SA R

PANEL SYSTEMS
AUTOMATIC TESTING CIRCUIT
FOR SUBSCRIBER SENDERS
OF THREE, OR THREE TWO DIGIT DECODER TYPE
USED WITH SENDERS SELECTORS
OR ROTARY LINK CIRCUITS

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 Provisions have been made to enable the Subscriber Sender Test Circuit to test Subscribers Senders and Auxiliary Sender circuits under conditions encountered during handling of service calls by these circuits wherein multifrequency outpulsing is used in passing directing information to the terminating equipment.

Several types of calls may be simulated by the added features as follows:

1. Ten digit calls to be directed to C.S.P.'s (control switch points) for direct distance dialing to foreign area dial terminations.

2. Seven or eight digit calls to be directed to control switch or tandem points for completion at "Home" area manual terminations with or without over ten thousands or stations digits required.

3. Seven digit calls to be directed to control switch or tandem points for completion to "Home" area dial terminations.

4. Seven digit skip-3 calls to be directed to crossbar single unit exchanges with direct trunk groups and capable of receiving terminating information on a multifrequency basis.

5. Seven digit skip-2 calls to be directed to crossbar multi-unit exchanges using a common incoming trunk group and capable of receiving terminating information on a multifrequency basis.

6. Ten digit skip-3 calls to be directed to crossbar tandem offices that handle calls only to local offices within one "foreign" numbering area.

B. CHANGES IN APPARATUS

B.1 Added

Fig. AJ		Fig. AK	
(PP)	R216 Relay	24	238A Jacks
(MFA)	R699 Relay	19	2G Lamps
(TRF)	R33 Relay	1	18AM Resistance

Fig. AJ

		Fig. AN	
(TRF1)	R529 Relay		
(DPC)	R2046 Relay		
(DPC1)	R1523 Relay		
(DPC2)	R1523 Relay	10	552A Keys
(DPC3)	R618 Relay		
(LC)	R1543 Relay		
(LC1)	R1543 Relay		

Fig. AO

(LMP1)	R1731 Relay
(MF1,MF2 & MF3)	18AM Resistances
(MF4)	18AC Resistance

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Sheet .021

Sixteen leads were added to connect the main figure to figure AJ and reference to note 178 added.

Leads 1 and 2 from Fig. K to Fig. AO were added to provide means for operating lamp lighting relay (LMP1) in connection with the use of the multifrequency adapter circuit.

D.2 Sheet .022

Seventy seven leads were added to connect the main figure to figures AJ, AK, AL, AM, AO and AN. Fig. AM and references to Note 178 added. Options AW & AX added.

D.3 Sheet .023

Twenty-one leads were added to connect the main figure to Figures AJ or AL. Reference to Note 178 added.

D.4 Sheet .027

Added with this issue showing Figures AM, AJ, AK, AL, AN, AO and Notes 178 and 179 in connection with the use of the multifrequency adapter circuit for testing subscribers and auxiliary sender circuits.

D.5 Sheet .028

Added with this issue showing term strip D.D.D. and page 14 of circuit requirements.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is designed to test three or 3/2 digit decoder type non-coin subscriber senders which are selected by sender selectors or rotary links.

It also provides means for testing auxiliary senders used in conjunction with the subscriber senders for 10-digit dialing and multi-frequency outpulsing.

1.2 The test calls are directed to each sender through a combination of master and sender selectors which are a part of this circuit.

1.3 The connecting selectors are automatically advanced to each sender in rotation, or manually advanced to any particular sender.

1.4 Two master selectors are required for each group of 400 senders or less. One sender selector is required for each subgroup of 20 senders or less.

1.5 The test circuit can be controlled to cover the advance from a busy sender after a predetermined period.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.01 Functions: General

3.011 Classes of Tests

Tests which simulate all classes of calls can be applied to any three digit decoder type subscriber sender which is selected by rotary links, or sender selectors during service operation. Optional figures are provided to permit the testing of either three-digit or three-two-digit types of senders. The feature used only for rotary links and those used only for coin test may be omitted. Any particular single test may be automatically applied to all senders in rotation or manually controlled to test a particular sender.

3.012 Location of Failures

The sender under test is first determined by inspecting the master selectors to determine the sender selector to which they are connected, then the sender to which that sender selector is connected is determined by reference to its position and a chart. If but one sender selector is off-normal reference to the master selectors is unnecessary.

3.013 Passing Busy Senders

The automatic pass busy feature functions only when the (APB) key is operated. The time which the test circuit continues to test for an idle condition is determined by the terminals of the time alarm selector to which the feature is connected.

3.014 Alarm Failure and Blocking

An alarm is given after a predetermined period which is usually a minimum of

one minute from the start of the busy or trouble test, and the test is blocked during trouble test.

3.015 Registration

Registers are provided to record the number of single tests (circuits tested), the number of repeated single tests (not recorded on the "circuits tested" meter), the number of busy senders which is passed without testing and the number of trouble test failures which bring in an alarm.

3.016 Special Tests

Current flow tests are applied to the sender (SC), (TG), (MTG), (GT), (SGT) and (L) relays; speed tests are applied to the (STP), (TG), (TG1), (TG2), (L), (OF), (RA), (SC) release, (SG) and (RA) relays, also, the grounding closures of the call indicator impulser and time required for (CI) impulses.

	REFER PAR.
3.1 Functions: Detail	
3.10 Means to connect with any subscriber sender.	3.01
3.11 To advance any sender selector either by automatic or manual control to connect with any sender.	31. 6.
3.12 To advance any sender selector past spare terminals and to restore it to normal.	31.
3.13 To give a signal to the tester when all senders have been tested.	34.
3.14 To advance any master selector from normal automatically or manually.	31.
3.15 To determine if the sender selector to which the master selector is connected is at normal.	5.02
3.16 To automatically advance the master selector when the connected sender selector has completed its cycle.	31.
3.17 To automatically pass spare master terminals and return the master switches to normal.	33.
3.18 To give an indication if the 2 master selectors are not in step.	31.
3.19 To first test all non-coin senders, if any, then the coin senders, if any.	Note 112 on SD-21026-02
3.2 Preparation for Test	
3.21 To determine if the testing sequence switches are in the correct position to start the intended test.	5.02
3.22 To determine if the connecting 200-206 type selectors are breaking the back interrupter contacts when energized.	5.02
3.23 To prevent interference with any sender while establishing connections either manually or automatically.	5.03
3.231 To release the sender (SG) relay if locked to the "TL" lead (Rotary Link Only).	
3.24 To test the sender to which connection has been established in order to insure that it is idle before completing the test.	5.03
3.25 To complete a connection through six (T, R, FT, FR, SC, TR) leads as soon as the connected sender is found to be idle.	5.03
3.26 To wait while testing a busy sender for a predetermined period giving a visual indication of cause and then giving an alarm, or under control of a key to advance the test to the next sender.	5.03
3.27 To test the sender (SC) relay for operation before any other test is made.	5.03
3.28 To connect battery to the counting relays of the test set only during test.	5.03
3.29 To check the performance of a test circuit relay used to assure the advance of the 200-206 type selectors thus reducing the possibility of sticking an energized selector.	5.03
3.291 Checks for direct battery on "TL" lead.	

