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Equipment Engineering Branch, Hawthorne
Printed in U. S. A.

This appendix was prepared from Issue 46 of Drawing ES-239515

Panel System - Automatic Test of Subscribers District Selector - Line Finder Type

Change to read:

24. In paragraph reading "When fig AF is used etc" change res (J) & (K) to read (BB) & (J) resp.

Att.
Mr. Stokes

ENG. R.J.S. CHK'D R.J.S. APP'D H. L. HOPE
EK C. C. C.

Western Electric Co., Incorporated
Equipment Engineering Branch, Hawthorne
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This Appendix was prepared from Issue 41 of Drawing ES-239515.

METHOD OF OPERATION

Panel System - Automatic Test of Subscriber's District Selector - Line Finder Type

Change to read:

3.05 A soak circuit is applied to (DC) relay of district. (In pos. 15 of test circuit under control of timing relays (SK), (SK-1) and (SK-2).

Change to read:

3.06 An 83 ohm soak circuit is applied Fig. "AI" to (CS) (polarized) relay in district in direction to operate the polarized relay. (In pos. 12 under control of (PSK) relay.)

Change to read:

3.14 Makes operate test of (CS) relay in district after reverse soak. ((CS) relay and resistances in test circuit used. Timing relays (I), (O), (RO), and (SO) involved in pos. 14). (Reverse soak not made when toll diversion offices are tested.)

Change to read:

3.45 The ground connected to the sleeve cam during talk selection is checked. ("Repeat coil in" test only when arranged to test toll diversion offices).

Added:

3.51 Provision is made to test districts in toll-diversion and non-toll-diversion offices.

Added:

5.55 The (TD) key is used to provide for operate soak test, and to advance district out of "awaiting operator's position" when "non-toll-diversion" and toll-diversion offices are tested by one test circuit.

Change to read:

19. MESSAGE REGISTER FALSE CHARGE

With "K" wiring the (MR7) & (MR8) relays operate in the dialing positions to connect the "M1" & "M2" leads to the (MX1) relay. If battery is connected to either charging lead at any time after the operation of the (MR7) or (MR8) relays, the (MX1) relay will operate operating the (FCH1) relay to block the test switch in positions 11 to 17 with the (FCH) lamp lighted. When used in offices where special district selector per SD-21755-01 is used, the (MR7) or (MR8) relay releases in position 13 to 14, for all other cases, the (MR7) or (MR8) relay releases in position 16, to prepare the circuit for the correct charging current in position 17.

Change to read:

20. TESTS FOR LINE CLOSURE

With the (R1) switch in position 11, the sender makes district brush and group selections. The first two sleeve terminals in the selected group are grounded, by the operation of the (GS) relay which operates in position 11, so that the third terminal in the group is selected. (With "E" wiring, the sender is held by the 100 ohm resistances connected to the "A" and "B" leads.) With "K" wiring the operation of the (GS) relay opens the circuit to the "A" and "B" leads and circuit is closed through the (O1) cam and resistances (X) and (Y) to hold the sender in order to place an operate test on the (DC) relay when the sender is released. The district bank terminal is connected to cams (R1), (Q1) and (P1). When the fundamental circuit is closed for trunk test the (TC) relay operates. The (TC) relay operated, operates the (TC-2) relay which locks in series with the (TC-1) relay. When the sender advances to make talking selection the (TC) relay releases allowing the (TC1) relay to operate in series with the (TC2) relay. When Fig. "E" is used and circuit is arranged to test non-toll diversion offices, the (TC1) relay operated grounds the "S" lead making the trunk terminal busy, and closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12. When Fig. E is used and circuit is arranged to test toll diversion offices, the operation of the (TC1) relay, closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12. When talking selection is completed and trunk closure is made the (TC) relay re-operates. With the (TC) and (TC1) relays reoperated, the (R1) switch advances to position 12. When Fig. F is used and circuit is arranged to test non-toll diversion offices, the (TC1) relay operated closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12.

When Fig. F is used and circuit is arranged to test toll diversion offices, with the (TC1) relay operated, the (R1) switch is advanced to position 12, without awaiting for a second closure of the (TC) relay by operating the (SK3) relay which in turn advances the switch, and connects the number 3 and 4 brushes of the (P1) cam together and to ground to hold ground on the sleeve of the district selector. When the switch used and the circuit is arranged for toll diversion. When the (TD) key is operated the (PSK) relay is operated in pos. 12 and the circuit functions same as for non-toll diversion. In position 14, the (CS) relay in the test circuit operates, through the (PSK) and (BB) relays normal, over the ring side of the district selector circuit through the master switches and (TR) relay, with the (R1) switch in pos. 14 the (SR) relay is operated, the (SR) relay prepares the operating circuit from the (SR2) and (SR3) relay, when the (R1) switch reaches pos. 18, with "E" wiring and apparatus, cams (M1) and (O1), contacts of the (REL) relay, "Y" resistance (20 ohms), cams (K1) and (K3) to ground. With "K" wiring and apparatus cam (O1), contacts of (SK1) and (REL) relay, "Y" resistance (100 ohms) cams (K1) and (K3) to ground. The (CS) relay operated, operates the (I) relay, over the tip side of the line, thru the interrupter contacts. The (I) relay locks through its make contact and operates the (RO) relay, when the "IV" contacts of the interrupter make. When "K" wiring is used and test line is on the district frame the (SL) relay is connected to the sleeve in place of ground and must operate from ground through the back contact of (L) relay in district before district sequence switch advances out of position 16. The operation of (RO) relay opens the sleeve circuit through cam (P) allowing the district to advance from its "Talking to Operator" position which releases the (CS) relay in the test circuit. The (CS) relay released, releases the (I) relay. The (RO) relay operated and the (I) relay released advances the (R1) switch to position 15. If the district circuit has failed to advance to the "Talking to Operator" position, the (CS), (I) and (RO) relays fail to operate and block the (R1) switch in position 14. When used in offices where special district selector per SD-21755-01 is used, the (MR7) or (MR8) relay is release due to a shunt circuit, see par. 19.

Added:

21.2 Fig. AF

When switch (R1) reaches position 12 and before relay (SK3) operates a negative soak is applied to the district (CS) relay as follows: Ground thru winding of relay (BB2) is connected to the ring conductor, thru winding of district (CS) relay, tip conductor to battery thru resistance lamp (NS). Relay (BB2) operates and in turn causes relay (BB3) to operate and lock to ground on cam (F1). Upon the operation of relay (SK3), as described under paragraph 21.1, relay (CS) is operated from battery thru its winding, contact of relay (CS1) operated, resistance (H), contact of relay (BB) normal, contact of relays (BB3) and (SK3) operated, ring conductor, district (CS) relay, tip conductor, contacts of (SK3) and (CS1) relays to ground on contact of (AD) relay. The district (CS) operates as described under paragraph 21.1 and advances the district to the talking to operator position. As the switch leaves position 12, the ground on contact of relay (AD) is removed. With switch (R1) in position 14, relay (CS) in test circuit operates, thru resistance (H) contact of relay (BB) normal, (BB3) operated, ring conductor, connector switches (TR) relay, cam O1, contacts (SK1) and (REL), (Y) resistance, (K1) and (K3) cams to ground. Relay (CS) operating operates relay (I) as follows: Battery from interrupter, winding of relay (I), cam (P3), contact of relay (CS) operated, cam (R3), (SK3) relay operated, tip conductor, to the same ground on cam (K3). The operation from this point on is the same as described above under paragraph 21.1. Relays (BB2), (BB3) and (SK3) release when switch (R1) leaves position 17.

Change to read:

22. TEST OF SUPERVISORY RELAY (DC) AND (RCO) KEY OPERATION

As the test switch passes from position 14 to 15, with "E" wiring and apparatus the 20 ohm soaking circuit is held across the tip and ring sides of the test circuit, with "K" wiring and apparatus the 100 ohm soaking circuit is held across the tip and ring sides of the test line soaking the supervisory relay (DC), when testing districts arranged to function over 1500 ohm subscribers loops, 190 ohms is held across the tip and ring instead of above 90 ohms or 100 ohms. With the switch in position 15, the (SK), (SK1) and (SK2) relays reoperate under control of interrupter contacts "F" and "B". The operation of the (SK1) relay removes the short circuit from around the (S), (U), (V), (W), (X) and (Z) resistances bridging them in series with the (Y) resistances across the tip and ring, thereby releasing the supervisory (DC) relay in the district circuit. With Fig. M, when testing districts arranged to function over 750 ohms the (V) resistance is not connected in release circuit. The (REL1) relay operates over this circuit as soon as the district releases the line so that 48 volts is connected through the line relay to the "R" lead and advances the (R1) switch to position 16. When Fig. K is used the (Z) resistance as shown by "Q" wiring is connected in circuit ahead of (REL1) relay to prevent a false operation of (REL1) relay, due to inductive surge from repeating coil. This surge caused trouble when "E" wiring was used. When Fig. "L" or "M" is used, (REL1) relay operates on release current and also when district returns to normal. However, the circuit thru contacts of (REL1) is opened by (FR3) relay, until district returns to normal. The (SK), (SK1) and (REL1) relays release as the switch advances to position 16. Withe the (R1) switch in position 16, and when "AU", "AW", and "L" wiring and apparatus is used the (MR7) or (MR8) relay is shunted to complete the circuit for moving the (R1) switch out of 16. Also the (R3) switch advances to the next position from ground on cam (H1), when the (RCO) key is operated the (SR3) relay operates as soon as (R3) switch reaches pos. 3, 6, 9 instead of awaiting (R1) switch position 18, the (SR2) relay remains normal until (R1) switch opens position 17 at (F1) cam. With the (RCO) and (RC1) keys normal and the (R3) switch in position 3, 6 or 9 ground on cam (Y1) through cam (C3) advances the (R1) switch to position 17. Ground on the (SR2) relay normal advances the (R1) switch to position 18 with "K" wiring switch awaits release of (FR3) relay. With the (R3) switch in position 3, the (SR3) relay operates through the contacts of the (SR2) relay, (SR) and (MR3) relays (BC) key normal (F3) cam (ST) relay and with the (RCO) key normal through (I1) and (U1) cams to ground, with the (RCO) key operated, through (RCO) key (PC) relay (F1) cam and (DB) relay to ground. With the (RCO) key normal the operation of the (SR3) relay advances the (R1) switch to position 1, and connects ground to the (SR2) relay, causing it to operate and lock in series with the (SR3) relay as the (R1) switch advances from position 18.

Change to read:

24. SECOND TEST OF DISTRICT CIRCUIT - REPEATING COIL IN (DC) SUPERVISORY RELAY TEST, USING "E" WIRING AND APPARATUS

With the (R1) switch in position 2 (second revolution) ground on the (SS1) relay through the contacts of the (PLFS), (PMG) and (DTS) relays through cam (B) advances the switch to position 6. The switch functions in position 6 to 10, inclusive in the same manner as described for the first revolution of the switch, with the exception that the digit code sent is such that it will stop the district circuit in a rept. coil position. In position 11, the (13U) resistance is bridged across the tip and ring holding the sender. The (TC) relay operates during trunk test by the sender. When the district is advanced to a talking position the (TC) relay reoperates. The (DC) relay in the district is operated. The (GS), (TC), (TC1) and (TC2) relays function as described in first test to advance the (R1) switch to position 12, except that when Fig. F is used and circuit is arranged for toll diversion the (R1) switch awaits the second operation of the (TC) relay, after talking selection before moving out of pos. 11. With the (R1) switch in position 12, the (DC) relay in the district is given a soak current, the (Y) resistance or the (Y) and (BC) resistances being connected across the tip and ring of the test line. Also the (CS) relays in both the test and district circuits are operated. The (CS) district relay operated, charges the call. The (SK), (SK-1) and (SK-2) relays operate, also (SK-3) with Fig. F, under control of the "F" and "B" contacts of the interrupter and advance the (R1) switch to position 13, the (A) cam advances it to position 14. As the (R1) switch enters position 13, ground on cam (Y-1) operates the (REL) relay which locks to ground through cam (F-1), and removes the shunt around the (X), (W), (V), (U) and (S) resistances giving a release condition to the (DC) relay. When "AX", "AU" and "L" wiring and apparatus is used, the operation of (REL) relay is delayed until the release of (MR7) or (MR8) relay, see paragraph 21. When Fig. M is used (S) resistance is not in circuit for 750 ohm loop. The (DC) relay in the district circuit releases due to the high resistance connected in series with the (REL1) relay but the district is not immediately released being held by the (D) relay. The (CS) relay in test circuit operates which operates the (O) relay in position 14, connecting ground to the (I) relay which operates when the interrupter contacts make. The operation of the (O) relay also shunts (Z), (S), (U), (V), (W) and a portion of the (X) resistance, allowing the supervisory (DC) relay in the district to operate over a condition which simulates 750 ohm loop. The interval of time between the release of the (DC) relay in the district in position 13 of the (R1) switch and the reoperation in position 14 is such that the district circuit is not released, due to the slow release of the (D) relay. The (I) relay locks and operates the (RO) relay. The (RO) relay operated locks and operates the (SO) relay. When the "IV" contact of the interrupter makes, it advances the test switch to position 15. This operation is effective only if the (DC) or (D) relay in district had not released falsely causing the district to run and releasing the (O) relay. When "L" wiring is used the (SL) relay will be required to hold over the sleeve busy ground, even when (FCH) key is operated. The (SO) relay operated, advances the (R1) switch to position 16. With the switch in position 16, ground on cam (Y1) advances the switch to position 17. When "AU", "AW" and "L" wiring and apparatus is used the (MR7) or (MR8) must release before the (R1) switch will advance to pos. 17. See par. 22. The tip and ring is opened as the switch advances from position 15, releasing the (DC) relay in the district allowing the district to advance to the message register or coin collect position or return to normal.

When FIG AF is used, a soak in the non-operate direction is applied to the district (CS) relay, until the (SK3) relay operates in position 12, in the same manner as described for "Repeat Coil Out" test. Relays (BB2) and (BB3) operate as heretofore described and when relay (SK3) operates an operate test is applied to the district (CS) relay as follows: Battery through resistances (J) and (K) contact of relay (CS1) normal, resistance (H), contact of relay (BB) normal, contact of (BB3) and (SK3) operated, ring conductor, district (CS) relay, tip conductor, (J3) cam to ground on lead 20.

In position 12 relay (BB6) is operated from ground on contact of relay (AD). Relay (BB6) operating connects a network consisting of condenser (CS) and resistances (L) and (P) across the T and R conductors through contacts of relays (AE) FIG AG and (BB6) operated. Relay (BB6) operating locks to ground on cam (F1). With relay (BB6) normal this network is short circuited. Relay (AE) is used to remove the network from the tip and ring conductors during transmission testing. The circuit from this point on will function the same as heretofore described except that in position 14 of switch (R1) relay (O) is operated through contacts of relay (CS1) normal.

Change to read:

25. The (CS) relay in both the test and district circuit are operated. The (CS) district relay operated causes the district to set for a charge call. The (SK), (SK1) and (SK2) relays operate also (SK3) with Fig. F under control of the "F" and "B" contacts of the interrupter and advances the (R1) switch to position 13. The (A) cam advances it to position 14. As the (R1) switch enters position 13 ground on cam (Y1) operates the (REL) relay which stays operated until the (R1) switch leaves position 14. When "AX", "AU" and "L" wiring and apparatus is used the operation of (REL) relay is delayed until the release of (MR7) or (MR8) relay. See paragraph 21. The operation of the (REL) relay opens the operate circuit of the (DC) relay. This operate circuit of the (DC) relay remains open for one position of the (R1) switch to test that the (D) relay will hold for this period of time. When the (R1) switch goes into position 14 the test operate circuit of the (DC) relay is reclosed through the make contact of the (REL) relay and (O1) cam. The test operate circuit of the (DC) relay remains closed in position 14 for a period of time to check that the (DC) relay reoperated and holds the district from releasing. With the (CS) relay in the test circuit operated, and the (R3) switch in position 3, the (O) relay operates, ground through (F1) cam position 14, make contact of (REL) relay (R3) cam, make contact of (CS) relay (P3) cam and winding of (O) relay. The operation of the (O) relay operates the (I) relay under control of "F" contact of "III" interrupter; with the (I) relay operated, the (RO) relay will operate under control of "B" contact of "IV" interrupter with (FCH) key normal or under control of (W) and (Z) relays operated, the (SO) relay will operate under control of "F" contact of "III" interrupter also the (SL) relay will operate from the sleeve make busy ground of district, the (SL) relay is held operated from district sleeve make busy ground until the "B" contact of interrupter "IV" makes which advances the (R1) switch to position 15, providing the (FR3) and (SL) relay are still operated. When the (R1) switch goes into position 15 a soak current is applied to the (DC) relay prior to its release current. When the (R1) switch reaches position 15 the (SK), (SK1) and (SK2) relays operate under control of #149C interrupter. The soak current is applied when the switch reaches position 15 and is replaced by a release current circuit when the (SK1) relay operates, this release current circuit remains closed until the (R1) switch advances out of position 17 after message register or coin current has been applied. The operation of the (SK2) relay advances the (R1) switch to position 16 where it is advanced to position 17 by ground from cam (Y1), see paragraph 24.

