Western Electric Co., Incorporated,
Equipment Engineering Branch, Hawthorne

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METHOD OF OPERATION

Subscriber's Sender Circuit - 2 Digit Office Code - Panel Machine Switching 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 (L) Relay - E827

Maximum external circuit loop resistance 1,000 ohms. Minimum resistance line leak 10,000 ohms.

2.2 (TG) Relay - B167 on Direct R.C.I. and Operator Class Calls

Maximum external circuit loop resistance 3682 ohms. Minimum battery 20 volts. Minimum resistance trunk leak 30,000 ohms.

On Calls Completed over Tandem R.C.I. Trunks

Maximum external circuit loop resistance 4640 ohms. Minimum battery 20 volts. Minimum resistance trunk leak 30,000 ohms.

On Mechanical Class Calls

Maximum external circuit loop resistance 2300 ohms. Minimum battery 45 volts. Minimum resistance trunk leak 30,000 ohms.

2.3 (STP) Relay - 207-A

Maximum external circuit loop resistance 2,900 ohms. Minimum resistance trunk leak 30,000 ohms - The trunks to office, incoming or final selector circuits shall not include more than 20 miles of #19 gauge cable.

2.4 (OFL) Relay - 206-G

Maximum external circuit loop resistance 2,300 ohms. Minimum resistance trunk leak 30,000 ohms.

2.5 (CT-4) Relay - 206-AK

Maximum subscriber's loop resistance 750 ohms. Minimum resistance line leak 10,000 ohms. Ground potential limits - 0.V. to + 18 V. Coin Battery 100 to 120 V.

2.6 (CT-9) Relay - E1759

Maximum subscriber's loop resistance 750 ohms. Minimum resistance line leak 10,000 ohms. Ground potential limits - 17 V. to + 18 V.

2.7 (CT-8) Relay - B217 -

Maximum subscriber's loop resistance 1,000 ohms. Minimum resistance line leak 10,000 ohms. Ground potential limits - 18 V. to + 18 V.

OPERATION

3. PRINCIPAL FUNCTIONS

The principal functions of the sender are:

3.01 To receive and register the pulses dialed by a calling subscriber.

3.02 To translate the office code into the class of office desired in order that the necessary district and office selections be made in selecting a trunk to the office desired.

3.03 To control incoming and final selections on calls to full mechanical offices so that the called subscriber's line, as indicated by the setting of the numerical registers, is selected and the calling line connected thereto.

3.04 To transmit such relay call indicator pulses on R.C.I. class calls as will cause the called number to be displayed in the manual office, or such as will cause the called number to be registered in a full mechanical tandem office.

3.05 To control talking selection so as to advance the district to the proper talking position for each call.

3.06 To display a signal at the monitor position if the sender requires more than a maximum allowable time for performing its various functions.

3.07 To cause the release of the subscriber's line if the calling subscriber abandons the call before the connection has been established.

3.08 To make a preliminary coin test (coin sender) to insure the deposit of a coin before selections are completed.

3.09 To collect the coin on completed calls from coin lines or to return the coin if the call is not completed or if the call is one for which no charge is made.

3.10 To make a final coin test to determine whether the coin has been properly collected or returned.

3.11 To reset all registers to normal.

3.12 To restore itself to normal in readiness for the next call.

4. CONNECTING CIRCUITS

This sender will function with:

4.1 Any standard district selector.

4.2 Any standard office selector.

4.3 Any standard incoming selector.

4.4 Any standard final selector.

4.5 Any standard R.C.I. trunk to a manual office.

4.6 Any standard outgoing trunk to an operator's position.

4.7 Associated cord circuits at trouble desk.

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REGULAR MECHANICAL CALL USING OFFICE SELECTOR - NON-COIN

DESCRIPTION OF OPERATION

5. This circuit contains 4 sequence switches, - a sender control switch, a sender switch, a class switch, and R.C.I. impulse switch, designated (R-1), (R-2), (R-3) and (R-4) respectively. The various switches control the circuit conditions in the sender during completion of a call, as follows:

(a) The sender control switch, (R-1), controls the seizure of the sender and the return of the sender to normal.

(b) The sender switch, (R-2), controls district selections, trunk test, numerical selections on mechanical calls, and the start of R.C.I. pulses on R.C.I. class calls.

(c) The class switch, (R-3), causes the sender to function as required for completing the various classes of calls.

(d) The R.C.I. impulse switch, (R-4), establishes the circuit conditions required for sending R.C.I. impulses to manual or tandem offices. The switch makes one revolution on direct and two revolutions on tandem R.C.I. calls.

6. The sender contains 11 #200 type selectors designated the register control (RC) switch, office code registers (A and B), the numerical registers (TH, H, T, U, SH, ST and SU), and the time measure switch (M). It also contains two No. 203-A or No. 1203-A selectors designated the "Translator". The use of these selectors is as follows:

(a) The "register control" (RC) switch directs the impulses from the calling subscriber's dial to the "office code" and numerical registers. The register control switch also prevents an attempt to make any selection before the registers which control this selection have been set.

(b) The "Office Code" (A and B) registers control the setting of the "Translator", and the translator controls the setting of the class switch, in order that the sender function as required for the class of call being made, and in order that the district selector select a trunk to the office desired. The translator also controls the trunk compensating resistance, talking selections, the "skip office" feature, and additional time for dialing a party designation on R.C.I. class calls.

(c) The "numerical registers" control incoming and final selections on mechanical class calls and control the circuit conditions established for sending R.C.I. impulses on R.C.I. class calls.

(d) The "time measure and alarm" (M) switch measures the time allowed the sender for performing its several functions, and, if a given part of the sender's operation has not been completed in this measured time, a signal is displayed at the monitor's position. On coin senders the (M) switch is also used to control preliminary coin test, coin collect or return, and final coin test on calls from coin lines, and if these functions are not properly performed a signal is given at the monitor's position.

REGULAR MECHANICAL CALLS USING OFFICE SELECTOR - NON-COIN ("X" WIRING)

SENDER SELECTED

7. With the sender control switch in position 1, battery is connected through the winding of the (T) relay to the multiple test terminal of the associated district sender selector (not shown). When a hunting sender selector selects and connects to the tip (T), ring (R), test, fundamental tip (FT), sender control (SC), fundamental ring (FR), terminals of this circuit, it connects ground to the test terminal, operating the (T) relay. The (T) relay operated, (a) is held operated from ground on the test lead, (b) operates the (ON) relay and (C) operates the (SLR) relay.

8. When the sender is selected, the associated district advances to the "awaiting sender" position, in which position a circuit is closed from battery, over lead SC, through both windings of the (SC) relay, to ground operating the (SC) relay. The operation of the (ON) relay, (a) closes a circuit from ground to operate the (SB) relay, (b) prepares in part a circuit for operating the (T-1) relay, (c) closes a circuit from ground on its make contact, (X wiring), normal terminal (terminal 22) and (M-2) brush, to battery through the break contact and winding of the (MS) relay, operating the (MS) relay. The operation of the (SB) relay, (a) opens the operating circuit to the (MB) relay so that this sender cannot be made busy by a make busy plug, (b) closes in part a chain circuit to the "all senders busy" register, (c) closes in part a circuit to light the sender busy lamp when the sender busy key is operated, and (d) closes a circuit from battery through the non-inductive winding of the (T-1) relay in parallel with battery through the winding of the (T) relay, through the 80 ohm winding of the (T-1) relay (in parallel with the 18-AC 500 ohm resistance, when used) to ground on the armature of the (MB) relay.

9. The (T-1) relay does not operate at this time, as its inductive winding is short-circuited by the ground on the test lead. The (MG) relay operated, functions as described under "Time measure and alarm". The operation of the (SC) relay opens the circuit through the (SLR) relay.

The (SLR) relay is slow to release and, if the call has not been abandoned or the sender seized to collect or return a coin, the (L) relay operates before the (SLR) relay releases. Circuit battery through the primary winding of the (L) relay (X wiring), (MSL) relay normal, R lead, through the associated district, line finder, and subscriber's line circuits (not shown) T lead, (MSL) relay normal, to ground through the outer winding of the 66-A repeating coil. The operation of the (L) relay closes a circuit from battery through the winding of the (SLR) relay, to ground, thus holding the (SLR) relay operated.

10. If the call is abandoned or the sender has been seized to collect or return a coin, the (L) relay does not operate and the (SLR) relay releases, causing the sender to function, as described for an abandoned call in paragraphs 43 to 45 or as described in paragraph 61 if seized for the purpose of collecting or refunding the coin. The operation of the (L) relay also closes a circuit from ground, (T) and (L) relays operated, (SC-1) relay normal, (SC) relay operated, winding of the (SC-1) relay, to battery, operating the (SC-1) relay. The (SC-1) relay locks to ground on the (T) relay. The operation of the (SC-1) relay (a) advances the sender control switch to position 2, and (b) closes a circuit to operate the (RLS) relay. The operation of the (RLS) relay closes a circuit from ground through the (RC-4) brush and normal terminal 25 ohms winding of the 66-A repeating coil, 1/2 mf condenser to battery on the lead "To Tone Circuits". A tone is thus induced in the 500 ohm winding of the 66-A repeating coil and transmitted to the calling station as an indication that the office apparatus is ready for the operation of the dial.

11. When the sender control switch enters position 1-3/4, ground is connected to the upper outer contact of control cam T through the winding of the (ON) relay, holding the (ON) relay operated until the sender control switch advances from position 6.

SETTING REGISTERS

12. The operation of the dial at the calling station alternately releases and re-operates the (L) relay, in synchronism with the impulses in each digit dialed. The (SLR) relay is slow to release and remains operated while the entire number is being dialed. The first release of the (L) relay closes a circuit from ground, (T) relay operated, (L) relay released, (RLS) relay operated, windings of the (RA) relay, RC-6 brush and N terminal, to battery through two paths in parallel. One of these paths is traced through the normal (PP) relay winding of the A magnet through the 44-E resistance and one winding of the (ON-2) relay in parallel, to battery, operating the (RA) relay, the A magnet, and

(ON-2) relay. The other path is traced through the A magnet normal, strapped terminals of arc (A-1), lead A, arc RC-5, normal terminal and brush, sender control cam F, winding of the (PH) relay, (PP) relay normal to battery, operating the (PH) relay. The (RA) relay is slow in releasing and remains operated until all digits are dialed.

13. The operation of the (RA) relay closes a circuit from ground on the (RLS) relay to operate the (RC) magnet. The (PH) relay is fast in operating, and when operated closes the register stepping magnet circuit to an additional ground on its left armature and locks to ground until the A magnet operates, to insure stepping of the register, if for any reason the impulses of the (L) relay are not of sufficient duration to operate the A magnet. The operation of the (PH) relay also closes a circuit from ground on its right armature to battery through the winding of the (SLR) relay and holds this relay operated during the pulsing period.

14. When the A register magnet operates, after the (L) relay releases it opens the circuit through the (PH) relay. The (PH) relay releases opening the circuit through the A magnet. The (ON-2) relay and A magnet release and the A register brush assembly is advanced to terminal 1. Each time the (L) relay releases and re-operates, the A register magnet and the A relay operate and release and the A register brush assembly is advanced one step. Upon the completion of the series of impulses, corresponding to the first digit of the office code, the (RA) relay and (ON-2) relays release. The release of the (RA) relay opens the circuit in which the RC magnet is energized, releasing the magnet, stepping the RC brush assembly to terminal 1. The number 1 is not used as a digit of the office code and therefore two or more impulses are received for the first digit dialed and the A register does not stop on terminal 1 except in the case of a preliminary impulse as described later in paragraph 47.

15. The sender is now ready to receive impulses for the second digit of the office code. The (L) relay again alternately releases and re-operates, responding to the impulses from the dial. The (RA), (PH) and (ON-2) relays, and the B register magnet operate and release, stepping the B register in a manner similar to that in which the "A" register was set, except, the pulsing circuit from ground through the (L) and (PH) relays operated is through the winding of the B register magnet and terminal 1 of the RC-6 arc, instead of the "A" register magnet, and the circuit in which the (PH) relay operates, passes through terminal 1 of the RC-5 arc, lead B, and strapped terminals of the B-1 arc, instead of the normal terminal of the RC-5 arc and lead A. The RC magnet is energized when the (RA) relay operates, and when the (RA) relay releases upon completion of the series of impulses corresponding to the second digit of the number dialed, the

RC magnet releases, stepping the RC brush assembly to terminal 2. The register control switch is now in position to direct the next series of impulses from the (L) relay to the thousands register. The TH, H, T and U registers are set in a similar manner to that described for the A and B registers. On all calls for which the H register is set in positions 5 to 9 inclusive. The (IG) relay operates, whereby the 1 counting relay is connected to the even numbered terminal of the arc TH-6 for incoming group selections instead of the (0) counting relay and where the 3 counting relay is connected to the odd numbered terminals of the TH-6 arc instead of the 2 counting relay.

TRANSLATION

16. When the brushes of the RC switch advance to terminal 2 after setting the "A" register, a circuit is closed to operate the (ST) relay from battery, winding and break contact of the (ST) relay, terminal 2 and arc RC-4 brush, to ground at the (RLS) relay. The (ST) relay operated, (a) locks in position 2 through its make contact, cam 0 to ground on the (RLS) relay operated, (b) closes a circuit from ground on its armature through the windings of the ROT-1 and ROT-2 magnets to battery, operating the magnets, thus rotating the power driven translator and (c) connects ground from the (RLS) relay operated, the (SSR) relay normal, the (ST) relay operated, A-3 brush and terminal, to one of the B register brushes and terminal through the cross connections to the translator arc T1-S and T2-S.