	REFER PAR.
3.3 Alarm and Blocking Facilities	
3.31 To start a time counting cycle as soon as any connection or test is started and to restore and restart the cycle at the start of each new busy or trouble test.	35.
3.32 To block the test circuit after a predetermined period during which a visual indication of progress has been given and to give an audible and visual indication of the blocked condition.	35.
3.33 To restore and restart the time counting feature manually when repeating a particular test.	35.
3.34 To prevent advancing the test to another sender unless the time alarm key is restored to the position permitting the alarm to operate.	35.
3.35 To record a failure on the meter only when a trouble condition is encountered.	35.
3.4 Simulating a Full Selector Call	
3.41 Under control of keys, checks the operation of the sender (L) relay and provides for a listening test of the dial tone.	5.03
3.411 Synchronizes the listening test in order to permit operation of the control keys at any time during the test without interference, and removes other tone that may interfere with the listening test for dial tone.	36.
3.42 Advances the dialing switch after the dialing path has been checked.	5.03
3.43 Primes the sender with any part of 10 pulses simulating a digit as received from a substation dial, Fig. Y.	5.12
3.44 Under control of keys, delivers one pulse or one, two or three separate pulses before dialing the first code digit.	5.11 5.12
3.45 By means of keys, controls any number of pulses, permitting the sender to receive only the desired number for each digit.	5.13
3.46 After dialing each digit advances the dialing control switch to the next or any predetermined digit or to the holding position.	5.13
3.47 Furnishes a distinctive tone except during actual dialing for the purpose of identification by the sender monitor.	5.13
3.48 Prevents the starting of the dialing of each digit until the arrival of the pulse interrupter at the correct position and stops the dialing of each digit at the correct point of the pulse interrupter, Fig. Y.	5.13
3.49 Provides extreme allowable variations in dial pulses, Fig. Y.	5.13
3.491 Provides a pulse having the maximum or minimum allowable open period, Fig. Y.	3.307
3.492 Provides the minimum or maximum allowable loop resistance and maximum allowable mutual leak in connection with the minimum loop resistance, Fig. Y.	3.311
3.493 Checks the shunt applied to the 1000 ohm winding of the (SC) relay.	
3.494 Controls the operation of the relay interrupter, when used to furnish pulses with maximum allowable variations.	
3.5 Checks the Sender Fundamental	
3.51 Checks the district brush, district group, office brush, office group or skip office, incoming brush, incoming group, final brush, final tens, final units, incoming advance	5.1 to 5.23

	REFER PAR.
and talking selection as indicated by the position of the control keys, giving a visual indication of the number of pulses sent and received, blocking the test if these pulses do not check and giving a visual indication of the particular feature wherein the failure occurred.	
3.52 Simulates a minimum or maximum fundamental circuit including an (L) relay of correct resistance and impedance to give a test which is slightly more severe than the worst circuit conditions.	5.161
3.53 Simulates commutator pulses of higher speed or greater length than those encountered in service, Fig. W.	
3.54 Insures that the first pulse is complete.	5.161
3.55 Delivers pulses to the counting relays of the test set, similar in number and effect to those delivered to the fundamental circuit of the sender.	5.161
3.56 Insures a check that the number of pulses delivered to the sender is neither more nor less than the predetermined number as controlled by the depressed keys.	5.161
3.561 Checks #6 (letter O) if O (zero) is dialed as the B or C code.	
3.57 Insures a maximum period for the release of the counting relays in the test circuit before advancing the check switch to a position where the relays will again be used.	5.161
3.58 Detects false grounds on the fundamental circuit between incoming advance or final heavy positive pulse and talking selection positions.	5.168
3.581 Checks the operation of the (TG) relay or under the control of a key in full selector class calls, checks either the operation of the (TG), or the non-operation and operation of the (MTG) relay.	5.164
3.582 Saturates the (SC) relay immediately before the release test (Rotary Link Only).	5.20
3.583 Checks the release of the (SC) and the operation of the (H) relays within a definite time interval (Rotary Link Only).	5.20
3.584 Awaits the operation of the (AV1) relay in the sender and the resulting increase in resistance of the SC lead.	5.20
3.585 Checks the failure of the (AV1) relay to operate within its allowable period.	5.14
3.586 Controls the relation between the checking and dialing circuits insuring synchronization and stops the test if checking is prematurely commenced.	5.165
3.587 Checks the momentary opening or grounding of the SC lead.	5.15
3.588 Checks the sequence contacts of the sender (IA) relay.	5.167
3.589 Checks for crossed (BO) contacts.	5.212
3.6 Restores Sender to Normal	
3.61 Checks the operation of the relay which connects 48-volt battery to the SC lead (Rotary Link Only).	5.23
3.62 Checks the restoration of test battery to the test lead "TR" (Rotary Link Only).	5.23
3.63 Checks the hold and quick release of the sender guard relay (Rotary Link Only).	
3.7 Class Control	
3.71 Assures that the correct check switch is used for each class of call.	
3.72 Controls the dialing circuit assuring that only the desired digits are dialed.	
3.73 Makes the necessary changes in the checking circuit for the different classes of calls.	

	REFER PAR.
3.8 Simulates a Call during Which the Incoming Selector Is Sent to Overflow	7.
3.81 Dials and checks the call in a manner similar to a full selector call until dialing is completed and checking has been completed up to and including the position of incoming group.	
3.82 Advances the test to give the sender reversed fundamental battery.	
3.83 Checks the increased resistance of the SC lead, talking selection and for restoration to normal in a manner similar to a full selector call except that the talking selection is made under the control of a different key.	
3.9 Simulates a Full Selector or Call Indicator Call during Which an Office Selector Is Sent to the Overflow Position	8.
3.91 Prepares for, dials and checks the call in a manner similar to a full selector call until it has been completely dialed and checked, up to and including the position of office group.	
3.92 Advances the check switch to produce a reverse battery condition of the fundamental circuit.	
3.93 If a full selector class of call is dialed, checks the operation of the relay which shunts the 14,500 ohm resistance and (TG) relay of the sender, by connecting the STP relay.	
3.94 Checks the fundamental closure in both classes FS and PCI and insures that the sender does not make talking selection before dialing is completed.	
3.95 Completes the check and restores the sender to normal in the same manner as in a full selector call.	
3.10 Simulates a Permanent Signal Condition	9.
3.101 Prepares the test in a manner similar to a full selector call.	9.
3.102 Advances the dialing switch to the holding position without dialing.	
3.103 Checks the district brush and group selections in accordance with the depressed keys, then advances the checking switch to connect reversed battery to the fundamental.	
3.104 Upon signal from the sender (increased resistance of the (SC) lead), advances the test to talking selection which always requires 4 pulses and then to normal in the same manner as in a full selector call.	
3.105 Increases the alarm period of the test circuit.	
3.11 Simulates a Call to the Special Service Operator	10.
3.111 Prepares the sender for the call in the same manner as for a full selector call, then dials one digit, a zero, and advances the dialing switch to the holding position.	
3.112 Checks the district brush and group, office brush and group or skip office selections as indicated by the depressed keys and in a manner similar to a full selector call.	
3.113 Connects battery to the fundamental for trunk test and awaits a signal from the sender before checking talking selection.	
3.114 Checks the talking selection and restores the sender to normal in the same manner as in a full selector call.	
3.12 Simulates a Call to a 3-Digit Operator	11.
3.121 Tests and prepares the sender in the same manner as in a full selector call.	

REFER PAR.

3.122 Dials three digits only, the second and third digits always being one, then advances the dialing switch to a holding position.

3.123 Completes the checking and restoration to normal in the same way as in a call to a special service operator.

3.13 Simulates a Call to a Restricted Zone, or One in Which an Unused Code Is Dialed — 12.

3.131 Tests and prepares the sender, then dials all digits in the same manner as in a full selector call.

3.132 Checks the district and office brush and group selections as indicated by the depressed keys and then simulates a trunk test.

3.133 Awaits a signal from the sender, then checks talking selection and restoration to normal in the same manner as in the full selector call.

3.14 Simulates a Full Selector Call Which Is Abandoned by the Calling Party after Dialing the Thousands Digit — 13.

3.141 Tests and prepares the sender, in the usual manner.

3.142 Dials all digits up to and including the thousands digit in the same manner as in previously described calls. The dialing switch then advances to the holding position where the holding loop is opened.

3.143 Checks the selection up to trunk test in the same manner as in the regular full selector call.

3.144 Awaits the release signal ground from the SC lead, and completes the trunk test.

3.145 Checks the closure from the sender which is intended to send a selector to tell-tale then connects reversed battery to the sender.

REFER PAR.

3.146 Awaits signal from the sender, then connects ground to the SC lead and checks the restoration of the sender to normal in the same manner as in a full selector call except that the talking selection is not checked.

3.15 Tests the Features of the Sender Which Are Involved in the Control of the Registers — 14.

3.151 Tests and prepares the sender and test circuit in the same manner as in the standard full selector call.

3.152 Dials three digits as indicated by the depressed code keys, then advances the dialing switch to the normal holding position.

3.153 Dials four zeros in rapid succession for which the "B" dialing interrupter and the "MAX LINE" key only, should be used.