Change to read:

28. MESSAGE REGISTER ONE-PARTY CLASS

The (MR-1) relay operates and locks in position 5 of the (R-1) switch, when the (LF) selector rests on terminal 1. The (MR-1) relay operated advances the (R-3) switch to position 2. The circuit functions as described in paragraphs 11 to 22 inclusive advancing the (R-1) switch to position 16 when "K" wiring is used or to 17 if "E" wiring is used in the 2nd revolution. When "AU", "AW" and "L" wiring is used the (MR7) relay is shunted in position 16 which closes circuit to advance switch to 17. At this time the district had advanced to the register position and connects battery to the "MZ" lead (the call having been charged) which operates the (R) relay. This battery is connected through three (18AN) resistances in parallel in the district; if one or two of these resistances are open the (R) relay will not operate; if these resistances are short-circuited the (BX) relay operates as well as the (R) relay. When Fig. C is used the (R) relay operated operates the (WD-1) relay, and in turn operates the (WD) relay. The (WD) relay operated locks and the (WD-1) relay releases as soon as the district advances disconnecting battery from the "MZ" lead. When "L" and "AD" wiring are used the removal of message register current operates (WD2) relay which advances the sequence switch out of position 17 after the district reaches normal. When "L" and "AE" wiring are used, the (WD2) operates the (WD3) relay, which advances the switch. The break contact of the (WD3) is used on coin class. When Fig. D is used the (R) relay operated, operates the (WD1) relay, and in turn operates the (WD) relay through contacts of (TMR) relay normal, (the (TMR) relay circuit was closed in position 7 with the operation of (AB) relay) the operation of (WD1) relay will open the short circuit from (TMR) condenser and (AN) resistance, which allows the (TMR) relay to operate slowly, the time required to operate the (TMR) relay will match the time, the message register current should be applied. If the message register current is removed before the contact of (TMR) relay breaks which releases (WD) relay the (FCH1) relay will operate, blocking the circuit in position 17. The (CC1) relay will operate when testing coin districts, and the (TMR) relay will stay on its back contact allowing the circuit to function as described above except that the timing feature will not function. The timing feature functions as follows: The (TMR) relay is a differential wound relay and both windings are closed in position 7 of test switch with the operation of (AB) relay, and when the (WD1) relay operates following the (R) relay, the "S" wiring is opened and connected in series with (TMR) condenser and (AN) resistance, this allows the (TMR) relay to operate thru the "P" winding, its operation being retarded by the (TMR) condenser and (AN) resistance. When the (TMR) relay operates the (WD) relay releases, this (WD) relay operated thru the normal contact of the (TMR) relay when the (WD1) relay operated and the (WD) relay locked thru the contact of (TMR) and its own contact to the operating ground. When the (WD1) relay releases at the end of the message registration current, with the (WD) relay released the (WD2) relay operates and locks, in turn operating the (WD3) relay when "L" wiring and apparatus is used. If an extra impulse of message register current is received during return to normal of district the (WD1) relay will reoperate. With (WD3) relay operated the reoperation of (WD1) relay operates (FCH1) relay blocking test circuit in position 17. When "AA" and "AD" wiring are used the (R-1) switch is advanced to position 17 from ground thru the (BX) relay normal through the (WD-1) relay normal and (WD) relay, operated. When "AA" and "AE" wiring are used this ground operates the (WD-3) relay which advances the R1 switch. Should the (BX) relay operate, or should the (R) relay not operate the (R-1) switch will be held in position 17 as a trouble condition. When the (R-1) switch leaves position 17, the (RO), (SO), (O), (REL) and (I) relays release. The circuit functions in position 18 as described above.

Change to read:

29. MESSAGE REGISTER TWO-PARTY CLASS

When testing two-party message register districts, the (MR-2) relay operates in position 5 of the (R-1) switch with the (LF) selector resting on terminal 1. The (MR-2) relay operated locks and advances the (R-3) switch to position 2. With the (RCO) key normal when the (SR-2) relay operates as the (R-1) switch starts on its second revolution, it operates the (MR-3) relay. When the (RCO) key is operated the circuit of the (MR3) relay is open. The (MR-3) relay operated, prepares a circuit for operating the (MR-4) relay instead of the (SR-1) relay as the (R-1) switch advances thru position 18 of the second revolution. When the (RCO) key is normal the (MR-4) relay, operated, advances the (R-1) switch to position 1, in turn operating the (MR-5) relay. The (MR-4) and (MR-5) relays operated lock to cam (M-3) with "E" wiring or to cam (L3) with "L" wiring. Otherwise the circuit functions as described in paragraphs 11 to 22 inclusive and 25. When "L" wiring is used the operation of (MR4) relay operates (MR6) in local circuit. The operation of (MR6) relay changes the shunt releasing circuit from (MR7) to (MR8) relay allowing the (MR7) relay to remain operated to detect a false charge.

Change to read:

43. FALSE CHARGE TESTS; MESSAGE REGISTER ONE-PARTY - FIG. A

The district circuit is tested for a no charge call by operating the (FCH) key. The circuit functions the same as described for charged calls with the following exceptions. When the (R-1) switch enters position 14 of the second revolution the (O) relay operates in turn operating the (BB) and (BB-1) relays through the (FCH) key operated. The (BB-1) relay operated holds the (R-1) switch in position 14 longer than for a charged call under control of the (W) and (Z) relay. When "AX", "AV" & "L" wiring is used the shunting circuit for the (MR8) or (MR7) relay is held closed. The (O) relay operated operates the (I) relay. The (I) relay, operated, operates the (W) relay under control of the "A" interrupter. When the interrupter contacts break, the (Z) relay operates. The next closure of the interrupter releases the (W) relay in turn operating the (RO) relay. When the interrupter contacts break the (Z) relay releases. The next closure and break of the interrupter operates the (W) and (Z) relays. The (SO) relay now operates under control of the (B) interrupter. With the (I), (RO) and (SO) relays operated the (SL) relay when "K" wiring is used the (R-1) switch is advanced to position 15, when interrupter contacts are closed. The (SO) relay operated advances the switch to position 16 and when "AU", "AW" & "L" wiring is used ground on cam (Y-1) advances it to position 17. During the time the (R-1) switch is held in position 14, (Fig. E), the (BB) relay operated, operates the (DR) relay, holds the (CS) relay operated and connects battery through 1000 ohms resistance to (R-3) lead. The (DR) relay operated transfers the (T-3) lead from direct ground to interrupter ground thus testing the (CS) relay in the district. The (CS) relay in the district follows the pulses of the interrupter (if it is properly adjusted) and the time interval is not sufficient to charge the call. The (DR) relay, operated, also transfers the (MZ) lead from the (R) relay to the (MX) relay. When the (R-1) switch leaves position 15 the "T" and "R" leads are opened releasing the district circuit. When the district circuit returns to normal ground is removed from the "DB" lead releasing the (DR) relay. The (DR) relay released, advances the (R-1) switch to position 18. The (O) relay releases as the switch advances from position 17, in turn releasing the (BB), (BB-1), and (Z) and (W) relays, if operated. Should the (CS) relay in the district fail to release, the call will be charged and consequently the district will stop in the message register position and register the call. Under such conditions the (MX) relay operates in position 17 over the (MZ) lead. The (MX) relay, operated, operates the (FCH) relay. When battery is removed from the (MZ) lead due to the district advancing the (MX) relay, releases allowing the (FCH-1) relay to operate and lock in series with the (FCH) relay. The (FCH) relays operated, open the circuit for advancing the (R-1) switch from position 17, light the (FCH) lamp and operate the (TR) and (DB-1) relays. The (DB-1) relay releases the (FR), and (DR) relays. The (TR) opens the "T", "R" and "S" leads releasing the associated line. The test switch remains in position 17 as a trouble condition.

When figure F is used, a closed circuit release test is made, to compensate for the effect of the condenser in multiple and repeat coil in series with the (CS) relay. With the FCH key operated, the R1 switch in position 14, and the class switch in the second test position, relays (CS), (O), (BB), (BB1) and (DR) operate following the tip and ring closure through the district (CS) relay. Relays (BB2) and (BB3) operate checking the continuity of the operate test path and when interrupter III closes, relay (I) operates, closing the busy back (J) interrupter path which short circuits the release path giving an operate current to the circuit (CS) relay. The test continues as previously described registering a false charge if the (CS) relay does not release during the interrupter open period.

When Fig. AF is used a reverse soak is applied before the operate current, until relay (SK3) operates and the flashing circuit is positive soak and release. Relays (BB2) and (BB3) operate in the usual manner on the reverse soak test. Relay (BB3) and (SK3) operating closes the operate path to the district (CS) relay until relay (BB) operates in position 14. Relay (BB) operating closes battery thru lamp (PS), winding of relay (BB4), interrupter (J), contacts of (BB) and (BB3) and (SK3) relays operated, ring conductor, district (CS) relay, tip conductor, (SK3) relay contact, (J3) cam to ground. Relay (BB4) operating, causes relay (BB5) to operate which locks to ground on cam (F1). Upon the open period of interrupter (J), the release current is applied to the district (CS) relay. This soak release current is applied in the same manner as heretofore described. In position 17 of switch (R1), the path for advancing the (R1) switch from position 17 is the same except that the circuit is carried thru a make contact of relay (BB5).

Change to read:

44. FALSE GROUND TWO-PARTY

During the third revolution with the (FCH) key operated, a test is made to determine whether the two-party districts recognize a false ground on the tip side and prevent the district charging a call on either register. The test switch arrives in position 11 and the (PT) relay is connected to the tip which causes the district selector to function a 2nd party charge. The district is held for a sufficient time to set up a charge condition and when the test switch arrives in position 17, the district circuit under test will be in position 16 and the (PT) relay is again operated over the tip which should cause the (T) relay in the district circuit to operate and block the district. The test and district circuits are held until the (FG) and (FG-1) relays operate. The (INT) relay operates in position 14 of the third revolution of the (R-1) switch under control of the (O) relay. These relays are held operated until the switch leaves position 17. When the (PT) relay operates in position 17, the (FG) and (FG-1) relays operated under control of the "C" interrupter. The (FG) relay locks under control of the (INT) relay and the (FG-1) relay locks to cam (H-1). The (FG-1) relay, operated, opens the "T" lead to the (PT) relay, releasing it and the (T) and (I) relays in the district, and short circuits the (INT) relay, releasing it. The party test switch in the district now advances and sends out register current over the "M-2" lead, operating the (R) relay and moving the test switch in the regular manner. When the (INT) relay is operated, it connects the (MX) relay to the "M-2" lead and also closes a circuit from the (MX) armature to the (FCH) relay. Should the district not recognize the false ground and register a call over the "M-2" lead, the (MX) relay operates. The

(MX) relay, operated, operates the (FCH) relays which function as described above. In the case that the district under test does not recognize the false ground on the tip side of the circuit in position 11, and fails to set the district for charging over the "M-2" lead, and for the same reason did not recognize it for retest, the charging current is sent out over the "MZ" lead. With "L" wiring the "MZ" lead being open at the (MR5) relay, no relay is operated, thus the test switch is stopped in position 17. With "AU", "AW" or "AX" and "AV" and "L" wiring the "MZ" lead is connected to the (MX1) relay. The operation of the (MX1) relay operates the (FCH1) relay blocking the test circuit in pos. 17.

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METHOD OF OPERATION
Panel System - Automatic Test Of - Subscriber's District Selectors - Line Finder Type

17. On page 19 change sentence "The (MR-7) and (MR-8) relays will lock until test switch leaves position 17", to read "The (MR-7) and (MR-8) relays will lock until test switch leaves position 17 or until one or the other is released due to a shunt".

19. At beginning of last sentence add "When used in offices where special district selector per SD-21755-01 is used, the (MR-7) or (MR-8) relay releases in position 13 to 14, for all other cases".

21. At the end of paragraph, add following sentence, "When used in offices where special district selector per SD-21755-01 is used, the (MR-7) or (MR-8) relay is released due to a shunt circuit, see paragraph 19".

22. On page 22 after sentence "The (SK), (SK1) and (REL 1) relays release as the switch advances to position 16", add the following "and when "AU", "AW" and "L" wiring and apparatus is used the (MR-7) or (MR-8) relay is shunted to complete the circuit for moving the (R1) switch out of 16".

24. After sentence ending "and (S) resistances giving a release condition to the (DC) relay", add the following sentence "When "AX", "AU" and "L" wiring and apparatus is used, the operation of (REL) relay is delayed until the release of (MR-7) or (MR-8) relay, see paragraph 21". After sentence "With the switch in position 16, ground on cam (Y-1) advances the switch to position 17", add sentence, "When "AU", "AW" and "L" wiring and apparatus is used the (MR-7) or (MR-8) must release before the (R1) switch will advance to position 17, see paragraph 22".

25. In third paragraph, after sentence ending "until the (R1) switch leaves position 14", add sentence "When "AX", "AU" and "L" wiring and apparatus is used the operation of (REL) relay is delayed until the release of (MR-7) or (MR-8) relay see paragraph 21". At end of paragraph, after " - - - - - from cam (Y1)" add "see paragraph 24".

28. Change first part of sentence "When "L" wiring is used the (MR-7) relay is shunted etc", to read "When "AU", "AW" and "L" wiring is used the (MR-7) relay is shunted etc".

43. After sentence ending " - - - - - charged call under control of the (W) and (Z) relays", add sentence "When "AX", "AV" and "L" wiring is used the shunting circuit for the (MR-8) or (MR-7) relay is held closed". Change sentence reading "The (SO) relay operated advances the switch to position 16 and ground on cam (Y-1) advances it to position 17," to read "The (SO) relay operated advances the switch to position 16 and when "AU", "AW" and "L" wiring is used ground on cam (Y-1) advances it to position 17."

44. Change next to last sentence, which reads "With "L" wiring the "MZ" lead is connected to the (MX-1) relay", to read "With "AU", "AW" or "AX" and "AV" and "L" wiring the "MZ" lead is connected to the (MX-1) relay".

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Panel System - Automatic Test Of Subscriber's District Selectors - Line Finder Type

3.14 Add, "(Reverse soak not made when toll diversion offices are tested)".

3.39 Change, "(CDH) lamp" to read "(DCH) lamp".

3.45 Add, "(Repeat coil in" test only when arranged to test toll diversion offices".

Add paragraphs 3.51 and 5.55 which read:-

3.51 Provision is made to test districts in toll diversion and non-toll diversion offices.

5.55 The (TD) key is used to provide for operate soak test, and to advance district out of "awaiting operator's position" when non-toll diversion and toll diversion offices are tested by one test circuit.