17. When the translator brush assembly advances to the particular terminal to which this ground is connected the circuit is extended through the (TR) relay operated or normal, to battery through the windings of the TS-1 and TS-2 relays and to battery through the windings of the STOP-1 and STOP-2 magnets. The (TR) relay operates if the A register is set in positions 3, 5, 7 or 9 thereby transmitting the hunting lead from the arc with terminals numbered 1 to 22 the arc with terminals numbered 23 to 44. The TS-1 and TS-2 relays and the STOP-1 and STOP-2 magnets operate in this circuit and lock to ground on the (ST) relay. The operation of the TS-1 and TS-2 relays, (a) closes another locking circuit for the (ST) relay, from ground on the armature of the TS-1 relay, through the lower contacts of sender control cam C, to battery through the make contact and winding of the (ST) relay, (b) closes a circuit from ground on the armature and make contact of the (TS-1) and (TS-2) relays operated, sender cam C, to battery through the winding of the R-2 magnet, advancing the sender switch to position 2, (c) closes a circuit from ground on the (TS-1) and (TS-2) relays, sender control cam B, to battery through the R-1 magnet, advancing the sender control switch to position 3.

18. Each power driven translator consists of one 203-A or 1203-A selector. It has a capacity of forty-four sets of terminals, each bank consisting of twenty-two sets. The two banks are mounted on the translator frame parallel to each other with the terminals in alignment with the springs of the brush assemblies of the selector. The selector is composed of a rotary magnet a STOP magnet and two step by step brush assemblies, which are clamped to a rotary shaft in the magnet end of which is fastened a metal driving disc. The brushes are single ended the bridging type and on one assembly are set 180 degrees from the brushes on the other assembly, so that the brushes of only one assembly can make contact with the terminals at any one time. The driving disc is actuated by the (ROT), magnet, which operates in a circuit through the break contact of the STOP magnet. The disc is provided with a notched rim, the notches of which serve to stop and hold the selector with the brush assemblies centered on the terminals. The armature of the STOP magnet is provided at its end with a projecting pawl, which is of sufficient size to engage any of the notches in the rim of the disc, thus providing a positive mechanical stop for the rotary unit when the STOP magnet is operated. Normally, the armature pawl does not touch the rim of the disc, at any point. The circuit is arranged so that the stop magnet operates when the hunting disc. of either assembly makes contact with the desired terminal. As the hunting brushes T1-S and T2-S are mounted to make contact brush slightly in advance of the other brushes, the STOP magnet is operated, before the corresponding notch in the rim of the disc. is under the armature pawl, causing the pawl to rest on th rim of the disc. between two complete notches. The ROT, magnet, therefore remains operated and the disc. continues to rotate until the armature pawl drops into the next notch which is associated with the desired row of terminals. When the pawl enters the notch, the contact springs associated with the STOP magnet are opened, thereby opening the circuit through the winding of the ROT. magnet. The STOP magnet remains operating during the progress of selection.

19. Assume for this class of call, that the translator stops in a position in which the T1-CL brush is resting on the contacts of the terminal to which the class set lead C is connected. The circuit is then closed from battery through the R-3 magnet and the (CL) relay in parallel, cam C_2 lead C_2 terminal and T2-CL brush, (OT) relay normal to ground at the (TS-2) relay operated, advancing the class switch to position 7 or 18 and operating the (CL) relay. The operation of the (CL) relay prevents the operation of the relays in the impulse circuit during the advance of the class switch. The (CL) relay releases when the switch advances beyond position 6 or 17.

DISTRICT SELECTION

20. With the sender control switch in position 3, and the sender switch in position 2, the fundamental circuit is closed for brush selection.

This circuit is from battery through the district line relay, over lead (FT). (S) and (ADV) relays normal, sender control cam S, upper outer and lower inner contacts of sender cam M, windings of the (OFL) relay, (BO) relay normal, windings of the (STP) relay, 1000 ohms resistance, lower inner and upper outer contacts of sender control cam J, to ground on sender cam I. The (OFL) relay does not operate at this time, as it is of the polarized type, unless one of the selectors goes to overflow, at which time the battery through its windings is in the reversed direction. The district (L), and (STP) relays operated, cause the selector to move upward and close a circuit in which one of the counting relays, operates. For this call, it is assumed that the 2 counting relay is the first to be operated. The circuit for operating 2 counting relay is from battery at sender control cam X, winding of the 2 counting relay, 2' counting relay normal, lead 2, terminal and T-2 DB brush, sender cams V and U, sender control cam N, (IA) relay normal, sender cam (L), (STP) relay operated to ground on sender cam I. The operation of (2) counting relay closes a circuit through its windings and the winding of the (2') counting relay in series from ground through sender cam J. The (2') counting relay does not operate at this time, however, as it is short circuited by ground on cam I under control of the (STP) relay. As the district selector moves upward for brush selection, ground is connected to the tip side of the fundamental circuit, each time the A commutator brush makes contact with one of the metal segments in the "A" commutator. This ground short circuits the winding of the (STP) relay, causing it to release. The release of the (STP) relay removes the short circuit from the winding of the 2' counting relay. The 2' counting relay now operates and the 2 counting relay holds in the circuit described above. The operation of the 2' counting relay transfers the pulsing circuit through its make contact, to the 1 counting relay, ready for the next impulse.

21. The district selector continues to move upward and each operation and release of the (STP) relay causes one set of counting relays to be operated.

22. The number of counting relays to be operated for a given selection is determined by connecting the counting relay terminals to the terminals of the translator arc as specified by the Telephone Company, so that the desired counting relay will be connected to the terminal on which the T1-DB and T2-DB brush of the translator shall be resting. When the (STP) relay releases after the operation of (0) counting relay, the short circuit to ground on cam I is removed from the winding of the (FO) and (BO) relays. The (D) counting relay holds, and the (FO) and (BO) relays operate in parallel to ground on cam J. The operation of the (BO) relay opens the fundamental circuit, thus stopping the up-drive of the district selector and causing the district switch to advance. The operation of the

(FO) relay, closes a circuit in which the sender switch is advanced to position 3. This circuit is from ground on the armature of the (FO) relay, (IA) relay normal, sender control cam I, sender cam C, to battery through the R-2 magnet. The A cam advances the switch to position 4. As the sender switch advances from position 2, the counting relays release, since the circuit through their windings is opened at cam I. With the sender switch in position 4, the 1,000 ohm non-inductive winding of the (SC) relay is short circuited from ground on the sender cam J, reducing the resistance to ground on lead SC, causing the operation of the (CH) relay in the district. When district group selection and trunk hunting have been completed, it is necessary that the district (CH) relay re-operate, in order to advance the district switch to the selection beyond position.

NOTE:- In order to prolong the life of the stepping relay contacts, the direction of current flow through these contacts is reversed for each successive selection by means of the cuttings on sender cams L and I.

23. With the sender switch in position 4, the fundamental circuit is again closed, for district group selection, as described for district brush selection. The circuit for operating the counting relays is from ground at the lower outer contact of cam I, (STP) relay operated, cam L, (IA) relay normal, sender control cam N, sender cams U and V, the T2-DG brush and terminal, and cross connection lead to battery through the proper counting relay. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate as described for brush selection. The operation of the (BO) relay opens the fundamental circuit, advancing the district to its trunk hunting position. Having selected an idle trunk, the district advances to selection beyond. The operation of the (FO) relay closes a circuit from ground on its armature, (IA) relay normal sender control cam I, sender cam C to battery through the R magnet, advancing the sender switch to position 5. The A cam advances the switch to position 6. The counting relays release when the switch advances from position 4.

OFFICE TEST AND SELECTION.

24. With the sender switch in position 6, a circuit is closed from battery, through one winding of the office line relay, over lead FT, S and (ADV) relays normal, top inner contact of sender control cam S, 14,500 ohms resistance, sender cam O, winding of the (TG), (OFL) and (STP) relays, (BO) relay normal, top inner contact of sender cam X, sender control cam M, compensating resistance, and OFF-T1 brush and arc, compensating resistance, (0-1200 ohms) sender control cam V, (ADV-1) relay

normal over lead FR, to ground in the office circuit. The (TG) relay operates, operating the (TG-1) relay. The operation of the (TG-1) relay operates the (CI) relay which is held operated through its make contacts, sender cam Y, sender control cam T to ground. The sender R magnet energizes from battery, top inner contact of cam B, operated (CI) relay, sender control cam U to ground advancing the sender switch to position 7. As the switch breaks position 6 the fundamental circuit is opened at sender cam O releasing the (TG) and (TG-1) relays. As the switch breaks position 6 1/4 at sender cam Y, the (CI) relay releases opening the energizing circuit of the sender R magnet, stopping the sender switch in position 7. The switch advances to position 8 from ground on the (IA) relay. While the switch is advancing to position 7, a circuit is closed from battery, sender control cam X, 500 ohms resistance, sender cams M and N, winding of the (OFL) relay, (BO) relay normal, windings of the (STP) relay, 1000 ohms resistance to ground on sender cam H. The (STP) relay operates and immediately releases as the switch advances from position 7. This condition soaks the (STP) relay.

25. In position 8 the fundamental circuit is again closed for office brush selection. This circuit is traced the same as for office test with the exception that it passes through the upper outer and lower contacts of sender cam N instead of through the 14,500 ohms resistance and winding of the (TG) relay. Ground from the segments of the office A commutator intermittently short circuit the (STP) relay alternately releasing and reoperating it. The counting relay circuit is the same as described for District Brush Selection, except that it is now closed through the lower outer contacts of cams L and I, upper inner contacts of cam V, terminal and T2-OB brush. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate. The operation of the (BO) relay opens the fundamental circuit stopping the up-drive of the office selector and advancing the office switch. The operation of the (FO) relay advances the sender switch to position 9, the A cam advancing it to position 10. The counting relays release when the switch advances from position 8.

26. With the sender switch in position 10, the fundamental circuit is closed and office group selection is made in the same manner as the office brush selection, except that the circuit to operate the counting relays is through the upper outer contacts of cams I and L, lower inner contact of cam U, terminal and T2-OG brush. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate. The operation of the (BO) relay opens the fundamental circuit and the operation of the (FO) relay advances the sender switch to position 11, the A cam advancing it to position 12. The counting relays release when the switch advances from position 10.

INCOMING TEST AND SELECTIONS

27. When the sender switch advances through positions 11 and 12, the (S) relay operates if the TH and H registers have not yet advanced from normal. CIRCUIT:- Battery, through its winding, (DWO) relay normal, sender cam F, cam I, terminal 3 and RC-4 brush, to ground on the make contact of the (RLS) relay. The operation of the (S) relay opens the fundamental circuit, thus preventing the operation of the (TG) relay for incoming test.

28. When the thousands and hundreds digits have been dialed, the RC switch advances to terminal 4, releasing the (S) relay. The release of the (S) relay closes a circuit from battery through one winding of the incoming (L) relay, over lead FT, and through the windings of the (TG) relay as described for office tests except that it is closed through the lower contacts of sender cam X and compensating resistance brush (T-1). (Beyond Office). The (TG) relay operates operating the (TG-1) relay. The (TG-1) relay operated, operates the (CI) relay. The operation of the (CI) relay closes a circuit through the upper inner contact of sender cam B, (CI) relay operated, sender control cam U to ground, advancing the sender switch to position 13, the A cam advancing the switch to position 14. As the switch advances from position 12, the (T) and (TG-1) relays release. As the switch breaks position 12 1/4 the (CI) relay releases.

29. With the sender switch in position 14, the fundamental circuit is closed for incoming brush selection. The circuit is from battery through the winding of the line relay in the incoming circuit, over lead FT, S and (ADV) relays normal, inner contacts of cam S, class cam O, sender cam N, winding of the (OFL) relay, (BO) relay normal, windings of the (STP) relay, sender cam X, T-1 brush and terminal compensating resistance, lower contacts of sender control cam V, (ADV-1) relay normal, over lead (FR) to ground in the incoming circuit. Incoming and office brush selections are similar except that in the former the circuit for operating the counting relays is closed through the upper contacts of cam U, terminal and TH-3 brush.

30. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate. The operation of the (BO) relay opens the fundamental circuit and the operation of the (FO) relay advances the sender switch to position 15 releasing the counting relays. The sender switch is advanced to position 16 in a circuit from battery through the R-2 magnet to ground through cam C and break contact of the (IA) relay. While the switch is advancing through position 15, the (STP) relay operates as similarly described with the switch advanced in position 7.

31. With the sender switch in position 16, the fundamental circuit is closed, and incoming group selection is made in the same manner as described for incoming brush selection except that the counting relay circuit is closed through the lower outer contact of cam U, TH-6 brush and terminal and the (IG) relay normal. When sufficient impulses have been received to satisfy the sender, the (BO) relay and (FO) relays operate. The operation of the (BO) relay opens the fundamental circuit and the operation of the (FO) relay advances the sender switch to position 17 releasing the counting relays. The A cam advances the switch to position 18.

32. As the sender switch advances through position 17 to position 18, a circuit is closed from battery through the sender control R magnet, cam B, sender cam D, to ground at class cam F, advancing the sender control cam switch to position 4. As the sender control switch enters position 4, ground on the upper inner contact of the sender control cam T maintains a short circuit on the outer winding of the (SC) relay following the removal of ground through the lower inner contact of sender cam J, which occurs when the sender switch advances from position 18.