3.154 Checks the district and office selections, the trunk test and all numerical digits (the numerical digits are zeros), then advances the sender to talking selection and checks its return to normal in the same manner as in the standard full selector call.

3.16 Simulates a Direct Call to a Manual Exchange Which Has No Lines with Numbers above 9,999 nor Any Station Designations — 15.

3.161 Prepares the test circuit for the test in the same manner as in a full selector call. — 15.1

3.162 Tests the TR lead for 48-volt battery through 150 ohms (Rotary Link Only) and if the battery is not present awaits for a predetermined period giving a visual indication of the cause of the wait, then gives an audible and visual alarm, or under the control of a key advances the test circuit to the next sender.

	REFER PAR.
3.163 Tests the TR lead for absence of "busy" ground (sender selector type only).	
3.164 After seizing an idle sender, closes through the remainder of the six testing leads.	15.1
3.165 Makes an operation test of the (SC) relay.	15.1
3.17 Priming the Sender	15.2
3.171 Tests for the closure of the dialing loop and under control of a key permits a synchronized listening test for dial tone.	
3.172 Awaits the proper position of the dialing pulse interrupter, then permits ten open periods in the dialing loop, shunting out, under control of a key as many of these pulses as are not required, in order to prime the sender with the desired digit. The interrupter is then disconnected from the dialing circuit and the control switch is advanced to the next position from which a digit is to be dialed.	
3.173 Under key control dials a preliminary pulse in the same manner, but previous to the first code pulse.	
3.174 Under the control of various keys, delivers a pulse of maximum or minimum allowable open period, over a dialing loop of maximum or minimum allowable resistance and over a mutual lead.	
3.175 Dials all digits, except 10,000, up to and including the final tens digit.	
3.176 Dials the units digit when ready to check trunk test.	
3.1761 Waits for the check of the coin feature if a coin sender is being tested for coin control.	
3.177 Advances the dialing switch to a position wherein the dialing loop is held as a closed circuit until the proper check is completed.	
3.18 Checks the Fundamental Circuit of a Call Indicator Call	15.3
3.181 Simulates a normal fundamental circuit with added margins in resistance and in speed of ground pulses used to simulate a selector commutator. Insures a proper form and correct number of pulses and provides a check when the required number of pulses does not satisfy the sender, also furnishes means for noting the variation between the actual and required pulses similar to the method of checking a full selector call, during district and office selections.	15.3
3.182 Insures that the sender does not wait for the stations digit.	27.
3.183 Makes a holding test of the (TG) relay train.	15.4 27.22
3.184 Checks the presence of the ground which is connected to the fundamental circuit by the impulser switch of the sender for the purpose of discharging the trunk cable capacity previous to the first pulse. This check is made only when the first pulse does not include a positive pulse in the first quarter.	15.5 26.
3.19 Checks the Accuracy of the Indicator Pulses as Delivered by the Impulse Switch	15.5
3.191 Checks the direction of the current flow (the current flow is positive when battery is connected to the fundamental tip and negative when battery is connected to the fundamental ring, ground being connected to the opposite side of the fundamental circuit in each instance).	22.
3.192 Checks the strength of the pulses by the operation and non-operation of the marginal relay.	
3.193 Records each digit on a group of relays as received, these relays being particularly fast in order to record any	

	REFER PAR.
short pulses which might affect the weakest allowable relay of a piece of equipment in service.	
3.194 Transfers the recording leads to the next set of relays after each digit is recorded.	
3.195 Closes a checking path through each set of relays which will be completed at the check switch.	
3.196 After recording the last numerical digit, establishes a path for checking the strength, polarity and continuity of the final heavy positive pulse, if this pulse is used.	
3.197 Checks the fundamental circuit for false grounds after units or final heavy positive pulse check. Disconnects the check for false ground before talking selection.	
3.198 Checks all numerical digits except the 10,000 digit and stops the test if the setting of the register relays does not agree with the keys as operated.	
3.199 Gives a visual indication of the digit sent and received.	
3.1991 On direct calls only, checks the time from assignment to the last pulse and blocks if excessive time is required.	
3.20 Checks for talking Selection and Return to Normal	15.7
3.201 Grounds the SC lead and releases the (SC) relay, checking its failure to release within a predetermined period (Rotary Link Only).	15.6
3.202 Checks the failure of the (H) relay to operate and hold, when locked to the SC lead (Rotary Link Only).	15.6
3.203 Checks the accuracy of the talking selection as indicated by the depressed control key.	15.7
3.204 Checks the connection of the test battery to the SC lead and the reconnection of the test battery to the "TR" lead.	15.8
3.21 Simulates a Direct Call to a Manual Exchange Not over 9,999 Lines, but with Station Designations	16.
3.211 Prepares for, dials and checks the call in the same manner as a call indicator call without station designations except as follows.	
3.212 Checks the failure of the sender to wait at least 2 seconds for the dialing of the station digit.	27.
3.213 Checks the time of operation of the (TG) relay train, giving the (TG) relay its current flow operate test.	27.21
3.22 Simulates a Direct Call to a Manual Exchange Having Line Numbers above 9,999 but without Stations Designations	17.
3.221 Prepares for, dials and checks the call in a manner similar to a call to an exchange having not more than 10,000 lines except as follows.	
3.2211 The ten thousands digit is dialed immediately following the last code digit and is checked in the same manner as a stations digit.	
3.2212 Checks a failure of the sender to wait at least 2 seconds for the fifth numerical digit to be dialed under the varying conditions which may occur during services.	
3.2213 Checks the operating time of the (TG) relay train	
3.23 Simulates a Direct Call to a Manual Exchange Having Lines Whose Numbers Are above 9,999 and Also Lines Using the Station Designations	18.

REFER PAR.

3.231 Prepares for, dials and checks the call in the same manner as a call to an exchange having station designations but no lines above 9,999 except as follows.

3.2311 No stations are dialed or checked for, when the first two numerical digits which are dialed, are 1 and 0 respectively.

3.2312 Depending on the form of wiring used in the sender and test circuit, the test circuit may or may not check the failure to wait for the fifth numerical digit when the third numerical digit is 5 to 9, inclusive.

3.24 Simulates a Call to a Manual Exchange through a Manual Tandem Point 15.

3.241 Prepares for and checks the call in the same manner as a similar type of direct call to a manual office except as follows.

3.2411 Checks the first three digits as indicated by the 3 depressed code keys and in the same manner as the numerical digits of a direct call. This check occurs immediately after the trunk test and assignment.

3.25 Simulates a Direct Call to Manual Office Having No Station Designations and Not Using a Distant Office Selector during Which a Release Occurs Before Assignment 19.

3.251 Dials and checks the call in the usual manner until the dialing is completed. A release condition is then simulated by opening the dialing loop and the trunk test is continued until the release signal is received from the sender.

REFER PAR.

3.252 Omitting a check of talking selection the restoration of the sender to normal is checked in the usual manner.

3.26 Simulates a Direct Call to Manual Exchange Having No Station Designations but Using a Distant Office Selector in Train. This Call is Abandoned Before Assignment 20.

3.261 Prepares for, dials and checks the call in a manner similar to a call without station designations but with a distant office selector and during which a late release occurs. Delays the check of numerical digits, as zero, to assure that the sender does not prematurely wipe out.

3.262 Checks the final heavy positive pulse which is required for the advance of the 2-W office selector. This check is for strength, direction and continuity of the pulse.

3.263 Waives the check of talking selection, but checks the restoration of the sender to normal in the usual manner.

3.27 Simulates a Tandem Call to a 3-Digit Operator Wherein XII Is Dialed and X1100000 Is Checked 21.

3.271 Prepares for, dials and checks the call in the same manner as a direct call to a manual exchange except as follows.

3.2711 After dialing the third code digit the dialing control switch is advanced to the holding position. The check switch does not omit the tandem positions as in a direct call but checks the code as dialed.

3.2712 Checks for zero as all numerical digits, for false ground on the fundamental circuit, for talking selection and for return to normal in the same manner as in a standard call indicator call.

REFER PAR.