Change paragraphs 20 and 21 to read:-

20. TEST FOR LINE CLOSURE

With the (R1) switch in position 11, the sender makes district brush and group selections. The first two sleeve terminals in the selected group are grounded, by the operation of the (GS) relay which operates in position 11, so that the third terminal in the group is selected. (With "E" wiring the sender is held by the 100 ohm resistances connected to the "A" and "B" leads). With "K" wiring the operation of the (GS) relay opens the circuit to the "A" and "B" leads and circuit is closed through the (O1) cam and resistances (X) and (Y) to hold the sender in order to place an operate test on the (DC) relay when the sender is released. The district bank terminal is connected to cams (R1), (Q1) and (P1). When the fundamental circuit is closed for trunk test the (TC) relay operates. The (TC) relay operated, operates the (TC-2) relay which locks in series with the (TC-1) relay. When the sender advances to make talking selection the (TC) relay releases allowing the (TC1) relay to operate in series with the (TC2) relay. When Fig. E is used and circuit is arranged to test non-toll diversion offices, the (TC1) relay operated grounds the "S" lead making the trunk terminal busy, and closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12. When Fig. E is used and circuit is arranged to test toll diversion offices, the operation of the (TC1) relay, closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12. When talking selection is completed and trunk closure is made the (TC) relay reoperates. With the (TC) and (TC1) relays reoperated, the (R1) switch advances to position 12. When Fig. F is used and circuit is arranged to test non-toll diversion offices, the (TC1) relay operated closes the advancing circuit of (R1) switch so that the next operation of the (TC) relay will advance the (R1) switch to position 12.

When Fig. F is used and circuit is arranged to test toll diversion offices, with the (TC1) relay operated, the (R1) switch is advanced to position 12, without awaiting for a second closure of the (TC) relay by operating the (SK3) relay which in turn advances the switch, and connects the number 3 and 4 brushes of the (P1) cam together and to ground to hold ground on the sleeve of the district selector. When the switch advances from position 11, the ground to the sleeve lead of the test line is transferred from the make contact of the (TC1) relay to the break contact of the (RO) relay, and the (TC), (TC1), (TC2) and (GS) relays release.

When Figure F is used and circuit is arranged to test non-toll diversion offices ground is not connected to the trunk sleeve until the district is advanced from the await operator position in a "repeat coil out" test. The ground from the operation of the (TC1) relay in R1 position 11 is disconnected and in R1 position 12 the operation of the (PSK) relay to close the trunk is delayed until the (SK), (SK1), and (SK3) relays have operated. The operation of the (SK3) relay connects ground to the sleeve and also operates relay (PSK). If the talk selection cam closures in the district are defective the absence of sleeve ground grom the testing circuit will result in wrong talk selection.

21. TEST OF DISTRICT IN "CUT THRU" POSITION K WIRING

With the switch in position 12, when the "B" contact of the interrupter closes, the (SK) relay operates and locks. When the "F" contact of the interrupter makes, the (SK1) relay operates and locks. On the next make of the "B" contact, the (SK2) relay operates and (R1) switch advances to position 13, the (A) cam carrying it to position 14. The (SK) relays release as the (R1) switch leaves position 12. When Fig. E or F is used and circuit is arranged to test non-toll diversion offices, and with Fig. E the PSK relay operates immediately when sw. reaches pos. 12 but when Fig. F is used the (PSK) relay awaits the operation of (SK3) relay. (PSK) relay operates from ground on cam (N1) and battery on the (SR2) relay, (Fig. E) when Fig. F is used it also goes through contacts of (SK3) relay. The (PSK) relay, operated, connects battery and ground through the (SK) resistance to the tip and ring sides of the test line to operate the (CS) relay in the district circuit. The polarized (CS) relay in the district circuit operates and advances the district to the "Talking to Operator" position, when the switch leaves position 12, the (PSK) relay releases. (Where circuit is arranged to test toll diversion office and Fig. E or F is provided the circuit to one side of the winding of the (PSK) relay is opened to prevent closing battery and ground through the resistance to the (CS) relay in the district to check that the district advances to "Talking to Operator" position). Where both non-toll diversion and toll diversion offices are tested with one test ckt. (TD) key is used and the circuit is arranged for toll diversion. When the (TD) key is operated the (PSK) relay is operated in pos. 12 and the circuit functions same as for non-toll diversion. In position 14, the (CS) relay in the test circuit operates, through the (PSK) and (BB) relays normal, over the ring side of the district selector circuit through the master switches and (TR) relay, with the (R1) switch in pos. 14 the (SR) relay is operated, the (SR) relay prepares the operating circuit for the (SR2) and (SR3) relay, when the (R1) switch reaches pos. 18, with "E" wiring and apparatus, cams (M1) and (O1), contacts of the (REL) relay, (Y) resistance (20 ohms), cams (K1) and (K3) to ground. With "K" wiring and apparatus cam (O1), contacts of (SK1) and (REL) relay, (Y) resistance (100 ohms) cams (K1) and (K3) to ground. The (CS) relay operated, operates the (I) relay, over the tip side of the line, thru the interrupter contacts. The (I) relay locks through its make contact and operates the (RO) relay, when the "IV" contacts of the interrupter make. When "K" wiring is used and test line is on the district frame the (SL) relay is connected to the sleeve in place of ground and must operate from ground through the back contact of (L) relay in district before district sequence switch advances out of position 16. The operation of (RO) relay opens the sleeve circuit through cam (P) allowing the district to advance from its "Talking to Operator" position which releases the (CS) relay in the test circuit. The (CS) relay released, releases the (I) relay. The (RO) relay operated and the (I) relay released advances the (R1) switch to position 15. If the district circuit has failed to advance to the "Talking to Operator" position, the (CS), (I) and (RO) relays fail to operate and block the (R1) switch in position 14.

24. To the sentence ending on line 13 add the following:- "except that when Fig. F is used and circuit is arranged for toll diversion the (R1) switch awaits the second operation of the (TC) relay, after talking selection before moving out of position 11".

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METHOD OF OPERATION
Panel System - Automatic Test Of - Subscriber's District Selectors - Line Finder Type

20. On line 8 change "(D1) cam" to ("01) cam". Add the following to the paragraph:- "When toll diversion is used and figures F and T are provided the (SK 3) relay is operated from the (TC 1) relay opening one side of the (PSK) relay, closes a circuit from ground on a back contact of the (SR) relay to SS3D1 moving the (R1) switch out of 11 and connects the number 3 and 4 brushes of the P1 cam together and to ground to hold ground on the sleeve of the district selector."

21. On line 14 add the following sentence:- "Where toll diversion is used and figure E or F is provided the circuit to one side of the winding of the (PSK) relay is opened to prevent closing battery and ground thru the resistance to the (CS) relay in the district to check that the district advances to "Talking To Operator" position."

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THIS METHOD OF OPERATION WAS PREPARED FROM ISSUE 35 OF DRAWING ES-239515

METHOD OF OPERATION

Panel System - Automatic Test of - Subscriber's District Selectors - Line Finder Type

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is designed to test all classes of sender selector type district selectors in a line finder office. When the (ST) key is operated on the test frame the testing circuit is associated with a district selector by means of series of 200 type selectors. At this time the test circuit establishes three connections; one to the individual leads of the district selector "LF", "B" and "DB" one to the test line at the frame where this selector is located; and one to the start circuit that is associated with the selector to be tested "MZ", "M2", "Z", "T", "R" and "S". If the district selector is idle the test circuit first makes it busy. When the associated start circuit is clear the line finder elevator is caused to hunt for the test line. This line is located on the bottom terminal of the lowest bank on the frame.

1.2 During the interval that the elevator is between the normal position and the tripping zone the start circuit is blocked to prevent an incoming call from interfering with the test call. As soon as the "K" segment is passed or the test line is found the start circuit is cleared. The district elevator is caused to hunt for the test line on the district frame or trunk line to office causing office selector to hunt for the test line when test line is located on office frame.

1.3 With the connections thus established test conditions are imposed on, the various elements of the line finder and district selector. Should the elements fail to meet a test imposed, the test circuit will block indicating by means of lamp and audible signals that trouble has been encountered. Should the test imposed fail to uncover trouble, the line finder district elevators are permitted to restore to a normal position.

1.4 The same district selector and line finder will be directed to the test line for each test imposed, with the (RCO), (RCI) key normal two tests are made for all types of district selector circuits except two-party, and three tests are made for two-party M.R. district selector circuits. When the two or three tests are completed, testing circuit will be directed to the next district circuit. With the (RCO) key operated the repeating coil out test only will be made on all district selectors. With the (RCI) key operated the repeating coil in test only will be made. On two party district selectors 2 tests will be made.

1.5 The testing circuit by means of the 200 type selectors will be directed to one district selector after another until all district selectors have been tested, after which a signal will be given at the test frame, indicating that a complete test has been made on all units in the office associated with this test circuit.

1.6 As shown by Figures 3 and 4, this circuit has been designed so that two district test circuits may be employed in the one office and work to the same group in the district or office multiple. This is done by associating each test circuit with the particular test line of the group. By means of a particular circuit feature, any particular line finder and district selector may be associated with the test circuit. A repeat test feature is provided so that as many tests can be made on any one unit as is desired.

2. WORKING LIMITS

2.1 This circuit is designed to operate when the central office battery voltage is between 24 and 25 for the 24 volt battery and 48.5 to 50 volts for the 48 volt battery.

OPERATING

3. PRINCIPAL FUNCTIONS

3.01 This circuit will automatically test all of the line finder and district selector circuits in the office, thereby insuring normal functioning under the worst circuit conditions in service.

3.02 This circuit will dial any one, two or three digit code (see wiring at cam G of (R-1) switch) that has been predetermined by flexible connections at the dial pulse sequence switch (R-2).

3.03 A test is made for sender closure through trunk guard relay in sender.((TC) relay involved.)

3.04 A test is made for closure through (CS) relay in district. ((TC) relay involved.)

3.05 A soak circuit is applied to (CS) (polarized) relay of district. (In pos. 15 of test circuit under control of timing relays (SK), (SK-1) and (SK-2).

3.06 An 83 ohm soak circuit is applied to (CS) (polarized) relay in district in direction to operate the polarized relay. (In pos. 12 under control of (PSK) relay.)

3.07 Test of the cut-through position of the district selector. (Made in pos. 14 with (CS) relay in test circuit over the Tip & Ring to ground. Timing relays (I) and (RO) involved).

3.08 Test for sleeve make busy ground thru (L) relay back contact in cut-through position, when test line is on district frame. (Test circuit (SL) relay involved.)

3.09 Tests advance of district out of cut-through positions.

3.10 Applies release test of (DC) relay of district and check for (DC) relay release. (REL-1) relay operates to 48 volts in line circuit.

3.11 Test for open circuit release of (CS) (polarized) relay of district after soak. ("Sticky" (CS) relay will cause revolving District Seq. Switch in which case the (FR-3) relay will hold and (SCS) lamp will light.)

3.12 Holds district busy during period of test for release of (CS) (polarized) relay of district. (FR) and (FR-1) relays involved.)

3.13 Tests for normal of district after test. (By release of (FR-3) relay.)

3.14 Makes operate test of (CS) relay in district after reverse soak. ((CS) relay and resistances in test circuit used. Timing relays (I), (O), (RO), and (SO) involved in pos. 14).

3.15 Makes operate test of (DC) relay.

3.16 Makes busy back test (CS) release with condensers in circuit, and checks for no charge, with (FCH) key operated. ((BB), (BB1), (INT), (DR), (MX), (FCH-1) relays and (FCH) lamp involved.)

3.17 For two-party circuits only, make a test to see that no charge is made while a ground is held on tip, with (FCH) key operated. ((PT), (FC), (FC-1), (INT), (MX) relays involved.)

3.18 Check against early false registration. ((MR-7), (MR-8), (MX-1), (FCH-1) relays and (FCH) lamp involved.)

3.19 Test for polarity of coin current. ((CN) and (CR) relays in test circuit involved.)

3.20 Test for potential of message register current, ((R) and (BX) relays involved.)

3.21 Test for registration on tip or ring party. ((R), (WD), (WD-1), and (WD-2) relays involved.)

3.22 Test for trunk make busy ground through switch cam and for talk selection ground.

3.23 The test circuit is arranged to select and test any line finder and District Selector by use of a particular circuit feature. ((PC), (ST), (STP) keys, Dial; (SS), (SS-1) and (PUL) relays involved.)

3.24 The test circuit is arranged to indicate the position of the Master, Group, Connector and Class selectors by means of lamps which are lighted under control of the (LP) lamp key. (The particular District to which the test circuit is connected is indicated by the use of a translating chart.)

3.25 The test circuit will indicate by lamps the class of test in progress. ((T-1), (T-2) or (T-3) lamps involved.)

3.26 The test circuit is arranged to distinguish between busy and idle selectors and to wait for a selector to become idle, after which it will proceed with the test. ((DB) and (IDL) relays involved.)

3.27 A pass busy key is provided to cause the testing circuit to pass district selectors at the time it is testing for busy. This pass busy key will cause circuit to advance by the district leaving a meter record. (PB) key; (DB-1) relay and (BSY register involved.)

3.28 The test circuit will give an alarm when trouble is encountered. An alarm will also be given after a suitable interval in the event that a selector remains busy for too long an interval when the test circuit is waiting to seize it. This will be with the pass busy key in a normal position.

3.29 Registers are provided to record the various conditions that a test circuit has encountered and to dedicate the performance of the test circuit ((ST), (CT), (BSY) and (TEL) meters involved.)

3.30 The test circuit may be returned to normal at any time by the operation of the (RN) key.

3.31 The circuit provides a "control advance (CA)" feature which when used with repeat keys, permits restoring test switch to normal, or without repeat key operated will allow circuit to advance. This (CA) key will restore circuit at any time.

3.32 The test circuit has a remote control feature to enable test man to repeat tests from the line finder and district frames (by using 32-A test set.) This feature is only operative with a (REP) key operated. (The (RC) relay in test circuit is used with this feature.

3.33 The test circuit gives a tone to notify sender monitor if sender is stuck during time test circuit is making use of it.

3.34 The test circuit employs a synchronizing scheme for keeping the master switches or the group switches in step. (The "A" arcs of A & B selectors are involved.)

3.35 When the line finder under test oversteps the test terminal, an (OS) lamp will light to indicate this condition. ((OS), (OS-1), (OS-2), (OS-3) and (OS-4) relays and (OS) lamp involved.)

3.36 When the line finder under test fails to pass the tripping zone in the time allowed, the (NLF) lamp will light to indicate this condition. ((NLF), (NLF-1), (NLF-2), (NLF-3) and (NLF-4) relays and (NLF) lamp involved.)

3.37 The test circuit is arranged to block if the dial path circuit over "T" and "R" leads to sender is open ((PC) relay does not operate and holds test switch in pos. 7 with (TEL) lamp lighted.)

3.38 The test circuit will detect a cross of the "Tip" and "Hunt" leads on any line finder circuit. (Test switch blocks in pos. 14 with (FR) lamp lighted.)

3.39 The test circuit will check that district will charge on a charge call, detects false charge under all other conditions. ((R), (WD), (WD-1), (WD-2), & (FCH) relays and (CDH) lamp involved.)

3.40 The test circuit will detect a reversal of "T" & "R" lead to sender. ((LC-1) relay contacts involved.)

3.41 Provides a check for brush contact of the district selector, the (BC) lamp indicates failure. (WD), (BT), (ADV), (BC), (FR1) relays, MC selector involved.

3.42 The test circuit will make repeat tests on either of the three tests. ((REP-1) key and (REP) relay - (REP-2) or (REP-3) keys involved.

3.43 The test circuit will make single test or multi tests depending on whether (RCO) or (RCI) key is operated or whether both keys are normal.

3.44 The closed circuit release test is provided for the 206L (CS) relay (SK3 relay).

3.45 The ground connected to the sleeve cam during talk selection is checked.

3.46 The delay and advance of the district when equipped for automatic release is checked.

3.47 Provide jacks for connecting a transmission measuring set.

3.48 A timing test is made of the message register pulse.

3.49 An arrangement is provided for testing district circuits arranged to function over 750 ohms and 1500 ohms.

3.50 An arrangement is provided for testing district selector circuits associated with two class of service in the same subscribers line group.

4. CONNECTING CIRCUITS

4.1 District Selector and Line Finder Circuit - All classes of sender selector type district selectors can be tested by the circuit.

4.2 District Selector Test Line - This is the line to which the district selector being tested is directed by the test circuit under control of a service sender.