FINAL SELECTIONS

33. With the sender switch in position 18, the fundamental circuit is closed, for final brush selection from battery through one winding of the final (L) relay, over lead FT, S and (ADV) relays normal, top outer contact of sender control cam S, sender cam N, windings of the (OFL) relay, (BO) relay normal, windings of the (STP) relay, top outer contact of sender cam X, sender control cam M, COMP. RES. T-1 brush and terminal, (beyond office), compensating resistance, control cam V, (ADV-1) relay normal, lead FR to ground in the incoming circuit. Final brush selection is made in the same manner as incoming brush selection, except that the operating circuit for the counting relays is through the upper outer contacts of sender cams L and I, (STP) relay operated, (IA) relay normal, sender control cam N, sender cam S, H-6 terminal and brush, over one of the counting relay cross connection leads, winding of the counting relay to battery at sender control of cam X. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate. The operation of the (BO) relay opens the fundamental circuit and the operation of the (FO) relay advances the sender switch to position 1 releasing the counting relays. As the switch enters position 1 on the second revolution, a circuit is closed from battery through the winding of the sender switch R magnet, cam C, (TS-2 and TS-1) relays operated, to ground advancing the sender switch to position 2.

34. As the sender switch advances through position 1 to position 2, the (S) relay operates if the T register has not yet advanced from normal, from battery, winding, (DWO) relay normal, sender cam F, control cam P, terminal 4 and RC-4 brush, to ground at the operated (RLS) relay. The operation of the (S) relay opens the fundamental circuit, thus preventing the operation of the (STP) relay for final tens selection, until the tens digit has been dialed. The RC switch then advances to terminal 5, releasing the (S) relay. The release of the (S) relay closes the fundamental circuit for final tens selection. Final tens selection is made in a similar manner as final brush selection, except that the counting relays operate through sender cam S and the T-3 terminal and brush. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate, opening the fundamental circuit and advancing the sender switch to position 3. The A cam advances the switch to position 4. The counting relays release as the switch advances from position 2

35. As the sender switch advances through position 3 to position 4, the (S) relay operates if the U register has not been advanced from normal. CIRCUIT: (DWO) relay normal, sender cam F, lower contacts of control cam K, terminal 5 and RC-4 brush, to ground at the operated (RLS) relay. The operation of the (S) relay opens the fundamental circuit, preventing the operation of the (STP) relay for final units selection until the units digit has been dialed. The (RC) switch is then advanced to terminal 6, closing a circuit from battery through the primary winding of the (ON-2) relay and a 58 ohm resistance in parallel winding and break contact of the RC magnet, RC-2 brush and strapped terminals 2 to 8 inclusive, class cam H, strapped terminals and brushes of the U-2, H-2 and TH-2 arcs, terminal and TI-SD brush (RA) relay normal, (RLS) relay operated to ground. The RC magnet alternately operates and releases in this circuit, thereby stepping the RC brush assembly to terminal 9. The (S) relay releases when the RC switch advances from terminal 5, closing the fundamental circuit for final units selection. Final units selection is made in the same manner as final brush selection, except that the circuit for operating the counting relays passes through the lower inner contact of cam S, (DWO) relay normal, U-3 terminal and brush. When sufficient impulses have been received to satisfy the sender, the (BO) and (FO) relays operate, opening the fundamental circuit and advancing the sender switch to position 5. The counting relays release when the switch advances from position 4. The A cam advances the switch to position 6.

INCOMING ADVANCE AND TALKING SELECTION

36. With the sender switch in position 6, a circuit is closed from battery through the incoming line relay, over the ring of the fundamental circuit, the (ADV-1) relay normal, control cam V, compensating resistance,

COMP. RES. T-1 (beyond office) terminal and brush, control cam M, sender cam X, windings of the (STP) relay, (BO) relay normal, winding of the (OFL) relay, sender cam N, control cam S, (ADV) and (S) relays normal, lead FT to ground in the incoming circuit. The current flow in this circuit is in the proper direction to operate both the (ST) and (OFL) relays. The (OFL) relay operated, locks through its 6400 ohms winding, cam K, to ground on its make contact. The operation of the (OFL) relay also closes a circuit from ground on its make contact, to battery through the winding of the (IA) relay. The (IA) relay operated, operates the zero counting relay. CIRCUIT:- Ground, sender cam I, (STP) relay operated, sender cam L, (IA) relay operated, O lead, to battery at control cam X, through the winding of the (O) relay. The closing of the fundamental circuit to operate the (STP) and (OFL) relays, advances the incoming sequence switch, thereby opening the fundamental circuit and when the (STP) relay releases, the (BO) and (FO) relays operate in parallel. The operation of the (FO) relay operates the (ADV) and (ADV-1) relays. CIRCUIT:- Ground on the armature of the (FO) relay, (IA) relay operated, sender control cam 4, M-4 brush and strapped terminals 17 and 22, to battery through the windings of the (ADV) and (ADV-1) relays, which are held operated to ground at sender control cam T. The operation of the (ADV-1) relay opens the FR lead, energizes the sender control R magnet advancing the sender control switch to position 5 and energizes the sender R magnet advancing the sender switch to position 7 releasing the (OFL) relay in turn releasing the (IA) relay.

37. The (STP) relay operates in position 7 and the sender switch advances to position 8 from ground at the (IA) relay normal and cam C. The operation of the (ADV) relay, disconnects ground from the SC lead, releasing the district line relay advancing the district, thus opening the dialing leads to the sender and releasing the sender (L) relay. The release of the sender (L) relay releases the (SLR) and (RLS) relays, closing a circuit from battery through the inner winding of the district (L) relay, lead FT, (S) relay normal, (ADV) relay operated, cams M and N, windings of the (OFL) relay, (BO) relay normal, windings of the (STP) relay, 1000 ohms resistance, sender control cam J, terminal 9 of RC-1 brush to ground on the (SLR) relay normal. The (STP) relay operates operating the zero counting relay from battery, sender control cam X, winding of the (O) counting relay, lead O, terminal and T-1 TALK. SEL. brush (OV) relay normal, sender control cam N, (IA) relay normal, sender cam L, (STP) relay operated, to ground on cam I. As the district advances to its talking position, it connects ground to the tip side of the fundamental circuit, thereby short circuiting and releasing the (STP) relay in the sender. The (STP) relay alternately releases and re-operates until the (O), (BO) and (FO) relays are operated. The operation of the (BO) relay opens the fundamental circuit, releasing the district (L) relay, thus stopping the

district switch in the proper talking position for this class of call. The operation of the (FO) relay closes a circuit from ground on its armature, (IA) relay, normal control cam I, to battery through the sender control R magnet, advancing the sender control switch to position 6. The release of the district (L) relay disconnects ground from the test lead. With the control switch in position 6, the sender switch is advanced to normal from battery through the R magnet cam C to ground at control cam U.

RESETTING REGISTERS

38. When the sender control switch enters position 3 after the setting of the translator as described in paragraph 16, a circuit is closed from ground on the armature of the (CL) relay normal, class cams N, sender control cams G and H, A-1 brush and terminal 9, contact and winding of the A magnet, to battery through a 44-E resistance and secondary winding of the (ON-2) relay in parallel. The A magnet and (ON-2) relay operate and the A register is stepped to normal. A circuit is closed from ground on control cam N, through the B magnet, stepping the B register to normal, in the same manner.

39. When the sender control switch enters position 4 for incoming group selection as described in paragraph 30, a circuit is closed from ground on the armature of the (CL) relay, class cam N, control cam R and sender cam D, control cams G and H, A-1 and B-1 brushes and normal terminals, outer contacts of sender control cam E, TH-1 brush and strapped terminals, through the contact and winding of the TH magnet, to battery through the secondary winding of the (ON-1) relay and 44-E resistance in parallel. The TH magnet and (ON-1) relay operate, stepping the TH register to normal terminal. This circuit is extended through the H magnet, stepping the H register to normal terminal. As the sender control switch enters position 5 for incoming advance as described in paragraph 36, the T and U registers, (SH, ST, and SU registers, when used) are returned to normal in like manner.

RETURN TO NORMAL

40. When ground is removed from the test lead by the release of the district (L) relay, as described in paragraph 37, the (T-1) relay operates in the circuit described in paragraph 8. The T-1 relay operated, (a) locks through both windings in series to ground on its armature, (b) releases the (T) relay, and (c) connects ground to the test lead through its 80 ohm winding, (and 18-AC "C" resistance in parallel when resistance is used), causing the test terminal of the sender selector to test busy. The release of the (T) relay closes a circuit from ground on its

armature, terminal 9 and RC-2 brush, break contact and winding of the RC magnet, to battery through the 44-E resistance and winding of the (ON-2) relay in parallel, stepping the RC switch to terminal 10.

41. With all the registers normal, a circuit is closed from battery through the 44-E resistance and winding of the (ON-2) relay in parallel, break contact and winding of the RC magnets, RC-2 brush and #10 terminal, normal terminals and brushes of the SH-1, U-1 and T-1 registers, outer contacts of sender control cam F, normal terminals and brushes of the H-1 and TH-1 registers, outer contacts of sender control cam E, normal terminals and brushes of the B-1 and A-1 registers control cams H and G, sender cam D, sender control cam R, class cam N, normal (CL) relay to ground stepping the RC register to normal terminal releasing the (ON-2) relay. With the RC brush on normal terminal, a circuit is closed from battery through the winding of the sender control R magnet, cam B, normal terminal and brush of the RC-1 arc, to ground on the armature of the (SLR) relay, advancing the sender control switch to position 6.

42. The sender R magnet energizes from battery, winding, lower inner contact of cam C, sender control cam U to ground advancing the sender switch to normal. The advance of the sender switch to position 1, closes a circuit from battery through the sender control R magnet, control cam C, impulser cam Y, cam Q, normal terminal and RC-1 brush, to ground on the (SLR) relay normal, advancing the sender control switch to its next normal position. When the sender control switch advances from position 6 to normal, the (ON) relay releases if all the switches and registers are in their normal positions. The release of the (ON) relay releases the (SB) relay. The release of the (SB) relay releases the (T-1) relay thus removing the busy condition (ground) from the test lead. The class switch does not advance to normal, but remains in whatever position it was set.

ABANDONED CALLS

43. If the receiver is replaced on the switchhook before district selection and trunk hunting are completed, the sender (L) relay fails to operate or release if already operated, causing the release of the (SLR) relay. The release of the (SLR) relay, (a) prevents the operation of or releases the (RLS) relay, (b) operates the (DWO) relay (SLR) relay normal, (SC) relay operated, (RLS) and (L) relays normal to ground on the armature of the (T) relay operated, and (c) closes a circuit from ground on the (SLR) relay normal, RC-1 brush and strapped terminals 1 to 8 inclusive, break contact and winding of the RC magnet to battery through the 44-E resistance and primary winding of the (ON-2) relay in parallel, stepping the RC switch to terminal 9. The (DWO) relay operated, (a) locks to ground at the (T) relay operated, (b) connects ground on its

armature and through its make contact to lead SC, short circuiting the 500 ohm winding of the (SC) relay, releasing the sender (SC) relay and the district (D) relay. The district then returns to normal, disconnecting ground from the TEST lead releasing the (T) relay. The release of the (T) relay, (a) releases the (DWO) and (SC-1) relays, (b) closes a circuit from battery through the primary winding of the (ON-2) relay and 44-E resistance in multiple, winding and back contact of the RC magnet, RC-2 brush and terminal 9, to ground on the (T) relay normal, advancing the RC switch to terminal 10. The sender control R magnet energizes from battery, winding, bottom inner contact of cam C, normal (T) relay to ground, advancing the switch to position 5. When the sender control switch enters position 5, and until it advances again from normal, the circuit is closed from ground through control cam H, advancing all off-normal registers and the RC switch to normal as described in paragraph 41. With the RC switch normal, the sender control switch advances to position 6, from battery through the R magnet, bottom inner contact of cam C, normal terminal and RC-1 brush, to ground at the (SLR) relay normal. With the sender control switch in position 6, return to normal is made as in paragraph 42.

44. If the call is abandoned without dialing after the (L) and (RLS) relays are operated, the release of the (L) relay closes a circuit through the winding of the A register magnet as described in paragraph 16 before the (RLS) relay releases. The release of the (RLS) relay opens the circuit through the winding of the A register magnet, stepping the A register to terminal 1. The (PP) relay operates as described in paragraph 117 but as the (RLS) relay has released, the (PP) relay also releases thus closing a circuit in which the A register is returned to normal as described in paragraph 39.

45. When a call is abandoned and its associated district selector has advanced for selection beyond position, the (DWO) relay operates as described in paragraph 43 but all selections up to and including talking selection must be made before the sender and district can return to normal. Office test and selections are completed as described under this heading in paragraphs 24 to 26 inclusive. The operation of the (DWO) relay connects the (O) counting relay to cam V for incoming brush and incoming group selection and to cam T for final brush and tens selection, the counting relay circuits otherwise being as described in paragraphs 27 to 35 inclusive. The counting relay circuit is open for final units selection, allowing the final selector to go to tell-tale. Incoming advance, talking selection, re-setting registers and return to normal completed as described in paragraphs 36 to 42 inclusive.

