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METHOD OF OPERATION
SENDER CIRCUIT

228190

Subscribers' Schematic Two Digit Office Code - Power Driven Machine Switching System.

GENERAL DESCRIPTION

1. This subscribers' sender circuit is used in a two digit full mechanical office. It is selected by and used with a district sender selector.

2. The "class" circuit provides means for the various classes of calls.

3. The sender circuit directs the impulses to the proper routing circuit and controls the fundamental circuit in connection with the various selections. The circuit consists of a sender switch, stepping and counting relays, which count the impulses sent from the various selectors during the progress of a call. The switch is arranged to make one or two revolutions depending upon the class of call involved.

4. The register and register control circuit directs the impulses transmitted from the station dial to the proper registers and later, in the progress of the call, controls the starting of selections and the disconnection of the sender.

5. The "translator" circuit causes the proper circuit condition to be established for directing the call to the office desired, and according to the kind of a call desired.

6. The number register circuit consists of the hundreds, tens, units, stations, stations tens and station units registers. The settings of these registers are determined by the impulses transmitted from the dial station.

7. The call indicator impulse circuit is used as a time measure to delay the closing of the impulse circuit immediately after the sender is seized. It consists of an impulser switch which closes the paths for sending the impulses required for either direct call indicator or tandem call indicator calls. The switch is arranged to make one revolution per cycle on direct call indicator calls and two revolutions per cycle on tandem call indicator calls.

8. The time measure and coin collect circuit is for the purpose of giving a signal to the sender monitor operator when any condition in the sender circuit remains unchanged for a period of time which is limited by this circuit. It is also used to provide a time interval, after units are dialed and the sender is in the position to transmit call indicator impulses, following which of the stations register is still normal, the sender circuit assumes that no station is required and continues to function. It is also used to monitor on coin and non-coin station calls, and to control coin collection or refund, on a coin station call.

9. The circuit has a jack to enable the monitor operator to supervise the sender, and a jack to enable the monitor operator to make the sender busy and to release it should it become "stuck" for other reason than circuit or apparatus failure.

I N D E X

DETAILED DESCRIPTION

REGULAR MECHANICAL CALLS, USING OFFICE SELECTOR - NON-COIN, (X WIRING) (1).

Sender Selected (1.01).

10. With the sender control switch in position 1, battery is connected through the winding of the T relay, the ~~T, ON~~, T-1, and MB relays normal, to the multiple test terminal of the associated district sender selectors (not shown). When a hunting sender selector selects and connects to the tip (T), ring (R), test, fundamental tip (FT), sender control (SC), and fundamental ring (FR) terminals of this circuit, it connects ground to the TEST terminal, operating the T relay. The T relay, operated, (a) locks to ground on the test lead, (b) operates the ON relay and (c) operates the SLR relay under the controls of the L, RLS, SC, and SC-1 relays. As soon as 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, the ADV relay normal, to ground through both windings of the SC relay in series, operating the SC relay. The operation of the ON relay, (a) closes a circuit from ground, the MB relay normal, the ON relay operated, to battery through the winding of the SB relay, operating the SB relay, (b) prepares in part a circuit for operating the T-1 relay, and (c) closes a circuit from ground on its make contact, (x wiring), to 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 for the MB relay so that this sender cannot be made busy, (b) closes a part of the chain circuit to the "all senders busy" register, (c) closes in part a circuit so that the sender busy lamp will light if the sender busy key is depressed, and (d) closes a circuit from battery through the non-inductive winding of the T-1 relay and the SB relay operated, (in parallel with battery through the winding of the T relay, operated, and the T-1 relay normal) through the 80 ohm winding of the T-1 relay and the ON relay operated to ground on the armature of the MB relay.

11. The T-1 relay does not operate at this time, since its inductive winding is short circuited by the ground on the test lead. The MS relay, operated, functions as hereinafter described under "Time Measure and Alarm". The operation of the SC relay opens the circuit in which the SLR relay operated. 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, in the dialing circuit, which is traced from battery through the inner winding of the L relay, (X wiring), the MSL relay normal, R lead, through the associated district, line finder, and subscribers' line circuits (not shown), T lead, the 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, L relay operated, to ground, T relay operated, thus holding the SLR relay operated.

12. 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 23 and 24 or as described in paragraphs 28 to 31 inclusive, if seized for the purpose of collecting or refunding a 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 at the T relay operated. The operation of the SC-1 relay (a) advances the sender control switch to position 2, and (b) closes a circuit from ground, the SLR and SC-1 relays operated, winding of the RIS relay to battery, operating the RIS relay. The operation of the RIS relay closes a circuit from ground RLS relay operated, RC-4 brush and normal terminal, 25 ohm 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 which is transmitted to the calling station to indicate that the office apparatus is ready for the operation of the dial.

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

Setting Registers (1.02)

14. The operation of the dial at the calling station alternately releases and reoperates 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, the T relay operated, the L relay released, the RIS 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 winding of the A magnet, the PP relay normal, through the 44-E resistance and one winding of the ON-2 relay in parallel, to battery, operating the RA relay, A magnet, and ON-2 relay. The other path is traced through the A magnet normal bridged terminals of arc A-1, lead A, RC-5 normal terminal and brush, sender control cam F, winding of the PH relay, and the PP relay normal, to battery, operating the PH relay. The RA relay is slow to release and remains operated during the impulse period for each digit dialed. The operation of the RA relay closes a circuit in which the RC magnet is energized from battery through the 44-E resistance and winding of the ON-2 relay in parallel, winding of the RC magnet, the RA relay operated to ground, RLS relay operated. 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 itself to this 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 to hold this relay operated during the pulsing period. When the A register magnet operates, after the L relay releases, it opens the circuit through the winding of the PH relay. The PH relay releases opening the circuit through the A magnet. The ON-2 relay and A magnet then release, the A register brush assembly is advanced to terminal 1. Each time the L relay releases and reoperates, the A register magnet and the PH 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 relay release. The release of the RA relay opens the circuit in which the RC magnet is energized, and the release of the RC magnet steps the RC brush assembly to terminal 1. The number 1 is not used as a digit in the office code, therefore 2 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 hereinafter described in paragraph 45.

15. The sender is now ready to receive the impulses for the second digit to the office code. The L relay again alternately releases and reoperates, responding to the impulses from the dial. The RA, PH, and ON-2 relays, and the B register magnet operate and release, setting the B register in a manner similar to that in which the A register was set, except (a) that the pulsing circuit from ground through the L and PH relays operated is traced through the winding of the B register magnet and terminal 1 of the RC-6 arc, instead of through the A register magnet, and (b) the circuit in which the PH relay operates, passes through the terminal 1 of the RC-5 arc, lead B, and strapped terminals of the B-1 arc, instead of through 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 (TH) 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 I counting relay is connected to the even numbered terminals of the arc TH-6 for incoming group selection instead of the O 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 (1.03)

16. When the brushes of the RC switch advance to terminal 2 after the setting of the A register, a circuit is closed in which the ST relay operates. This circuit is traced from battery through the winding and break contact of the ST relay, terminal 2 and RC-4 brush, to ground on the left armature of the RLS relay. The ST relay, operated, (a) locks in position 2 through its make contact, cam O, to ground, 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 causing the power driven translators to rotate, and (c) connects

ground from the RLS relay operated, the SSR relay normal, the ST relay operated, A-3 brush and terminals, through one of the B register brushes and terminal, through the cross connection to the translator arcs T1-S T2-S. When the translator brush assembly advances to the particular terminal to which this ground is connected, a circuit is closed 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 transferring the hunting lead from the arc with terminals numbered 1 to 22 to the arc with terminals numbered 23 to 44. The TS-1 and TS-2 relays and the STOP-1 and the STOP-2 magnets operate in this circuit and lock to ground, at the operated 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 O, to battery through the make contact and winding of the ST relay, (b) closes a circuit from ground and 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, and (c) closes a circuit from ground of the TS-1 and TS-2 relays operated, sender control cam B, to battery through the R-1 magnet, advancing the sender control switch to position 3.

NOTE: Each translator consists of one 202-C selector and two 10-C banks. It has a capacity of 44 sets of terminals, each bank consisting of 22 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 202-C selector is composed of a rotary magnet ROT, STOP magnet and two step by step brush assemblies, which are clamped to a rotary shaft on the magnet end of which is fastened a metal driving disc. The brushes are single ended of 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 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 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 of T1-S are mounted to make contact 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 the rim of the disc between two 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 set of terminals. When the pawl drops into 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 operated during the process of selection.

17. 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 class set lead C is connected. A circuit is then closed from battery through the R-3 magnet and the CL relay in parallel, cam C, lead C, terminal and T2-CL brush, the 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 Selections (1.04).

