impulse be impressed on the pulsing circuit before dialing, but after the receiver has been removed from the switchhook, due to an accidental jarring of the switchhook or other reasons, the A selector operates as described in paragraph 9 and steps its brush assembly to terminal 1. With the brush assembly of the (A) selector on terminal 1 and the (RA) relay normal, the (PP) relay operates. The (PP) relay operated, disconnects the (A) selector magnet from the impulse circuit, thus preventing the operation of the (A) selector magnet in the first impulse of the first digit dialed. The (RC) selector magnet operates at this time but does not release to step its brushes off-normal. Holding circuit:- Battery, winding (ON) relay, winding (RC) magnet, terminal 1 and (A-6) brush, cam F (R-4) cam I (R-1), ground. When the (L) relay releases on the first pulse of the first digit, a circuit is closed through the 15 ohm winding of the (PP) relay and the winding of the (RA) relay, operating the (RA) relay, which remains operated throughout the pulsing period. Thus the first impulse after a preliminary impulse passes through the (PP) relay instead of the (A) selector magnet. The (PP) relay is thus held operated during the period of the first impulse and releases at the completion of the first impulse as the circuit through its 1500 ohm winding is opened by the operation of the (RA) relay. When the (L) relay releases again on the second impulse, the (A) selector magnet operates and advances its brush assembly to terminal 2. Upon the completion of the first series of impulses corresponding to the first digit dialed, the (RA) relay releases. The (RA) relay released, releases the (RC) magnet which advances its brush assembly to terminal 1. From this point on the circuit functions as described under Regular Call.

119. CALL ABANDONED AFTER PRELIMINARY IMPULSE

Should the receiver be replaced on the switchhook after a preliminary impulse has been impressed upon the circuit, but before dialing has been started, the circuit functions as described under Disconnection in paragraph 60.

120. RELEASING STUCK SENDER ON ABANDONED CALL

Assuming that the calling subscriber abandons the call after dialing two (2) digits of the office code but fails to replace the receiver on the switchhook, the circuit functions as follows: The (T), (SB), (SC-2), (L), (RLS), (ST), (SC), and (E) relays are operated, the (A) and (B) office selectors set, the brush assemblies of the (TM) selector advances to terminal 6 in case of GG wiring and to terminal 2 in case of FF wiring and the (RC) selector advances to terminals 2, and the (R-1) switch advanced to position 5, as described in paragraph 20. As the third digit has not been dialed, the (S) relay operates and functions as described in paragraph 22. If, after a certain interval of time, the third digit is not dialed, the associated alarm circuit functions causing a lamp at the monitor's position to light when the sender monitor is located at the trouble desk. If the sender monitor's position is located at the M.S. "A" switchboard the timing circuit which would be specified for this arrangement is arranged to automatically route the call to permanent signal holding trunks instead of lighting the lamp at the sender monitor's position. This feature is accomplished in the time measure circuit by connecting the permanent signal terminal to the (TR) relay instead of the sender lamp.

121. CORD INSERTED IN MADE BUSY JACK

When the sender is primed at the monitor's position, ground to connected to the (TR) relay. The (TR) relay operated, locks under control of the (T) relay and operates the (RC) selector magnet through brush (RC-3) stepping the brush assembly of the (RC) selector to terminal 10. As the brush of arc (RC-1) advances from terminal 2, the (S) relay releases operating the (TC) relay. The (TC) relay operated advances the (R-1) switch to position 6. As the (R-1) switch leaves position 5, the (TC) relay locks to ground on the break contact of the (TS) relay. As the switch enters position 5-3/4, the (TS) relay operates from ground on the (TR) relay operated. The (TS) relay operated, releases the (TC) relay. The (TC) relay released, advances the (R-1) switch to position 7, the A cam advancing it to position 8. As the switch leaves position 6-1/4 the (TS) relay releases. As the switch enters position 7, the (P) and (P-1) relays operate to ground through the break contact of the (CS) relay and inner contacts of cam J, of (R-1) switch. Pulse count takes place the same as described under Pulse Count and Registration. No register relays are set at this time.

122. ZERO RELAYS OPERATE

The (TR) relay operated, also operates and locks the (Z) and (Z-1) relays. The (Z-1) and (TR) relays operated, advance the (R-4)

switch to position 6. The (Z-1) relay operated, also advances the (R-3) switch to position 13 at the same time operating the (CL) relay.

123. (R-4) SWITCH IN POSITION 6

The (CL) relay operated, operates the (OS) and (GS) relays which function as described in paragraph 28. With the (R-4) switch set in position 6, and the (R-3) switch set in position 13, the (R-2) switch is advanced to position 2. When the B-431 sequence switch is used for the route switch the S cam spring #4 is cut in position 6 to advance the (M) switch in time measure circuit past the permanent signal terminal to prevent the ground from the permanent signal terminal holding the (TR) relay and delaying the restore to normal. The circuit functions for district brush, district group, office test, office brush and office group selections as described in paragraphs 34 to 40 inclusive except the counting relay circuit is closed through cams U, P, M, J and G (R-4) instead of through the make contact of the operated translater register relays.