TIME MEASURE AND ALARM (X AND J WIRING)

46. During the progress of the call, the time measure and alarm circuit functions to indicate a permanent signal. Partial dialing or stuck sender condition. When the (MS) relay operates as described in paragraph 12 it locks through its make contact to the same ground. When the interrupter contacts are closed, the STP magnet is energized from battery, winding, make contact of the interrupter, normal terminal and M-5 brush, (MS) relay operated, (TMA) and (MSL) relays normal to ground. When the interrupter opens the circuit the STP magnet releases, stepping the time measure and alarm switch to terminal 1. When the interrupter contacts again close, the STP magnet is energized, through terminal 1 and M-5 brush and when the circuit is opened, the STP magnet releases, stepping the switch to terminal 2. The switch is then stepped to terminal 3 by the closing and opening of the interrupter contacts. If the register control switch has not been advanced from normal, the time measure switch cannot step from terminal 3. A circuit is closed from battery through the sender monitor lamp (green), terminal 3 and M-5 brush, (MS) relay operated, (TMS) and (MSL) relays normal, to ground, lighting the lamp to indicate a permanent signal condition. Ground at the armature of the normal (MSL) relay is connected through the (TMA) and the (MSL) relays normal, the M-6 brush and terminal 3 to the "Miscellaneous Auxiliary Signal Circuit".

47. If the RC switch has stepped off normal, the (TMA) relay operates from battery through its winding, M-3 brush and strapped terminals N to 5 inclusive strapped terminals 1 to 8 inclusive and RC-3 brush, the (SSR) relay normal, to ground on the armature of the operated (RLS) relay. The operation of the (TMA) relay closes a circuit from battery through the winding and break contact of the STP magnet, (TMA) relay operated, to ground as described for operating the (TMA) relay. The time measure switch is thereby stepped to terminal 6, independently of the interrupter releasing the (TMA) relay.

48. A circuit is again closed through the interrupter, strapped terminals 6 to 8 inclusive and M-5 brush, stepping the switch to terminal 9. If at this time the RC switch has not advanced to terminal 9, the time measure switch cannot leave terminal 9 and the green sender lamp flashes in unison with the contacts of the interrupter, terminal 9 and M-5 brush, to indicate an unfinished dialing condition. Ground is connected to terminal 9 and M-6 brush and the lead S to the miscellaneous "Auxiliary Signal Circuit", as described for terminal 3.

49. If the RC switch has been stepped to terminal 9, the (TMA) relay operates through the M-3 brush and strapped terminals 6 to 11 inclusive, terminal 9 and RC-3 brush, (SSR) relay normal, (RLS) relay operated to ground.

The operation of the (TMA) relay closes a circuit through the STP magnet, stepping the time measure switch to terminal 12, independently of the interrupter. The lamp stops flashing when the switch steps from terminal 9. The (SKS) relay not being operated for a direct mechanical call, the (TMA) relay does not release as the switch steps from terminal 11, but holds in a circuit from battery through its winding, M-3 brush and strapped terminal 12 to 16 inclusive, to ground through the (SKS) and (MSL) relays normal. With the (TMA) relay operated, the STP magnet operates and releases, stepping the time measure switch to terminal 17.

50. The (TMA) relay releases as the switch steps from terminal 16. The STP magnet circuit is closed through the interrupter, strapped terminals 17 to 19 inclusive and M-5 brush, stepping the switch to terminal 20. If the sender has not returned to normal when the switch steps to terminal 20, ground is connected through terminal 20 and the M-6 brush to the lead "To Miscellaneous Auxiliary Signal Circuit" as described for terminal 3, and the green sender lamp flashes in a circuit through the break contact of the (SKS) relay interrupter, terminal 20 and M-5 brush, to indicate a stuck sender. When the sender returns to normal, the release of the (ON) relay releases the (MS) relay. The release of the (MS) relay at this or any other time, closes a circuit from battery through the (TMA) relay, strapped terminals and M-1 brush, to ground through the (MS) relay normal. The (TMA) relay operated, closes the STP magnet circuit to the same ground, stepping the switch to normal.

REGULAR MECHANICAL CALLS USING OFFICE SELECTOR - COIN (Y WIRING)

51. The registers are set and translation and selection are made as described for a non-coin call, except that the dialing circuit as traced in paragraph 13 is from the T lead, (MSL), (C-1), (CT-7) and (CT-2) relays normal, winding of the repeating coil to ground and from the R lead, (MSL), (C-1), (CT-7) and (CT-2) relays normal, winding of the L relay to battery.

OPERATION OF TIME MEASURE CIRCUIT

52. When the MS relay operates as described in paragraph 8, it locks to the operating ground. When the interrupter contacts close, the STP magnet is energized through its winding, make contact of the interrupter, normal terminal and (M-5) brush, the TMA relay normal, the MS relay operated, to ground at the (C) and (MSL-1) relays normal. When the interrupter opens this circuit, the STP magnet releases, stepping the time measure switch to terminal 1. The switch is stepped to terminal 3 under control of the interrupter. If the RC switch has not been stepped off-normal when the time measure switch steps to terminal 3, a circuit is

closed from battery through the sender lamp, the (CT-1) and (C-2) relays normal, terminal 3 and (M-5) brush, TMA relay normal, MS relay operated to ground at the C and (MSL-1) relays normal, to indicate a permanent signal condition. Ground is connected through the (M-6) brush and terminal 3, the TMA and (MSL-1) relays normal, "To the Miscellaneous Auxiliary Signal Circuit". If the RC switch has stepped off-normal, the (CT-6) relay is operated and the (TMA) relay operates through strapped terminals N to 4 and (M-3) brush and (CT-6) relay front contact and the switch steps to terminal 5 independently of the interrupter. The TMA relay releases, when the switch advances from position 4.

When the sender monitor positions are located at the M.S. "A" switchboard the circuit is arranged to operate the (SBR) relay on permanent signal calls and route these calls as described in paragraphs 119 to 122.

53. The STP magnet circuit is closed through the interrupter, strapped terminals 5 to 7 inclusive and (M-5) brush to ground as for terminal 1, stepping the switch to terminal 8. If at this time the RC switch has not advanced to position 9, the time measure switch cannot advance from position 8 and the sender lamp flashes to indicate an unfinished dialing condition from battery, through the lamp, (CT-1) and (C-2) relays normal, interrupter contacts, terminal 8 and (M-5) brush, TMA relay normal, MS relay operated, to ground at the C and (MSL-1) relays normal. The (TMA) relay operates with the RC switch on terminal 9, from battery through its winding, (M-3) brush and strapped terminal 5 to 8 inclusive, terminal 9 and (RC-3) brush, to ground at the operated RLS relay. The operation of the TMA relay closed a circuit through its make contact, from battery through the STP magnet to the same ground on the armature of the RLS relay, stepping the time measure switch to terminal 9. The TMA relay is held operated as the time measure switch steps from terminal 8 from battery, through its winding, (M-3) brush and strapped terminals 9 to 12 inclusive, the SKS and C relays normal, to ground at the (MSL-1) relay, thereby stepping the time measure switch to position 13, releasing the TMA relay.

54. The (CT), (CT-1) and (CT-2) relays operate from ground on terminal 13, at arc M-6, normal (C-3), SKS and CN relays dividing beyond this point into two paths, one through the break contacts of the (CT-7) relay, winding of the (CT-2) relay to battery, and the other through the break contact of the (CT-3) relay, winding of the (CT) relay to battery. The (CT-1) relay operated operates the TMA relay from battery, (M-3) brush and terminal 13, operated (CT-1) relay, normal (MSL-1) relay to ground. The TMA relay, operated, energizes the STP magnet, stepping the time measure switch to terminal 14 releasing the TMA relay.

PRELIMINARY COIN TEST

55. The time measure switch steps from terminal 14 to 17 under control of the interrupter in a circuit through strapped terminals 14 to 16 inclusive and (M-5) brush. The operation of the (CT-2) relay operates relay (CWO) and operates the CB relay from battery, winding (CB) relay, contacts of relay (CT-2) and terminal 14 and brush of arc (M-6), to ground, and the (CB) relay is held operated as the time measure switch steps from terminal 14 from battery, operated (CT-2) relay, operated (CB) relay, normal (C-3) relay, strapped terminals 14 to 17 and brush of (M-2) arc, operated ON relay to ground, disconnects the dialing circuit from the L relay and the 66-A repeating coil, closes a circuit from battery through the winding of the (L) relay to the 1000 ohm ground on the contact of the (CT-2) relay operated thereby holding the L relay operated. Should the subscriber hang up at this time relay (CWO) will release and the 52.5 ohm resistance to 48 volt battery will shunt relay (L), releasing it, thereby causing the sender to be released. The CB relay operated, closes a circuit from 48 volt battery through the 18-BA resistance, (CB) relay operated, 1000 ohm winding of the (CT-9) relay, (CT-3) relay normal, (CT-2) relay operated, (CT-7), (C-1) and (MSL) relays normal, over the lead T to the subscriber's line and from 110 volts coin battery, operated CB relay, 18-BA resistance, 950 ohm winding of the (CT-9) relay, (CT-3) relay normal, (CT-2) relay operated, (CT-7), (C-1) and MSL relays normal, over lead R to the subscriber's line. The (CT-9) relay operates if the coin has been deposited but does not operate on a 10,000 ohm leak.

56. The (CT-9) relay locks through its 950 ohm winding and strapped terminals 14 to 17 inclusive and the (M-2) brush to ground. The operation of the (CT-9) relay operates the (CT-3) relay, which opens the circuit from 48 volt battery through the 1000 ohm winding of the (CT-9) relay, closes a circuit from 110 volt battery, CB relay operated to the 1500 ohm winding of the (CT-4) relay, closes a circuit from ground, terminals 14 to 17 of arc (M-2) to the break contact and 350 ohm winding of the (CT-4) relay. The operation of the (CT-3) relay also opens the circuit through the winding of the (CT) relay but (CT) - (CT-1) relay combination is slow to release and does not release until the (CT-4) and (SGA) relays have had time to operate. The (CT-4) relay operates if there is solid ground on the line, thereby operating and locking the (SGA) relay which closes a circuit through the winding of the (CT-1) relay preventing its release. The (CT-4) relay does not operate, however, if the resistance to ground on the subscriber's line is that of the coin collect magnet, thus permitting the (CT) and (CT-1) relays to release.

57. If the time measure switch enters position 17 before the (CT-1) relay releases, due either to the failure of the (CT-9) relay to operate

or to the operation of the (CT-4) and (SGA) relays, the red coin lamp flashes in a circuit through the (CT-1) relay operated (C-2) relay normal, contacts of the interrupter, terminal 17 and (M-5) brush. Under these conditions, the S relay operates when the sender switch enters position 3 for final tens selection. The operation of the S relay opens the fundamental circuit, preventing final units selection and the sender is released by the sender monitor operator as described in paragraph 120. With the time measure switch in position 17 and the TMA relay normal, ground is connected from the (M-6) brush and terminal 17, to the "Miscellaneous Auxiliary Signal Circuit".

58. The release of the (CT-1) relay, if the coin has been deposited, closes a circuit from the TMA relay, (M-3) brush and strapped terminals 14 to 17 to ground at the (MSL-1) relay normal. The operation of the TMA relay energizes the STP magnet, stepping the time measure switch to terminal 18, releasing the TMA, (CT-2), (CT-3) and (CT-9) relays. The time measure switch is stepped from terminal 18 to terminal 21 by the operation of the STP magnet in a circuit through the contacts of the interrupter, strapped terminals 18 to 20 of the (M-5) brush, TMA relay normal, MS relay operated, to ground through the C and (MSL-1) relays normal.

59. If the sender has not returned to normal when the switch steps to terminal 21, ground is connected through terminal 21 and (M-5) brush to the "Miscellaneous Auxiliary Signal Circuit". The sender lamp flashes in a circuit through the contacts of the interrupter, terminal 21 and (M-5) brush, indicating a stuck sender. When the sender returns to normal, the release of the SB relay releases the MS relay. The release of the MS relay at this, or at any other time, closes a circuit from battery through the winding of the TMA relay, strapped terminals, and (M-1) brush to ground at the MS relay. The TMA relay operated, energizes the STP magnet, stepping the switch to normal, releasing the TMA relay.

60. On calls originating at coin stations for which no charge is made, (free routes), the CN relay operates at the completion of translation from battery, secondary winding, lead 1 or 2, terminal and (T-1) - SKO brush, control cam E, to ground at cam U. The CN relay, operated, locks through its continuity contacts. The time measure and alarm switch will function as described in the preceding paragraphs, until it steps to terminal 13 for a preliminary coin test. The (CT), (CT-1) and (CT-2) relays do not operate, but the TMA relay operates from battery, winding (M-3) brush and terminal 13, CN relay operated SKS and (C-3) relays normal, terminal 13 and (M-6) brush. The operation of the TMA relay energizes the STP magnet, stepping the switch to terminal 14. The TMA relay

is held operated through the (M-3) brush and strapped terminals 14 to 17 inclusive to ground on the armature of the (MSL-1) relay, stepping the switch to terminal 18, releasing the TMA relay. From this point the operation is as described in paragraphs 58 and 59.