18. With the sender control switch in position 3, and the sender switch in position 2, the fundamental circuit is closed for district brush selection. This circuit is traced from battery through the district line relay, over the lead FT, the S and ADV relays normal, sender control cam S, upper outer and lower inner contacts of sender cam N, windings of the STP and OFL relays, the BO relay normal, the 18-AC resistance, lower inner and upper outer contacts of sender control cam J to ground at sender cam I. The OFL relay does not operate at this time as it is of the polarized type, unless one of the selectors go to overflow, at which time the battery through its 54 ohm winding is in the reverse direction. The district L and STP relays operate in this circuit, causing the district selector to move upward and close a circuit in which one of the counting relays operates. For this call it is assumed that 2 counting relay is the first to be operated. The circuit for operating the 2 counting relay is traced from battery at sender control cam X, winding of the 2 counting relay, 2' counting relay normal, lead 2, terminal and T2-DB brush, sender cams V and U, sender control cam N, the IA relay normal, sender cam L, the STP relay operated, to ground at sender cam I. The operation of the 2 counting relay closes a circuit through its winding and the winding of the 2' counting relays in series, to ground through sender cam J. The 2' counting relay does not operate at this time however, as it is short circuited by the ground on cam I. 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 of the A commutator. This ground short circuits the winding of the STP relay, causing its 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 pulse.

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

20. 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 arcs as specified by the Telephone Company, so that the desired counting relay will be connected to the terminal on which the T1-DB or T2-DB brush of the translator shall be resting. When the STP relay next releases after the operation of the 0 counting relay, the short circuit to

ground on cam I is removed from the windings of the FO and BO relays. The O counting relay then holds, and the BO and FO 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 traced 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 causes the switch to advance 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 1000 ohm non-inductive winding of the SC relay is short circuited by ground through sender cam T, reducing the resistance to ground of the 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 be operated, 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.

21. 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 traced from ground on 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 connecting 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 causing the district to advance to the "Trunk hunting" position. Having selected an idle trunk the district advances to "Selection beyond" position. The operation of the FO relay closes a circuit from ground on its armature, the IA relay normal, sender control cam I, sender cam O, to battery through the R-2 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 Selections (1.05)

22. With the sender switch in position 6, a circuit is closed from battery through one winding of the office line relay, over the lead FT, the S and ADV relays normal, sender control cam S, through the 40-K resistance, sender cam O, windings of the TG, STP, and OFL relays, the BO relay normal, sender cam X, sender control cam M, compensating resistance brush OFF-T1 and terminal, compensating resistance, sender control cam V, ADV-1 relay normal, over the lead FR, to ground in the office circuit. The TG relay operates in this circuit, closing a circuit in which the TG-1 relay operates. The operation of the TG-1 relay closes a circuit in which the CI relay operates.

The operation of the CI relay closes a circuit from ground at sender control cam U, CI relay operated, sender cam B, to battery through the R-2 magnet, advancing the switch to position 7. As the switch advances from position 6, the TG, TG-1, and CI relays release. The switch advances to position 8 in a circuit from battery through the R-2 magnet, cam C, to ground the IA relay normal. While the switch is advancing through position 7, a circuit is closed from battery sender control cam X, two 18-AC resistances, sender cams M and N, windings of the STP and OFL relays, BO relay normal, (and inner contacts of sender cam P) 18-AC resistance, to ground at sender cam H. The STP relay operates in this circuit but immediately releases when the switch advances from position 7.

23. In position 8 the fundamental circuit is again closed, for office brush selection. This circuit is traced the same as far office test, with the exception that it passes through the upper outer and lower inner contacts of sender cam N, instead of through the 40-K resistance and winding of the TG relay. Ground from the segments of the office A commutator intermittently short circuits the STP relay, alternately causing its release and permitting its reoperation. Each operation and release of the STP relay causes a set of counting relays to be operated. The counting relay circuit is traced as described for district brush selection except that this time it is closed through the lower outer contacts of cams L and I, the upper inner contact 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 relays opens the fundamental circuit stopping the up drive of the office selector and causing the office switch to advance. The operation of the FO relay closes a circuit in which the sender switch advances to position 9, the A cam advancing it to position 10. The counting relays release when the switch advances from position 8.

24. With the sender switch in position 10, the fundamental circuit is closed and office group selection is made in the same manner as office brush selection, except that this time the circuit to operate the counting relays is through the upper outer contact 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 (1.06).

25. When the sender switch advances through position 11 to position 12, the S relay operates if the TH and H registers have not been advanced from normal, in a circuit from battery through its winding, break contact of the DWO relay, sender cam F, class 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.

26. 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 the tip side of the fundamental circuit, over lead FT and through the winding of the TG relay, as described for office test except that this time it is closed through the lower contacts of sender cam X and compensating resistance brush T-1 (beyond office). TG relay operates closing a circuit in which the TG-1 relay operates and the operation of the TG-1 relay closes a circuit in which the CI relay operates. The operation of the CI relay closes a circuit through the upper inner contact of sender cam B, to ground, control cam U, CI relay operated, sender cam B to battery through the R-2 magnet advancing the sender switch to position 13. The A cam advances the switch to position 14. As the switch advances from position 12 the TG, TG-1 and CI relays release.

27. With the sender switch in position 14, the fundamental circuit is closed for incoming brush selection. This circuit is traced from battery through the winding of the line relay in the incoming circuit, over the lead FT, break contacts of the S and ADV relays, inner contacts of cam S, class cam O, sender cam N, winding of the STP and OFL relays, BO relay normal, sender cam X, COMP, RES. T-1 brush and terminal, compensating resistance, lower contacts of sender control cam V, break contact of the ADV-1 relay, over the lead FR, to ground in the incoming circuit. Incoming and office brush selection 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.

28. 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. The counting relays release when the sender switch advances to position 14. The sender switch is advanced to position 16 in a circuit from battery through the R-2 magnet, to ground through cam C and the break contact of the IA relay. While the switch is advancing through position 15, the STP relay operates as described in paragraph 12, when the switch is advancing through position 7.

29. With the sender switch in position 16, the fundamental circuit is closed and incoming group selection is completed in the same manner as described for incoming brush selection except that the circuit for operating the counting relays 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 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. The counting relays release when the sender switch advances from position 16. The sender switch is advanced to position 17 in a circuit from battery through the R-2 magnet, and cam C to ground through the break contact of the IA relay. The A cam advances the switch to position 18. While the switch is advancing through position 17, the STP relay operates as described in paragraph 11 and 12, when the switch is advancing through

position 7.

30. As the sender switch advances through position 17 to position 18, a circuit is closed from battery through the R-1 magnet, control cam B, sender cam D, to ground through class cam F, advancing the sender control switch to position 4. As the sender control switch enters position 4, ground on the upper inner contact of the sender control cam T short circuits the outer winding of SC relay, in anticipation of 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 (1.07).

31. 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, the S and ADV relays normal, sender control cam S, sender cam N, windings of the STP and OFL relays, the BO relay normal, sender cam X, sender control cam M, COMP, RES. T-1 brush and terminal, (Beyond Office) compensating resistance, control cam V, the ADV-1 relay normal, over lead LA, to ground in the incoming circuit. Final brush selection is made in the same manner as incoming brush selection, except that the circuit for operating the counting relays is traced from ground through the upper outer contacts of sender cams L and I, the 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 connecting leads, (prime counting relay normal through the winding of the counting relay, to battery at sender control cam X. When sufficient impulses have been received to satisfy the sender the BO and FO relay 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. The counting relays release when the switch advances from position 18. As the switch enters position 1 of the second revolution, a circuit is closed from battery through the winding of the R-2 magnet, cam C, the TS-2 and TS-1 relays operated, to ground, advancing the switch to position 2.

32. As the sender switch advances through position 1 to position 2, the S relay operates if the T register has not been advanced from normal, in a circuit from battery through its winding, DWO relay normal, sender cam F, control cam P, terminal 4 and RC-4 brush, to ground at the RLS relay normal. 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 the same manner as final brush selection, except that the circuit for operating the counting relays passes through sender cam S, and the T-3 terminal and brush. When sufficeint 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 when the switch advances from position 2.

33. 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, in a circuit through the break contact of the DWO relay, sender cam F, control cam K, terminal 5 and RC-4 brush, to ground on the armature of the 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 one winding of the ON-2 relay and the 44-E resistance, winding and break contact of the RC magnet, RC-2 brush and strapped terminals 2 to 8 inclusive, class cam H, strapped terminals and U-2 brush, strapped terminals of the H-2 and TH-2 arcs, leads 3, terminal and T1-SD brush, the RA relay normal, to the RLS relay operated. The RC magnet alternately operates and releases in this circuit thereby stepping the RC brush assemblies 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 this circuit for operating the counting relays passes through the lower inner contact of cam S, break contact of the DWO relay, 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 (1.08)

34. With the sender switch in position 6, a circuit is closed from battery through the incoming line relay, over the ring side 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 K, BO relay normal, windings of the OFL and STP relays, 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 STP and OFL relays. The OFL relay, operated, locks in a circuit through the 6400 ohm 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 operates, closing a circuit in which the O counting relay operates. This circuit is traced from ground through 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, causes the incoming to advance, 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 closes a circuit in which the ADV and ADV-1 relays operate. This circuit is traced from ground on the armature of the FO relay, the IA relay operated, sender control cam [illegible] to battery through the windings of the ADV and ADV-1 relays. The ADV and ADV-1 relays, operated, lock in a circuit through the ADV relay operated, to ground through sender control cam T. The operation of the ADV-1 relay, (a) opens the FR lead, (b) closes a circuit from ground on its inner right armature, through cam C, to battery through the R-1 magnet, advancing the sender control switch to position 5, (c) closes a

circuit from ground on its left armature through sender cam B, to battery through the R-2 magnet, advancing the sender switch to position 7. As the sender switch advances from position 6, the BO, FO, and IA relays release.