3.28 Simulates a Call from a Coin Station in Certain Classes Only — 23.

3.281 Applies the test only to coin senders and not when the free call "FC" key is operated

3.282 Awaits the start of the coin test in the sender before starting the check.

3.283 Makes a non-operate test of the relay used for recognizing the coin ground and checks a failure if the relay operates within a predetermined period.

3.284 Checks the operation of the relay for recognizing the coin ground, by means of its current flow requirements.

3.285 Under manual control, transfers the above test to the sender feature for detecting a solid ground which may be substituted for the coin ground, and makes an operate test of the (SGT) relay, releasing the test if the sender sticks as expected.

3.286 Or makes a non-operate test of the (SGT) relay.

3.287 Completes the check in the usual manner for the particular type of call involved. — 21.

3.29 Permits the Dialing and Checking of Each Digit or of a Connected Group of Digits under the Control of Keys or by the Use of a Jack at the Sender Frame

3.30 Checks the sender restricted PBX call diversion feature. — 42.

3.31 The following keys are provided for the purposes as indicated, the detailed use being described in connection with the circuit operation.

3.311 Start Key (ST) - This key furnishes an off-normal ground and partially closes a normal checking path, also a path for advancing the sender selectors. When restored to normal it restores the connector switch to normal and furnishes a ground which is used for stepping the selectors until joint control with the particular circuit key.

3.312 Particular Circuit Key (PC) - This key is used only when the ST key is normal and closes a path which permits the manual operation of the master and sender selectors. It also prevents interference with the test leads. If the "ST" key is operated "AB" wiring must be used to guarantee non-interference on the "TL" lead.

3.313 Master Selector Keys (Master 1) (Master 2)

These keys are used for the manual advance of the master 200-206 type selector and are used only in conjunction with the PC key.

3.314 Sender Selector Key (SDR. SEL.)

This key is used for advancing the sender selector to which the master selectors are connected and its use is similar to that of the master keys.

3.315 Control Advance Key (CA)

This key furnishes a ground for operating the control advance relay under certain conditions and advancing the R1 switch to position 8. When restored to normal it releases the (CA) relay, advancing the connector switch from position 8.

3.316 Repeat Key (REP)

This key causes the test circuit to continue testing the same sender and is also used in connection with the remote control. It should not be operated until the test of a particular sender has been started.

3.317 Repeat Key (REP 2)

This key causes the test circuit to make two consecutive tests of a sender and then advance to the next sender, repeating the same operation. It should not be operated until the test of a particular sender has been started.

3.318 Dial Pulse Key (D PL B)

This key when normal causes the use of a dialing interrupter with the shortest allowable open period. When operated the key connects a dialing interrupter having the longest allowable open period.

3.319 Pulse Check Key ($\frac{PL}{LP}$)

When operated this key and its associated relays display a lamp for each operated counting relay.

3.320 Capacity Call Indicator Key (Cap. RCI)

This key connects 1.5 mf capacity across the resistance which is connected to the FR side of the fundamental circuit thus bridging the testing leads with a capacity, and producing a resonant condition for checking discharge closures. It is used with a beyond office compensation of 1300 ohms.

3.321 Dial Tone and Dial Tone Advance Keys (DT) (DTA)

The operation of the DT key remains locked, causes a relay to operate at the proper moment and connects the dialing loop to a test receiver, arresting the dial control switch in position 1. After making the listening test the DTA non-locking key is operated to advance the circuit for the next test.

3.322 Maximum Line Key (MAX LINE)

This key when operated adds 1000 ohms to the dialing loop. When normal, it connects 10,000 ohms in multiple with the dialing interrupter also a subscribers set which simulates two ringers each in series with a 2 mf condenser. When normal no resistance is connected in series with the dialing circuit.

3.323 Minimum Line Key B - (MIN B)

This key provides a leak of 15,000 ohms and cuts in the (B) dialing interrupter on a minimum line to test the (L) relay coded L-24.

3.324 Free Call Key (FC)

This key prevents the operation of the (CN) relay and causes the test circuit to test a coin sender for a free call.

3.325 (SGT) Relay Operate Test Key (SGT-OPR)

This key provides paths for operating the (SGT) relay and releasing the circuit after a suitable time if the relay operates.

3.326 (SGT) Relay Non-operate Test Key (SGT-NO)

This key provides for a non-operate test of the (SGT) relay.

3.327 Preliminary Pulse Key (PP)

When operated, no preliminary pulse is dialed into the sender.

3.328 Prefix "One-One" Key (1-1)

When operated, two digits, one, are dialed into the sender.

3.329 Dial Step-by-Step Key and Advance Dialing Key (DSS) (AD)

These two keys permit the dialing of each digit individually. The operation of of the DSS locking key stops the dialing after each digit, from which point it is advanced by the momentary operation of the AD non-locking key.

3.330 Stage-by-Stage Checking and Advance Keys (SS) (SA)

The operation of the SS key and its associated relays stops the check at the end of each selection. The momentary operation of the non-locking SA key advances the check to the next selection if the normal operating ground is available.

3.331 MTG Relay Testing Key (MTG)

This key transfers the fundamental during the trunk test period from the (TG) relay to the (MTG) relay. This permits a non-operate and operate test of the (MTG) relay and is used only in the classes where the (MTG) relay may be connected in service.

3.332 Special Pulse Key (SP)

This key, when operated, connects a slow pulsing condenser discharge feature, giving revertive pulses of much slower frequency. It is used only in FS Class #1.

3.333 Group Keys (GR)

These keys are used to stop the test before advancing to a succeeding group where it is necessary to reset the control keys due to the use of a different district and office selection for the same dialed code.

3.334 Time Alarm Key (TA)

Permits the time alarm selector to restore to a normal point, disconnecting the alarm. It must be restored to normal before advancing the test to the next sender.

3.335 Link Class Keys (0), (FT), (FR), (FT/FR)

These keys are used to simulate the paths which are momentarily connected to the sender at the start of a call over the fundamental tip and fundamental ring from ground or ground through resistance in the link circuit. The (FR) key closes the operating path of relay (FR).

3.336 Class Control Keys (0) to (19)

These keys are used in conjunction with a class switch which is set in the associated position by the operation of any one of these keys to control the type of call which is to be tested.

3.337 Compensating Resistance Keys for Office and Beyond Office Compensation (OFF.) (BEY. OFF.)

These keys connect resistance, as indicated by their designations, to fundamental ring for selections through the office selectors and also for selections beyond the office selectors. Their use is in conjunction with the compensating resistance which is connected to the fundamental ring in the sender.

3.338 Code Keys (A), (B), (C)

The depression of one key in each of these rows results in the dialing of that particular digit as part of the office code, also its check if part of a manual tandem code.

3.339 Second Code Digit Key (B)

Used to omit dialing the B code digit and to check zero for tandem call indicator codes.

3.340 Selection Control, District Brush, District Group, Office Brush, Office Group and Skip Office Keys (DB), (DG), (OB), (OG) or (SKO)

The depression of one key in each of these rows is necessary in order to check the district or office selection which will result from the associated keys which have been used. The SKO key causes the checking switch to omit a check of the office brush and group selections.

3.341 Talking Selection Keys (TS)

These keys check the designated number of pulses which constitutes the talking selection.

3.342 Automatic Pass Busy Key (APB)

This key causes the test circuit to pass a busy sender after a period which is determined by the wiring of the #3 arc of the time alarm selector.

3.343 Sender Lamp Key (SL)

Permits in certain classes, the checking of the partial dial or stuck sender lamp, the no coin ground and the advance after either test when the sender is primed.

3.344 Numerical Keys (TD), (H), (T) and (U)

The numerical keys result in the dialing of the designated thousands, hundreds, tens and units digits and in conjunction with the thousands and hundreds sequence switches which are caused to be set by the depression of the TD and H keys, result in a check of the selection which will result from the operated keys.

3.345 Stations and Tens Thousands Keys (STAT-TTD)

The depression of the appropriate key results in the dialing and checking of a stations or ten thousands digit. A key in this row should be depressed on all calls to exchanges where either the stations or over 10,000 digits apply.

3.346 Lamp Key (LP)

Connects battery to the progress lamps.

3.347 Station Delay Key (SD)

When operated this key checks a station delay of 2 seconds minimum.