COIN COLLECT AND RETURN

61. When the receiver is replaced on the switchhook at the calling station, the district selector selects an idle sender for the purpose of collecting or returning the coin. The T, ON, SB, MS, SC and (SC-1) relays operate as described in paragraph 12. If the charge relay in the district is operated, ground is connected over lead FR, (ADV-1) relay normal, sender control cam V, to battery through the winding of the CC relay, operating the CC relay. The operation of the CC relay operates the DWO relay. The DWO relay, operated, locks to ground. The (C-3) relay then operates and is held operated through its continuity contacts. The (C) relay operates from the normal terminal and (M-1) brush, to ground on the armature of the DWO relay, and locks through its secondary winding and continuity contacts to ground at the DWO relay. The TMA relay then operates through (M-4) brush, to ground at the normal (MSL-1) relay. The operation of the TMA relay closes a circuit through the winding of the STP magnet stepping the switch to terminal 1. The TMA relay is held operated through strapped terminals 1 to 9, ("R" wiring used) stepping the switch to terminal 10, releasing the TMA relay.

62. The (C-1) relay operates from terminals 10 to 12 inclusive and (M-4) brush. The operation of the (C-1) relay operates the CB and C2 relays. The operation of the CB relay closes a circuit from positive coin battery, CB relay operated, winding of the (CT-5) relay, CC and (C-1) relays operated, to the tip and ring of the line. The (CT-5) relay operates if there is a coin in the coin box, operating the (CT-6) relay which is held operated through its make contact (C-3) relay operated, to ground at the operated DWO relay. The operation of the (CT-6) relay opens the circuit which gives an alarm during final coin test as described in paragraph 67.

63. The operation of the (C-2) relay closes a circuit from battery, winding of the STP magnet, the (C-2) relay operated, contacts of the interrupter, (C-2) relay operated, strapped terminals and brush of arc (M-2), ON relay operated to ground. As the interrupter makes and breaks contact, the switch steps to terminal 13. When switch (M) steps from terminal 11 relay (CB) releases opening the positive coin collect battery, but relay (C-1) does not release until the switch steps from position 12. The (C-1) relay is held operated through terminal 12 for the

purpose of holding a circuit to ground through the 2 mf. condenser and 2200 ohms resistance until the coin magnet in the coin box has had time to discharge thus protecting the multiple bank.

64. If the coin is to be returned the charge relay in the district selector circuit does not connect ground to the FR lead and the CC relay does not operate but the time measure and sender circuits function as described in the preceding paragraph, except that negative coin battery is connected to the tip and ring of the line through the CB relay operated, CC relay normal, (C-1) relay operated and the (MSL-1) relay normal. The (DWO) relay operates from battery through winding (SLR) relay normal (SC) relay operated (RLS) and (L) relays normal to ground on front contact of (T) relay. The switch steps to terminal 13 as described in the preceding paragraph.

FINAL COIN TEST

65. The (CT-7) relay operates from the terminal 13 and brush of arc (M-6), to ground. The operation of the (CT-7) relay connects the (CT-8) relay to the tip and ring sides of the line. If the coin has not been collected or returned by this time, or if either side of the line is grounded in some other way, the differentially wound relay (CT-8) operates, operating the (CT-1) relay. The (CT-1) relay operated, operates the TMA relay, through the (M-3) brush and terminal 13.

66. The time measure switch steps from terminal 13 to terminal 14. The TMA relay operates, (or holds if already operated), through strapped terminals 14 to 16 inclusive and (M-4) brush, to ground on the armature of the (MSL-1) relay, stepping the switch to terminal 17, releasing the TMA relay. If operated, the (CT-1) relay prevents the advance of the switch from terminal 17. If the coin has not been collected by the time terminal 17 is reached and with the CC relay operated, a circuit is closed from battery, through the red coin lamp. (CT-1) relay operated, contacts of the interrupter, terminal 17 and (M-4) brush C relay operated, to ground at the (MSL-1) relay. The lamp flashes in this circuit indicating that the coin has not been collected, or that there is some other ground on the line.

67. If the coin should have been returned, and there is a ground on the line the CC relay being normal, the red coin lamp lights permanently in a circuit through the (CT-1) relay operated, CC relay normal, terminal 17 and (M-4) brush to ground at the (MSL-1) relay.

68. If when coin collect battery was connected to the line paragraph 62, the (CT-5) and (CT-6) relays did not operate, the (CT-8) relay does

not operate as in paragraph 65. The relay, (CT-1) operates from battery, winding, CC relay operated, (CT-6) relay normal; C relay operated to ground through terminal 13 and (M-6) brush and held operated over terminals 14 to 17 and arc (M-2). In any case the operation of the (CT-1) relay prevents the switch from stepping beyond terminal 17, the red lamp flashing or lighting as above described.

RETURN TO NORMAL

69. In case the coin has been properly collected or returned, the line is clear, the (CT-1) relay is not operated and switch (M) is advanced from terminal 13 to 14 over lead 13 arc (M-4) CT-7 relay operated and (B) interrupter contact. The TMA relay operates and holds through terminals 14 to 17 and brush of arc (M-3), to ground on the armature of the (MSL-1) relay stepping the switch to terminal 18 releasing the TMA relay. The (CT-7) relay also releases as the switch steps from terminal 17. The time measure switch steps from terminal 18 under control of (C-2) relay and interrupters (B) and (C) and from 19 to 21 as described in paragraph 58 giving a stuck sender alarm as described in paragraph 59 if the sender has not by this time returned to normal.

70. When the time measure switch reaches terminal 18, ground is connected from the (M-2) brush and strapped terminals 18 to 21 inclusive, to lead SC, releasing the D relay in the district, advancing the district to normal. As the district advances to normal ground is disconnected from lead FR, releasing the CC relay, from the TEST lead, allowing the (T-1) relay to operate and the T relay to release as described in paragraph 40. The release of the T relay releases the ON, SB, MS, (SC-1), and DWO relays. The release of the DWO relay releases the C and (C-3) relays and the (CT-6) relay if operated. The release of the MS relay steps the time measure switch to normal releasing the (T-1) relay.

CALLS TO MECHANICAL A.B.X.

71. For this class of call the sender functions as described in paragraphs 7 to 35 inclusive, except that the SH, ST and SU registers are set in a similar manner to the setting of the other numerical registers. The RC switch, instead of advancing from position 6 to position 9, as described in paragraph 35, advances one step when the RA relay releases, after the setting of the station registers in a similar manner to its advance from normal to position 6.

72. With the translation completed, a circuit is closed through the top outer contact of class cam B, lead E, terminal and brush of the T2-CL translator arc, operating the CL relay and advancing the class

switch to position 8. As the sender switch advances through position 5, the S relay operates, if the RC switch does not advance from position 8, indicating that the station register has not been set. This circuit is from battery, winding of the S relay, DWO relay normal, sender cam G, class cam G, control cam D, strapped terminals 6 to 8 inclusive and (RC-4) brush, to ground on the RLS relay operated. The operation of the S relay opens the fundamental circuit, preventing the operation of the STP relay for station hundreds selection.

73. When the station registers have been set, the RC switch steps to terminal 9 and the S relay releases, closing the fundamental circuit. Stations hundreds selection then takes place instead of incoming advance. The STP relay operates in the fundamental circuit for station hundred tens and units selections, closing circuits to operate the proper counting relays from ground at sender cam I, STP relay operated, cam L, IA relay normal, control cam N, sender cam S and contacts of cam T, through the station hundreds, tens and units register arcs to the proper counting relays for the station hundreds, tens and units selections respectively. At the completion of each selection, the BO and FO relays operate, opening the fundamental circuit. The operation of the FO relay in position 6, advances the sender switch to position 7 from ground, FO relay operated, IA relay normal, control cam I, sender cam B to battery through the sender R magnet. In position 7, the STP relay operates as described in paragraph 24. The switch then advances to position 8 from ground through the IA relay normal and sender cam C.

74. The operation of the FO relay in positions 8 and 10 advances the switch to positions 10 and 12 respectively as described for position 6 with the help of cam A. In position 12, incoming advance is made as described in paragraph 36, except that the operation of the (ADV-1) relay advances the sender switch to position 15, instead of to position 7 releasing the BO, FO and IA relays. The STP relay operates as in position 7, and the sender switch advances to position 16 in a circuit through sender cam C to ground at the normal IA relay. Talking selection is completed, registers reset, and the sender circuit returned to normal as described in paragraphs 37 to 42 inclusive.

CALL TO ZERO OPERATOR AND ONE DIGIT CODES

75. On calls from a coin station to a zero operator or other one digit code operators, the sender circuit functions as described in paragraphs 7 to 14 inclusive, setting the A register in position 10 for zero operator. With the RC switch in position 1 and the A register in position 10, (or any other position corresponding to a one digit code) a circuit is

closed from battery through the winding and break contact of the RC magnet, (RC-2) brush and terminal 1, terminal 10 and (A-4) brush, RA relay normal, to ground on the armature of the RLS relay operated, stepping the RC switch to terminal 2 operating the ST relay.

76. When translation takes place the sender control switch advances to position 3, and the sender advances to position 2, as described in paragraph 16 to 19 inclusive. The terminals for one digit codes on the hunting arcs are connected directly to the terminals of arc (A-3). The CL relay operates and the class switch is advanced to position 10 through class cam B, over lead F to the contact of the T2-TL translator arc. The CL relay releases as the class switch breaks position 9, and the RC switch is advanced from position 2 to position 9 from battery through the winding and break contact of the RC magnet, (RC-2) brush and strapped terminals 2 to 8 inclusive, class cam H, CL relay normal, control cam O, to ground at the operated (TS-1) relay.

77. District group and brush selections are made, the district selecting a trunk to the zero operator or other one digit code operator or station, and the sender advances to position 6, as described in paragraphs 20 to 23 inclusive. For this class of call, the CN relay operates as soon as the translator is set, from battery, secondary winding and break contact, terminal and brush of the T1-SKO arc, control cam B, to ground at control cam U, and locks through its continuity contacts to the same ground. The operation of the CN relay holds the BO and FO relays after operating in position 4 until the sender switch advances from position 10, in a circuit through the sender cam R, CN relay operated, over lead 3, terminal and brush of arc T1-SKO, inner contacts of control cam E, to ground at control cam U. The TG, (TG-1) and CI relays operate as described in paragraph 24, except that battery is connected to one winding of the L relay in the trunk circuit to zero operator, instead of the L relay of an office selector.

78. With the aid of cam A the sender advances from position 6 to position 12, in a circuit through cam C, control cam I, the IA relay normal, to ground at the operated FO relay. The TG, (TG-1) and (CI) relays release as the switch advances from position 6. In position 12, the TG (TG-1), and CI relays operate and the switch advances to position 14, as described in paragraph 28. In position 14 the ADV and (ADV-1) relays operate from battery, windings in parallel. (CT-6) and (C-3) relays normal, class cam P, sender cam R, IA relay normal, to ground at sender cam J. The operation of the (ADV-1) relay advances the control switch to position 5 through cam C, and advances the sender switch to position 15 through sender cam B. The sender switch advances to position 16 through cam C. The operation of the ADV relay disconnects ground from lead SC

allowing the district L relay to release and advance the district, thus opening the dial leads to the sender, releasing the sender L relay. The release of the sender L relay releases the SLR and RLS relays, operating the STP relay, and causing talking selection to be made as described in paragraphs 36 and 37 with the switch in position 5. The operation of the FO relay, closes a circuit in which the sender control switch advances to position 6. From this point on the registers are reset and the sender returns to normal as described in paragraphs 38 to 42 inclusive.

79. On calls from a non-coin station to zero operator, or other one digit code operator, the sender functions as described in the preceding paragraphs, except that the counting relays hold in position 4 until the sender switch advances beyond position 10, through sender cam R, lead 2, terminal and brush of the T1-SKO translator arc.

CALL TO THREE DIGIT OPERATOR

80. On calls to long distance, information, complaint, repair, Commercial Department, or other special operator, three digits are dialed. The sender is selected, registers are set and translation is made as described in paragraphs 7 to 19 inclusive. Only the first two digits are required to complete selections. The CL relay operates and the class switch advances to position 11 through cam B, over lead G to the T2-CL translator arc. The CL relay releases when the class switch advances from position 10, and the RC switch is then advanced from position 2 to position 9, as described in paragraph 76. From this point on the sender functions as described under "Call to Zero Operator" in paragraphs 75 to 79 inclusive.

CALL TO RESTRICTED ZONE

81. If a number is dialed which should be obtained by a toll operator, or if office code digits are dialed for which there is no office, the sender is selected, the registers are set and translation made as described in paragraphs 7 to 19 inclusive. The CL relay operates and the class switch advances to position 9, through the upper inner contact of class cam B, over lead D to the T2-CL translator arc. The CL relay releases as the switch advances from position 8. District selections (and office selections if an office selector is used) are made as described for a mechanical class call. The (S) relay operates on non-coin senders when the sender switch enters position 11/12 preventing trunk test until the RC switch is advanced to terminal C. The RC switch is advanced as on a mechanical class call to term 6 after the setting of the U register. The SKS relay then operates causing the M switch to count time to be allowed for dialing another digit or a party designation. If it is desired that the RC switch be advanced to terminal O as soon as the U

register is set lead 3 is connected at the STA, DEL, translator arc. If it is desired that the advance of the RC switch be delayed until the SH register is set lead 1 is connected in which case the RC switch is advanced to terminal 7 when the SH register is set. The SKS relay releases in either case when RC switch advances from terminal 6. If lead 1 is used the RC switch is advanced from terminal 7 to terminal 0 when the SKS relay releases, or it advances from terminal 6 (SH register not set) when the M switch advances to terminal 16. When the RC switch advances from terminal 9 the (S) relay releases permitting trunk test and the completion of the call as for zero operator. On coin sender the operation is similar except that the (S) relay is held until the M switch advances to terminal 13.