4.3 Start Circuit - This circuit is connected to the test circuit so that line finder elevator can be directed to the test line without interfering with service.

4.4 Line Finder Test Line - This is the line to which the line finder elevator is directed. The bottom terminals on the bottom bank of each line finder frame is used for testing purposes. Both the terminals and the line and cut-off relay of this line in the (A) sub-group are employed as shown on the standard line circuit, the proper hunting condition being placed on the terminal of the frame only when a selector on that frame is being directed to the test line.

4.5 Sender - Any service sender associated with a particular group of districts may be used the same as in service to direct the district selector to the test line.

DESCRIPTION OF OPERATION

5. APPARATUS AND FUNCTIONS

5.1 Selectors and Switches

5.11 Connector Stepper - One of these stepping switches is used for each 20 or less district selectors that are to be tested. This switch serves to connect the individual leads (LF), (B) and (DB) for controlling the line finder and district selector, also the particular "Z" lead which connects the start circuit.

5.12 Group Connector Stepper - Two 200 type selectors which are designated (GA) and (GB), serve to associate the test circuit with a connector stepper, and to the start circuit of the frame being served by the district selectors reached by the connector stepper. A synchronizing arrangement is employed to keep these steppers in step.

5.13 Master Stepper - Two 200 type selectors designated (MA) and (MB) serve the proper set of group connectors. The master steppers permit the use of 20 group connectors.

5.14 Test Sequence Switch B141 - This sequence switch serves to control the 200 type selectors that connect the test circuit to the circuit to be tested. It makes the busy test and advances the district selector leads of the unit being tested. It makes one revolution for each test imposed.

5.15 Class Sequence Switch - This sequence switch controls the various tests imposed for the various classes of calls that tests are made for on each district selector. The testing of this switch is controlled by relays operated from the first terminal of the connector switches by means of a cross-connecting method.

5.2 Lamps

5.21 Progress Lamps - The connector (N to 20) group (G1ON) to (G170N) and master (MON) lamps indicate the district selector to which the test circuit is attached.

5.22 Busy Lamp (BLF) - When lighted indicates that the district is busy.

5.23 Busy Lamp (BY) - Indicates district selector is busy for more than time allowed.

5.24 No Line Finder (NLF) - This lamp is a trouble lamp and indicates that the line finder selector will not pass the tripping zone.

5.25 Trouble Lamp (TBL) - This lamp is part of the alarm circuit and will light in series with miscellaneous alarm.

5.26 Overstep Lamp (OS) - This lamp indicates that the line finder has overstepped or that the sleeve of the line finder is open.

5.27 False Return Lamp (FR) - This lamp when lighted indicates the false return of district.

5.28 Double Charge Lamp (DCH) - This is a trouble lamp which lights when a double charge is encountered.

5.29 False Charge Lamp (FCH) - This is a trouble lamp which lights under the following conditions:

a - false charge is first test, switch blocks in pos. 15.

b - false charge is second test, before regular charge sw. blocks in 17.

c - false charge in second test with (FCH) key operated either before or during regular charge.

d - false charge in third test before regular charge.

e - In third test false charge in regular charge position of ring pty.

f - In third test with (FCH) key operated false advance of district.

5.30 Stuck (CS) Relay (SCS) - This lamp is a trouble lamp and indicates that the (CS) relay of district has failed to release.

5.31 1st, 2nd & 3rd Test Lamps - These lamps are test indicating lamps and indicates the particular test in progress.

5.32 End of Cycle (EC) - This lamp indicates the last districts to be tested in one cycle.

5.33 Group Off Normal (GON) - This is a trouble lamp and lights when more than one group switch is off normal at the same time.

5.34 Class Lamps MR, FL & CC - These lamps are Class Indicating Lamps and indicate the class of district under test.

5.35 Brush Continuity Lamp indicates a failure of the fundamental to close.

5.4 Keys

5.41 Start Key (ST) - The operation of this key starts the automatic test which continues until all district selector circuits have been tested. The release of the start key at any time will restore the test and class switches to normal.

5.42 False Charge Key (FCH) - The operation of this key changes the operation of the second test so as to indicate a false charge during a busy back condition and in the third test to simulate a block condition with a ground on tip of line.

5.43 Return to Normal Key (RN) - The operation of this key, causes the return to normal of the entire circuit, including connector steppers.

5.44 Pass Busy Key (PB) - The operation of this key causes the connector to recognize a busy condition and pass on to the next district.

5.45 Control Advance Key (CA) - This key is operated when the test circuit fails to complete its cycle due to a fault in the circuit under test. The operation and release of the key causes the test switch to advance to position 18. The connector stepper advances to the next district. When the

(REP) key is operated the connector sequence switch will not cause stepper to step to next district but will repeat the same test.

5.46 Time Alarm Key (TA) – The operation of this key causes the release of the trouble or busy alarm. As long as the key remains operated the alarm is out of service and the test circuit will block before making another test, except when the repeat key is operated. The operating of this key will not interfere with the particular circuit feature.

5.47 Repeat Keys (REP1), (REP2) and (REP3) – The operation of any of these keys causes the test circuit to repeat that test as long as the key remains operated. The operation of either repeat key in combination with the (CA) key will cause the test circuit to repeat the test in progress. The (PB) key must be released with above keys operated before (CA) key will function.

5.48 Particular Circuit Key (PC) – The operation of this key arranges the circuit in such a way as to dial master group and connector stepper switches to the particular district desired.

5.49 Step Key (STP) – This key is operated after dialing master stepper to some particular terminal in order to advance the test sequence switch for group dialing and the key is operated after group and connector dialing to advance the test sequence switch the same as after master dialing. It will be necessary to dial twice in order to reach more than 10 terminals in group and connector selectors before operating (STP) key. (PC) key is always operated in connection with (STP) key.

5.50 Lamp Key (LP) – This key is operated to complete the circuit of all progress lamps which will indicate the position of the master, group and connector switches.

5.51 Brush Continuity Key (BC) – This key provides a circuit for checking the fundamental closure thru the multiple brushes, etc.

5.52 "Repeating Coil Out" (RCO) or "Repeating Coil In" (RCI) Keys – These keys arrange circuit for single tests of above features and will permit a multi-test with both keys normal.

5.53 The (1), (2) and (3) keys are used for control of dialing and checking when "two classes of service" are tested.

5.54 The (DR) key is used to check the called subscribers release feature of the district sets.

5.6 Jacks and Dials

5.61 Remote Control Jack (CA) – The purpose of this jack in connection with the 32A test set is to make it possible for a man to watch the functioning of the selector under test at the time the (REP) key is operated. It controls the (CA) feature.

5.62 2EA or 4EA Dial – This dial associated with (PUL) relay is used to advance the 200 type selectors to the particular district selector desired. The (PC) and (STP) keys are used to connect this dial to a particular district.

5.63 T-R Jacks for listening on the calling loop during the test.

5.64 R-S Jacks for connecting the transmission measuring set.

5.7 Relays

5.71 (R) Relay -- This relay is used to check the potention of registration current. The secondary winding is connected in series with a 1000 ohm resistance to battery in order to give a margin between the operation on 117 ohm battery (3 resistances in series) and the higher resistances due to one or more of these resistances being open.

5.72 (BX) Relay – This relay is connected in parallel with the (R) relay described in above, in order to detect a battery cross on the message register leads resulting in blowing the fuse of district and leaving the (BX) relay locked, blocking test circuit in position 17.

5.73 (MR7) Relay – The function of this relay is to connect the ring party message register lead to the (MX1) relay at other times than when circuit expects message register current. If (MX1) relay operates, it will operate the (FCH1) relay and block the test circuit in position 17.

5.74 (MR8) Relay – The function of this relay is to connect the tip party message register lead to the (MX1) relay at other times than the test circuit expects message register current. If (MX1) relay operates it will operate the (FCH1) relay and block the test circuit in position 17.

5.75 (SL) Relay - The function of the relay is to test the trunk make busy ground from sleeve of district, and from back contact of "L" relay when the test line is on the district frame.

5.76 18-BH Resistance in Series with Tone Condenser - The function of this resistance is to prevent the (PC) relay from operating momentarily, which will render the overstep feature ineffective by unlocking the (OS) and (OS1) relays at the time the (OS3) relay operates (TR) relay.

5.77 18-AM Resistance (Z) - The function of this resistance is to prevent the (REL-1) relay from receiving the "inductive kick" of the repeating coil at the time release test is applied. The (REL) relay being marginal, is not switched into the circuit until after this "inductive kick" has been dissipated.

OPERATION

6. START TEST

The oper tion of the (ST) key closes four circuits as follows:

6.1 Closes a circuit which operates (BY) relay to start the busy time alarm

6.2 Closes a lead from miscellaneous tone circuit through (TT) condenser to the "T" lead through district to sender.

6.3 Closes circuit to advance test sequence switch to position 2 from ground through (CA) key, ("E" wiring) or (RC) relay, ("K" wiring) start key contact (GON1) relay, (FR) relay, ("E" wiring) or direct to ("K" wiring) (B1) cam to (R) magnet.

6.4 Closes local circuit to operate (ST) relay.

7. STEPS MASTER SELECTOR

In position 2 the (SM) and (STP2) relays operate from ground to contact of (SS1) relay, (PLFS) relay normal, (PMG) relay normal, (PM) relay normal (I1) and (J1) cams secondary winding of (STP2) relay, (STP) arc (MA) selector contact of (EC) relay (STP) arc (MB) selector, winding of (SM) relay to battery.

7.1 The operation of the (SM) relay closes a circuit from the battery through the stepping magnet, contacts of (SM) relay, (U1) cam, contact of (SPT1) relay, contacts of (EC1) relay, (PC) key normal (REP1), (REP2) and (REP3) keys, ("K" wiring or contacts of (REP) relay, ("E" wiring) (CA) key normal, ("E" wiring) or (RC) relay, ("K" wiring) contacts of (FR) relay, ("E" wiring) or direct ("K" wiring) through contacts of (MR1) relay normal (FL) relay normal, (CC) relay normal, (MR2) relay normal, (Q1) cam to ground. This same ground is closed in parallel from the (U1) cam through contacts of (STP2) relay, primary and secondary windings of (STP) relay to battery, shunted by the ground circuit through the contact of stepper, contact (SM) relay, (T1) cam to middle tap at (STP) relay. The operation of the (SM) relay in position 2 also operates the (MON) relay which lights the (MON) lamp, with the lamp key operated.

7.2 The operation of the master stopped magnet opens contact, removing shunt from (STP) relay which allows the (STP) relay to operate. Operation of the (STP) relay closes a ground circuit through (L3) and (K3) cams, contacts of (SLFT) relay normal, (PC) key normal, contact of (SPT) relay normal contact of (STP) relay operated, contact of (DTS) relay normal through SSE-B1 cam to (R) magnet. This circuit advances the test switch to position 3.

8. STEPS GROUP SELECTOR

In position 3, the (SM) relay releases, but the (MON) relay holds through the (CO) arc and primary winding of (G1ON) relay which operates. The (G1ON) relay operated, connects battery to the (G1ON) lamp and the (GON) relay. The battery to the (GON) relay is connected through 18 type resistances, 18-BW and 18-AP, contacts of (G1ON) operated, (GON1) relay normal winding of (GON) relay. (RN) key normal to ground. The (GON) relay does not receive enough current to operate with one group selector off normal but will operate if more than one group selector is off normal. The (SG1) and (STP2) relays operate in position 3, with (SG1) relay operated (G1A) and (G1B) magnets operate in parallel to ground on cam (Q1). With the (SG1) relay operated a short circuit is closed for the (STP) relay through the back contact of the (G1A) and (G1B) magnets. When the (G1A) and (G1B) magnets operate the short circuit is removed and the (STP) relay operates advancing the switch to position 4.

9. STEP LINE FINDER SELECTOR

As the switch leaves position 3, the (STP), (STP2) and (SG1) relays and the (G1A) and (G1B) magnets release. The selectors step to the first terminal. With the group selector on the first terminal the (LF1) and (RTS) relays operate in series through the secondary winding of the (G1ON) relay and the (CO) brush. When the (RTS) relay operates, it operates the (PM) relay in a local circuit. The (SLF1) relay and (STP1) relay operate in series, battery through the (SLF1) relay, (P) arc (C1B) selector, primary winding on (STP1) relay, (J1) (I1) cams, (PMG) relay normal, (PLFS) relay normal and (SS1) relay normal to ground. Ground on the cam (Q1) through the (SLF1) relay operated, operates the (LF1) magnet. When the (LF1) magnet operates and the contacts break, the (STP) relay operates, advancing the (R1) switch to position 5. The operation of the (LF-1) relay lights the associated lamp, if the lamp key is operated, indicating that the first line finder connector has been associated with the group switch which is off normal. As the switch leaves position 4, the (STP), (STP1) and (SLF1) relays and the (LF1) magnet release; releasing the (LF1) magnet steps the brushes to terminal 1.

10. SETTING OF CLASS CIRCUIT AND STEP LINE FINDER SELECTOR

The (CL) relay operates in position 5, through cam (V1) (B) arc (CL) stepper, contacts of (SR1) relay normal, and (M3) cam to ground, the same ground through the (B) brush and normal terminal of the (B) arc (V) cam, (MB) and (G1B) and (LF1) selectors over leads, "A", "B", "C" or "D" contact of the (CL) relay and winding of the proper class relay and winding of the (N) relay to battery through (BAT) arc (CL) stepper operates the proper class relay and the (N) relay in series. The operation of the (N) relay opens the "RN" lead to the class selector stepper, preventing the class stepper from being returned to normal prematurely. The operated class relay locks to ground on the (RN) key; the class relay operated closes a circuit to ground through the break contact of (DB) and (DB1) relays and (G1) and (F1) cams and contacts of the proper class relay advancing the (R3) sequence switch to position 2, 5, or 8, depending upon which class relay is operated. The (DTS) relay operates in parallel with the (R3) magnet, thus preventing the (R1) switch from moving out of position 5. When the (R3) switch is set the (DTS) relay releases. As the (R1) switch entered position 5 the (SLF1) and (STP1) relay operated. With the (SLF1) relay operated and the (DTS) relay normal, the (LF1) magnet operates through the contacts of the particular class relay, closing path for the (LF1) selector from ground to (DB) and (DB1) relays normal, (G1) cam, (DTS) relay normal. (Q3) cam, contact of some class relay operated, (FR) relay or direct depending upon whether "E" or "K" wiring is used, contact of (RC) relay, or (CA) key depending upon whether "K" or "E" wiring is used, contact (REP) relay or (REP1) (REP2) and (REP3) keys, depending upon whether "E" or "K" wiring is used, contact of (PC) key normal, contact of (EC1) relay (SPT1) relay to (U1) cam and contacts of (SLF1) relay to magnet of (LF1) selector. When the selector contact breaks the (STP) relay operates, advancing the (R1) switch to position 6. In position 2, 5 or 8 of the (R3 switch (first test) a lamp is lighted if the lamp key is operated. With "AK" wiring the (EC) relay operates when the class switch (R3) goes off normal and locks to ground through normal contacts of (RN) key until the master selector returns to normal where the (EC1) relay is operated, lighting the (EC) lamp and blocking the circuit until the (EC) key is operated. The operating circuit for the (EC) relay is through S54L3 cam to ground. With "AH" wiring (EC) relay operated with the test sw. in pos. 7, see paragraph 14. As the (R1) switch advances from position 5, the (LF1) magnet releases, moving the brushes to terminal 2. Terminals 2 to 21 inclusive, (B) arc, (LF1) selector are grounded to operate the (PMG) relay. In position 6, the (SLF1), (STP), (STP1) and (CL) relays release.