3.348 (TG) Operate Test Key (TGO)

Applies an operating circuit for the (TG) relay to the fundamental circuit for a short time.

3.349 Cancel Synchronizing Key (CAN. SY.)

This key permits the dialing of all digits including units before starting the check of selectors. It should be used with class key #2.

3.350 Sender Monitor Key

This key connects a handset to the Sender Monitor's Telephone Set.

3.351 STP Release Test (STP) Key

Provides a variable release test of (STP) relay. The test value is to be used normally. The adjust value, key operated, is only for use directly after the relay has been readjusted to the current flow values.

3.352 Particular Auxiliary Sender Keys (PAS-0) to (PAS-9)

Provides a means for causing the particular subscribers sender under test to pick a particular auxiliary sender from a group, for testing purposes.

3.36 The following jacks are provided for the purposes indicated, the detailed use is described under circuit operation.

3.361 Jacks (RC)

Remote control jacks are installed in suitable locations on the sender frames and by the use of a make-busy plug the control advance feature is operated. The use of a 32A test set which has a cord with two keys equipped to furnish ground over either the tip or the ring will perform the same function as the make-busy plug when the proper key is depressed for furnishing the ground on the ring. When the key which furnishes ground upon the tip is depressed with the plug inserted in the jack the step-by-step feature is operated.

3.362 Jack (RV)

This jack facilitates the adjustment of relay (RV).

3.363 Jacks - Dial Control - (PBX surge) (LS Min BR) (LS Max BR) (MS Min BR) (MS Max BR) (HS Min BR) (HS Max BR), control relays that establish line loop extremes and dial speed.

3.364 Jacks (LR), (E827), (L1) and (L24) provide special requirements for different (L) relays.

3.365 Jack (SP) controls relay revertive pulses.

3.366 Jack (IGT) controls the test for additional five incoming groups.

3.367 STP Release Test (STP) Jack

This jack supersedes the (STP) key. A 184B plug in the jack gives the adjust value.

3.368 Jack (TDV) controls the test for the sender PBX call diversion feature.

3.369 Jacks (ACA 2/9) (ACB 0/1) (ACC 0/9)

The insertion of a plug in one of each of the (ACA-) (ACB-) and (ACC-) jacks results in the dialing of that particular digit as part of the area code, also its check in conjunction with the use of the multifrequency adapter.

3.370 Jack (MF)

The insertion of a plug in this jack prepares the sender test circuit and M.F. adapter circuits for handling calls outpulsed on a multifrequency basis.

3.371 Jack (7DG)

Used in conjunction with the M.F. adapter circuit for simulating calls where seven digits are to be outpulsed on a multifrequency basis.

3.372 Jack (SK2)

Used in conjunction with the M.F. adapter circuit together with the (7DG) jack for simulating a call where five digits are to be outpulsed on a multifrequency basis.

3.373 Jack (SK3)

Used in conjunction with the M.F. adapter circuit together with the (7DG) jack for simulating a call where four digits are to be outpulsed on a multifrequency basis. Also used on ten-digit Skip-3 calls where ten digits are dialed and only seven multifrequency outpulsed.

3.38 Lamps

3.381 RCI Check Lamps

Indicate the digit actually registered by the register relays which are controlled by the polarized and marginal relays.

3.382 Match Lamps

Show the digit which was dialed by the test circuit.

3.383 Dial Progress Lamps

Indicate the position of the dial control switch.

3.384 FM Progress Lamps

Indicate the position of the check switch used to check full selector calls.

3.385 MF-RCI Progress Lamps

Indicate the position of the switch used to check relay call indicator calls or multifrequency outpulsed calls.

3.386 Pulse Lamps (Revertive)

Indicate the number of counting relays which have been operated in any selection check.

3.387 Synchronizing Lamp (S)

Indicates that the check is ahead of its proper sequence.

3.388 Dial Tone (DT) Lamp

Indicates that the dial tone circuit is in position for the listening test.

3.389 Overflow Relay (OF) Lamp

Indicates failure of the (OF) relay to operate, or failure of the (AV1) relay to operate.

3.390 Sender Normal (Sdr. Nor.) Lamp

Indicates the test position awaiting the restoration of the sender to normal.

3.391 M.F. Pulse Lamps (P0) to (P9)

Indicate the numerical value of a multifrequency pulsed digit actually received by the adapter circuit in the event of a failure during pulse checking.

3.392 PTF-KP-ST Lamps

M.F. adapter pulse timing failure. Awaiting key pulse or gate-opener signal. Awaiting start pulse or signal that pulsing is completed.

3.393 Area Code Dial Progress Lamps (ADA) (ADB) (ADC)

Indicates the next area code digit to be dialed.

3.394 Area Code Check Lamps (AMA) (AMB) (AMC)

Indicates the area code digit being checked by the adapter circuit.

3.40 Sequence Switches

3.401 Connector Switch (R1)

Controls the movement of the master and sender selectors and also performs the test for busy sender conditions and restoration of the sender.

3.402 Dial Control Switch (R2)

Controls the dialing, also coin test, (SC) relay tests, and link release when used.

3.403 Full Selector (Mech.) Check Switch (R3)

Performs the check of the full selector and operators class calls.

3.404 Multifrequency and Call Indicator (MF)-(RCI) Check Switch (R4)

Controls the check of call indicator calls including station delay, slipping impulser switch, TG relay operate, hold and release tests. Also in conjunction with the adapter circuit checks multifrequency pulsed calls.

3.405 Class Switch (R5)

Selects either the R3 or R4 check switch, controls the number of digits to be dialed and makes the circuit changes necessary for checking the different classes of calls.

3.406 Thousands (TD) and Hundreds (H) Switches (R6) and (R7)

These switches supplement the similarly designated rows of plunger keys and control the circuits for translating the thousands and hundreds digits into incoming brush and group also final brush selections.

3.41 In conjunction with a multifrequency adapter circuit, simulates a seven, eight or ten digit call to a toll Control Switch or Tandem Point capable of receiving switching information by means of multifrequency pulsing.

3.411 In conjunction with a multifrequency adapter circuit, simulates a four or five digit call to a crossbar type of local central office capable of receiving switching information by means of multifrequency pulsing.

3.412 With the aid of jacks and plugs, provides means for dialing a toll "Area" code to a Subscribers Sender Circuit.

3.413 Establishes by means of a connector circuit, paths to a multifrequency adapter circuit to control dialing of a toll Area Code to the Subscribers Sender Circuit and paths from the adapter circuit to assist in the receiving and checking of multifrequency pulses from the Auxiliary Sender Circuit under test.

3.414 By means of jacks and plugs, indicates to the adapter and Subscribers Sender test circuits the number of digits they can expect to be multifrequency outpulsed from the Auxiliary Sender Circuit.

4. CONNECTING CIRCUITS

When a circuit is listed on a key sheet the information thereon shall be followed.

4.1 SD-21193-02 Sender Selector Decoder Type Subscriber Sender

4.2 SD-20028-02 Sender Selector Decoder Type Subscriber Sender

4.3 SD-21826-01 Sender Selector Decoder Type Subscriber Sender

4.4 SD-21581-01 Fuse and Time Alarm Ckt., Floor Alarm Bd.

4.5 SD-20328-01 Transfer Key Ckt.

4.6 SD-20255-01 Miscellaneous Int. Ckt.

4.7 SD-21234-01 Miscellaneous Ckt. for Sender Frame

4.8 SD-21856-01 Relay Int. Ckt.

4.9 SD-21837-01 Relay Int. Ckt.

4.10 SD-21971-01 M.F. Adapter Ckt.

4.11 SD-95536-01 M.F. Receiver Ckt.

5. DESCRIPTION OF OPERATION

5.01 Preparation

This description details the operations performed in testing a 3-digit subscriber

sender. The variations necessary for the 3-2 digit sender are later described in a separate paragraph. Before starting a test it is necessary to operate the proper class, code numerical, selection control, link class, compensating resistance, talking selection and stations control keys. But one key is operated in each row, with the exception of the class keys where but one key only is operated in the two rows. In certain classes of calls, as described later it may not be necessary to operate a key in the stations and other rows. The operation of these keys prepares the path for setting the thousands and hundreds, (R6) and (R7) numerical switches, and sets the class (R5) switch for the class of call which it is intended to test. The tester then operates such of the lever keys as may be necessary for imposing the tolerances that are desired for the particular test and for starting the test.