35. The STP relay operates in position 7 and the sender switch advances to position 8 from ground through the IA relay normal and cam C, causing the OFL relay to release. The operation of the ADV relay, (a) disconnects ground from the SC lead, allowing the district line relay to release and advance the district, thus opening the dialing leads to the sender, releasing the sender L relay. The release of the sender L relay causes the release of the SLR and RIS relays, closing a circuit from battery through the inner winding of the district L relay, lead FT, S and ADV relays normal, cams M and N, windings of the STP and OFL relays, the BO relay normal, 18-AC resistance, sender control cam J, terminal 9 and RC-1 brush to ground on the SLR relay normal. The STP relay operates in this circuit, closing a circuit in which the O counting relay operates. This circuit is traced from battery through the sender control cam X, winding of the O counting relay, connecting lead O, terminal and T-1 TALK.SEL. brush, CV relay normal, sender control cam N, IA relay normal, sender cam L, STP relay operated, to ground on through 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 reoperates until the O, BO, 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, break contact of the IA relay, control cam I, to battery through the R-1 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 in a circuit from battery through the R-2 magnet, cam C, to ground through control cam U.

Resetting Register (1.09).

36. When the sender control switch enters position 3 after the setting of the translator as described in paragraph 5, a circuit is closed from ground on the armature of the CL relay normal, through class cam N, sender control cams G and H, A-1 brush and terminal, contact and winding of the A magnet, the PP relay normal, to battery through the 44-E resistance and winding of the ON-2 relay in parallel. The A magnet and ON-2 relay operate, and the A register is stepped to normal. With the A register normal, the circuit from ground on control cam N is closed through the B magnet causing the B register to be advanced to normal in the same manner. The ON-2 relay releases with the A and B registers normal. When the sender control switch enters position 4 for incoming group selection, as described in paragraphs 29 and 30, a circuit is closed from ground on the armature of the CL relay normal, 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 off normal terminal,

through the contact and winding of the TH stepping magnet, to battery through the winding of the ON-1 relay and 44-E resistance in parallel. The TH magnet and ON-1 relay operate, advancing the TH register to normal. With the TH register normal, the circuit from ground on cam H is closed through the H magnet, causing the H register to be advanced to normal. As the sender control switch enters position 5 for incoming advance as described in paragraph 34 and 35, the T and U registers, (and SH, ST, and SU registers, when used) are advancing to normal in like manner, except that ground is supplied from the lower inner contacts of control cam H, instead of by the armature of the CL. relay. The ON-1 relay releases when all of the numerical registers are normal.

Return To Normal (1.10)

37. When ground was removed from the test lead by the release of the district L relay, as described in paragraphs 34 and 35, the T-1 relay operated in the circuit described in paragraph 3. The T-1 relay, operated, (a) locks through both its 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, 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, through terminal 9 and RC-2 brush, the break contact and winding of the RC magnet to battery through 44-E resistance and winding of the ON-2 relay in parallel, stepping the RC switch to terminal 0. With all registers normal, a circuit is closed from battery through the 58 ohm resistance and winding of the ON-2 relay in parallel winding and break contact of the RC magnet, RC-2 brush and 0 terminal, normal terminals and brushes of the SU-1, ST-1, 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 to ground through the sender control cam H, advancing the RC switch to normal. The ON-2 relay releases when the RC switch advances from position 0. When the RC switch entered position 0, a circuit was closed from battery through the winding of the R-1 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, if not already advanced to position 6 in the circuit from ground on the armature of the FO relay, as described in paragraph 20. The sender switch then advances to normal as described in paragraph 20. The advance of the sender switch to position 1 closes a circuit from battery through the R-1 magnet, control cam C, impulser cam Y, cam 1, normal terminal and RC-1 brush, to ground at 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 causes the release of the SB relay. The release of the SB relay causes the release of the T-1 relay, thus removing the busy (ground) condition from the test lead. The class switch does not advance to normal, but remains in whatever position it was set.

Abandoned Call. (1.11)

38. If the receiver is replaced on the switchhook before district

selections and trunk hunting are completed, the sender L relay fails to operate or releases if already operated, causing the release of the SLR relay. The release of the SLR relay, (a) prevents the operation or causes the release of the RLS relay, (b) closes a circuit through the winding of the DWO relay, cam W, SLR relay normal, SC relay operated, RLS and L relays normal to ground on the armature of the T relay operated, operating the DWO relay, and (c) closes a circuit from ground 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 winding of the ON-2 relay in parallel thereby stepping the RC switch to terminal 9. The DWO relay, operated, (a) locks to ground at the T relay operated, and (b) connects ground on its armature and through its make contact to the lead SC, thereby short-circuiting the 500 ohm winding of the SC relay, causing ethe release of the sender relay SC and releases the district D relay differentially. The district then returns to normal, disconnecting ground from the lead TEST, releasing the T relay. The release of the T relay, (a) releases the SC-1 relay, and (b) closes a circuit from battery through the ON-2 relay and 44-E resistance in multiple, winding and contact of the RC magnet, RC-2 brush and terminal 9, to ground at the T relay normal, which advances the RC switch to terminal 0. The sender control switch then advances to position 5 in a circuit from battery through the R-1 magnet, cam C, terminal 0 and RC-1 brush, to ground through the SLR relay normal. As soon as the sender control switch enters position 5, and until it advances again from normal, a circuit is closed from ground through control cam H, whereby all off-normal registers and the RC switch are advanced to normal as described under "Resetting Registers" (1.09) in paragraph 21. With the RC switch advanced to normal, the sender control switch advances to position 6 in a circuit from battery through the R-1 magnet, cam B, normal terminal and RC-1 brush, to ground at the SLR relay normal. With the sender control switch in position 6, the sender switch advances to normal in a circuit from battery through the R-2 magnet, cam C, to ground through control cam U.

39. Return to normal is completed as described under "Return to Normal" (1.10) in paragraph 22. 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 4 before the RLS relay releases. The release of the RLS relay opens the circuit through the winding of the A register magnet, advancing the A register to position 1. In position 1 the PP relay operates as described under "Preliminary Pulse" 8.02 in paragraph 16, but since the RLS relay has released, the PP relay also releases thus closing the circuit in which the A register is returned to normal as described under "Resetting Registers" (1.09) in paragraph 21.

40. Should the call be abandoned after the associated district selector has advanced to the "selection beyond" position, the DWO relay operates as described under "Return to Normal - Abandoned Call" (1.11) in paragraphs 30 and 39, but all selections up to and including talking selection, must be made before the district and sender can return to normal. Office test and selections are completed as described under this heading (1.05) in paragraphs 22 to 24 inclusive. The operation of the DWO

relay connects the O counting relay to cam V, for incoming brush and incoming group selections, and to cam T for final brush and final tens selections, the counting relay circuits otherwise being as described for these selections (1.06 and 1.07) in paragraphs 25 to 33, inclusive. The counting relay circuit is open for final units selection, allowing the final selector to go to tell tale. Incoming advance, talking selection, resetting registers, and return to normal are completed as described under these headings (1.08, 1.09, 1.10) in paragraphs 34 to 37, inclusive.

Time Measure and Alarm (J wiring). (1.12)

41. During the progress of the call the time measure and alarm circuit functions to indicate permanent signal, partial dialing, or stuck sender conditions. When the MS relay operates as described under "Sender Selected" (1.01), it locks through its make contact to the same ground. When the 152-E interrupter contacts are closed, the STP magnet is energized in a circuit from battery through its winding, make contact of the 152-E interrupter normal terminal (terminal 22) and M-5 brush, the MS relay operated, to ground through the TMA and MSL relays normal. When the interrupter opens this circuit, the STP magnet releases, advancing the time measure switch to position 1. When the interrupter contacts again close, the STP magnet is energized, in a circuit through terminal 1 and M-5 brush, and when the circuit is opened, the STP magnet releases advancing the switch to position 2. The switch is advanced to position 3 by the next closing and opening of the 152-E interrupter contacts. If the register control switch has not been advanced from normal, the time measure switch cannot advance from position 3. In position 3 a circuit is closed from battery through the sender monitoring lamp, Green Sender, terminal 3 and M-5 brush, the MS relay operated, the TMA and MSL relays normal, to ground, lighting the lamp to indicate a permanent signal condition. In position 3 ground on the armature of the MSL relay is connected through the TMA and MSL relays normal, M-6 brush and terminal 3 to the lead "To Misc. Aux. Sig. Cct". When the RC switch has advanced from normal, the TMA relay operates in a circuit 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 RLS relay operated. The operation of the TMA relay closes a circuit from battery through the winding and break contact of the STP magnet, the TMA relay operated, to ground as described for operating the TMA relay. The time measure switch is thereby advanced to position 6, independently of the interrupter. The TMA relay releases when the switch advances from position 5.