11. SPARE LINE FINDER TERMINAL

The spare stepper terminals on the (Z) arc of the line finder connector are connected to lead "I". When the (Z) brushes make contact with the spare terminals, the (SLFT) relay operates and locks to ground on cam (N1). The operation of the (SLFT) relay operates the (DB), (DB1) and (TR) relays and advances the test switch to position 18. The (DB) relay lights the (BLF) lamp. In position 18, the (STP1) and (SLF1) relays operate in series to ground on cam (J1) and the (SLF1) relay. This closes a path to operate the (LF1) magnet as described in above paragraph. When the (LF1) magnet operates the (STP) relay operates advancing the test switch to pos. 1. As the switch leaves position 18, the (SLF1), (STP) and (STP1) relays release. The (ST) key operated, advances the (R1) switch to position 2. The (PMG) relay operated, or the (LDC) relay operated in turn operating the (PMG) relay which advances the switch to position 6. The next terminal is then tested for spare, busy or idle conditions. The (IDC) relay is used when district circuits arranged to test 1500 ohm subscribers loops are tested by this circuit.

12. STEP LOCATING (CL) SELECTOR

With the test switch in pos. 5 and the class switch in position 2 and the (DTS) relay normal the (LS) selector is stepped one point.

The circuit is from ground through (Y1) cam (REP1) key (With "E" wiring) or (REP) relay ("K" wiring) (PC) key normal (DTS) relay normal (E3) cam positions 2, 5 or 8 to magnet of (CL) stepper.

13. BUSY LINE FINDER

When the line finder under test is busy, ground is connected to the (DB) lead, operating the (DB) relay as the (R1) switch advances to position 6. With the (DB) relay operated, the circuit through the (IDL) relay is opened, preventing its operation and the advancement of the (R1) switch from position 6. The operation of the (DB) relay also operates the (DB1) and (TR) relays and lights the (BLF) lamp. The (TR) relay operated opens the tip, ring and sleeve leads. The (DB1) relay performs no useful function at this time. The test circuit remains in position 6 until the busy condition is removed from the line finder or until the time alarm operates.

14. IDLE LINE FINDER – START CIRCUIT OPERATION

When a line finder circuit is idle, ground is not connected to the (DB) lead and the (DB) relay remains normal. The (IDL) relay operates to battery on cam (X1) in pos. 6. The (IDL) relay operated, connects ground to the (DB) lead making the district busy, advances the (R1) switch to position 7, operates the (ST) meter and (CT) relay. When the (RCI) key is operated the operation of the (ST) meter operates (SR) relay. The (SR) relay closes circuit for advancing class (R3) seq. sw. to pos. 3, 6, 9. When the class switch (R3) reaches positions 3, 6, 9 the (SR2) and (SR3) relays operate in series arranging the circuit to make "Repeating Coil In" tests only. The (CT) relay operated, operates the (CT) meter. Ground from the (DB) relays normal, through cams (G) and (F), (TR) relay contacts, (S) brush of the master selector and lead "S" operates the (A) relay in the start circuit when the start circuit is idle. In the following description "LFD" refers to the line finder circuits. The (A) start relay operated, operates the (B) start relay. The (B) start relay operated, operates the (C) start relay and (C1) start relay and closes the ring side of line circuit operating the (LC) and (LC1) relays and line (L) relays. The (LC) relay operated disconnects the busy ground from (DB) lead. The line (L) relay operated, operates the (BA) trip relay. The line (L) and (BA) relays operated connect battery to the (H) lead. The (BA) and (C1) start relays operated, operate the (TR) trip relay. The (TR) relay operated operates the (ST-A) start relay through the (C) start relay operated. The (ST-A) start relay operated, operates the (D) start relay and connects ground to lead (Z) to the test circuit through the (C) start relay operated. With the (LC) relay operated, ground on the (Z) lead is connected to the (LF) lead operating the (LF) "LFD" relay. From this point on the trip, start, line finder and district selector circuits function as for a regular call hunting the test line and an idle sender and releasing the trip and start circuits. When the (ST-A) start relay releases, the (E) start relay operates. The (E) relay operated, releases, the (C) and (C1) relays. The (B), (D) and (E) start relays are locked under control of the (A) start relay which remains operated until the (R1) advances to position 18 or the (TR) relay operates. When the test line and an idle sender are found, battery and ground are connected to the ring and tip leads operating the (PC) relay. The (PC) relay operated, advances the (R1) switch to position 8. With "H" or "G" wiring (EC) relay operates with the test switch in position 7 and locks to the (RN) key, until the master selectors return to normal, when the (EC1) relay is operated. With "AK" wiring the (EC) relay operates when the class switch (R3) goes off normal. See paragraph 10.

15. TESTS FOR NON-START OF LINE FINDER

While in position 7, ground is connected to the (Z) lead from the start circuit operating the (NLF) relay and the (LF) relay in the line finder. With "H" or "G" wiring the operating circuit of the (NLF) relay is through the normal contact of (NLF1) relay and SS3T1 cam. With "AK" wiring the operating circuit of the (NLF) relay is through normal contact of (NLF1) relay, operated contact of (LC) relay and SS3T1 cam, this circuit is closed by the operation of the (LC) relay to avoid a false battery connection to the "H" lead, thereby preventing the blocking of service line finders. If the operation of the (LF) relay fails to start the up-drive, the circuit functions as follows:- The first closure of the interrupter contacts, operates the (NLF-2) relay. The (NLF-2) relay operated, locks in series with the (NLF-3) relay which operates when the interrupter contacts break. The (NLF-4) relay operates upon the next closure of the interrupter contacts. The (NLF-4) relay operated, locks to ground on the (DB) relay, operates the (TR) relay and lights the (NLF) lamp as an indication that the (LF) relay has failed to start the up-drive. The operation of the (TR) relay opens the tip, ring and sleeve leads from the start circuit, thus holding the test circuit in position 7. The circuit remains in this position as a trouble condition lighting the (NLF) lamp. If the operation of the (LF) relay starts the up-drive the (GA) relay in the start circuit operates and removes ground from the (Z) lead, thus removing the short circuit from the (NLF-1) relay, which operates in series with the (NLF) relay to ground on the (DB) relays. The (NLF-1) relay operated, removes ground from the interrupter contacts preventing the (NLF-2), (NLF-3) and (NLF-4) relays from operating and the test proceeds.

16. TEST FOR OVERSTEP OF LINE FINDER AND OPEN SLEEVE

In position 7, with the (LC) relays operated, when the elevator reaches the (M) segment, ground is connected to the (B) lead, operating the (OS) relay and in turn operates the (OS-2) relay, which prevents the operation of the (OS-3) relay. When the line finder relay (LF) releases, ground is removed from the (B) lead, removing the short circuit from the (OS-1) relay, which operates. The (OS-1) relay operated, releases the (OS-2) relay. With "E" wiring the release of the (OS-2) relay is very slow, sufficient time is allowed for the sender selector to hunt over 7 terminals and the test switch to be moved out of position 7 before the (OS-3) relay is operated. Should the line finder overstep, the tip and ring leads will not be connected through to the sender and the (PC) relay will not be operated, holding the (R1) switch in position 7 and the (OS3) relay operates. When "K" wiring is used the release of the (OS2) relay will operate the (OS4) and (OS3) relays if the (LC) relays remain operated with the (PC) relay normal indicating that the line finder has overstepped. The (OS-3) relay operated, lights the (OS) lamp indicating that the line finder has over-stepped and operates the (TR) relay. The (TR) relay opens the tip, ring and sleeve leads of the start circuit holding the test circuit in position 7 until the operation of the (CA) key to restore the circuit to normal. If the (CO) relay should fail to operate due to an open sleeve the (PC) relay would not operate and the (OS) lamp will light blocking the circuit in position 7 until (CA) key is operated.

17. DIALING OF THREE DIGIT CODE - FIG. A

When line finder finds the test terminal and the sender is connected to the test line the (PC) relay operates and advances switch to position 8. With the (R1) switch in position 8, ground on the (DB) relays normal advances the (R2) switch out of position 1, the (B) cam carrying one complete revolution. As the (R-1) switch is advancing out of position 7, the tip and ring of the test line are closed through to the 100 ohm resistance in the pulse circuit over leads (A) and (B) contact of (GS) relay and cam (E2) to hold the sender. As the (R2) switch rotates, the (E2) cam sends pulses to the sender until it reaches a position where leads (M1) and (J) shunts cam (E2) preventing further pulses from being sent. When the dial pulse sequence switch reaches position 16 1/2, the (CK1) relay operates and when in position 17 1/2, the (CK) relay operates and both relays lock to ground on the (DB) relays normal through cam (C1). The (CK1) relay operated prevents the (R2) switch from making a second revolution until the (R1) switch has advanced to position 9. When "K" wiring is used the (MR-7) and (MR-8) relays operate in positions 18 to 20 of the dialing sequence switch. The (MR-7) and (MR-8) relays will lock until test switch leaves position 17. The (MR-7) relay must operate before test switch will advance to position 9. The (MR-8) relay must operate before test switch will advance to position 10. The (CK) relay operated, advances the (R1) switch to position 9. When the (R1) switch leaves position 8, the (CK) and (CK1) relays release, advancing the (R2) switch out of position 1. The second digit of the three digit code is sent during the second revolution of the (R2) switch over leads (A) and (B) until shunted by the (M2) and (K) leads. As the (R2) enters position 16 1/2 on the second revolution, the (CK1) relay reoperates, performing the same function as just described and the (CK) relay operated, advances the (R1) switch to position 10. In position 10, the (CK) and (CK1) relays release. The third digit is sent during a third revolution of the (R2) switch in the same manner as described for the 1st and 2nd digits. The switch advances to position 11.

Fig. B - When used, the jack number in the 1st, 2nd or 3rd digit row in which the plug is inserted, determines the digits to be dialed for second position tests.

18. DIALING OF OTHER THAN THREE DIGIT CODE

When only one or two digits are required to satisfy the sender associated with the district selector circuit under test, the first digit is sent in position 8 in the same manner as the first digit of a three digit code. In position 9, ground on cam (G-1), advances the (R1) switch to position 10. The (R1) switch advances to position 11 by ground through cam (F1) using "W" wiring. When two digits are required to satisfy the sender, they are sent in position 8 and 9 as described for the three digit code. In position 10, it is advanced by using "W" wiring and ground on cam (F1).

19. MESSAGE REGISTER FALSE CHARGE

With "K" wiring the (MR7) & (MR8) relays operate in the dialing positions to connect the (M1) & (M2) leads to the (MX1) relay. If battery is connected to either charging lead at any time after the operation of the (MR7) or (MR8) relays, the (MX1) relay will operate operating the (FCH1) relay to block the test switch in positions 11 to 17 with the (FCH) lamp lighted. The (MR7) or (MR8) relay releases in pos. 16 to prepare the circuit for the correct charging current in position 17.

20. TESTS FOR LINE CLOSURE

With the (R1) switch in position 11, the sender makes district brush and group selections. The first two sleeve terminals in the selected group are grounded, by the operation of the (GS) relay which operates in position 11, so that the third terminal in the group is selected. With "E" wiring the sender is held by the 100 ohm resistances connected to the A and B leads. With "K" wiring the operation of the (GS) relay opens the circuit to the A and B leads and circuit is closed through the (D1) cam and resistances (X) and (Y) to hold the sender in order to place an operate test on the (DC) relay when the sender is released. The district bank terminal is connected to cams (R1), (Q1) and (P1). When the fundamental circuit is closed for trunk test the (TC) relay operates. The (TC) relay operated, operates the (TC-2) relay which locks in series with the (TC-1) relay. When the sender advances to make talking selection the (TC) relay releases allowing the (TC1) relay to operate in series with the (TC2) relay. The (TC1) relay operated, grounds the (S) lead making the trunk terminal busy. When talking selection is completed and trunk closure is made the (TC) relay reoperates. With the (TC) and (TC1) relays reoperated, the (R1) switch advances to position 12. When the switch advances from position 11, the ground to the sleeve lead of the test line is transferred from the make contact of the (TC1) relay to the break contact of the (RO) relay, and the (TC), (TC1), (TC2) and (GS) relays release.

When figure F is used ground is not connected to the trunk sleeve until the district is advanced from the await operator position in a "repeat coil out" test. The ground from the operation of the (TC1) relay in R1 position 11 is disconnected and in R1 position 12 the operation of the (PSK) relay to close the trunk is delayed until the (SK), (SK1), and (SK3) relays have operated. The operation of the (SK3) relay connects ground to the sleeve and also operates relay (PSK). If the talk selection cam closures in the district are defective the absence of sleeve ground from the testing circuit will result in wrong talk selection.

21. TEST OF DISTRICT IN "CUT THRU" POSITION K WIRING

With the switch in position 12, when the "B" contact of the interrupter closes, the (SK) relay operates and locks. When the "F" contact of the interrupter makes, the (SK1) relay operates and locks. On the next make of the "B" contact, the (SK2) relay operates and (R1) switch advances to position 13, the (A) cam carrying it to position 14. The (SK) relays release as the (R1) switch leaves position 12. While in position 12, the (PSK) relay operates from ground on cam (N1) and battery on the (SR2) relay. The (PSK) relay, operates, connects battery and ground through the (SK) resistance to the tip and ring sides of the test line to operate the (CS) relay in the district circuit. The polarized (CS) relay in the district circuit operates and advances the district to the "Talking to Operator" position. When the switch leaves position 12, the (PSK) relay releases and in position 14, the (CS) relay in the test circuit operates, through the (PSK) and (BB) relays normal, over the ring side of the district selector circuit through the master switches (TR) relay, with the (R1) switch in pos. 14 the (SR) relay is operated, the (SR) relay prepares the operating circuit for the (SR2) and (SR3) relay when the (R1) switch reaches pos. 18, with "E" wiring and apparatus, cams (M1) and (O1) contacts of the (REL) relay (Y) resistance (20 ohms), cams (K1) and (K3) to ground. With K wiring and apparatus cam (O1) contacts of (SK1) and (REL) relay (Y) resistance (100 ohms) cams (K1) and (K3) to ground. The (CS) relay operated, operates the (I) relay over the tip side of the line, thru the interrupter contacts. The (I) relay locks through its make contact and operates the (RO) relay, when the "IV" contacts, of the interrupter make. When "K" wiring is used and test line is on the district frame the (SL) relay is connected to the sleeve in place of ground and must operate from ground through the back contact of (L) relay in district before district sequence switch advances out of position 16. The operation of (RO) relay ("E" wiring) opens the sleeve circuit through cam (P) allowing the district to advance from its "talking to operator" position which releases the (CS) relay in the test circuit. The (CS) relay released, releases the (I) relay. The (RO) relay operated and the (I) relay released advances the (R1) switch to position 15. If the district circuit has failed to advance to the "talking to operator" position, the (CS) (I) and (RO) relays fail to operate and block the (R1) switch in position 14.

22. TEST OF SUPERVISORY RELAY (DC) AND RCO KEY OPERATION

As the test switch passes from position 14 to 15, with "E" wiring and apparatus the 20 ohm soaking circuit is held across the tip and ring sides of the test circuit, with "K" wiring and apparatus the 100 ohm soaking circuit is held across the tip and ring sides of the test line soaking the supervisory relay (DC), when testing districts arranged to function over 1500 ohm subscribers loops, 190 ohms is held across the tip and ring instead of above 90 ohms or 100 ohms. With the switch in position 15, the (SK), (SK1) and (SK2) relays reoperate under control of interrupter contacts "F" and "B". The operation of the (SK1) relay removes the short circuit from around the (S), (U), (V), (W), (X) and (Z) resistances bridging them in series with the (Y) resistances across the tip and ring, thereby releasing the supervisory (DC) relay in the district circuit. With Fig. M, when testing districts arranged to function over 750 ohms the (V) resistance is not connected in release circuit. The (REL1) relay operates over this circuit as soon as the district releases the line so that 48 volts is connected through the line relay to the (R) lead and advances the (R1) switch to position 16. When Fig. K is used the (Z) resistance as shown by "Q" wiring is connected in circuit ahead of (REL1) relay to prevent a false operation of (REL1) relay, due to inductive surge from repeating coil. This surge caused trouble when "E" wiring was used. When Fig. L or M is used, (REL1) relay operates on release current and also when district returns to normal. However the circuit thru contacts of (REL1) is opened by (FR3) relay, until district returns to normal. The (SK), (SK1) and (REL1) relays release as the switch advances to position 16. With the (R1) switch in position 16, the (R3) switch advances to the next position from ground on cam (H1), when the (RCO) key is operated the (SR3) relay operates as soon as (R3) switch reaches pos. 3, 6, 9 instead of awaiting (R1) sw. pos. 18, the (SR2) relay remains normal until (R1) sw. opens pos. 17 at (F1) cam. With the (RCO) and (RC1) keys normal and the (R3) switch in position 3, 6 or 9 ground on cam (Y1) through cam (C3) advances the (R1) switch to position 17. Ground on the (SR2) relay normal advances the (R1) switch to position 18 with "K" wiring switch awaits release of (FR3) relay. With the (R3) switch in position 3, the (SR3) relay operates through the contacts of the (SR2) relay, (SR) and (MR3) relays (BC) key normal (F3) cam (ST) relay and with the (RCO) key normal through (I1) & (U1) cams to ground, with the (RCO) key operated, through (RCO) key (PC) relay (F1) cam and (DB) relay to ground. With the (RCO) key normal the operation of the (SR3) relay advances the (R1) switch to position 1, and connects ground to the (SR2) relay causing it to operate and lock in series with the (SR3) relay as the (R1) switch advances from position 18.