5.02 Connections - R1 Pos. 1 or 10, R2 Pos. 1, R3 or R4 Pos 1, (R5) Pos. as Desired, R6-R7 Pos. 1

Following the operation of the necessary control keys and assuming the master and sender selectors to be at their normal positions, the start key (ST) is operated. The normal checking path, which may be traced from ground at the 4 and 5T contacts of the (S) relay, a closure in position 1 of cams H4 and I3, the normal contact of the (CL) relay, contact of the TD key which is depressed, R magnet of R6 switch which sets in position corresponding to key, then same operation of R7 switch, normal position of the J2 cam, contact of ST key operating the (T) and (T1) relays, advancing the connector switch to position 2. This path determines that the class switch is not moving, that the dialing and checking switches are in their normal positions and that the thousands and hundreds switches have taken settings corresponding to their control keys. The (T) and (T1) relays release as a sender selector is not connected, and the (T2) relay does not operate. At the same time the (TA) relay is operated and locked under the control of the TA key to ground through cam SS2-K1. In position 2 of the R1 switch the (T) and (T1) relays release and the (MS) relay is operated from ground at the normal (22) position of the #1 arc of master selector No. 22. If the (MS) relay fails to operate and advance the connector switch from position 2 the SB lamp will remain lighted. If the APB key is operated at this time the connector switch will advance to position 9 and stick after the time alarm stepper has taken two steps. The alarm will be given 30 seconds later. Position 3 of the connector switch is passed by from the (MS) relay operated. In position 4 the (AX) relay is operated by a path which includes an operated contact of the (MS) relay and is a check upon the operation of this relay. Position 5 is passed by as the (MS) relay is in an operated position and the (AX) relay releases. In position 6 a ground is connected to the M1 and M2 steppers energizing them preparatory to advancing them from their normal positions. As soon as the selectors have energized and have broken the back contact of their interrupter springs the (AX) relay again operates advancing the connector switch to position 7. During the advance the two master selector magnets are de-energized, permitting the selectors to advance, and the (AX) relay is also released. The connector switch passes by position 7 as the (MS) relay is operated. In position 8 ground is connected to the R magnet causing the connector switch to pass the position if the sender selector to which the master selector is now connected is at normal. In position 9 ground is connected to the sender selector just seized if the two master selectors are in step, causing it to energize and as soon as its interrupter contact is broken permits the operation of the (AX) relay. This in turn advances the sequence switch to position 10 or 1 of the second cycle. In advancing from position 9 the sender selector is de-energized and steps, and the (AX) relay releases. All the above operations may occur if the connector switch is in positions 10 to 18 inclusive as well as the corresponding positions 1 to 9 inclusive.

5.03 Seizure - R1 Pos. 1-2

5.031 Testing for a Busy Sender, Sender Selector Type

The following operations would immediately follow the operation of the ST key if the master selectors had been connected to a sender selector which was connected to a sender. The (T) relay operates over the normal checking lead and in turn operates the (T1) relay, advancing the R1 switch to position 11. The (T1) relay connects the secondary winding of the (T) relay to the TR lead and the (T) relay will not release if the sender is busy. The SB lamp remains lighted and the time alarm functions after the predetermined period.

5.0311 Automatic Pass Busy Feature

If the "APB" key is operated, when the time alarm has grounded the APB lead, the PB meter is operated and in turn the (CA) relay, advancing the R1 switch to position 17 where the test is advanced to the next sender.

5.0312 Open Test Lead

The operation will be similar to that of paragraph 5.031 or 5.0311 depending on the position of the "APB" key. The (T2) relay will not operate and the sender will cause a busy signal. If the APB key is operated the test circuit will not detect the trouble.

5.0313 Sender Idle

When leaving position 10 or 1 an idle sender releases the (T) and (T1) relays. In position 11 the (T2) relay operates from battery through the sender (T) relay in multiple with the 1000-ohm winding of the sender (SG) relay, operating relay (AX) and advancing the R1 switch from position 11 and operating the (AD) and (CI) relays. In position 12 battery through 1500 ohms is applied to the "SC" lead in the sender closing the dialing path at the sender (CR) relay. The increased battery through the (SN1) relay is not connected to the SC lead until the dial control switch arrives in position 5 and therefore if the SC relay fails to operate the first code digit will not be recorded.

The R1 switch is advanced from position 12 by ground to cam SS1-D1 and from position 13 by ground from the (MS) relay normal. In position 14 battery is connected to the counting relays and dialing is started.

5.0314 Double Connection

If a district seizes the sender at the same instant as the testing circuit, relay (T2) will not operate and the circuit will function as for an open test lead.

5.032 Testing Cycle: Rotary Link Type

Ground is connected to the M1-1 arc of the master selectors corresponding to the terminals to which rotary link sender switches are connected and the (RL) and (RL1) relays operate as soon as the master switches advance to these sender switches. This transfers the TR, SC leads, etc., to Fig. A.

5.0321 Testing for an Idle Sender - R1 Pos. 1-2 or 10-11

The testing circuit advances from position 10 over the same path that it advanced from normal. If the testing circuit is standing on a busy sender which becomes idle leaving the (SG) relay locked up, the (SGR) relay will momentarily open the (TL) lead and cause the sender to become idle. In position 11 battery on the TR lead operates the (T3) relay which removes the shunt from the locks over its secondary winding. The tertiary winding is also shunted permitting the operation of the (T4) relay which operates relay (AX) advancing R1 switch to position 12. The release of the (T4) relay when the sender removes the battery from the TR lead advances the R1 switch to position 13 and ground from the (MS) relay normal to position 14.

5.0322 False Direct Battery on "TL" Lead - "AB"

Ground through the testing relays will operate the 1/2 amp. "TL" fuse which will ground this lead toward the sender blowing the sender fuse which supplies the direct battery.

5.0323 Sender Busy

When the sender under test is busy there is no battery connected to the TR lead and the (T3) and (T4) relays do not operate. If this condition continues until the time alarm functions, the blocking relay and alarm signals are operated. The blocking relay does not lock and the circuit advances if the sender becomes idle. The (TBL) meter is not operated.

5.0324 Pass Busy Senders

When the APB key is operated and the time alarm advances, ground is connected to the PB meter through the APB lead. The (CA) relay is operated and the test advanced to the next sender as described under control advance. The (AD) and (CI) relays do not operate.

5.0325 Advancing the Dial Control Switch

The operation of the (AD) relay connects the dialing loop to the (DY) relay which operates in series with the sender (L) relay advancing the R2 switch to position 3 (DT key normal).

5.04 SC Relay Test R1 Pos. 3/5, R2 Pos. 1/7

When the (CI) relay operates the SC lead is closed through SS2-Q2 to the resistance which will give the (SC) relay a current flow operate test. If the (SC) relay does not operate the dialing path is not closed in the sender during the A code digit (sender selector type).

If the (SC) relay does not operate the battery is not removed from the TR lead (rotary link type).

In R2 position 5 the (SN1) or (SN2) relay is connected to the SC lead and the testing resistance is opened in R2 position 6. Relay (SN1) will not operate until the sender has shunted the 1000 ohm winding of relay (SC). The (SC1) relay operates and closes a locking path to the (SN) relay the operating path being opened after R2 position 7. If the (SN) relay is released by a momentary open of the SC lead it will remain normal, opening the fundamental ring. The (LR2) or (LR3) relay is connected to the SC lead in R2 position 6 and holds the SC lead closed when the (SN) relay is normally released. The path for advancing the R2 switch through position 7 is open if the (SC1) relay fails to operate. When making a CAN-SY on Perm. Sig. Test Call, (SN3) relay operates from ground at SS2-W2 through a make contact of (CAN-SY) on (TS-3) key. Ground through 475 ohms shunts the 350 ohm side of the (CL) resistance allowing the (SN1) relay to operate to the 1500 ohm ground on the SC lead.