42. In position 6 a circuit is again closed through the interrupter, strapped terminals 6 to 8 inclusive and M-5 brush, advancing the switch to position 9. If at this time the RC switch has not advanced to position 9, the time measure switch cannot advance from position 9, and the Green Sender lamp flashes in a circuit through the contacts of the 149-F interrupter, terminal 9 and M-5 brush, to indicate an unfinished dialing condition. In position 9 ground is connected through terminal 9 and M-6 brush to the lead "To Misc. Aux. Sig. Cct", as described for position 3. When the RC switch advances to position 9, the TMA relay operates in a circuit through the M-3 brush and strapped terminals 6 to 11 inclusive. The operation of the TMA relay closes a circuit through the STP magnet, thereby advancing the time

non-coin switch to position 6, as described in paragraph 25. The TMA relay releases when the switch advances from position 4.

45. In position 5 the STP magnet circuit is closed through to the 152-E interrupter, strapped terminals 5 to 7 inclusive and M-5 brush, to ground as in position 1, advancing the switch to position 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 Green Sender, lamp flashes to indicate an unfinished dialing condition, in a circuit from battery through the lamp, the CT-1 and C-2 relays normal, 149-F interrupter contacts, terminal 8 and M-5 brush, the TMA relay normal, the MS relay operated, to ground through the C and MSL-1 relays normal. The TMA relay operates as soon as the RC switch enters position 9, in a circuit from battery through its winding, M-3 brush and strapped terminal 5 to 8 inclusive, terminal 9 and RC-3 brush, to ground on the armature of the RLS relay operated. The operation of the TMA relay closes a circuit through its make contact, from battery through the STP magnet, to the same ground on the armature of the RLS relay, advancing the time measure switch to position 9. The TMA relay is held when the time measure switch advances from position 8, in a circuit from battery through its winding, M-3 brush and strapped terminals 9 to 12 inclusive, the SKS and C relay normal, to ground on the armature of the MSL -1 relay normal, thereby advancing the time measure switch to position 13. The TMA relay releases when the switch advances from position 12. With the time measure switch in position 13, the CT-1 and CT-2 relays operate in a circuit from ground through the M-6 brush and strapped terminals 13 to 17 inclusive, break contact of the C, SKS and ON relays normal, to battery through the CT-3 relay normal, and winding of the CT-1 relay, and to battery through the CT-7 relay normal and winding of the CT-2 relay. The operation of the CT-1 relay closes a circuit from battery through the winding of the TMA relay, M-5 brush and terminal 13, the CT-1 relay operated, to ground on the armature of the MSL-1 relay normal. The TMA relay operates in this circuit and the STP magnet is energized in a circuit through its break contact and the TMA relay operated to the same ground, thereby advancing the time measure switch to position 14. The TMA relay releases when the switch advances from position 13.

46. The time measure switch advances from position 13 to 17 under control of the 152-E interrupter in a circuit through strapped terminals 14 to 16 inclusive and the M-3 brush. The operation of the CT-2 relay (a) closes a circuit in which the CB relay operates, (b) disconnects the dialing circuit from the L relay and the 66-A repeating coil, (c) closes a circuit from battery through the winding of the L relay, the CT-2 relay operated, 800 ohm non-inductive winding of the MSL relay, to ground on the armature of the RLS relay operated, thereby holding the L relay operated, and (d) closes a circuit from 48 volt battery through the 18-BA resistance, 450 ohm winding of the CT-9 relay, the CT-3 relay normal , the CT-2 relay operated, the CT-7, C1 and MSL relays normal, out over lead T to the subscribers line. The operation of the CB relay closes a circuit from 110 volt coin battery, 18-BA resistance, 1000 ohm winding of the CT-9 relay, the CT-3 relay normal, the CT-2 relay operated, the CT-7, C1, and MSL relays normal, out over lead R to the subscribers line. The CT-9 relay operates if a coin has been deposited but

measure switch to position 12, independently of the interrupter. The lamp stops flashing when the switch advances from position 9. The SKS relay not being operated for a direct mechanical call, the TMA relay does not release when the switch advances from position 11, but holds in a circuit from battery through its winding, M-3 brush and strapped terminals 12 to 16 inclsuive, to ground through the SKS and MSL relays normal. With the TMA relay operated, the STP magnet alternately operates and releases, advancing the time measure switch to position 17.

43. The TMS relay releases when the switch advances from position 16. In position 17 the STP magnet circuit is closed through the 152-E interrupter, strapped terminals 17 to 19 inclusive and M-5 brush, advancing the switch to position 20. If the sender has not returned to normal when the switch enters position 20, ground is connected through terminal 20 and the M-6 brush to the lead "To. Misc. Aux. Sig. Cct", as described for position 3 and the Green Sender lamp flashes in a circuit through the break contact of the SKS relay, make contact of the 149-A type interrupter, terminal 20 and the 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 operates, closing the STP magnet circuit to the same ground, causing the switch to advance to position 22 or normal.

REGULAR MECHANICAL CALLS USING OFFICE SELECTOR - COIN (Y WIRING) (2).

Establishing Connection and Preliminary Coin Test. (2.01).

44. The registers are set and translation and selection are made as described for a non-coin call, (b) except that the dialing circuit passes through the CT-2, CT-7, and C-1 relays normal, in addition of the MSL relay normal, also the time measure and alarm circuit makes a preliminary coin test. When the MS relay operates as described under "Sender Selected" (1.01), it locks to the same ground. When the interrupter contacts close, the STP magnet is energized in a circuit through its winding, make contact of the 152-E interrupter, terminal 22 (F terminal) and M-5 brush, the TMA relay normal, the MS relay operated, to ground through C and MSL-1 relays normal. When the interrupter opens this circuit the STP magnet release, advancing the time measure switch to position 1. The switch is advanced in like manner to position 3 under control of the interrupter. If the RC switch has not been advanced from normal when the time measure switch enters position 3, a circuit is closed from battery through the sender monitoring lamp, Green Sender, the CT-1, and C-2 relays normal, terminal 3 and M-5 brush, the TMA relay normal, the MS relay operated, to ground through the C and MSL-1 relays normal lighting the lamp to indicate a permanent signal condition. In position 3 ground is connected through the M-6 brush and terminal 3, the TMA and MSL-1 relays normal, to the lead "To Misc. Aux. Sig. Cct". When the RC switch advances from normal, the TMA relay operates in a circuit through strapped terminal N to 4 and M-3 brush and the switch advances to position 5 independently of the interrupter, in a similar manner to the operation of the TMA relay and advance of the

does not operate on a 10,000 ohm line lead. The CT-9 relay locks to ground through the strapped terminals 13 to 17 inclusive and the M-6 brush. The operation of the CT-9 relay closes a circuit from 48 volt battery CT-9 relay operated winding of the CT-3 relay, the CN, SKS, and C relays normal, to ground through strapped terminals 13 to 17 inclusive and the M-6 brush, operating the CT-3 relay. The operation of the CT-3 relay (a) opens the circuit from 48 volt battery through the 950 ohm winding of the CT-9 relay, (b) opens the circuit from 110 volt battery, (c) closes a circuit from 110 volt battery, the CB relay operated, 1500 ohm winding of the CT-4 relay, the CT-3 and CT-2 relays operated, the CT-7, C1, and MSL relays normal, to lead T, and (d) closes a circuit from 48 volt battery through the 18-BA resistance, 350 ohm winding of the CT-4 relay, the CT-3 and CT-2 relays operated, the CT-7, C1 and MSL relays to normal, lead R, and from the 18-BA resistance through the CT-4, CN, SKS, and C relays normal, to ground through strapped terminals 13 to 17 inclusive and the M-6 brush.