23. TEST FOR OPEN CIRCUIT RELEASE OF (CS) RELAY OF DISTRICT

When the test switch reached position 10 with "E" wiring or 7 with "K" wiring, the (FR) relay operated. When "K" wiring is used, the operation of the (FR) operates the (FR1) which operates the (FR2). With (FR1), (FR2) and (FR4) relays operated the (FR3) relay operates. The (FR1) is very slow in releasing and will allow sufficient time for the district sequence switch to pass from position 18 1/4 to 1 1/2 before releasing and will release before district sequence switch can make an extra revolution. As long as the (FR3) relay remains operated the test switch will be blocked in pos. 15 or 17. The test switch would not move out of pos. 14 until the (FR3) relay had operated. Should the (CS) relay in the district fail to release the district sequence switch will rotate until the (CS) relay releases. Under normal conditions the (FR) relay releases when the district reaches normal, and will hold the district busy until the release of the (FR1) relay. The (FR2) relay is slow enough to assure the release of the (FR3) relay. When "E" wiring is used the (FR) relay is not slow enough hence under extreme conditions the test circuit will not test for a rotating condition.

When the (FR) relay holds, the test switch is blocked in position 1 and will advance to 2 of next revolution when released.

24. SECOND TEST OF DISTRICT CIRCUIT - REPEATING COIL IN (DC) SUPERVISORY RELAY TEST, USING "E" WIRING AND APPARATUS

With the (R-1) switch in position 2 (second revolution) ground on the (SS-1) relay through the contacts of the (PLFS), (PMG) and (DTS) relays through cam (B) advances the switch to position 6. The switch functions in position 6 to 10 inclusive in the same manner as described for the first revolution of the switch, with the exception that the digit code sent is such that it will stop the district circuit in a rept. coil position. In position 11, the (18-U) resistance is bridged across the tip and ring holding the sender. The (TC) relay operates during trunk test by the sender. When the district is advanced to a talking position the (TC) relay reoperates. The (DC) relay in the district is operated. The (GS), (TC), (TC-1) and (TC-2) relays function as described in first test to advance the (R-1) switch to position 12. With the (R-1) switch in position 12, the (DC) relay in the district is given a soak current, the (Y) resistance or the (Y) and (BC) resistances being connected across the tip and ring of the test line. Also the (CS) relays in both the test and district circuits are operated. The (CS) district relay operated, charges the call. The (SK), (SK-1) and (SK-2) relays operate, also (SK-3) with Fig. F, under control of the "F" and "E" contacts of the interrupter and advance the (R-1) switch to position 13, the (A) cam advances it to position 14. As the (R-1) switch enters position 13, ground on cam (Y-1) operates the (REL) relay which locks to ground through cam (F-1), and removes the shunt around the (X), (W), (V), (U) and (S) resistances giving a release condition to the (DC) relay. When Fig. M. is used (S) resistance is not in circuit for 750 ohm loop. The (DC) relay in the district circuit releases due to the high resistance connected in series with the (REL-1) relay but the district is not immediately released being held by the (D) relay. The (CS) relay in test circuit operates which operates the (O) relay in position 14, connecting ground to the (I) relay which operates when the interrupter contacts make. The operation of the (O) relay also shunts (Z), (S), (U), (V), (W) and a portion of the (X) resistance, allowing the supervisory (DC) relay in the district to operate over a condition which simulates 750 ohm loop. The interval of time between the release of the (DC) relay in the district in position 13 of the (R-1) switch and the reoperation in position 14 is such that the district circuit is not released, due to the slow release of the (D) relay. The (I) relay locks and operates the (RO) relay. The (RO) relay operated locks and operates the (SO) relay. When the "IV" contact of the interrupter makes, it advances the test switch to position 15. This operation is effective only if the (DC) or (D) relay in district had not released falsely causing the district to run and releasing the (O) relay. When "L" wiring is used the (SL) relay will be required to hold over the sleeve busy ground, even when (FCH) key is operated. The (SO) relay operated, advances the (R-1) switch to position 16. With the switch in position 16, ground on cam (Y-1) advances the switch to position 17. The tip and ring is opened as the switch advances from position 15, releasing the (DC) relay in the district allowing the district to advance to the message register or coin collect position or return to normal.

25. (DC) SUPERVISORY RELAY TEST USING "K" WIRING AND APPARATUS

With the (R1) switch in position 2 (second revolution) ground on the (SS1) relay through the contacts of the (PLFS) and (PMG) and (DTS) relays through cam (B) advances the switch to position 6. The switch functions in positions 6 to 10 inclusive in the same manner as described for the first revolution of the switch with the exception that the digit code sent is such that it will stop district circuit in a talking position. In position 11 the (GS) relay operates in a local circuit, which opens the circuit of the 18U resistance used for dialing and leaves the circuit of the (Y), (X) and (W) resistances and sometimes (BD) resistance closed across the tip and ring to hold the sender. The (GS) relay connects ground to district test line terminals 1 and 2 to prevent district selector from stopping on terminals 1 and 2 the same as described for the first test. It also connects a ground to lead through normal contact of (FR) relay and (AJ) resistance to light the (FR) lamp in case the district goes to normal falsely due to an early wipe out.

The (TC) relay operates during trunk test by the sender. When the district is advanced to a talking position the (TC) relay reoperates. The (DC) relay of the district is operated through resistances (Y) & (X) & 70 ohm of (W) when arranged to simulate a 750 ohm loop or through (Y), (X) & (W) resistances when arranged to simulate a 900 ohm loop. The (TCI) & (TC2) relays function as described in first test to advance the (R1) switch to position 12. The (X), (Y) & (W) resistance closure to operate the (DC) relay applied the test operate current.

The (CS) relay in both the test and district circuit are operated. The (CS) district relay operated causes the district to set for a charge call. The (SK), (SK1) and (SK2) relays operate also (SK3) with Fig. F under control of the "F" and "B" contacts of the interrupter and advances the (R1) switch to position 13. The (A) cam advances it to position 14. As the (R1) switch enters position 13 ground on cam (Y1) operates the (REL) relay which stays operated until the (R1) switch leaves position 14. The operation of the (REL) relay opens the operate circuit of the (DC) relay. This operate circuit of the (DC) relay remains open for one position of the (R1) switch to test that the (D) relay will hold for this period of time. When the (R1) switch goes into position 14 the test operate circuit of the (DC) relay is reclosed through the make contact of the (REL) relay and (O1) cam. The test operate circuit of the (DC) relay remains closed in position 14 for a period of time to check that the (DC) relay reoperated and holds the district from releasing. With the (CS) relay in the test circuit operated, and the (R3) switch in position 3, the (O) relay operates, ground through (F1) cam position 14, make contact of (REL) relay (R3) cam, make contact of (CS) relay (P3) cam and winding of (O) relay. The operation of the (O) relay operates the (I) relay under control of "F" contact of "III" interrupter; with the (I) relay operated, the (RO) relay will operate under control of "B" contact of "IV" interrupter with (FCH) key normal or under control of (W) & (Z) relays operated, the (SO) relay will operate under control of "F" contact of "III" interrupter also the (SL) relay will operate from the sleeve make busy ground of district, the (SL) relay is held operated from district sleeve make busy ground until the "B" contact of interrupter "IV" makes which advances the (R1) switch to position 15, providing the (FR3) and (SL) relay are still operated. When the (R1) switch goes into position 15 a soak current is applied to the (DC) relay prior to its release current. When the (R1) reaches position 15 the (SK), (SK1) & (SK2) relays operate under control of #149C interrupter. The soak current is applied when the switch reaches position 15 and is replaced by a release current circuit when the (SK1) relay operates, this release current circuit remains closed until the (R1) switch advances out of position 17 after message register or coin current has been applied. The operation of the (SK2) relay advances the (R1) switch to position 16 where it is advanced to position 17 by ground from cam (Y1).

26. FLAT RATE AND RCI OPERATION

When testing flat rate districts, the (FL) relay operates in position 5 of the first revolution of the (R-1) switch. The (FL) relay operated, sets the (R-3) switch in position 8. The (R-3) switch is moved to position 9 when the (R-1) switch is in position 16 of the 1st revolution, if (RCO)-(RCI) key is normal or if the (RCO) key is operated. When the (RCI) key is operated the (R3) switch advances to pos. 9 when the (R1) switch is in pos. 6 and 7. The circuit functions as has previously been described up to position 17 of the (R-1) switch (2nd revolution). The (R-1) switch is advanced to position 18 by ground on cam (K-3). As the (R-1) switch leaves position 17, the (RO), (SO), (O), (REL) and (I) relays release.

27. ADVANCE TO NEXT DISTRICT

The (SR-1) relay operates from ground on cam (I-1), with the test switch in pos. 18. The (SR-1) relay operated, advances the (R-3) switch to position 10 causing the (SR), (SR-1), (SR-2) and (SR-3) relays to release. The (SLF-1) and (STP-1) relays operate in position 18. With the (R-3) switch in position 1, the (SLF-1) relay operated and (with "E" wiring) the (FR) relay normal, (the district having returned to normal), the (LF-1) magnet operates. The operation of the (LF-1) magnet allows the (STP) relay to operate, which advances the (R-1) switch to position 1. When the (R-1) switch advances from position 18, the (SLF-1), (STP) and (STP-1) relays release and the (LF-1) magnet releases stepping the (LF) selector to the next terminals. The circuit is now ready to test the next district.

28. MESSAGE REGISTER ONE-PARTY CLASS

The (MR-1) relay operates and locks in position 5 of the (R-1) switch, when the (LF) selector rests on terminal 1. The (MR-1) relay operated advances the (R-3) switch to position 2. The circuit functions as described in paragraphs 11 to 22 inclusive advancing the (R-1) switch to position 16 when "K" wiring is used or to 17 if "E" wiring is used in the 2nd revolution. When "L" wiring is used the (MR7) relay is shunted in pos. 16 which closes circuit to advance switch to 17. At this time the district had advanced to the register position and connects battery to the (MZ) lead (the call having been charged) which operates the (R) relay. This battery is connected through three (18-AN) resistances in parallel in the district; if one or two of these resistances are open the (R) relay will not operate; if these resistances are short-circuited the (BX) relay operates as well as the (R) relay. When Fig. C is used the (R) relay operated operates the (WD-1) relay, and in turn operates the (WD) relay. The (WD) relay operated locks and the (WD-1) relay releases as soon as the district advances disconnecting battery from the "MZ" lead. When "L" and "AD" wiring are used the removal of message register current operates (WD2) relay which advances the sequence switch out of position 17 after the district reaches normal. When "L" and "AE" wiring are used, the (WD2) operates the (WD3) relay, which advances the switch. The break contact of the (WD3) is used on coin class. When Fig. D is used the (R) relay operated, operates the (WD1) relay, and in turn operates the (WD) relay through contacts of (TMR) relay normal, (the (TMR) relay circuit was closed in position 7 with the operation of (AB) relay) the operation of (WD1) relay will open the short circuit from (TMR) condenser and (AN) resistance, which allows the (TMR) relay to operate slowly, the time required to operate the (TMR) relay will match the time the message register current should be applied. If the message register current is removed before the contact of (TMR) relay breaks which releases (WD) relay the (FCH1) relay will operate, blocking the circuit in position 17. The (CC1) relay will operate when testing coin districts, and the (TMR) relay will stay on its back contact allowing the circuit to function as described above except that the timing feature will not function. The timing feature functions as follows: The (TMR) relay is a differential wound relay and both windings are closed in position 7 of test switch with the operation of (AB) relay, and when the (WD1) relay operates following the (R) relay, the "S" winding is opened and connected in series with (TMR) condenser and (AN) resistance, this allows the (TMR) relay to operate thru the "P" winding, its operation being retarded by the (TMR) condenser and (AN) resistance. When the (TMR) relay operates the (WD) relay releases, this (WD) relay operated thru the normal contact of the (TMR) relay when the (WD1) relay operated and the (WD) relay locked thru the contact of (TMR) and its own contact to the operating ground. When the (WD1) relay releases at the end of the message registration current, with the (WD) relay released the (WD2) relay operated and locks, in turn operating the (WD3) relay when "L" wiring and apparatus is used. If an extra impulse of message register current is received during return to normal of district the (WD1) relay will reoperate. With (WD3) relay operated the reoperation of (WD1) relay operates (FCH1) relay blocking test circuit in position 17. When "AA" and "AD" wiring are used (R-1) switch is advanced to position 17 from ground through the (BX) relay normal through the (WD-1) relay normal and (WD) relay, operated. When "AA" and "AE" wiring are used this ground operates the (WD3) relay which advances the R1 switch. Should the (BX) relay operate, or should the (R) relay not operate the (R-1) switch will be held in position 17 as a trouble condition. When the (R-1) switch leaves position 17, the (RO), (SO), (O), (REL) and (I) relays release. The circuit functions in position 18 as described above.

29. MESSAGE REGISTER TWO-PARTY CLASS

When testing two-party message register districts, the (MR-2) relay operates in position 5 of the (R-1) switch with the (LF) selector resting on terminal 1. The (MR-2) relay operated locks and advances the (R-3) switch to position 2. With the (RCO) key normal when the (SR-2) relay operates as the (R-1) switch starts on its second revolution, it operates the (MR-3) relay. When the (RCO) key is operated the circuit of the (MR3) relay is open. The (MR-3) relay operated, prepares a circuit for operating the (MR-4) relay instead of the (SR-1) relay as the (R-1) switch advances thru position 18 of the second revolution. When the (RCO) key is normal the (MR-4) relay, operated, advances the (R-1) switch to position 1, in turn operating the (MR-5) relay. The (MR-4) and (MR-5) relays operated lock to cam (M-3) with "E" wiring or to cam (L3) with "L" wiring. Otherwise the circuit functions as described in paragraphs 11 to 22 inclusive and 25. When "L" wiring is used the operation of (MR4) relay operates (MR6) in local circuit. The operation of (MR6) relay changes the position 16 shunt from (MR7) to (MR8) relay allowing the (MR7) relay to remain operated to detect a false charge.

30. THIRD REVOLUTION

With the (RCO) & (RCI) keys normal the (R-1) switch is required to make a third revolution when testing 2 party districts. The class switch remains in second test position. In positions 1 to 16 of the third revolution tests are made in a similar manner to the corresponding positions in the second revolution, the same digit code being sent by the (R-2) switch in this revolution as in the previous one. When the test switch advances to position 11 on this third revolution it waits until the district makes party test. The district selector circuit before making party test, connects battery to the tip side of the test line, and operating the (PT) relay in test circuit to ground on cam (M-3). The (PT) relay operated, opens the circuit for advancing the (R-1) switch from position 18 and operates and locks the (PT-1) relay. With "E" wiring the (PT-1) relay operated, disconnects ground through 1000 ohms to the "T" lead to the district and connects it to 24 volts battery through the (GS) relay operated. With "K" wiring the (GS) relay connects ground thru 2000 ohms instead of direct 24 volts battery. When message register current is connected to the test line in position 17, the (R) relay operates, in turn operating the (TMR), (WD), (WD1), (WD2) and (WD3) relays, as described in paragraph 28, which advances the switch to position 18 when the (CR3) relay releases. In position 18 of the third revolution, the (SR-1) relay operates and locks, advancing the (R-3) switch to position 10 or next normal position. As the (R-3) switch returns to normal all the (PT) and (SR) relays release in turn releasing the (MR) relays. The (R-3) switch in normal, the (LF) connector is advanced one step and the (R-1) switch is advanced to position 1, in a manner similar to that described above.