5.1 Full Selector Call - R1 Pos. 5 or 14, R2 Pos. 3, R3 Pos. 1

5.101 L-1 Pulsing Relay - Fig. Y

Two dialing conditions are required to test the dial pulse circuit using the L-1 (L) relay. The "minimum line test A", (MAX LINE) key normal and (DPL B) key normal, uses zero loop, 10,000 ohm lead, maximum capacity across the line (two 2 MF condensers if Fig. U is used or two 2.7 MF condensers if Fig. V is used) and the (A) (minimum per cent break) interrupter. The "maximum line" test, (MAX LINE) key operated and (DPL B) key operated, uses a 1000 ohm loop, no capacity or lead across the line and the (B) (maximum per cent break) interrupter. The former test checks the operate and hold adjustments of the (RA) relays and, in relay registers, it tests the operation of the counting relays. The latter test checks the holding ability of the (SR) relays and, in relay registers, tests the operation of the prime counting relays. Equivalent tests are provided by the relay interrupter with Fig. Z.

5.102 L-24 Pulsing Relay - Figs. Y and V

In addition to the tests required for the L-1 (L) relay the L-24 (L) relay requires a special line condition for a complete check. This condition is applied when the (MIN LINE B) key is operated and consists of zero loop, maximum capacity across the line (two 2.7 MF ringer bridges), 15,000 ohm leak "Z" and the (B) interrupter. This test checks for false operation of the L-24 (L) relay and dial pulse counting relays on line surges. To make this test as rigid as possible it is necessary to dial high numbers including at least one zero but no restriction is necessary on the office code dialed. To test the L-24 (L) relay and associated register circuit use the tests mentioned for the L-1 (L) relay plus the test given in this section.

"Q" Option. When the L24 (L) relay is protected by a varistor in place of a filter, the 15,000 ohm leak is replaced by a 10,000 ohm leak and a filter is connected to the ring side of the line.

5.11 Dialing the Preliminary Pulse - Fig. Y - 170A Int.

Assuming that the particular call which is being tested is a full selector call involving talking selection No. 1, operation of the MTG key and FC keys, if coin sender, office compensating key 900 ohms and beyond office compensating key 300, and has resulted in the class switch being set in position 1, by the depression of class key 0, the following operation will take place. In R2 position 3 if the PP key is not operated ground through SS2-J2, the normal contact of the PP key causes the operation of the (PU) relay during the open period of the "P" interrupter. As soon as the "P" interrupter is closed the (AV) relay is operated through the operated contacts of the (PU) relay and the (PU) operating path is transferred to the (AV) relay, leaving the (PU) relay locked to the "P" interrupter. The operation of the (PU) relay shunts the (TT) tone coil from the dialing loop, and also removes a shunt from the A or B high speed interrupter. Ten pulses are delivered by whichever interrupter is in use, before a shunt is established by the "D" interrupter and the (PU) relay is released by the opening of the "P" interrupter. Nine of these pulses are shorted by a circuit through the "E" interrupter and cam SS4-02, and one pulse, the last of the train, is delivered to the (L) relay of the sender as a preliminary pulse. The release of the (PU) relay advances the R2 switch from position 3 and the (AV) relay releases.

If the PP key is operated the R2 switch advances through position 3 without dialing as ground from SS2-J2 is connected to the R magnet.

5.111 Dialing the Preliminary Pulse - Fig. Z - Relay Interrupter

The speed, length, number of pulses and line conditions are controlled by jacks in Fig. 2 and are described for the relay interrupter circuit.

Assuming that the particular call which is being tested is a full selector call involving talking selection No. 1, operation of the MTG key, office compensating key 900 (ohms) and beyond office compensating key 300, and has resulted in the class switch being set in position 1, by the depression of class key 0, the following operations will take place: In R1 position 3, battery is connected to the Relay Int. Ckt. and ground when the ST key is operated.

In R2 position 3 with the PP key normal, ground from the Relay Interrupter Circuit over lead 12, through 3T-5T of (PU) normal, operated a relay in the R.I. circuit, when battery from SS4-F1 over lead 17, also ground on lead 5, was connected to that circuit. Ground from SS2-J2 through the normal PP and DSS keys operates relay (PU) to battery through 580 ohms. Ground from the R.I. circuit over lead 12 is removed from lead 8, of the R.I. circuit and is connected to lead "SY". Removal of ground from lead 8 releases a slow release relay in the R.I. circuit, providing the necessary time before the first digit can be dialed. Ground over lead "SY" operates R.I. circuit relays which shunt the tone coil over leads 7 and 10 also close a path from ground, through a pulsing relay over lead 2, to SS4-N2, SS4-02, to lead 21, dialing 1 pulse. When relay (PU) operated, ground from the R.I. circuit over lead "AV" through 3 and 4B of PU and cam S5, operated relay (AV), transferring the holding ground of relay (PU) to the AV lead, above described. Removal of ground from the AV

lead by the R.I. circuit, released relay (PU), advancing the R2 switch from position 3 and releasing the (AV) relay when SS2-J2 breaks.

5.12 Dialing the Prefix "One-One" - Fig. Z - Relay Interrupter Circuit

To dial a preliminary pulse followed by the prefix "one-one" the 1-1 key is operated and the PP key is normal. With the dial control sequence switch (R2) in position 3 ground at SS2-J2 cam is closed by the operated 1-1 key through (EA1) relay normal, (EA2) relay normal and the DSS key normal to operate the (PU) relay. The (PU) relay in operating results in the following: First, a ground on the AV lead from the Relay Interrupter Circuit is closed to operate the (AV) relay which, upon operating, locks to the operate path of the (PU) relay and transfers the holding circuit of the (PU) relay to the AV lead ground. Second, it transfers the ground on lead 12 from lead 8 to the SY lead. This ground came from the Relay Interrupter Circuit which had been prepared for operation by the operation of its (ST) relay from battery on the F1 cam of the test circuit. At this point with the SY lead grounded and the 8 lead opened, the Interrupter will function. Since the dial control sequence switch is in position 3, preliminary pulse position, ground on lead 2 through a pulsing relay is closed through SS4-N2 cam and SS4-O2 cam to lead 21 for dialing 1 pulse. Removal of ground, at the completion of dialing, from the AV lead by the interrupter circuit releases the (PU) relay. The AV lead is held opened until the interdigital timing is completed. One pulse has now been dialed into the sender. The (PU) relay released closes ground through the operated contacts of the (AV) relay to operate (EA1) relay and shunt (EA1') relay. The (EA1) relay in operating opens the holding circuit of the (AV) relay which, upon releasing, removes the shunt on the (EA1') relay allowing it to operate and lock in series with (EA1) relay to a ground on SS4-S2 cam. The (EA1') relay operated restores the operate path of the (PU) relay. The (PU) relay reoperates closing the ground which was restored to the AV lead when the interdigital timing was completed to reoperate the (AV) relay. The (AV) relay reoperated causes the same sequence of events as described above until the (PU) relay releases again signifying that the second pulse has been dialed into the sender. The (PU) relay released now closes ground through the operated contacts of the (EA1') relay to operate the (EA2) relay and shunt the (EA2') relay. The (EA2) operated opens the holding circuit of the (AV) relay which, upon releasing, removes the shunt on the (EA2') relay allowing it to operate and lock in series with the (EA2) relay to ground on SS4-S2 cam. The (EA2') relay operated restores the operate circuit of the (PU) relay. The (PU) relay reoperated closes the AV lead ground restored after the interdigital interval to reoperate the (AV) relay. The (AV) relay reoperated causes the same sequence of events as described above until the (PU) relay releases again signifying that the third pulse has been dialed into the sender. The (PU) relay released closes ground through the operated contacts of the (AV) relay through (EA1') and (EA2') relays operated to operate the dial control switch (R2) moving it out of position 3. The (AV) relay releases as the V2 and J2 cams move out of position 3.

To dial the prefix "one-one" alone the PP key and the 1-1 key are both operated. The circuit description is exactly the same as for the preceding paragraph (preliminary pulse and prefix "one-one") up to the operation of the (EA2') relay. The (PU) relay at this point is released indicating two pulses have been dialed into the sender. The (EA2') relay operated closes a ground at SS2-V2 cam through the operated PP key to operate the dial control sequence switch (R2) moving it into position 4.