CALL VIA R.C.I. TRUNKS

DIRECT RELAY CALL INDICATOR - NUMBER LESS THAN 10,000

82. When a call to a manual station is made via direct R.C.I. trunks the sender is selected and the registers are set as described in paragraphs 7 to 15 inclusive except that the SH register is also set if the station is on a party line, the RC switch being advanced to terminal 7. If the party line is in a party line office with less than 10,000 lines, the RC switch is stepped from terminal 7 to terminal 9 from battery, winding and break contact of the RC magnet, (RC-2) brush, and strapped terminals 2 to 8 inclusive, lower terminals of class cam H, strapped terminals 1 to 0 inclusive and the (SH-6) brush, lead 1, terminal and T1-SL brush, RA relay, normal, to ground as the RLS relay operated.

83. If this party line is in a party line office with more than 10,000 lines and the first digit is 1, the RC switch is advanced from position 7 to position 9 through the (RC-2) brush and terminals, lower contacts of class cam H, strapped terminals 1 to 0 inclusive and the (SH-6) brush strapped terminals 1 to 9 inclusive and (H-4) brush, terminal 1 and (TH-4) brush, over lead 2, to the T1-SD arc. (Numbers whose first two digits are 10 will always be private lines).

84. If this party line is in a party line office with more than 10,000 lines, and the first digit is not 1, the RC switch is advanced, as just described, except that the circuit to ground over lead 2 passes through strapped terminals 2 to 10 inclusive and the (TH-4) brush. If the line is a private line in a party line office (either with more than 9999 or less than 10,000 lines) the SH register is not set and the RC switch is stepped from terminal 6 to terminal 9, after sufficient time has elapsed

for the dialing of a station digit, as described below in paragraph 96.

85. If the line is a private line in a private line office with less than 10,000 lines, the RC switch is strapped from terminal 6 to terminal 9, through the (RC-2) brush and terminals, class cam H, strapped terminals 1 to 0 inclusive and (U-2) brush, over lead S, to the T1-SD translator arc.

86. If the line is a private line in a private line office with more than 9999 lines, and the first digit is 1 and the second digit is not zero, the RC switch is stepped from terminal 6 to terminal 9 through the (RC-2) brush and terminals, lower contacts of class cam H, strapped terminals 1 to 0 inclusive and (U-2) brush, terminals 1 to 9 inclusive and (H-2) brush, terminals 1 and (TH-2) brush, over lead 4, to the T1-SD translator arc. If the line is a private line in a private line office with more than 9999 lines, and the first digit is not 1, the RC switch is stepped as just described, except that the circuit to ground over lead 4 passes through strapped terminals 2 to 0 inclusive and the (TH-2) brush. If the line is a private line office with more than 9999 lines and the first two digits are 10, a fifth digit not being dialed, the SH register is not advanced, and the RC switch is again advanced from terminal 6 to terminal 9 after sufficient time has elapsed for the dialing of a fifth digit, as described under "Time Measure and Alarm" in paragraphs 77 to 79 inclusive. Translation is made as described in paragraphs 16 to 19 inclusive, except that the CL relay operates and the class switch advances to position 2, (or 13) through the upper outer contact of class cam C, over lead A, to the T2-CL translator arc. The CL relay releases when the switch advances from position 1, (or 12).

87. District and office selections are made and the sender switch advances to position 12 as described in paragraphs 20 to 26 inclusive. The S relay operates and functions as described in paragraph 27, if the RC switch has not advanced to position 4. With the sender switch in position 12, a circuit is closed from battery at the manual office, over the fundamental tip, S and ADV relays normal, control cam S, class cam O, sender cam O, windings of the TG, STP, and OFL relays, the BO relay normal, sender cam X, "COMP. RES. (T-1) BEYOND OFF" translator brush, compensating resistance, control cam V, (ADV-1) normal, over lead FR to ground in the manual office. The TG relay operates in this circuit causing the operation of the (TG-1) and CI relays. The operation of the CI relay advances the sender switch to position 14, and during this advance the fundamental circuit is closed through the TG relay operated, short-circuiting the 14,500 ohm resistance. This is traced through class cam O, the CI relay operated, and sender cam O. The guard lamp associated with the trunk at the R.C.I. position lights.

88. With the switch in position 14, the TG relay remains operated until the distant operator depresses the display key associated with the lighted guard lamp. The release of the CL relay operates the D relay, from battery, winding, class cam E, CL relay normal, to ground at sender cam H. The D relay locks until the impulse switch advances beyond position 9 1/2 through its make contact, impulser cam D, class cam M, to ground through control cam U. The operation of the D relay closes a circuit in which the FP relay operates. The operation of the D relay also closed a circuit through the D relay operated, and impulser cam C, in which the impulser switch advances from position 1, ground on cam B advancing it to position 9. With the impulser switch in position 9, when the display key is depressed the TG relay releases, releasing the (TG-1) and CI relays. The release of the CI relay closes the tip and ring sides of the fundamental circuit through its break contacts, sender cams Q and P, class cams J and L, to the contacts of the impulser switch cams.

89. The release of the CI relay also closes a circuit through impulser cam C, FP relay operated, class cam K, CI relay normal, to ground at sender cam H, advancing the impulser switch from position 9 to position 10. The B cam advances the switch in position 1. The D relay releases when the switch advances beyond position 9 1/2. The FP relay holds, after the D relay releases, through the make contact, impulser cam D, class cam M, to ground at control cam U. For the second time the impulser switch is advanced from position 1 to position 2 in the same circuit as from position 9 to position 10, the B cam advancing the switch to position 9. As the switch advances beyond position 2-1/2 in the second revolution the FP relay releases. The switch is advanced from position 9 to 10 in a circuit through impulser cam C, to ground through the D relay normal, the B cam advancing the switch to normal. During the rotation of the impulser switch R.C.I. impulses are sent out to the manual office by connecting battery and ground to the tip and ring of the fundamental circuit, through the contacts of the impulser switch cams, for the purpose of operating that combination of relays in the manual office which will cause the called number to be displayed at the R.C.I. position.

90. The order in which these impulses are sent is stations, thousands, hundreds, tens and units. Four circuit conditions are established for each digit or letter displayed. Each one of these circuit conditions may be such as to send no impulse, to send a heavy negative impulse, or a light negative impulse. For example, to display station W, the following four circuit conditions are set up in the order named, (1) while the impulser switch advances from position 9 to position 9-1/2 an open circuit exists, (2) while the switch advances from position 10 to position 10-1/2, a heavy negative impulse is transmitted from battery through the

52.5 ohm resistance, impulser cam T, impulser cam Q, terminal 9 and (SH-4) brush, class cam Q, impulser cam M, TAN relay normal, RLS relay operated, impulser cams G and H, FP relay operated, over the ring side of the fundamental circuit, back over the tip side, FP relay operated to ground through impulser cam I, (3) while the impulser switch advances from position 11 to position 11-1/2 an open circuit exists, (4) while the switch advances from position 12 to position 12-1/2 a light negative impulse is transmitted, from battery through the 3500 ohm resistance, impulser cams G and H, FP relay operated, over the ring side of the fundamental circuit, back over the tip side, FP relay operated to ground through impulser cam I. In case the station is not on a party line, the first and third conditions are open circuits, and the second and fourth conditions cause light negative impulses to be transmitted, whereby the digit zero is displayed at the R.C.I. office to indicate that there is no party designation required.

91. Circuit conditions are established for transmitting impulses through the contacts of the impulser switch cams, for the thousands digit in positions 13, 14, 15 and 16, for hundreds digits in positions 17, 18, 19 and 20, for the tens digits in positions 1, 2, 3 and 4 and for the units digits in position 5, 6, 7 and 8. The switch advances from position 8-1/2 to 11 in the second revolution with the fundamental circuit open. While the switch advances from position 11 to position 12-1/2 a heavy positive impulse is transmitted from battery through a 52.5 ohm resistance, FP relay normal, class cam J, over the tip side of the fundamental circuit, back over the ring side, FP relay normal, to ground through cam I. This is to provide for the operation of a polarized relay in a distant two-wire office selector, in order to advance this selector.

92. As the impulser switch is advanced from position 13 to position 1, a circuit is closed, in which the ADV and (ADV-1) relays operate, through impulser cam E, FP relay normal, class cam K, CI relay normal, to ground at sender cam H. The operation of the ADV relay advances the district selector, following which talking selection, resetting registers and return to normal take place as described in paragraphs 37 to 42 inclusive.

TANDEM RELAY CALL INDICATOR - NUMBERS LESS THAN 10,000

93. On a call to a manual station via tandem R.C.I. trunks whose number is less than 10,000 the circuit operates as described in the preceding paragraphs up to the point where the display key is operated at the R.C.I. office, except (a) that the CL relay operates and the class switch is advanced to position 5, (or position 16) in a circuit through class cam C and Lead B, to the T2-CL translator arc. The CL relay releases when the switch advances from position 4 (or position 15), (b) that the impulser switch is not advanced from normal until after the display key

is operated and (c) the TAN relay operates when the CL relay releases, in place of the D relay, causing the operation of the FP relay. The circuit in which the TAN relay operates, is from battery, winding, class cam E, break contact of the CL relay, to ground at sender cam H. The TAN relay locks until the switch advances beyond position 9 1/2, through impulser cam D, class cam M, to ground at control cam U.

94. When the display key is operated, the TG and (TG-1) and CI relays release, closing a circuit in which the impulser switch advances, with the aid of cam B, from position 1 to position 9. This circuit is through impulser cam C, the FP relay operated, class cam K, CI relay normal, to ground at sender cam H. The impulser switch is advanced with the aid of cam B from position 9 to position 1 and again from position 1 to position 9 in the same circuit. The TAN relay releases when the switch advances beyond position 9-1/2, but the FP relay holds as described in the paragraph 89 until the switch advances from position 2-1/2 of the second revolution. The switch advances from position 9 to position 1 in a circuit through impulser cam C, to ground at the D relay normal. The release of the FP relay prevents the advance of the switch from normal a third time. Each manual office which is tandem to the originating office is assigned a tandem code number by means of which the particular office called is identified by the tandem operator. Impulses are transmitted over the tandem R.C.I. trunk for displaying the tandem code number in addition to those for displaying the called number. The order in which the impulses are transmitted is tandem tens, tandem units, stations, thousands, hundreds, tens and units.

95. During the advance of the impulser switch from position 1 to position 4 inclusive, four circuit conditions are established for tandem tens, according to the setting of the A register (arc A-5), as required. The impulses for tandem units are transmitted during the advance from position 5 to position 8 inclusive, according to the setting of the B register (arc B-5). The impulses for stations, thousands, hundreds, tens and units digits are transmitted, talking selection, resetting registers and sender return are all completed as described in paragraphs 91 and 92.

OPERATION OF THE TIME MEASURE AND ALARM CIRCUIT ON R.C.I. CALLS

96. The non-coin time measure and alarm circuit functions as described for Time Measure and Alarm in paragraph 46, with the following exceptions. When the register control switch enters position 6, indicating that the fourth digit of the number has been dialed, the SKS relay operates from battery, winding, class cam G, control cam D, strapped terminals 6 to 8 inclusive and (RC-4) brush, to ground at the RLS relay

operated. If the time measure switch has stepped from terminal 5, but not beyond terminal 11, the TMA relay operates stepping the time measure switch to terminal 12. The TMA relay releases as the switch steps from terminal 11 if the SKS relay has not by this time been released. The SKS relay does not release unless the RC switch has stepped to terminal 9.

97. On terminal 11 with the SKS relay operated, a circuit is closed from battery through the STP magnet, SKS relay operated, contacts of the interrupter, strapped terminals 12 to 15 inclusive and (M-5) brush, MS relay operated, to ground through the TMA and MSL relays normal, advancing the switch one step each time the interrupter makes and breaks contact. When the switch makes terminal 16, sufficient time for the dialing of the stations digit has elapsed.

98. In case the stations digit is dialed before the time measure switch makes terminal 16, the SH register advances stepping the RC switch to terminal 9 as described in paragraph 82. In case the stations digit has not been dialed when the time measure switch steps to terminal 16, the RC switch is stepped to terminal 9 through the (RC-2) brush and strapped terminals 2 to 8 inclusive, through terminal 16 and the (M-6) brush, MS relay operated, to ground at the TMA and MSL relays normal. In either case the SKS relay releases, the time measure circuit continues to function as described for Time Measure and Alarm in paragraphs 46 to 50.

99. The coin sender time measure and alarm circuit functions as described in paragraph 51 with the following exceptions: the SKS relay operates as described in paragraph 96. If the time measure switch has stepped from terminal 4, but not beyond terminal 8 when the SKS relay operates, a circuit is closed in which the TMA relay operates through the (M-3) brush and strapped terminals 5 to 8 inclusive, the SKS relay operated, a ground through C and (MSL-1) relays normal. The operation of the TMA relay closes a circuit through the STP magnet and the TMA relay operated, stepping the switch to terminal 9. The TMA relay releases when the switch advances from terminal 8 if the SKS relay has not by that time released. The SKS relay does not release unless the RC switch has stepped to terminal 9. A circuit is closed from battery, winding of the STP magnet contacts of the interrupter. SKS relay operated, strapped terminals 9 to 12 inclusive and (M-5) brush, TMA relay normal, MS relay operated, to ground through the C and (MSL-1) relays normal, advancing the switch one step each time the interrupter makes and breaks contact.