31. CLASS SELECTOR

Each time the (R-3) switch advances to position 2, 5 or 8, the circuit is closed through the winding of the (CL) stepping magnet and cam (A-3) to ground on cam (Y-1) in position 5, energizing the magnet. When the (R-1) switch leaves position 5, the (CL) magnet releases, stepping the brush assembly of the selector switch to the next terminal, extinguishing the previous lamp and lighting the successive lamps 1, 2 or 3 etc. under control of the (LAMP) key. The lighted lamp indicated which district selector is being tested. As the class switch brush assembly steps from terminal to terminal, lamps 1 to 20 will light indicating the progress of the test. Thus the class selector follows the movement of the line finder connector. When the brush assembly of the class selector switch reaches terminal 22, the holding circuit through the operated class relay and (N) relay is opened, releasing the relays. The (R-3) switch is returned to normal with the (R-1) switch in position 1 to 17, and the (DB) or (DB-1) and class relays normal.

32. COIN CLASS

When testing coin districts, the (CC) relay operates in position 5 of the (R-1) switch and advances the (R3) switch to position 8. The tests are made as described in previous paragraphs, two revolutions of the (R1) switch being made for a complete test. Ground is supplied thru the winding of the (CN) relay in position 11 to permit the sender to operate and in position 17 to check the coin current from the sender. The (CN) relay operates on the coin current, and releases when coin current is disconnected, and it operates the (WD), (WD1), (WD2) and (WD3) relays in the usual manner. When the (WD3) relay is used its operation opens the circuit of the (CN) relay to permit the sender to advance. The (R) and (MX) relays are ineffective except in positions 3 and 12 of (R3) switch so that if message register battery is supplied from the coin district it will not affect the test circuit.

33. DISTRICTS ARRANGED FOR TWO CLASS SERVICE

When the line group of districts is arranged for two kinds of service in the same subscriber's group with optional wiring in the district for grounding the FR lead or advancing the district to the second talking position, Fig. P is used. Fig. R is also used in combination single and 2-party offices. The combinations of service which may occur in one group are:

Flat rate limited service and Flat rate extended service
Flat rate limited service and Message rate service
Flat rate extended service and Message rate service

In this description flat rate limited service is that service which results from the district placing a ground on the FR lead which is effective in changing certain non-charge office codes to charge codes. Flat rate extended service is that service which results from the district not placing a ground on the FR lead. Message rate service is that service which results by the district automatically advancing to the second or charge talking position regardless of the office code dialed.

In districts handling two kinds of service a relay is added to the district which controls the various connections so that the proper kind of service will be given to the calling subscriber. For this description this relay will be termed as the "Z" relay and when it controls the ground placed on the FR lead this type of wiring in the district will be termed "H" wiring. When the "Z" relay controls the lead that advances the district to the second talking position this type of wiring in the district will be termed "J" wiring. When the district has ground connected permanently to the FR lead this wiring in the district will be termed "E" wiring. When the district has wiring permanently connected that advances the district to the second talking position this wiring is termed "X" wiring.

In order to test the various combinations of this "J", "H", "E" and "X" wiring in the district it is necessary to send two different non-charge codes to the sender from the test circuit, one of which results in a non-charge condition on a flat rate limited service district and one that will result in advancing a district to the charge position when ground is supplied to the FR lead by the district. These two codes will be termed local and extended service codes respectively. The "BZ" relay of the test circuit controls which of these codes is sent.

If a local code is sent to the sender when testing a flat rate limited service district, the district is tested as a flat rate district, if an extended code is sent, a flat rate limited service district is tested as a message rate district. The "BV" relay controls which way the district is checked.

The 1, 2 & 3 keys control the "Z" relay of the district by means of the 800 ohm resistance (B). They also control the "BZ" and "BV" relays.

For the various classes of districts tested terminals "A" or "Y" are connected according to note 56.

The following table shows the code sent, the check made of the "E", "H", "J" and "X" wiring and the check made as to whether the "Z" relay is operated or not according to the 1, 2 or 3 key that may be operated, on districts arranged for the various classes of service.

Key Operated	None			#1		
Service Arrangement of District	Code Sent	Check Made		Code Sent	Check Made	
		EHJ Wiring	Z Relay		EHJ Wiring	Z Relay
B	L	FJ	None	L	FJ	None
C	L	FJ	None	L	FJ	None
D	L	J	None	L	J	None
E	L	FJ	No	L	FJ	O
F	L	FJ	No	L	J	O
G	L	FJ	No	L	J	O

Key Operated	#2			#3		
Service Arrangement of District	Code Sent	Check Made		Code Sent	Check Made	
		EHJ Wiring	Z Relay		EHJ Wiring	Z Relay
	L	FJ	None	S	H	None
	L	FJ	None	S	FH	None
	L	J	None	L	J	None
	S	FJ,FH	No	S	H	0
	S	H	No	L	J	0
	S	FJ,FH	No	L	J	0

Abbreviations Used in Table

B Flat rate limited service (Ground on FR lead of district)
C Flat rate extended service (Non-grounded FR lead)
D Message rate service (District advances to second talk position)
E Flat rate limited and flat rate extended service
F Flat rate limited and message rate service
G Flat rate extended and message rate service
L Local code
S Extended code
FJ "J" or "X" wiring wrongly installed
J "J" or "X" wiring correctly installed
FH "H" or "E" wiring wrongly installed
H "H" or "E" wiring correctly installed
NO Z relay non operated
O Z relay operated

34. STEP GROUP CONNECTOR SWITCH

In order to test the district selector associated with another line finder connector switch, it is necessary to step the brush assembly of the group connector one terminal.

When the line finder connector just used, leaves terminal 21, the (PMG) relay releases and the (R-1) switch is advanced to position 1. The (PM) relay operated, advances the (R-1) switch to position 3. The group selector is advanced, another line finder selector being seized and advanced, the class relays are set and another test is started as described in paragraphs 7 to 10 inclusive.

35. STEP MASTER CONNECTOR SWITCH

After the district selector circuits associated with a terminal of the master connector switch have been tested, the brush assembly of the group connector switch being released, steps off terminal 21, and the associated (RTS) relay releases, in turn releasing the (PM) relay. The (PM) and (RTS) relays, released, advance the (R1) switch from position 4 to position 1. The switch is advanced to position 2 by a contact of the (ST) key. With "AC" wiring the (PM) relay, released, prevents energizing the R2 switch as the R1 switch advances thru positions 8, 9, and 10. The (PM) relay released, operates the (SM) and (STP-2) relays in position 2 of the (R-1) switch. The (SM) relay operated, operates the (MA) and (MB) magnets. When the (MA) and (MB) magnets operate, the (STP) relay operates. The operation of the (STP) relay advances the (R-1) switch to position 3, and in so doing, releases the (MB) and (MA) magnets, moving the brush assemblies of the master switch to the next terminal. From this point on, the test proceeds in the same manner as with the group connector associated with the first terminal.

36. CONCLUSION OF A ROUTINE TEST

As explained in paragraphs 10 and 14, the (EC) relay operates when the (R-1) switch enters position 7 when "AH" wiring is used and when the class switch goes off normal when "AK" wiring is used, at the beginning of a routine test, when all the district selector circuits have been tested by this circuit, the master connector switch steps from terminal 21 to normal, operating the (EC-1) and (SM) relays. The (EC-1) relay operated, operates the (SLFT) relay, lights the (EC) lamp and opens the operating circuits of the (MB) and (MA) stepping magnets. The (SLFT) relay locks through cam (N-1), advancing the (R-1) switch to position 1 with "E" wiring, or to position 2 when "K" wiring is used, and operates (DB) and (DB-1), and (TR) relays. The operation of the (DB) relays remove ground from cams (F) and (G), preventing the relays under control of these cams from operating. The (DB), (DB-1), (TR) and (SLFT) relays release as the switch advances from position 17. The (R-1) switch is advanced to position 1 by the (RTS) relays normal. With "E" wiring the (FR) relay operated prevents the (R-1) switch from advancing out of position 1. If another cycle of test is not desired, the (RN) key is operated and the (ST) key released. The operation of the (RN) key releases all operated relays locked through the break contacts of the (RN) key. The (EC) relay released, releases the (SM) and (EC-1) relays, in turn the (FR) relay, restoring the circuit to normal.

37. RETURN TO NORMAL (RN) KEY

When it is desired to restore the test circuit to normal from any position, the (RN) key is operated. The (RN) key, operated, (a) releases the (TA) relay, if operated, returning the time measure switch to normal, (b) releases the class relays, (c) opens the circuit to the (GON) relays, (d) operates the (DB) relay and in turn the (DB-1) and (TR) relays which function as described above, (e) advances the (R-1) switch to position 1 and (f) resets the master, group and line finder selectors. The (DB), (DB-1) and (TR) relays release as the (R-1) leaves position 17. With the (R-1) switch in position 1, and the (DB) and class relays normal, the (R-3) switch is advanced to the next normal position. With the (R-1) switch in position 1, the (SM) relay (if the master switches are off normal) operates in series with the (STP-1) relay through the (MON) relay operated. The (SM) and (STP-1) relays operated, the master selector magnets operate allowing the (STP) relay to operate. The (STP) relay operated, operates the (RN) relay. The operation of the (RN) relay releases the selector magnets allowing the brush assembly to step one terminal. When the magnets release they short-circuit the (STP) relay, releasing the (RN) relay. The (RN) relay released, permits the (SM), (STP-1) and (STP) relays and the selector magnets to function stepping the brush assembly one more step. This magnet continues to operate and release stepping the master selectors to normal at which time the (MON) relay releases. The (MON) relay, normal, transfers the circuit from the (SM) relay to an (SG) relay where the circuit functions as has just been described stepping any off-normal group selector to normal. When the group selectors are all normal the operated (G-1-ON), (RTS) and (LF) relays release. With the (LF) relays normal, the (LF) selector that is off normal will be returned to normal.

38. SPARE TERMINAL ON MASTER AND GROUP SWITCH

When the master switch steps to a spare terminal, the (R-1) switch being in position 3; the (SPT) relay operates. The (SPT) relay operated, opens the lead for advancing the (R-1) switch until all spare terminals have been passed and operates the (SPT-1) relay, as soon as the (STP) relay operates as described above. The (SPT-1) relay opens the ground lead to the master magnet, allowing the master magnet to release and step the brushes to the next terminal. As the magnets release the (STP) relay releases in turn releasing the (SPT-1) relay. The cycle is repeated until a working terminal is found. When the group selector steps to a spare terminal the (R-1) switch has advanced to position 4 and the selector is stepped to the next working terminal as just described, for the master selector.

39. TIME MEASURE FEATURE FIG. 1

As stated in paragraph 5, the operation of the (ST) key operates, the (TA) relay which locks to ground on cam (N-1). Should trouble develop either in the test circuit or in the district circuit under test or should sufficient time not be left after the return of the district circuit to permit the completion of a test, the time alarm circuit operates, lighting the lamps and operating the (ALM) register. Ground through the interrupter, and the (STP) arc operates the (TA) magnet. When the interrupter contacts break, the (TA) magnet releases stepping the brush assembly of the (TM) switch to the next terminal. This cycle is repeated until the brushes rest on terminal 16. If this occurs before the (R-1) switch has passed position 18 on its second or third revolution through the make contact of the (TA) relay, operates the (ALM) register and lights the lamp. The brushes remain on terminal 16 until the operation of the (TA) key. The operation of the key releases the (TA) relay which steps the (TM) switch to normal.

40. SEPARATE BUSY TIME ALARM AND TROUBLE ALARM FIG. 2

When figure 2 is specified, the operation of the (ST) key operates the (BY) relay, which locks over lead (B). The operation of the (BY) relay connects the (200-R) selector magnet to ground through the interrupter. As the interrupter contacts make and break the selector magnet follows, stepping the brush assembly of the (BY) switch. When the (AL) brush encounters terminal 10 or 20, the circuit is closed from ground on the (BY) relay to the (BY) lamp which lights, indicating that a busy district selector circuit has been encountered. The circuit remains in this position until the operation of the (TA) key, which when using "E" wiring operates the (HA) relay. The (HA) relay locks through cam (N-1) and releases the (BY) relay, the latter relay stepping the brush assembly of the (BY) switch to normal. Should trouble develop in the test circuit or be encountered in the district circuit under test, it is advisable to decrease the time before the alarm is operated. The operation of the (IDL) relay as described above operates, the (TBL) relay which locks to cam (N-1). The (TBL) relay operated, connects the interrupter through the (STP) arc of the (TBL) switch to the (TBL) magnet, causing it to operate and release in sequence with the interrupter. The operation and release of the magnet, moves the brush assembly of the (TBL) switch to terminal 3 or 4 or as determined by the wiring used. When the brush assembly of the switch has stepped to the third or fourth terminal, the (TBL) lamp lights and the (TBL) register operates. The circuit remains in this position until the operation of the (TA) key which when "K" wiring is used opens alarm circuit and circuit for advancing test circuit to next district. When the brush assembly of selector reaches alarm point the (HA) relay will operate and trip the block circuit when two test circuits are in same office. When no trouble is encountered, the circuit is opened through cam (N-1) in position 18 of the (R-1) switch, releasing the (TBL) relay. The (TBL) relay released steps the selector to the next normal terminal. With "K" wiring the test circuit can be used for a particular circuit test or repeat tests with the (TA) key operated.

41. CONTROL ADVANCE (CA) KEY

If trouble develops in the test circuit or in the district selector circuit under test after position 5 of the test switch, the time alarm lights as described under "Timing Features." If after the (TA) key is operated, the circuit does not continue to function, the (CA) key is operated. The operation of the (CA) key operates the (DB) relay, advances the (R-1) switch out of position 1 and opens the circuit for operating (LF) magnet. The (DB) relay operated, lights the (BLF) lamp and operates the (DB-1), and (TR) relays. The (DB-1) relay, operated, releases the (FR) relay. The (TR) relay, operated, opens the (T), (R) and (S) leads releasing the district and start circuit. The (R-1) switch remains in position 18 until the release of the (CA) key. When the (CA) key is released the routine testing proceeds in the usual manner.

42. TWO GROUP SELECTORS OFF NORMAL

Should two group switches step off normal or get off normal at the same time battery through the 600 ohms resistance in parallel associated with each group connector, operates the (GON) relay. The (GON) relay does not operate in series with one 600 ohm resistance. The (GON) relay operated, lights the (GON) lamp, and operates the (GON-1) relay. The (GON-1) relay operated, (a) locks (b) advances the (R-1) switch to position 1, (c) prevents the switch from advancing out of position 1, (d) releases the (GON) relay and lights the (GON) lamp. To continue the test, the (RN) key is operated, restoring the apparatus to normal.