48. The operation of the CT-3 relay also opens the circuit through the winding of the CT-1 relay but the CT-1 relay is slow to release and does not release until the CT-4 relay has time to operate. The CT-4 relay operates if there is a solid ground on the line thereby closing the circuit through the winding of the CT-1 relay, thus preventing its release. The CT-4 relay does not operate if the resistance to ground on the subscribers line is that of the sub-set coin collector magnet, and the CT-1 relay therefore releases. 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 relay, the red coin lamp flashes in a circuit through the CT-1 relay operated, the C2 relay normal, contacts of the 149-F interrupter, terminal 17 and M-5 brush, the TMA relay normal, the MS relay operated, to ground through the C and MSL-1 relays normal. Under these conditions the S relay operates, when the sender switch enters position 3 after completing final tens selection, in a circuit from battery through its winding, the DWO relay normal, sender cam F, control cam K, to ground on the armature of the CT-1 relay operated. The operation of the S relay opens the fundamental circuit preventing final units selection and the sender is released by the sender monitoring operator as described under "Release of Stuck Sender" (8.04) in paragraph 99. With the time measure switch in position 17 and the TMA relay unoperated ground is connected from the armature and through the ON relay operated, M-2 brush and terminal 17, the TMA and MSL-1 relays normal, to the lead "To Misc. Aux. Sig. CCT". The release of the CT relay, if the coin has been deposited closes a circuit from battery winding of the TMA relay, through the M-2 brush and strapped terminals 14 to 17 inclusive, the CT-1 relay normal, to ground on the armature of the MSL-1 relay normal, operating the TMA relay. The operation of the TMA relay closes a circuit through the winding of the STP magnet and the TMA relay operated to the same ground, advancing the time measure switch to position 18. The TMA relay releases when the switch advances from position 17. The time measure switch is advanced from position 18 to position 21 by the operation of the STP magnet in a circuit through the contacts of the 152-E interrupter, strapped terminals 18 to 20 inclusive and the M-5 brush, the TMA relay normal, the MS relay operated, to ground through the C and MSL-1 relays normal.

49. If the sender has not returned to normal when the switch enters position 21, ground is connected through termina 21 and the M-6 brush, to th lead "TO MISC. AUX. SIG. CCT", and the "Green Sender", lamp flashes in a circuit through the contacts of the 149-H interrupter, terminal 21 and the M-5 brush, to indicate 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 any other time, closes a circuit from battery through the winding of the TMA relay, strapped terminals and M-1 brush, to ground through the MS relay normal. The TMS relay operates, closing the STP magnet circuit to the same ground, causing the switch to advance to position 22 (or N).

50. On calls originating at coin stations for which no charge should be made, (free routes), the CN relay operates at the completion of translation, in a circuit from battery through its winding, lead 1 or lead 3, terminal and TI-SKO brush, control cam E, to ground through cam U. The CN relay, operated, locks through its make before break contact to the same ground. The time measure and alarm circuits will function as described in the preceding paragraph, until it enters position 13 to make the preliminary coin test. In position 13 the CT-1 and CT-2 relays do not operate, but the TM1 relay operates in a circuit from battery through its winding, M-3 brush and terminal 13, the CN relay operated, the SKS and C relays normal, to ground through strapped terminal 13 to 17 inclusive and the M-6 brush. The operation of the TM1 relay closes the STP magnet circuit to the same ground, advancing the switch to position 14. The TM1 relay is held, in position 14 to 17 inclusive, in a circuit through the M-3 brush and strapped terminals 14 to 17 inclusive, the CT-1 relay normal, to ground on the armature of the MSL-1 relay, advancing the switch to position 18. The TM1 relay releases when the switch advances from position 17. From this point on the operation is as described in the preceding paragraph.

Coin Collect and Return (2.02)

51. 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, CN, SB, MS, SC, and SC-1 relays operate as described under "Sender Selected" (1.01) in paragraph 10. If the charge relay in the district is operated, ground is connected over lead FR, the 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 SC relay closes a circuit, in which the DWO relay operates, from ground through the T relay operated, the L and RLS relays normal. The SC relay operated, the SLR relay normal, cam W, to battery, through the winding of the DWO relay. The DWO relay, operated, locks to the same ground. The operation of the DWO relay closes a circuit, in which the C relay operates, from battery through the winding of the C relay, the MS relay operated, terminal 22 and M-1 brush, the MS relay operated, the C and ST relays normal, to ground on the armature of the DWO relay operated. The C relay locks through its make before break contacts to the same ground. The C relay operated, closes a circuit in which the TMA relay operates, from battery through the winding of the TMA relay, strapped terminals 22 to 8 inclusive and the

M-4 brush, the C relay operated, to ground on the armature of the MSL -1 relay normal. The operation of the TLI relay closes the circuit from battery through the winding and break contact of the STP magnet, and the TMA relay operated to the same ground on the armature of the MSL-1 relay, advancing the time measure switch to position 9.

52. In position 9 the C-1 relay operates in a circuit from battery through its winding, strapped terminals 9 to 11 inclusive and M-4 brush, to ground on the armature of the MSL-1 relay. The operation of the C-1 relay closes circuits in which the CB and C2 relays operate. The operation of the CB relay connects positive coin battery through the CB relay operated, winding of the CT-5 relay, the CC relay and C-1 relays operated and the MSL relay normal, to the tip and ring sides of the line. The operation of the C-2 relay connects ground through the 19-BF resistance and 2 MF condenser, the C-2 relay operated and the MSL relay normal, to the tip and ring sides of the line. The CT-5 relay operates if there is a coin in the coin box, closing a circuit in which the CT-6 relay operates. The CT-6 relay locks through its make contact, the C relay operated, the C and ST relay normal to ground on the armature of the 170 relay operated. The operation of the CT-6 relay opens the circuit which gives an alarm during final coin test as described in paragraph 30. The operation of the C-2 relay also closes a circuit from battery through the winding of the STP magnet, the C-2 relay operated contacts of the 149-F interrupter, to ground at the C-2 relay. As the interrupter makes and breaks contact, the switch is advanced to position 13. When the switch advances from position 11, the C-1 relay releases but the C-2 relay holds in a circuit through terminal 12 and brush M-4, thus holding the circuit to ground through the 2 MF condenser closed until the coin magnets in the coin box here had time to discharge to ground through the condenser, thus protecting the multiple banks. When the switch advances from position 12 the C2 relay releases opening the circuit through the STP magnet, stopping the switch in position 13. The CB relay releases when the C1 relay releases.

53. If the coin is to be returned, the charge relay in the direct selector circuit does not connect ground to the ER lead, and the CC relay does not operate. The sender and time measure circuit functions otherwise as described in the preceding paragraph, except that negative coin battery is connected to the tip and ring sides of the line through the CF relay operated, the CC relay normal, the C-1 relay operated, and the MSL-1 relay normal. The switch advances to position 13 as described in the preceding paragraph.

Final Coin Test (2.05).

54. In position 13 the CT-7 relay operates in a circuit from battery through its winding, the C relay operated, to ground through strapped terminals 13 to 17 inclusive and the M-6 brush. The operation of the CT-7 relay connects battery through the windings of the CT-8 relay, to the tip and ring sides of the line. If the coin has not been collected or returned, as was desired, or if either side of the line is grounded in

some other way, the differentially wound relay CT-8 operates closing a circuit, in which the CT-1 relay operates. The operation of the CT-1 relay closes a circuit, in which the TMA relay operates, through the M-3 brush and terminal 13, the CT-1 relay operated, to ground on the armature of the MSL-1 relay.

55. The time measure switch advances from position 13 to position 14, in a circuit through the STP magnet, contacts of the 149-H interrupter, the CT-7 relay operated, terminal 13 and M-4 brush, make contact of the C relay operated to ground at the MSL-1 relay. The operation of the TMA relay (in case the CT-1 relay operates also), closes a circuit in which the STP magnet operates to advance the switch from position 13 to position 14. The TMA relay operates, (or holds if already operated) in position 14 in a circuit through strapped terminals 14 to 16 inclusive and M-4 brush, the C relay operated, to ground on the armature of the MSL-1 relay, advancing the switch to position 17. If operated, the CT-1 relay prevents the advance of the switch from position 17. The TMA relay releases when the switch advances from position 16. If the coin should have been collected in position 17 a circuit is closed from battery, through the red COIN lamp, the CT-1 relay operated, contacts of the 149-H interrupter, the CC relay operated, terminal 17 and M-4 brush, the C relay operated, to ground at the MSL-1 relay. The lamp flashes in this circuit, indicating that the coin was not collected, or that there is some other ground on the line.

56. If the coin should have been returned, and there is a ground on the line, (the CC relay will not have been operated) the COIN lamp will light permanently in a circuit through the CT-1 relay operated, the CC relay normal, terminal 17 and M-4 brush, to ground at the MSL-1 relay. If the coin collect battery was connected in position 9, but the CT-5 and CT-6 relays did not operate, and the CT-8 relay does not operate in position 13, the CT-1 relay operates in a circuit from battery through its winding, the CC relay operated, the CT-6 relay normal, the C relay operated, to ground through strapped terminals 13 to 17 inclusive and M-6 brush. In any case the operation of the CT-1 relay prevents the switch from advancing beyond position 17, and in position 17 the red lamp flashes or lights as above described.

Return To Normal (2.04).