124. AT THE END OF OFFICE GROUP SELECTION

At the end of office group selection the (FO') relay operates and advances the (R-2) switch to position 11, the A cam advances it to position 12. From this point on the circuit functions as described under call to Zero Operator - Non-Coin with the following exceptions: - As the (R-1) switch has advanced off-normal, it is returned to normal the same as described under Regular Disconnection. The (TR), (Z) and (Z-1) relays release either following the release of the (T) relay or when the plug of the cord is withdrawn from the make busy jack, depending upon whether the plug is withdrawn before or after the (T) relay releases. The (B) selector, which has advanced off-normal is returned to normal as described in paragraph 55. The register control, (ST), (E), (DD), (OS) and (CL-1) relays release the same as described under Disconnection.

125. SENDER STUCK AFTER TRANSLATION

Should the sender be stuck after translation has been completed, the time measure alarm circuit will function lighting a lamp before the monitoring operator. To release the sender the plug of the monitoring cord is inserted in the (MB) jack, operating the (TR) relay. The (TR) relay operated, advances the (RC) switch to terminal 10 and operates the (DWO-1) relay. The circuit functions from this point on as described in paragraphs 64 to 67 inclusive, in case of GG wiring. In case of FF wiring on coin senders the coin is refunded by the monitor attendant, and the (TR) relay operated by

the insertion of the monitoring cord into the (MB) jack. The (TR) relay operated (a) operates the (DWO-1) relay thru the make contacts of the (SON) relay, (b) operates the (DWO-1) relay (c) advances the (RC) selector to terminal 10. The (DWO-1) relay operated (a) locks to the off-normal ground, (b) operates the (DWO) relay. The (DWO) relay operated advances the (TM) selector to terminal 6, the (RC) selector on terminal 10 advances the (TM) selector to terminal 7. The (TR) relay operated advances the (TM) selector to terminal 8 thru the contacts of the (SON) relay operated. The (DWO-1) relay operated closes a path to operate the (LR) relay in the coin time measure and alarm circuit from ground at terminals 8/9 of the TM selector. The (LR) relay operated closes a path which grounds the SC lead dismissing the subscriber. With the TM selector on terminals 8/9 a circuit is closed from ground at the (TR) relay, operated thru the (SON) relay operated and the (TM) interrupter which advances the (TM) selector to terminal 10. On terminal 10 of the TM selector a circuit is closed which operates the ADV and (ADV-1) relays, opening the SC lead, advancing the district and releasing the sender, disconnecting ground from the (TST) lead, from this point the circuit functions as described in paragraphs 60 to 62 except that in addition to the relays released in paragraph 61 the (TR) relay also releases.

On non-coin senders (FF wiring) the operations are the same as for coin senders except that as there is no (LR) relay in the non-coin time measure circuit the SC lead is grounded when the (DWO) relay operated.

126. HIGH RESISTANCE R.C.I. FEATURE

The function of the (HR-6) relay (high resistance) is to increase the resistance of the high resistance impulse. The (HR-6) relay is operated during the translation under control of the pulse machine. This condition is used for calls to R.C.I. offices where universal call indicator trunks are used.

127. WIPE OUT ON ABANDONED CALLS ON R.C.I. DIRECT AND TANDEM CLASSES DURING THE AWAITING ASSIGNMENT PERIOD

When the sender sequence switch reaches the R.C.I. impulse position (14) on R.C.I. and Tandem Classes of Call the (RWO) relay operates, with the (RWO) relay operated as long as the (TG-2) relay is operated a circuit is closed thru the (TW-6) register relay to operate the (ADV) and (ADV-1) relays in case of an abandoned call. With the (ADV) relays operated the (SC) lead is opened advancing the district and disconnecting ground from the (TST) lead. From this point the circuit functions as described in paragraphs 60 to 62 for non-coin and paragraphs 60 to 63 for coin senders.

Should the call be made thru a two-wire office selector or to a Full Mechanical Tandem Office the (TW-6) relay is operated cancelling the above operations.

128. ADDED TIME BEFORE STUCK SENDER SIGNAL IS GIVEN ON R.C.I. AND TANDEM CLASSES OF CALL AFTER TRUNK TEST IS MADE

With the (RWO) relay normal, a path over lead 24 is closed which functions the time measure and alarm circuit in a minimum of 0.5 minutes maximum 1.0 minute. When the (RWO) operates as described in paragraph 127 the (RWO) relay locks up to the off-normal ground. With the (RWO) relay operated the path over lead 24 is opened which permits the time measure and alarm circuit to function for stuck sender in a minimum of 1.0 minute maximum of 1.5 minutes.

A

ENG: C.W.H.
August 31, 1928
IB

CHK'D.BY: C.W.H.

APP'D.BY: L. T. MARKS
J.M.C.