43. FALSE CHARGE TESTS; MESSAGE REGISTER ONE-PARTY - FIG. A

The district circuit is tested for a no charge call by operating the (FCH) key. The circuit functions the same as described for charged calls with the following exceptions. When the (R-1) switch enters position 14 of the second revolution the (O) relay operates in turn operating the (BB) and (BB-1) relays through the (FCH) key operated. The (BB-1) relay operated holds the (R-1) switch in position 14 longer than for a charged call under control of the (W) and (Z) relays. The (O) relay operated operates the (I) relay. The (I) relay, operated, operates the (W) relay under control of the "A" interrupter. When the interrupter contacts break, the (Z) relay operates. The next closure of the interrupter releases the (W) relay in turn operating the (RO) relay. When the interrupter contacts break the (Z) relay releases. The next closure and break of the interrupter operates the (W) and (Z) relays. The (SO) relay now operates under control of the (B) interrupter. With the (I), (RO) and (SO) relays operated the (SL) relay when "K" wiring is used the (R-1) switch is advanced to position 15, when interrupter contacts are closed. The (SO) relay operated advances the switch to position 16, and ground on cam (Y-1) advances it to position 17. During the time the (R-1) switch is held in position 14, (Fig. E), the (BB) relay operated, operates the (DR) relay, holds the (CS) relay operated and connects battery through 1000 ohms resistance to (R-3) lead. The (DR) relay operated transfers the (T-3) lead from direct ground to interrupted ground thus testing the (CS) relay in the district. The (CS) relay in the district follows the pulses of the interrupter (if it is properly adjusted) and the time interval is not sufficient to charge the call. The (DR) relay, operated, also transfers the (MZ) lead from the (R) relay to the (MX) relay. When the (R-1) switch leaves position 15 the "T" and "R" leads are opened releasing the district circuit. When the district circuit returns to normal ground is removed from the "DB" lead releasing the (DR) relay. The (DR) relay released, advances the (R-1) switch to position 18. The (O) relay releases as the switch advances from position 17, in turn releasing the (BB); (BB-1), and (Z) and (W) relays, if operated. Should the (CS) relay in the district fail to release, the call will be charged and consequently the district will stop in the message register position and register the call. Under such conditions the (MX) relay operates in position 17 over the (MZ) lead. The (MX) relay, operated, operates the (FCH) relay. When battery is removed from the (MZ) lead due to the district advancing the (MX) relay, releases allowing the (FCH-1) relay to operate and lock in series with the (FCH) relay. The (FCH) relays operated, open the circuit for advancing the (R-1) switch from position 17, light the (FCH) lamp and operate the (TR) and (DB-1) relays. The (DB-1) relay releases the (FR), and (DR) relays. The (TR) opens the "T", "R" and "S" leads releasing the associated line. The test switch remains in position 17 as a trouble condition.

When figure F is used, a closed circuit release test is made, to compensate for the effect of the condenser in multiple and repeat coil in series with the (CS) relay. With the FCH key operated, the R1 switch in position 14, and the class switch in the second test position, relays (CS) (O) (BB) (BB1) and (DR) operate following the tip and ring closure through the district (CS) relay. Relays (BB2) and (BB3) operate checking the continuity of the operate test path and when interrupter III closes, relay (I) operates, closing the busy back (J) interrupter path which short circuits the release path giving an operate current to the circuit (CS) relay. The test continues as previously described registering a false charge if the (CS) relay does not release during the interrupter open period.

44. FALSE GROUND TWO-PARTY

During the third revolution with the (FCH) key operated, a test is made to determine whether the two-party districts recognize a false ground on the tip side and prevent the district charging a call on either register. The test switch arrives in position 11 and the (PT) relay is connected to the tip which causes the district selector to function a 2nd party charge. The district is held for a sufficient time to set up a charge condition and when the test switch arrives in position 17, the district circuit under test will be in position 16 and the (PT) relay is again operated over the tip which should cause the (T) relay in the district circuit to operate and block the district. The test and district circuits are held until the (FG) and (FG-1) relays operate. The (INT) relay operates in position 14 of the third revolution of the (R-1) switch under control of the (O) relay. These relays are held operated until the switch leaves position 17. When the (PT) relay operates in position 17, the (FG) and (FG-1) relays operated under control of the "C" interrupter. The (FC) relay locks under control of the (INT) relay and the (FG-1) relay locks to cam (H-1). The (FG-1) relay, operated, opens the "T" lead to the (PT) relay, releasing it and the (T) and (I) relays in the district, and short circuits the (INT) relay, releasing it. The party test switch in the district now advances and sends out register current over the "M-2" lead, operating the (R) relay and moving the test switch in the regular manner. When the (INT) relay is operated, it connects the (MX) relay to the "M-2" lead and also closes a circuit from the (MX) armature to the (FCH) relay. Should the district not recognize the false ground and register a call over the "M-2" lead, the (MX) relay operates. The (MX) relay, operated, operates the (FCH) relays which function as described above. In the case that the district under test does not recognize the false ground on the tip side of the circuit in position 11, and fails to set the district for charging over the "M-2" lead, and for the same reason did not recognize it for retest, the charging current is sent out over the "MZ" lead. With "L" wiring the "MZ" lead being open at the (MR5) relay, no relay is operated, thus the test switch is stopped in position 17. With "L" wiring the "MZ" lead is connected to the (MX1) relay. The operation of the (MX1) relay operates the (FCH1) relay blocking the test circuit in pos.17.

45. COIN DISTRICT (FCH) KEY OPERATED

On coin districts the current to the (CS) relay in the district is interrupted in the same manner as for the message register district, but in this case, the (CR) relay is added to operate on making coil return test and moves the test switch out of position 17 in the usual manner when the (CS) relay in district has functioned properly. The (CN) and (CR) relays are connected in multiple when the (FCH) key is operated, and should the (CS) relay stick, the charge relays in the district operate, causing the sender to send positive coin current which operates the (CN) relay in turn causing the (FCH) and (FCH-1) relays to operate. The (FCH-1) relay operated, performs the same function as described in above paragraph.

46. TEST PARTICULAR DISTRICT

To test a particular district, the (PC) and (ST) keys are operated in the order named. The (ST) key operated advances the (R-1) switch to position 2. The (PC) key, operated, (a) opens the regular circuits for advancing the (R-1) switch out of position 2, 3, 4 and 5 and for operating the selector magnets, (b) provides a circuit for operating the selector magnets under control of the dial, (c) operates the (PUL) and (PLFS) relays. In position 2 the (SM) relay operates and the dial is operated. The operation of the dial releases and reoperates the (PUL) relay which in turn operates and releases the master selector magnet thus stepping the selector around to the desired terminal. The (STP) key is not operated operating the (SS) relay, when the (STP) key is released the (SS-1) relay operates and locks in series with the (SS) relay. The (SS-1) relay operated, advances the (R-1) switch to position 3. As the (R-1) switch leaves position 2 the (SS) relays release. The (PLFS) relay operated closes a circuit for operating the (SG) or (SLF) relays in positions 3, 4 and 5 of the (R-1) switch and also opens the operating circuit for the (SLFT) relay. The (SG) relay, corresponding to the selected master selector terminal, operates in position 3. The group selector is stepped to the desired group by the operation of the dial and (R-1) switch is advanced to position 4 by the operation of the (STP) key. In position 4 the (LF) selector is advanced one step for class setting. The (STP) key is again operated advancing the (R-1) switch to position 5. In position 5, the (LF) selector is stepped around to the desired district by the operation of the dial. At the same time the (CL) selector is stepped around so that it will keep in step with the particular (LF) selector. The (R-1) switch is advanced to position 6 by the operation of the (STP) key. Otherwise the circuit functions in the usual manner as has been described. The (PC) key is returned to normal otherwise the circuit stops in position 18.

47. REPEAT KEY (REP) FIRST TEST

When it is desired to repeat the test of a certain district selector circuit, one of the repeat keys is operated depending upon which test it is desired to repeat. The operation of the "REP" First Test" key (a) opens the circuit through the (R-3) switch, preventing the class circuit for advancing to next position, (b) opens the circuit through the stepping magnet of the line finder connector, preventing stepping to the next terminal, (c) opens the circuit for stepping the class selector, (d) closes circuits for advancing the (R-1) switch from position 16 and 18, and (e) opens the circuit through the (CT) relay preventing its reoperation on the repeat test. Otherwise the circuit functions in the usual manner testing the circuit repeatedly as described for the first revolution of the (R-1) switch. With "E" wiring the key must be operated while (R-3) switch is in the first test. With "K" wiring the (REP) key may be operated at any time as the operation of the (REP) relay in pos. 7 or R-1 switch closes the above paths at the proper time. (REP) 1st Test - key must not be operated at the same time the (RCI) key is operated.

48. REPEAT KEY SECOND TEST

The operation of the ""REP" Second Test" key (a) prevents the stepping magnet associated with the line finder connector from operating and moving the brush assembly of this connector to the next terminal as in the second revolution of a regular test, (b) closes a circuit for advancing the (R-1) switch from position 18 and (c) prevents the (R-3) switch from advancing by opening the operating circuit of the (SR-1) relay. Ground on the (ST) key advances the switch to position 2 from which point the repeat test of the second revolution is performed in a manner similar to the regular test in the second revolution. The test circuit continues to repeat the test until the key is released. With "E" wiring the key must be operated while the (R-3) switch is in the 2nd test position. (Rep) 2nd Test - Key must not be operated at the same time the (RCO) key is operated.

49. REPEAT KEY THIRD TEST

The operation of ""REP" Third Test" key, (a) closes a circuit to advance the (R-1) switch from position 18, (b) opens the circuit through the stepping magnet associated with the line finder connector, preventing its operation and (c) prevents the (R-3) switch from being advanced by opening the operating circuit of the (SR-1) relay. The third revolution test is repeated in the usual manner. When the operated (REP) key is released the circuit continues making routine tests. With "E" wiring the key must be operated during the 3rd test. (REP) 3rd Test - Key must not be operated at the same time (RCO) Key is operated.

50. STOP AUTOMATIC TEST

The release of the (ST) key advances the (R-1) switch to normal, stopping the automatic test of the district circuit and prevents the (R-1) switch from advancing out of position 1. If it is desired to restore the test circuit to normal after the release of the (ST) key, the (RN) key is operated.

51. PASS BUSY (PB) KEY

When it is desired to pass by all busy districts, the (PB) key is operated. The test circuit may also be advanced when held by a busy district by the operation of the (PB) key. When the (LF) selector steps to terminals connected to a busy district the (DB) relays operate. The (DB), (DB-1) and (TR) relays operated, lock when the (PB) key is operated, until the (R-1) switch advances from position 17. With the (DB) relays and the (PB) key operated, (a) the (BSY) register operates registering the number of busy districts passed, (b) advances the (R-1) switch to position 18 and (c) in position 18 advances the (LF) selector one terminal as described above, the (FR) relay being released by the operation of the (DB-1) relay, the (R-3) switch remains in the 2, 5, or 8 position as the case may be. The (R-1) switch is advanced to position 1 as described above and the circuit tests another district. Should the district under test be allotted and made busy by a calling subscriber between the 1st and 2nd or 2nd and 3rd revolutions of the (R-1) switch, the (DB) relays are operated in position 6 of the (R-1) switch as described above. The (DB) relays with the (PB) key operated, performs the functions as just described and also operate the (SR-1) relay which returns (R-3) switch to normal. The (DB-1) relay advances the (R-1) switch to position 18. This circuit then functions as has just been described advancing the (LF) selector to test another district without making the 2nd test in the district.

52. BLOCK FEATURE

The (BLK) relay used in this circuit, associated with terminal 4 of test, group will put ground on 3rd sleeve terminal of test group; when the (BLK) relay operates, it will advance the test switch to position 8. The (BLK) relay being blocked to ground through the contact of (TC) relay will hold, preventing other test circuit from advancing beyond the dial tone test position, until this circuit makes trunk test, which is indicated by the 1st operation of (TC) relay.

The release of the (BLK) relay permits the operation of (BLK) relay in the other test circuit so that it, in turn, can advance for brush selection. When "K" wiring is used, the block feature will be tripped by the trouble alarm.

53. WIPING OUT SENDER WHEN IN SELECTION BEYOND POS.

If the test circuit is returned to normal at time sender is in selection beyond position, the sender "T" & "R" leads will be connected to a battery and ground, as soon as the (FR1) relay releases which is controlled by the district reaching normal.

54. REMOTE CONTROL

Jacks are provided at the district and line finder frames, so as to control the test circuit from the district and line finder frames. The (RC) relay is operated by using a 32-A test set in connection with these added jacks, and function the test circuit the same as the

(CA) key, as described above. This remote control feature will only function with (REP) keys operated.

55. TEST FOR REVERSAL OF T & R LEADS TO SENDER

When "K" wiring and (LC1) relay is used, the test circuit will test for a reversal of the "T" & "R" leads to sender at the time the dial tone is connected through from the sender. This test is made by a direct ground on "R" lead through contacts of (LC1) relay, which prevents the operation of the (LC) relay when ground is connected to "R" lead of sender, however, when battery through (L) relay of sender is connected to the "R" lead the (LC) relay will operate, in turn operating the (LC1) which removes this ground.

56. BRUSH CONTINUITY TEST

The brushes of the district selector under test may be checked for continuity with the (BC) key of the test circuit operated. This test is made by dialing from the test circuit into the sender an office code which corresponds to the district brush and group to be checked. An office code used by subscribers in regular service operation is used for this test. Codes may be used which cause the district selector to select an incoming selector either directly or through the medium of an office selector. Office codes which cause an "RCI" trunk, an operators trunk, or similar circuit to be selected should not be used because of interference with these operators. After the office code is dialed the test circuit waits an interval sufficiently long for the district selector to reach the selection beyond position, and then abandons the call by opening the tip and ring. The sender will complete office selections and due to the fact that no numerical digits have been recorded and the call has been abandoned the sender will advance the incoming of final selector to tell tale. A signal from the selector to the sender indicating that it has arrived at the tell tale will cause the sender to advance the district to its overflow position. With the tip and ring open the district selector will advance to normal. The return to normal of the district selector is used as an indication that the brush continuity test has been satisfactory and the next district selector will then be tested. If the district selector does not return to normal within a predetermined interval the trouble alarm will be sounded.

The circuit operation to accomplish the above is described in the following. The district selector to be tested is selected and the (CL) switch and the class sequence switch are set in the usual manner. If the district selector to be tested is idle, the operation of the (IDL) relay in position 6 of the (R1) switch closes a circuit through the contact of the (BC) key operated and the (C-3) cam to advance the (R3) switch to its second test position. This enables the dial jacks to be used. With the (R3) switch in the second test position the (R1) switch advances to position 7. In position 7 the usual overstep test is made. In positions 8, 9 and 10 of the (R1) switch the code is dialed corresponding to the plugs inserted in the dial jacks. When the (R1) switch reaches position 11, the (BC) relay operates through cam (H1). The (BC) relay operated closes the circuit for stepping the (MC) switch under control of the "B" interrupter. When the (MC) switch has reached position 5 a circuit is closed through the (BC) arc to operate the (WO) relay. The (WO) relay operated, locks under control of cam (N1) and operates the (TR) relay. The (TR) relay operated opens the tip and ring to the district selector and sender. While the (MC) switch continues to step under control of the "B" interrupter, the district selector should be returned to normal due to the call being abandoned. If the district is returned to normal ground will be removed from the "DB" lead releasing the (FR) and (FR1) relays. The (FR1) relay released operates the (ADV) relay which locks under control of the (N1) cam and advances the (R1) switch to position 18. In position 18 the connector switches are advanced to the next district to be tested in the usual manner.

If the district selector does not return to normal due to brush trouble, rotating district, sender failures or any other trouble, the (MC) switch advances to terminal 15, where it operates the (BT) relay through the (BC) arc. The (BT) relay operated locks under control of cam (N1) and prevents the operation of the (ADV) relay if the district selector should be released due to the action of the sender monitor and lights the (BC) lamp. The trouble alarm sounds after the usual interval. To repeat this test the (REP-2) key is operated advancing the (R1) switch and preventing the R3 and class switches from advancing.

57. AUTOMATIC RELEASE FROM TIME ALARM POSITION

To check the automatic release feature of the district selectors the (DR) key is operated and the RCI key must be operated as the test is effective only in the second test position with the district (CS) and (CH) relays operated. The test switch advances to position 17 in the usual manner but the district remains in talk position as the (DR) key provides a hold circuit for the (DC) relay. It also closes a path which holds the (SL) relay in position 15 to 17 until the district advances from talk position. When the (SL) relay releases the hold circuit for the (DC) relay is changed to a release circuit, to prevent the (L) relay from operating when line finder returns to normal and to remove shunt, for coin current. The test of the flat rate district advances from position 17 when the (SL) relay releases but a message rate or coin district awaits the charge.

The time alarm period is lengthened to provide a minimum of five minutes.

58. S & R JACKS

The S and R jacks are used for connecting the transmission testing set to the test circuit so that the test circuit can be used for connecting it to the district selector.

ENG.	CHK'D.	APP'D.
W.W.L.	W.W.L.	C. A. MELSHEIMER
12-8-37		S.C.E.
MO'D-EP		