57. In case the coin has been properly collected or returned, and the line is clear, the CT-1 relay is not operated and the TMA holds in position 17 in a circuit through the M-3 brush and strapped terminals 13 to 17 inclusive, the CT-1 relay normal, to ground on the armature of the MSL-1 relay, advancing the switch to positi 18. The CT-7 relay releases when the switch advances from position 17. The time measure switch functions as described under "Establishing the Connection" (2.01) in paragraph 44, advancing to position 21. In position 21, a stuck sender alarm is given, as described in paragraph 44, if the sender has not by this time returned to normal. When the time measure switch enters position 18, ground is connected from the armature of the ON relay operated, M-2 brush and strapped terminals 18 to 21 inclusive, the C relay operated, the ADV relay normal, to lead SC, causing the D relay in the district circuit to release and advance the district to normal and causing the release of the CC relay. When the district

advances from the coin collect or return position, ground is disconnected from the lead FR, releasing the CC relay, and ground is also disconnected from the TEST lead causing the T-1 relay to operate and the T relay to release as described under "Return To Normal" (1.10) in paragraph 37. The release of the T relay releases the ON, SB, MS, SC-1, and DWO relays. The release of the SB relay releases the T-1 relay. The release of the DWO relay releases the C relay and the CT-6 relay, if operated. The release of the MS relay advances the time measure switch to position 22, (or N) as described under "Establishing the Connection" (2.01) in paragraph 26.

CALLS TO MECHANICAL A. B. X. (3).

58. For this class of call the sender functions as described under "Sender Selected" (1.01), "Setting Register" (1.02), and Translation (1.03), 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 under "Final Selections" (1.07) in paragraph 33, advances one step when the RA relay releases after the setting of each of the station registers in a similar manner to its advance from normal to position 6. With translation completed a circuit is closed through the upper outer contacts of class cam B, lead E, terminal and brush of the T2-CL translator arc, in which the CL relay operates and the class switch is advanced to position 8. Selections are made as described under these headings (1.04, 1.05, 1.06, and 1.07), advancing the sender switch to position 6. As the sender switch advances through position 5, a circuit is closed in which the S relay operates if the RC switch has not advanced from position 8, indicating that the station's register has not been set. This circuit is traced from battery through the winding of the S relay, the DWO relay normal, sender cam G, class cam G, control cam D, strapped terminals 6 to 8 inclusive and RC-4 brush, to ground at the RLS operated relay. The operation of the S relay opens the fundamental circuit, preventing the operation of the STP relay for station's hundreds selection.

59. When the station's registers have been set, and the RC switch advanced to position 9, the S relay releases closing the fundamental circuit. Station hundreds selection then takes place instead of incoming advance. The STP relay operates in the fundamental circuit for station's hundreds, tens, and units selection, closing the circuits in which the proper counting relays operate, from ground on sender cam I, the STP relay operated and cam L, the IA relay normal, control cam N, sender cam S, and contacts of cam T, and through the stations hundreds, tens and units register arcs to the proper counting relays for hundreds, ten and unit 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 switch to position 7, in a circuit from ground, FO relay operated, the IA relay normal, control cam I, and sender cam B, to battery through the R-2 magnet. In position 7 the STP relay operates as described under "Incoming Test" (1.06) in paragraph 14. The switch then advances to position 8 in a circuit from ground through the IA relay normal, and sender cam C.

60. The operation of the FO relay in position 8 and 10 advances the switch to position 10 and 12, respectively, as described in position 6, with the help of cam A. In position 12 incoming advance is made as described under this heading (1.08) in paragraph 34, 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 the circuit through sender cam C, to ground through the IA relay normal. Talking selection is completed, registers reset, and the sender circuit returned to normal as described under these headings (1,08, 1,09, and 1,10).

CALLS TO ZERO OPERATOR AND ONE DIGIT CODES. (4).

61. On calls from a coin station to a zero operator or other one digit code operator, the sender circuit functions as described under "Sender Selected" (1.01) and "Setting Registers" (1.02) in paragraphs 10 and 11, the A register being set 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 other strapped terminals and A-4 brush, RA relay normal, to ground on the armature of the RLS relay operated, advancing the RC switch to position 2. In position 2 the ST relay operates, translation takes place, the sender control switch advances to position 3, and the sender advances to position 2, all as described under "Translation" (1.03). 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 in a circuit through class cam B, and through lead F, to the contact of the T2-CL translator arc. The CL relay releases when the class switch advances beyond position 9, and the RC switch is then advanced from position 2 to position 9 in a circuit from battery through the winding and break contact of the RC magnet, RC-2 brush and strapped terminals 2 to 8 inclusive, of class cam H, the CL relay normal, control cam O, to ground on the armature of the TS-1 relay operated.

62. District group and brush selections are made, the district selecting a trunk to zero operator or other one digit code operator or station, and the sender advancing to position 6, all as described under "District Selections" (1.04). For this class of call the CN relay operates as soon as the translator was set, in a circuit from battery through its winding and break contact, over lead 3, terminal and SKO brush, control cam E, to ground through control cam U, and locks through its make before break contacts of the same ground. The operation of the CN relay causes the counting, BO and FO relays, (after operating in position 4,) to hold until the sender switch advances from position 10, in a circuit through sender cam R, the CN relay operated, over lead 3, terminal and SKO brush, inner contacts of control cam E, to ground through the upper outer control of control cam U. The TG, TG-1, and CI relays operate as described under "Office Test" (1.05) in paragraph 11 except

that battery is connected through one winding of the L relay of the trunk circuit to zero operator, instead of the L relay of an office selector circuit.

63. 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 through the FO relay operated. The TG, TG-1, and CI relays release when 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 under "Incoming Test" (1.06) in paragraph 25. In position 14 the ADV and ADV-1 relays operate in a circuit from battery through their windings in parallel, class cam P and sender cam R, the I1 relay normal, to ground through sender cam J. The operation of the ADV-1 relay advances the control switch to position 5 in a circuit through cam C, and advances the sender switch to position 15 in a circuit through sender cam B. The sender switch advances to position 16 in a circuit through the cam C. The operation of the ADV relay disconnects ground from the lead SC allowing the district L relay to release and advance the district, thus opening the dialing leads to the sender, releasing the sender L relay. The release of the sender L relay releases the SLR and RIS relays, operating the STP relay, and causing talking selection to be made, all as described under "Talking Selection" (1.08) in paragraphs 34 and 35 with the switch in position 8. 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 under "Resetting Register" (1.09) and "Return to Normal" (1.10).

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

CALL TO THROUGH DIGIT OPERATOR (5)

65. 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 under these headings (1.01, 1.02, and 1.03) inclusive. Only the first two digits are required to complete selections. The CL relay operates and the class switch advances to position 11 in a circuit through cam B, and over lead G to the T2-CL translator arc. The CL relay releases when the class switch advances from position 10, and the RO switch is then advanced from position 2 to position 9, as described under "Call to Zero Operator" (4) in paragraph 33. From this point on the sender functions as described under "Call to Zero Operator" (4) in paragraphs 61 to 64 inclusive.

CALL TO RESTRICTED ZONE. (6)

66. Should a number be dialed which should be obtained through a toll operator, or should office code digits be dialed for which there is no office, the sender is selected, the registers are set, and translation made as described under these headings (1.01, 1.02, and 1.03). The CL relay operates

and the class switch advances to position 9, in a circuit through the upper inner contact of class cam B, over lead D to the T2-CL translator arc. The CL relay releases when the switch advances from position 8, and the RC switch is then advanced from position 2 to position 9, as described under "Call to Zero Operator" (4), in paragraphs 61 to 63 inclusive. From this point on the sender functions as described under "Call to Zero Operator" (4), in paragraphs 61 to 64 inclusive.

CALLS VIA R.C.I. TRUNKS - USING OFFICE SELECTOR (7)

Direct Relay Call Indicator - Number Less Than 10,000. (7.01)

67. When a call to a manual station is made via direct R.C.I., the Sender is selected and the registers are set as described under these headings (1.01 and 1.02) except that the SH register is also set if the station is on a party line, the RC switch being advanced to position 7. If the party line is in a party line office with less than 10,000 lines, the RC switch is advanced from position 7 to position 9 in a circuit from battery through the 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-SD brush, RA relay, normal to ground through the RLS relay operated.

68. 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 in a circuit through the RC-2 brush and terminals, lower terminals of class cam H, strapped terminals 1 to 0 inclusive and the SH-6 brush, strapped terminal 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).

69. 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 line) the SH register is not set and the RC switch is advanced from position 6 to position 9, after sufficient time has elasped for the dialing of a station digit, as described below in paragraph 70.

70. If the line is a private line in a private line office with less than 10,000 lines, the RC switch is advanced from position 6 to position 9, in a circuit 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.

71. If the line is a private line in a private line office with more than 9,999 lines, and the first digit is 1 and the second digit is not zero, the RC switch is advanced from position 6 to position 9 in a circuit through the RC-2 brush and terminals, lower terminals of class cam H, strapped terminals 1 to 0 inclusive and U-2 brush, terminals 1 to 9 inclusive and H-2

brush, terminal 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 advanced 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 in 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 position 6 to position 9 after sufficient time has elapsed for the dialing of a fifth digit, as described below under "Time Measure and Alarm (7.03)" in paragraph 75 to 77 inclusive. Translation is made as described in paragraphs 6 to 8 inclusive, except that the CL relay operates and the class switch advances to position 2, (or 13), in a circuit 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).