100. When the switch makes terminal 13, time sufficient for the dialing of the stations digit has elapsed. In case the stations digit has been dialed before the time measure switch enters position 15, the RC switch has stepped to terminal 9 as described in paragraph 82. If the stations digit has not

been dialed when the time measure switch makes terminal 13, the RC switch is stepped to terminal 9 through the (RC-2) brush and strapped terminals 2 to 8 inclusive, terminal 13 and the (M-5) brush, break contact of the TMA relay, MS relay operated, to ground at the C and (MSL-1) relays normal.

101. In either case the SKS relay releases when the RC switch steps from terminal 8. With the SKS relay released, the time measure switch continues to function as described in paragraphs 53 to 60 inclusive.

DIRECT AND TANDEM R.C.I. - NUMBERS MORE THAN 9999

102. On a call to a manual station via either direct or tandem R.C.I. trunks for a number greater than 9999, the sender functions as described for "Direct Relay Call Indicator" and as described for "Tandem Relay Call Indicator" with the following exceptions. For numbers more than 9999 the dialing of the fifth digit sets the SH register and steps the RC switch to terminal 7. If the station is in an office with no party lines, the advance of the SH register closes a circuit from battery, winding of the CT relay, strapped terminals 1 to 0 inclusive and (SH-2) brush, 0 terminal and (H-2) brush, terminal 1 and (TH-2) brush, lead 4, terminal and T1-SD brush, the RA relay normal, to ground on the armature of the RLS relay operated, operating the CT relay.

103. If the station is in an office with party lines, the advance of the SH register closes a circuit to ground through the winding of the CT relay, the T1-SD translator terminal and brush, as just described, except that it passes through terminal 0 and the (H-4) brush, terminal 1 and the (TH-4) brush, and over lead 2. The CT relay locks to ground on the armature of the (TS-2) relay operated. The operation of the CT relay in either case closes a circuit from battery through the windings of the CL relay and class switch R magnet in parallel, class cam D, CT relay operated, to ground on the armature of the (TS-2) relay operated, advancing the class switch one step to position 3, 6, 14, or 17 as the case may be and operating the CL relay. The CL relay releases when the class switch advances.

104. The advance of the class switch closes a circuit in which the RC switch is advanced from position 7 to position 9. This circuit is from battery, 44-E resistance and winding of the (ON-2) relay in multiple, break contact of the RC magnet through the (RC-2) brush and strapped terminals 2 to 8 inclusive, class cam H, CL relay normal, control cam O, to ground at the (TS-1) relay operated. The advance of the class switch causes impulses for the first numerical digit to be transmitted

first on a direct R.C.I. call, and to be transmitted immediately following the impulses for office code on a tandem R.C.I. call, instead of impulses as would normally be controlled by the setting of the SH register.

105. The circuit conditions necessary for displaying digit 1 as controlled by the setting of the TH register, and established in positions 9, 10, 11 and 12 of the impulser switch, for the digit 0 as controlled by the setting of the H register, in positions 13, 14, 15 and 16, for the hundreds digit as controlled by the setting of the tens register, in positions 17, 18, 19 and 20, for the tens digit as controlled by the setting of the units register in positions 1, 2, 3, and 4, and for the units digit as controlled by the setting of the SH register, (arc (SH-5) in positions 5, 6, 7 and 8).

MISCELLANEOUS

OVERFLOW CONDITIONS

DISTRICT SELECTOR

106. With the sender switch in position 6 and the control switch in position 3, should the district selector go to the overflow position during trunk hunting, the pulsing circuit is opened when the district advances from the "Selection Beyond" position, causing the release of the sender L, SLR and RLS relays. The release of the SLR relay advances the RC switch to position 9 as described in paragraph 43, if not already advanced to that position. As the district switch continues to advance to the overflow position ground is removed from the lead TEST causing the operation of the (T-1) relay and the release of the T relay. In position 9 a circuit is closed from ground through the T relay normal, terminal 9 and (RC-2) brush, to battery through the RC magnet, advancing the RC switch to position 0.

107. With the RC switch in position 0 a circuit is closed from battery, through the sender control R magnet, cam C terminal 0 and (RC-1) brush, to ground at the SLR relay normal, advancing the sender control switch to position 5. As the control switch advances from position 3 to position 5, the registers are reset as described under this heading in paragraphs 38 and 39. With all registers normal the RC switch advances to normal causing the sender control switch and the sender switch to return to normal as described in paragraphs 40 and 42.

OFFICE SELECTOR

108. Should the office selector go to overflow during trunk hunting on a call to a mechanical office, reverse battery is connected to the

fundamental circuit, when the sender switch enters position 12, "Trunk Test". The TG and CI relays operate and the sender switch advances to position 14 as described in paragraph 28, except that the current is in the opposite direction. In position 14 the fundamental circuit is again closed through the STP and OFL relays, as described in paragraph 29, except that the current flows in the opposite direction, operating both the STP and OFL relays. The OFL relay, operated, locks through its 6400 ohm winding, to ground on its armature through the lower contacts of cam K.

109. The operation of the OFL relay closes a circuit in which the IA and OV relays operate. The circuit in which the OV relay operates is from battery winding, control cam L and sender cam K, to ground through the OFL relay operated. The OV relay locks to ground through control cam T. The operation of the OV relay closes a holding circuit through the winding of the CI relay, OV relay operated, to ground at control cam T. The operation of the IA relay connects the lead from the 0 counting relay, through the IA relay operated, contacts of cam L, STP relay operated, to ground through cam I, operating the 0 counting relay. The operation of the IA relay closes a circuit from battery through the winding of the sender control R magnet, cam B, cam Q, OV relay operated, to ground through the cam H, advancing the control switch to position 4.

110. In position 4 the ADV and (ADV-1) relays operate through control cam Q, to the same ground, and lock through the ADV relay operated, to ground through cam T. The operation of the ADV relay, (a) opens the FR lead, releasing the STP relay and thus causing the operation of the BO and FO relays, (b) closes a circuit through control cam C, advancing the control switch to position 5, and (c) closes a circuit from ground on its left armature, through sender cam B advancing the sender switch to position 15. The operation of the ADV relay opens the SC lead, releasing the SC relay and causing the advance of the district. The advance of the district releases the sender L relay. The release of the L relay releases the SLR and RLS relays. When the switch advances from position 14, the OFL, IA, 0, BO and FO relays release. In position 15 a circuit is closed from the STP and OFL relays, as described in paragraph 24 to insure the release of the OFL relay. With the IA relay released, the sender advances to position 16 as described in paragraph 30.

111. In position 16 a circuit is closed from battery through the district L relay, over lead FT, in which the STP relay operates. When the STP relay operates in this circuit, it closes a circuit from battery through the winding of the 3 counting relay, lead C, OV relay

operated, control cam N, IA relay normal, sender cam L, STP relay operated to ground at cam I.

112. As the district switch advances, the STP relay is intermittently short-circuited by ground in the district connected to lead FT, thereby causing the alternate release and operation of the STP relay until the BO and FO relays operate. The operation of the BO relay opens the fundamental circuit, releasing the district L relay, stopping the district in the overflow position. The operation from this point on is as described in paragraphs 106 and 107.

113. Should the office selector go to overflow on an R.C.I. call, the operation is as just described, except that the operation of the TG and CI relays in positions 12 and 14 shunts the 40-K resistance, in order to operate the marginal polarized relay in the distant two wire office selector, if used.

INCOMING SELECTOR

114. Should the incoming selector go to overflow, with the sender in position 18 and the control switch in position 4, the fundamental circuit is closed from battery and ground in the incoming circuit through the STP and OFL relays in the sender as described for final brush selection in paragraph 33, except that the flow of current is in the opposite direction. The OFL and incoming L relays operate in addition to the STP relay, advancing the incoming to the awaiting trunk closure position. (The polarized relay in the distant two wire office, if used, also operates in this circuit, advancing the selector, from the "Selection Beyond" position). The OFL relay, operated, locks through cam K to ground. The IA relay operates to the same ground.

115. The OV relay operates through cam E, control cam L, sender cam K, to ground through the make contact of the OFL relay. The CI relay operates, and the OV relay locks in a circuit through the OV relay operated, to ground through cam T. The operation of the IA relay closes a circuit in which the O counting relay operates, as described in paragraph 108. The advance of the incoming selector opens the fundamental circuit, releasing the STP relay and causing the operation of the BO and FO relays. The operation of the FO relay closes a circuit, in which the ADV and (ADV-1) relays operate, through control cam Q, IA and FO relays operated, to ground. The operation of the (ADV-1) relay opens the FR lead, and advances the control switch to position 5. The operation of the ADV relay opens the SC lead, releasing the SC relay, causing the advance of the district selector.

116. The advance of the district selector releases the sender L relay, causing the release of the SLR and BLS relays. The operation of the

(ADV-1) relay advances the sender switch to position 8. In position 8 a circuit is closed from battery through the district L relay, over lead FT, in which the STP relay operates as described in paragraph 39. The counting relays are operated and the district advanced to the overflow position, as described in paragraphs 108 and 109. The operation from this point on is as described in paragraphs 106 and 107.

PRELIMINARY PULSE

117. Should one preliminary pulse be transmitted over the pulsing circuit before dialing, due to accidental dialing or any other temporary open circuit, the A register is advanced to terminal 1, closing a circuit in which the PP relay operates, from battery, RA relay normal, 1000 ohm winding of the PP relay, terminal 1 and (A-4) brush, RA relay normal, to ground at the RLS relay operated. The RC magnet and the (ON-2) relay hold in a circuit through terminal 1 and (A-6) brush, SSR relay normal, to ground at the RLS relay operated, thus preventing the advance of the RC switch from normal. With the PP relay operated, when the L relay next release, a circuit is closed from battery through the secondary winding of the (ON-1) relay in parallel with the 58 ohm resistance, 15 ohm winding and make contact of the PP relay, normal terminal and (RC-6) brush, winding of the FA relay, RLS relay operated, L relay normal to ground at the T relay operated, operating the RA relay opening the circuit through the 1000 ohm winding of the PP relay. The PP relay holds through its 15 ohm winding until the L relay reoperates. The RA relay holds during the series of impulses corresponding to the first digit.

118. The PP relay releases when the L relay operates after the receipt of the first impulse of the series closing the circuit through the A register magnet, as described in paragraph 12. The second pulse of the series then advances the A register from terminal 1 to terminal 2, and from this point on the circuit functions in the regular manner. If there is only one pulse a second time, the release of the RA relay closes a circuit through the 1000 ohm winding of the PP relay, as before described and (ON-2) relay and RC magnet remain energized, preventing the advance of the RC switch. This operation is repeated until more than one pulse is required.

RELEASE OF SENDER FROM PERMANENT SIGNAL CONDITIONS

119. If the sender monitor lamp lights to indicate a permanent signal condition as described in paragraphs 46 to 50 for a non-coin sender, the plug of the monitor operator's cord is inserted in test jack T, operating the MSL relay from battery on the sleeve of the cord. The

operation of the MSL relay disconnects the tip and ring of the line from the sender L relay, and connects its non-inductive winding or an 800w N.I. resistance across the L relay holding it operated to prevent a false disconnect. The line is then connected to the tip and ring of the cord circuit.

120. To release the sender (E wiring) the plug of the cord is inserted in and immediately removed from jack MB at the trouble desk, operating the SSR relay which locks to off-normal ground. The operation of the SSR relay closes a circuit from the RC switch in positions "N" and "1" to operate relay SSA, advancing the RC switch to terminal 2. With the RC switch off normal the (M) switch is advanced to terminal 6 from ground on RC-3 brush. The ST relay operates and locks as described in paragraph 16. The translator rotates until the hunting brush finds the terminal on the T1 arc, to which ground from the RLS and SSR relays operated is connected over lead B. The (TS-1) and (TS-2) relays operate and the translator is stepped in a position in which the class switch advances to position 10. The (TS-1) and (TS-2) relays, operated, function as described in paragraph 17.

121. When the CL relay releases as the switch advances from position 9, and the RC switch advances from position 2 to position 9, as described in paragraph 76, the setting of the translator causes district and office selections to be made, such that the line is connected to a "permanent signal trunk" to the trouble desk. With the RC switch on terminal 9 the M switch is advanced to terminal 12 from ground on RC-3 brush and to terminal 17 from ground on (MSL) relay through contact on SKS relay normal. The sender advances to position 12 as on "zero operator's" calls. When trunk test is made, however, reverse battery from the permanent signal trunk operates the (OFL), (STP) and (TG) relays. The (OFL) relay operates the (OV) and (IA) relays. The (TG-1) and (CI) relays also operates. The (CI) relay advances the sender to position 14. The (OV) relay operated advances the sender control switch to position 4. The (ADV) and (ADV-1) relays operate through M-4 arc, cam Q of sender control switch and contact of (OV) relay advancing the sender switch to position 16 and the sender control switch to position 5 and opening the (SC) lead to advance the district for talking selections. When the district advances from selection beyond position the (L) and (SLR) relays release, a contact on the (SLR) relay closing the fundamental circuit for talking selections. With the (OV) relay operated counting relay 3 is connected to the pulsing circuit, the district selector is advanced to "talking to operator" position where it is held by the ground on trunk sleeve holding the district (L) relay up. From this point on the sender functions as on zero operator's calls. When the MS relay releases the TMA relay operates from battery, winding

strapped terminals 1 to 21 inclusive and (M-1) brush, to ground at the MS relay normal. The operation of the TMA relay closes a circuit from battery through the winding and break contact of the stepping magnet, TMA relay operated, to the same ground advancing the time measure switch to normal. The TMA relay releases when the switch advances from position 21.