72. District and office selections are made and the sender switch advances to position 12 as described under these headings (1.04 and 1.05) in paragraphs 9 to 13 inclusive. The S relay operates and functions as described under "Incoming Test" (1.06) in paragraoh 14, 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 tip of the trunk, the S and ADV relays normal, control cam S, class cam O, sender cam O, windings of the TH, STP, and OFL relays, the BO relay normal, sender cam X, "COMP. RES. T-J BEYOND OFF", translator brush, compensating resistance, control cam V, the 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 it closes a short circuit through the STP and OFL relays, around the 40-K 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 RCI position lights. 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 when the class switch advances from position 1 to position 2, (or from position 12 to position 13) as described in the first part of this paragraph, closes a circuit, in which the D relay, while the sender switch is in position 2 to 12 inclusive from battery through the winding of the D relay, class cam E, CL relay normal, to ground through sender cam H. The D relay locks, until the impulse switch advances beyond position 9-1/2 in a circuit 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 closes 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.

73. The release of the CI relay also closes a circuit through impulser cam C, FP relay operated, class cam K, the CI relay normal, to ground through the sender cam H, advancing the impulser switch from position 9 to position 10. The B cam advances the switch to position 1. The D relay releases when the switch advances beyond position 9-1/2. The FP relay holds, after the D relay releases, in a circuit through its make contact, impulser cam D, class cam M, to ground through 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 from position 9 of the first revolution, to normal after the second revolution is completed, RCI 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 RCI position. 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, a light positive 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 and open circuit exists, (2) while the switch advances from position 10 to position 10-1/2, a heavy negative impulse is transmitted in a circuit 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, the TAN relay normal, the RLS relay operated, impulser cams G and H, the FP relay operated, over the ring side of the fundamental circuit, back over the tip side, the FP relay operated, impulser cam F, 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, the FP relay operated, impulser cam F, 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 RCI office to indicate that there is no party designation required.

74. 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 the hundreds digits in positions 17, 18, 19 and 20, for the tens digits in positions 1, 2, 3, and 4 and for the digits in position 5, 6, 7, and 8. The switch advances from position 6-1/2

to 10-1/2 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 in a circuit from battery through the 52.5 ohm resistance, impulser cams T and cam Q, FP relay normal, cut over the tip side of the fundamental circuit, back over the ring side, the FP relay normal, to ground through cam I. This is to provide for the operation of a polarized relay in a proposed distant two wire office selector, in order to advance this selector, (such a selector is not yet designed).

75. 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, the FP relay normal, class cam K, the CI relay normal, to ground through 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 under these headings (1.08, 1.09, and 1.10).

Tandem Relay Call Indicator - Numbers Less Than 10,000 (.7.021)

76. On a call to a manual station via, tandem RCI, whose number is less than 10,000, the circuit operates as described in the preceding paragraph up to the point where the display key is operated at the RCI 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 traced from battery through its winding, class cam E, break contact of the CL relay, to ground through sender cam H. The TAN relay locks until the switch advances beyond position 9-1/2 in a circuit through impulser cam D, class cam M, to ground through control cam U.

77. 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 traced through impulser cam C, the FP relay operated, class cam K, CI relay normal, to ground through 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 preceding paragraph 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 through 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 RCI 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.

78. 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, incoming advance and talking selection, resetting registers, and sender returns are all completed as described in the preceding paragraph.

Operation Of The Time Measure And Alarm Circuit On RCI Calls. (7.03)

79. The non-coin time measure and alarm circuit functions as described under "Time Measure And Alarm" (1.12), 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 in a circuit from battery through its winding, class cam G, control cam D, strapped terminals 6 to 8 inclusive and RC-4 brush, to ground on the armature of the RIS relay operated. If the time measure switch has advanced from position 5, but not beyond position 11, the TMA relay operates in a circuit through the SKS relay operated, to ground on the armature of the MSL relay normal, thereby advancing the time measure switch to position 12. The TMA relay releases when the switch advances from position 11 if the SKS relay has not by this time been released. The SKS relay has not released unless the RC switch has advanced to position 9. In position 11 with the SKS relay operated, a circuit is closed from battery through the STP magnet, the SKS relay operated, contacts of the 149-H interrupter, strapped terminals 12 to 15 inclusive and M-5 brush, the 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 enters position 16, time sufficient for the dialing of the stations digit has elapsed.

80. In case the stations digit has been dialed before the time measure switch enters position 16, the SH register is advanced, thereby advancing the RC switch to position 9 as described under "Direct Relay Call Indicator" (7.01). In case the stations digit has not been dialed when the time measure switch enters position 16, the RC switch is advanced to position 9 in a circuit through the RC-2 brush and strapped terminals 2 to 8 inclusive, through terminal 16 and the M-5 brush, MS relay operated, to ground through the TMA and MSL relays normal. In either case the SKS relay releases, the time measure circuit continues to function as described under "Time Measure And Alarm" (1.12).

81 The coin sender time measure and alarm circuit functions as described under "Establishing the Connection" (2.01) with the following exceptions. The SKS relay operates as described under "Time Measure and Alarm". If the time measure switch has advanced from position 4, but not beyond position 8, when the SKS relay operates, a circuit is closed

which the TM1 relay operates, through the M-3 brush and strapped terminals 5 to 8 inclusive, the SKS relay operated, to ground through C and MSL-1 relays normal. The operation of the TM1 closes a circuit through the STP magnet and the TM1 relay operated, advancing the switch to position 9. The TM1 relay releases when the switch advances from position 8 if the SKS relay has not by that time released. The SKS relay has not released, unless the RC switch has advanced to position 9. In position 9, with the SKS relay operated, a circuit is closed from battery through the winding of the STP magnet, contacts of the 149-H interrupter, the SKS relay operated, strapped terminals 9 to 12 inclusive and M-5 brush, the TM1 relay normal, the 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.

82. When the switch enters position 13, time sufficient for the dialing of the station's digit has elapsed. In case the stations digit has been dialed before the time measure switch enters position 13, the RC switch has advanced to position 9 as described under "Direct Relay Call Indicator" (7.01). If the stations digit has not been dialed when the time measure switch enters position 13, the RC switch is advanced to position 9 in a circuit through the RC-2 brush and strapped terminals 2 to 8 inclusive, terminal 13 and the M-5 brush, break contact of the TM1 relay, the MS relay operated, to ground through the C and MSL-1 relays normal.

83. In either case the SKS relay releases when the RC switch advances from position 8. With the SKS relay released, the time measure switch continues to function as described under "Establishing the Connection" (2.01).

Direct And Tandem R.C.I. - Numbers More Than 9,999 (7.04)

84. On a call to a manual station, via. either direct or tandem RCI, for a number greater than 9999, the sender functions as described under "Direct Relay Call Indicator" (7.01) for direct and as described under "Tandem Relay Call Indicator" (7.02) for tandem operation, with the following exceptions. For numbers more than 9,999 the dialing of the fifth digit sets the SH register and advances the RC switch to position 7. If the station is in an office with no party lines, the advance of the SH register closes a circuit from battery through the winding of the OT 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 R1 relay normal, to ground on the armature of the RLS relay operated, operating the OT relay.

85. 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 OT relay, and 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 OT relay locks to ground on the armature of the TS-2 relay operated. The operation of the OT relay in either case closes a circuit from battery through the windings of the CL relay and class switch R-3 magnet in parallel, class cam D, the OT 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. 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 traced from battery 44-E resistance and winding of the CN-2 relay in multiple break contact of the RC magnet through the RC-2 brush and strapped terminals 2 to 8 inclusive, contacts of class cam H, the CL relay normal, control cam 0, to ground at the TS-1 relay operated. The advance of the class switch causes impulses for the thousands digits to be transmitted first on a direct R C I call, and to be transmitted immediately following the impulses for tandem tens, on a tandem RCI call, instead of impulses as controlled by the setting of the SH register. The circuit conditions necessary for displaying the digit 1, as controlled by the setting of the TH register, and then 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 (8)

Overflow Conditions (8.01)

District Selector (3.011)

86. With the sender 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 under "Return to Normal Abandoned Call" (1.11), 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 R relay. In position 9 a circuit is closed from ground through the R relay normal, terminal 9 and RC-2 brush, to battery through the RC magnet, advancing the RC switch to position 0. With the RC switch in position 0 a circuit is closed from bat y through the sender control R-4 magnet, cam C, terminal 0 and RC-1 brush, to ground through 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 (1.09). With all registers normal the RC switch advances to normal causing the sender control switch to advance to normal as described under "Return to Normal" (1.10) in paragraph 22. The sender switch is then advanced to normal as described under "Talking Selection" (1.08) and return to normal is completed as described under "Return to Normal" (1.10).

Office Selector (8.012)

87. Should the office selector go to overflow during trunk hunting, on a call to a mechanical office, reverse battery is connected to the furdamental 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 14, 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 14. 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. 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 traced from battery through its winding, control cam L and sender cam K, to ground through the OFL relay operate. 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, the OV relay operated, to ground through control cam T. The operation of the IA relay connects the lead from the O counting relay, through the IA relay operated, contacts of cam L, the STP relay operated, to ground through cam I, operating the O counting relay. The operation of the IA relay closes a circuit from battery through the winding of the sender control R-4 magnet, cam R, cam Q, the OV relay operated, to ground through the cam H, advancing the control switch to position 4.

88. In position 4 the ADV and ADV-1 relays operate in a circuit 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, O, BO, and FO relays releases. In position 15 the circuit is closed from the STP and OFL relays, as described under "Office Test" (1.05) to insure the release of the OFL and IA relays. With the IA relay released, the sender advances to position 16, as described in paragraph 15.

89. In position 16 a circuit is closed from battery through the district L relay, over the lead FT, in which the STP relay operates as described under "Talking selection" (1.08) in paragraph 20. When the STP relay operates in this circuit, it closes a circuit from battery through the winding of the 3 counting relay, lead C, the OV relay operated, control cam N, the IA relay normal, sender cam L, the STP relay operated to ground through cam I.

90. As the district switch advances, the STP relay is intermittently short circuited by ground in the district, connected to the 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, thus stopping the district in the overflow position. The operation from this point on as described under "District Selector" (8.011).

91. Should the office selector go to overflow on an RCI 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, as described under "Direct Relay Call Indicator" (7.01), in order to operate the marginal polarized relay in the distant two wire office selector, if used.

Incoming Selector (8.013).

92. 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 17, 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. The OV relay operates in a circuit 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 under "Office Selector" (8.012). 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, the 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.

93. The advance of the district selector releases the sender L relay, causing the release of the SLR and RIS relays. The operation of the ADV-1 relay also advances the sender switch to position 8. The OFL, IA, O, BO, and FO relays release when the switch advances from position 18. 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 under "Talking Selection" (1.08). The counting relays are operated and the district advanced to the overflow position, as described under "Office Selector" (8.012). The operation from this point on is as described under "District Selector" (8.011).

Preliminary Pulse. (8.02)

94. 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, the RA relay normal, 1000 ohm winding of the PP relay, terminal 1 and A-4 brush, the RA relay normal, to ground through the RLS relay operated. The RC magnet and the ON-2 relay hold in a circuit through terminal 1 and A-6 brush, the SSR relay normal, to ground through the RLS relay operated, thus preventing the advance of the RC switch from normal. With the PP relay operated, when the L relay next releases, a circuit is closed from battery through one winding of the ON-2 relay in parallel with the 58 ohm resistance, 5 ohm winding and make contact of the PP relay, normal terminal and RC-6 brush, winding of the RA relay, the RLS relay, the L relay normal, to ground through the T relay operated, operating the RA relay and thus opening the circuit through the 1000 ohm winding of the PP relay. The PP relay holds through its 5 ohm winding until the L relay reoperates. The RA relay holds during the series of impulses corresponding to the first digit. The PP relay released, 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 under "Setting Registers" (1.02). The second pulse of the series then advances the A register from position 1 to position 2, and from this point on the circuit functions in the regular manner. If there were 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 received.

Release Of The Sender From Permanent Signal Conditions. (8.03)

95. If the sender monitoring lamp lights to indicate a permanent signal condition, as described under "Time Measure And Alarm" (1.12) for a non-coin sender, the plug of the monitoring operator's cord is inserted in the test jack T, operating the MSL relay in a circuit 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 across the L relay to hold it operated to prevent a false disconnect. The line is then connected to the tip and ring of the cord circuit. To release the sender the plug of the cord is inserted in and immediately removes from the jack MB, operating the SSR relay. The operation of the SSR relay closes a locking circuit to ground through the T relay operated, and closes a circuit from ground the RLS and SSR relays operated, and I terminals of the RC-2 brush, to battery through the winding of the RC magnet, advancing the RC switch to position 2. The ST relay now operates and locks as described under "Translation" (1.03). The translator rotates as described in paragraph 6 until the hunting brush finds the terminal on the T1-S arc, to which ground the RLS and SSR relays operated, is connected, over lead B. The TS-1 and TS-2 relays operate and the translator is stopped, in a position in which the SSA relay operates. The circuit in which the SSA relay operates, is traced from battery through its winding, terminal and contact of the S2-CL arc, to ground through

the OT relay normal and the TS-2 relay operated. The SSA relay operated closes a circuit, in which the CL relay operates, and in which the class switch advances to position 10. The TS-1 and TS-2 relays, operated, function as described under "Translation" (1.03).

96. 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 under "Call To Zero Operator" (4). 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. From this point on the operation of the sender circuit is as described under "Call To Zero Operator" (4). When the M relay releases the TMA relay operates in a circuit from battery through its winding, strapped terminals 1 to 21 inclusive and M-1 brush, to ground through 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, the 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.

97. For a permanent signal condition as described under "Establishing the Connection" (2.01) for a coin sender, the MSL-1 relay operates and functions as described for the MSL relay in the preceding paragraph. In releasing the sender the SSR relay operates and locks and the RC switch advances to position 2 as described under "Preliminary Pulse" (8.02). The ST relay operates, translation is completed, the SSA relay operates, and the class switch is advances to position 10, all as described in the preceding paragraph. The CN relay also operates as described under "Call To Zero Operator" (4), 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 as described under "Call to Zero Operator" (4). A trunk at the trouble desk is selected as described under "Call to Zero Operator" (4). When the MS relay releases the time measure switch advances to normal as described under "Preliminary Pulse" (8.02).

Release Of Stuck Sender (8.04.

98. In case the sender monitoring lamp lights to indicate a partial dialing condition or a stuck sender condition, as described under "Time Measure and Alarm" (1.12) for a non-coin sender, or as described under "Establishing the Connection" (2.01) for a coin sender, the plug of the monitoring operator's cord is inser in the test jack T, and the MSL relay operates as described in paragraph 47. If translation has not been completed, the sender is released as described in the two preceding paragraphs, 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 under "Release of the Sender From Permanent Signal Condition" in paragraph 47. The DWO relay operates in a circuit through its winding, control cam W, the SSR relay operated, the SSA relay normal, to ground through 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, and causes the release of the district D relay. District group selection should

have been completed before the D relay releases, but if not the district returns to normal immediately, causing the release of the L, RLS and SLR relay. If district group selection has been completed, when the district D relay releases, office test, office selections, trunk test and incoming selection take place as described under "Return to Normal Abandoned Call" (1.11). Incoming advance and talking selection then take place as described under this heading (1.08), advancing the district and thereby releasing the L, RLS, and SLR relays. If incoming advance has already been completed when the SSA 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 under "Return to Normal Abandoned Call" (1.11). "Resetting the register" and "return to normal" are completed as described under these headings (1.09 and 1.10). The time measure switch advances from position 11 (or 20) to normal as described under "Preliminary Pulse" (8.02) in paragraph 46.

99. On a call from a coin station the operation is as described in the preceding paragraph except that the associated district circuit re-selects 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 under "Coin Collect and Return" (2.02), in paragraph 29. 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" (8.02) in paragraph 46, routing the call to a trunk in the permanent signal group, or returning to normal as described in the preceding paragraph.

Register Or Switch off Normal. (8.05)

100. 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" (1.09), advancing them to normal. The operation of the ON-1 and ON-2 relays 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. 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 as described under "Time Measure And Alarm" (1.12) or "Establishing the Connection" (2.01) in paragraph 25 or 26. Should any one of the sequence switch, 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 in a circuit 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 position 7 (normal) as described under "Return To Normal" (1.10).

Skip Office. (8.06)

1.01. On non-coin calls which do not require an office selector, a circuit is closed, in position 4 to 10 inclusive of the sender switch, to hold the counting 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 traced from battery through their windings, sender cam R, lead 2, terminal and T1-SKO brush, control cam E, to ground through cam U. When the sender switch advances from position 10, the counting relays release, and the call is completed as described under "Incoming Test" (1.06), "Final Selections" (1.07), "Incoming Advance" (1.08), "Resetting Registers" (1.09) and "Return to Normal" (1.10). 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. (8.07)

1.02. When necessary to work on any of the sender apparatus, a plug with its tip and ring stripped is inserted in the MB jack, MS at the monitoring position, operating the MB relay in a circuit to ground on the ring spring of the 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 partially closing the sender busy lamp, at the alarm board. Should the motors for driving the sender switches stop, ground is connected to the lead "To Motor Stop Alarm Circuit" operating the MB relay, causing the sender to function as above described.

Heat and Spark Protection. (8.08)

1.03. The 44-A, B and C 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.