When "D" wiring is used the operation of the SSR relay advances the RC switch to terminal 2 and closes ground to a point on arc (T1-A-3) over the B lead. The (ST) relay operates and translation takes place as before. When the translator is set ground from the (TS-2) relay through arc (T2-A-CL) operates the (SSA) relay which advances the class switch to position 10. From this point on the circuit functions as described above for E wiring except that the (M) switch is advanced from the permanent signal terminal through the sender control cam in position 4 and contact on (OV) relay operated.

122. For a permanent signal condition as described in paragraph 56 for a coin sender, the (MSL-1) relay operates and functions as described for the MSL relay in paragraph 119. In releasing the sender the SSR and SSA relays operate and lock and the RC switch advances to position 2, the (ST) relay operates, translation is completed and the class switch is advanced to position 10, as described in paragraphs 120 and 121 for "D" or "E" wiring. The (CN) relay also operates thereby preventing the operation of the (CT-1) and (CT-2) relays when the time measure switch advances to normal. The RC switch advances from position 2 to position 9 and a trunk at the trouble desk is selected as described above. The ADV relays are operated through normally closed contacts on (CT-6) and (C-3) relays when sender control switch reaches position 4. The (M) selector is advanced to terminal 5 when RC switch moves to terminal 2, advances to terminal 9 when RC switch reaches terminal 9. From 9 to 13 it advances through back contact of (SKS) relay and from 13 to 18 through front contact on (CN) relay and from 18 to normal through back contact of (MS) relay released.

When the sender monitor positions are located at the M.S."A" switchboard, on permanent signal calls the circuit functions as above except that the (SSR) relay is operated immediately upon the (M) selector reaching the permanent signal terminal. No signal is given to the moniter in this case.

RELEASE OF STUCK SENDER (D WIRING)

123. In case the sender monitor lamp lights to indicate a partial dialed condition or a stuck sender condition, as described in paragraphs 46 to 50 non-coin sender, or as described in paragraph 56 for a coin

sender the plug of the monitoring operator's cord is inserted in (MB) jack at the trouble desk or in the (P) jack at the M.S. "A" switchboard operating the (SSR) relay. If translation has not been completed, the sender is released as described in paragraphs 119 to 122 inclusive, but if translation has been completed, the SSA relay does not operate. If incoming advance has not been completed, the sender control switch will then be in position 3 or position 4 and when the SSR relay operates as described in paragraph 120, the DWO relay operates through its winding, SSR relay operated, SSA relay normal, to ground at control cam U. The DWO relay locks to ground on the armature of the T relay operated. The operation of the DWO relay short-circuits the winding of and therefore releases the SC relay. This causes the release of the district D relay.

124. District group selection should have been completed before the D relay releases, causing the release of the L, RLS and SLR relays. If the district group selection has been completed when the district D relay releases, office test, office selections, trunk test and incoming selection takes place as described in paragraph 45. Incoming advance and talking selection then take place advancing the district and thereby releasing the L, RLS and SLR relays.

125. On a call using a coin sender the operation of relay DWO, as described in paragraph 123, immediately grounds the SC lead (relay SSR being operated). This will release relay (D) in district releasing the subscribers line to allow the calling party to come in on another sender if he still has his receiver off the switchhook. The sender will then be released as described in paragraphs 123 and 124.

126. If incoming advance has already been completed when the SSR relay operates, the DWO relay does not operate since the control switch is then in position 5 and the L, RLS and SLR relays will have released when the district advanced from the "selection beyond" position. In each case the release of the SLR relay advances the RC switch to position 9 as described in paragraph 43. "Resetting and register" and "return to normal" are completed as described in paragraphs 38 to 42.

127. On a call from a coin station the operation is as described in the preceding paragraphs except that the associated district circuit reselects a sender for the purpose of returning the coin. If at this time the receiver has been replaced on the switchhook the coin is returned as described in paragraphs 61 to 64. If the receiver has not been replaced on the switchhook and the subscriber does not dial another number the sender functions as described under "Preliminary Pulse" routing the call to a trunk in the permanent signal group, or returning to normal as described in preceding paragraph 125.

RELEASE OF STUCK SENDER - E WIRING - (PRIMING WIPE-OUT)

128. NON-COIN SENDERS

In case the sender monitor lamp lights to indicate a partial dialing condition or a stuck sender condition, the operation is the same as described in paragraph 123. If the M selector is not already on terminal 17/21, the RC selector is advanced to terminal 9. With the RC switch on terminal 9, ground at RC brush #3 advances the M selector to terminal 17. When the subscriber was released as described in paragraph 123 the (L) and (SLR) relays release. With the M selector on terminals 17/21 and the (SLR) relay released a circuit is closed from ground at the (SLR) relay, (SSR) relay (E) operated, M brush #4, terminals 17/21 to battery through the windings of the (ADV) and (ADV-1) relays, operating these relays. The (ADV) relay, operated, opens the SC lead, advancing the district as the district advances, ground is removed from the TEST lead. From this point the circuit functions as outlined in paragraphs 40 to 42 inclusive.

On coin senders the operation is the same as in paragraph 123 up to and including the operation of the (DWO) relay. With the (DWO) relay operated, ground from the (DWO) relay operates the (C-3) relay, the (C-3) relay, operated, locks to its operating ground and connects this same ground through the contacts of the (MS) relay operated, and brush and strapped terminals of arc M-1, operates the (TMA) relay. With the (TMA) relay operated, the M selector is returned to normal. With the M selector normal, the same ground that returned it to normal operates the (C) relay. From this point the M selector operates to refund the coin as outlined in paragraph 61, after the operation of the (C) relay, and subsequent paragraphs covering refunding of the coin. When the M selector reaches terminal 18, ground from the (ON) relay, operated, and brush and terminals 18/21 arc M-2, grounds the SC relay releasing the subscriber, the M selector steps through position 18/20. When the subscriber was released the (L) and (SLR) relays released. On terminals 19 and 20 the (C-3) relay is shunted down from ground on brush M-6, in turn releasing the (CT-6) relay. With the (C-3) and (CT-6) relays released, ground from the (SLR) relay, released, through contacts of the (SSR) relay, operated, operate the (ADV) and (ADV-1) relays. The (ADV) relay, operated, opens the SC lead causing the district to advance and, as the district advances, ground is removed from the test lead. From this point the circuit functions as outlined in paragraphs 40 to 42 inclusive.

On "no coin" and "stuck coin" conditions, when the sender has been seized to collect or return the coin, the priming wipe-out feature is ineffective because the (CT-1) relay operated prevents the (M) switch from leaving terminal 17. The subscriber's line is held to locate the trouble in this case.

IMMEDIATE WIPE-OUT ON ABANDONED R.C.I. CLASSES OF CALL IN THE AWAITING ASSIGNMENT POSITION - G WIRING

129. When an R.C.I. class of call reaches the 14th (awaiting assignment) position of the sender sequence switch the (RWO) relay operates; should the call be abandoned in this position, before the (TG) relay releases, ground from the (CI) relay through the break contacts of the (TWO) relay, or V wiring if the (TWO) relay is not installed, break contact of the (RLS) relay, released, make contact of the (TWO) relay operated, brush and strapped terminals 17/21 of the M-4 selector to battery through the windings of the (ADV) and (ADV-1) relays, operate the (ADV) and (ADV-1) relays, in case of non-coin senders, or through the contacts of the (TWO) relay or V wiring (RWO) relay, operated, RLS relay, released, break contacts of the (CT-6) and (C-3) relays, normal, operates the ADV and ADV-1 relays, in case of coin senders. The (ADV) relay, operated, opens the SC lead advancing the district; as the district advances ground is removed from the TEST lead. From this point the circuit functions as outlined in paragraphs 40 to 42 inclusive.

130. When calls are made through two-wire office selectors, the translator is arranged to operate the (TWO) relay and cancel the above operations.

Should the call be made through a two-wire office selector on a coin sender for a free route, in addition to cancelling the above operations, the (CN) relay is operated and the circuit functions as outlined in paragraph 60.

Should two-wire office selectors not be employed the (TWO) relay is not installed and the (ADV) relay is operated through V wiring.

ADDED TIME ON R.C.I. CLASSES OF CALL BEFORE STUCK SENDER SIGNAL FUNCTIONS AFTER TRUNK TEST - G WIRING

131. In case of stuck sender after trunk test, the circuit functions as outlined in paragraphs 50 and 59 except that on all classes of calls except R.C.I. classes after trunk test the lead G connected to terminal 19, arc M-3 non-coin and terminal 20, arc M-3, coin makes the elapsed time before stuck sender signal functions a minimum of 1/2 minute, maximum 1 minute. On R.C.I. classes of call, after trunk test is made, the (RWO) relay, having been operated as outlined in paragraph 134, this G lead is opened and the elapsed time before stuck sender signal functions is a minimum of 1 minute, maximum of 1-1/2 minutes. When this feature is used the 3 second make, 27 second break, interrupter should be used.

REGISTER OR SWITCH OFF NORMAL

132. Should any register be moved off normal, while the sender is idle, the (ON-1) and (ON-2) relays operate in series with the stepping magnet of the register which is off normal, as described under "Resetting Registers" advancing them to normal. The operation of the (ON-1) and (ON-2) relay operates the ON relay. The operation of the ON relay operates the SB and the MS relays. The operation of the SB relay operates the (T-1) relay, thereby connecting ground through its 80 ohm winding to the test lead in order to make the sender test busy.

133. When the registers are all returned to normal, the ON relay releases, releasing the SB and MS relays. The release of the SB relay releases the T relay, thereby removing ground from the test lead. The release of the MS relay causes the time measure switch to return to normal.

134. Should any one of the sequence switches, except the class switch, be moved off normal, the ON relay operates causing the operation of the SB, MS and (T-1) relays as just described. The sender control switch advances to position 5 from ground on the armature and through the SLR relay normal, (RC-1) brush and terminals O and N, control cam C to battery through the winding of the (RC-1) magnet, and to position 6, in the same circuit, except that it passes through cam B instead of cam C. With the sender control switch in position 6 all the other sequence switches advance to normal as described in paragraph 42.

SKIP OFFICE

135. On non-coin calls which do not require an office selector, a circuit is closed, in positions 4 to 10 inclusive of the sender switch, to hold the (FO) and (BO) relays operated while ground from the armature and make contact of the FO relay advances the sender switch to position 12, with the aid of cam A. The circuit for holding the counting relays operated is from battery through their windings, sender cam R, lead 2, terminal and (T1-SKO) brush, control cam E, to ground at cam U. When the sender switch advances from position 10, the counting relays release, and the call is completed as described in paragraphs 27 to 42. On coin calls which do not require an office selector, and which do not require the collection of a coin (free route), the circuit for holding the counting relays operated passes through lead 3 and the CN relay operated, otherwise it is as just described for non-coin calls.

MAKE BUSY WHEN SENDER MONITOR POSITION IS LOCATED AT THE TROUBLE DESK

136. When necessary to work on any of the sender apparatus a plug with its sleeve and ring strapped is inserted in the MB jack at the monitoring position, operating the MB relay in a circuit to ground on the ring

spring of jack MB. The operation of the MB relay connects ground to the test terminals of the sender selector, causing the sender to test busy, and closing a contact in the sender busy lamp lead. A contact is also closed in a "chain" circuit of all senders in a group to indicate an "All sender busy" condition. Should the motors for driving the sender switches stop, ground is connected to the lead "Motor Stop Alarm Circuit" operating the MB relay, causing the sender to function as above described.

MAKE BUSY WHEN SENDER MONITOR'S POSITION IS LOCATED AT THE M.S.A. SWITCHBOARD

137. When a "partial dial" or "stuck sender" condition is obtained a flashing signal appears on the (Send) lamp at the M.S.A. switchboard. If the monitor desires to have the sender made busy she inserts a "make busy" plug in jack (P) which lights the associated (MB) lamp at the sender make busy panel as an indication that the sender is to be made busy. The (send) lamp continues to flash until a "make busy" plug is inserted in the (MB) jack at the sender make busy panel when it changes to a steady light.

If for any reason other than a signal from the sender monitor, it is necessary to take a sender out of service, the insertion of the "make busy" plug in the (MB) jack lights the (send) lamp steadily at the M.S.A. board as an indication to the sender monitor that the sender has been made busy.

The insertion of the make busy plug in the (MB) jack performs all the functions, in addition to those above mentioned, covered in paragraph 65.

The removal of the plug from the (MB) jack extinguishes the (send) lamp as an indication to the sender monitor that the sender has been made idle. The (MB) lamp remains lighted until the plug is removed from the (P) jack by the sender monitor.

HEAT AND SPARK PROTECTION

138. The 44-A, E and G resistances are for the purpose of protecting the apparatus against heating on account of the low resistance of the register magnets and other apparatus. The 0.5 mf condensers are used in series with the various resistances to protect the relay and register contacts from excessive sparking.

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March 19, 1929. J.J.C.
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