To move immediately into position for the A digit without dialing either a preliminary pulse or the prefix "one-one" the PP key is operated and the 1-1 key is normal. Ground at SS2-J2 cam through the 1-1 key normal and the PP key operated operates the dial control sequence switch R2 moving it through position 3 into position 4.

5.13 Dialing the "A" Digit - R1 Pos. 5 or 14, R2 Pos. 4, R3 Pos. 1 - "A" Lamp - Fig. Y

In position 4 ground from the 0 class key, through SS1-E2 will operate the (PU) relay while the P interrupter cam is open. This relay is shunted through its back contact, and cannot be operated while the P cam is closed in order to assure that dialing starts at the correct position of the dialing interrupter. The operation of the (PU) relay shunts the tone coil from the dialing loop, this coil being normally connected except during the actual dialing of the digits to inform the sender monitor that a sender signal is caused by the test frame. Ten pulses will be dialed as before and a number of these open periods will be shunted depending upon the particular key which is depressed in the A code row and the sender will receive only the number of pulses corresponding to the depressed A code digit key. Dialing does not commence until the D cam of the slow speed interrupter is broken and the end of the digit is controlled by the closing of this same interrupter cam. At the end of the digit the (PU) relay released restoring the tone coil to the dialing loop and the circuit closes contacts in connection with the synchronizing feature to be described later and also closes a path in conjunction with the operated contacts of the (AV) relay, the normal contacts of the (SY) and (LR) relays which will advance the dial control switch from position 4. As soon as the switch is advanced from this position the (AV) relay locking path will open at cam

SS1-E2 which will result in the stopping of the dial control switch in position 5.

5.131 Dialing the "A" Digit - R1 Pos. 5 or 14, R2 Pos. 4, R3 Pos. 1 - "A" Lamp - Fig. Z

In position 4 ground from the O class key, through SS1-E2 will operate the (PU) relay, starting the dialing of the A digit as described in paragraph 5.111. The tone coil is shunted from the dialing loop, this coil being normally connected except during the actual dialing of the digits to inform the sender monitor that a sender signal is caused by the test frame. Not more than ten pulses will be dialed as above, and the sender will receive the number of pulses corresponding to the depressed A code digit key. At the end of the digit the (PU) relay releases, the tone coil is restored to the dialing loop and the circuit closes contacts in connection with a synchronizing feature to be described later and also closes a path in conjunction with the operated contacts of the (AV) relay, the normal contacts of the (SY) and (LR) relays which will advance the dial control switch from position 4. As soon as the switch is advanced from this position the (AV) relay locking path will open at SS1-E2 and the R2 switch will stop in the next position.

5.14 Dialing the "B" Digit - R1 Pos. 5 or 14, R2 Pos. 5, R3 Pos. 1 - "B" Lamp

The (PU) relay is again operated and the B code digit is dialed in a similar manner to the previous digit except that it is under the control of the depressed B code key.

5.15 Dialing the "C" Digit - R1 Pos. 5 or 14, R2 Pos. 6/7, R3 Pos. 1 + - "C" Lamp

The dialing features are identical for all of the digits and the number of pulses is controlled by the appropriate keys in each digit. The (SS) relay is operated in position 6 and advances the R2 switch to position 7 while dialing the C digit to save time. No digit is regularly dialed in position 7 in FS or special classes. When the dial control switch advances from position 7 the class ground is transferred from cam SS1-E2 to SS1-D2. The dial control switch was advanced from position 7 to position 8 as the (AV) relay was held operated through positions 6 and 7 by the cutting of the SS1-E2 cam. The path to advance from position 7 requires the operation of the (SN) and (SC1) relay, indicating a 500 ohm ground through relay (SC) of the sender.

5.16 Dialing the Numerical Digits - R1 Pos. 5 or 14, R2 Pos. 8/14, R3 Pos. 1 + - TD, H T or U Lamp

The operation of the (PU) relay in position 8 awaits the ground which is supplied by the R3 check switch in position 6 and in position 9 it awaits a ground which is not connected until the R3 check switch has arrived in position 9. Likewise in position 10 the ground is not connected for dialing until the R3 check switch is in position 11. In position 11 the ground is connected when the checking switch arrives in position 13. As this is a full selector call the control switch advances to position 13 and immediately to position 14 as the (CN) relay is normal, if furnished, indicating a non-coin test. If the test had included the coin test of a coin sender it will have proceeded as explained in the paragraph on coin tests.

5.161 Failures

The (SY) relay if operated indicates that the dialing and checking are out of step and the (LR1) relay when operated, indicates the application of a ground to the SC lead which may be at a wrong period resulting from a trouble condition.

5.17 Fundamental Circuit Check

When the dial control switch arrives in position 7, ground is closed through cam O-5 from SS3-S2, advancing the R3 switch to position 2.

5.171 District Brush Selection - R1 Pos. 5 or 14, R2 Pos. 7 +, R3 Pos. 2 - DB Lamp

The checking switch awaits the closure of the fundamental by the sender. This fundamental is closed as soon as the sender has made the necessary settings and is ready to control the district brush selection. The testing path may be traced from the (L) relay of the test circuit through normal contacts of the (P1) and (R) relays, cam N3, 600 ohms resistance, cam F3, FT lead, contacts of the (CI) relay terminals No. 1 and 1', FT arcs of the master and sender selectors to the sender, then through the stepping relay, the back contact of the (BO) relay, the winding of the overflow relay, and 1000 ohm resistance to ground. Closure of this path causes the operation of the (L) relay in the test circuit, this in turn connecting ground to the interrupters which are used to simulate commutator pulses. The first closure of the interrupter which is of sufficient length to operate a counting relay, operates the (P) relay and the following open period permits the (P1) and (P2) relays to operate. This opens the operating path of the (L) relay leaving it locked to the fundamental. It also closes a path through the contacts of the (P1) relay and the DEF interrupter which permits the next interrupter closure to be connected to the fundamental lead through 37 ohms "B" option, or 90 or 110 ohms as controlled by the (STP) key "A" option, or (STP) jack "AF" option, and this results in the momentary release and reoperation of the (STP) relay in the sender.

This in turn operates and locks a pair of counting relays in the sender, the number of the pair of relays depending upon the connections which have been established through the registers of the sender. This condition continues until a sufficient number of pulses has been sent to operate and lock the counting relays of the sender up to and including the (BO) and (FO) relays. The operation of the (BO) relay opens the fundamental and releases the (L) relay of the test circuit, when the int. breaks. The release of this relay causes the operation of the (R) and (R1) relays in the test circuit only if the (BO') relay of the test circuit has been operated. During the time in which the DEF or FND interrupter (fast pulsing) was delivering simulated commutator pulses the corresponding interrupter ABC or CHK was delivering a similar number of pulses to the counting relays of the test circuit starting with the counting relay which was connected over a path including the depressed DB selection control key, and cams SS1 and SS2-J3. If the number of pulses required to satisfy the sender is not sufficient to operate the (BO') relay, ground would not be furnished from the operation of the (R) and (R1) relays and the checking switch would remain in position 2 where the DB progress lamp is lighted. If the (BO') relay was operated before the sender has been satisfied the ground would have been removed from the interrupters and the fundamental would have remained closed in the sender, the switch remaining in position 2. The depression of the (PL/LP) key will cause a lamp to be lighted for each operated set of counting relays. If the selection is satisfactorily checked indicating that the number of pulses required to satisfy the sender was the same as the number of pulses indicated by the depression of the DB selection control key the release of the (L) relay is followed in turn by the operation of the (R) and (R1) relays. The operation of these relays disconnects the locking grounds from the counting relays, and the (P), (P1) and (P2) relays, permitting these relays to release. It also closes a path through the normal contact of the (LR1) relay to the R magnet of the R3 checking switch advancing the checking switch from position 2, when the (BO') relay has released. The (R) relay when operated was locked to ground on cam SS2-I3 and the advance of the sequence switch opened this locking ground permitting the (R) relay and in turn the (R1) relay to release. The operating path for the (R) relay has been previously opened by the release of the (BO') relay following the operation of the (R1) relay.

With the relay interrupter, ground from the start key on lead 4 and from the (L) relay operated, on lead 16, starts the pulsing. When the BO' operates at the end of the digit, ground on lead 3 operates a relay which stops the interrupter if the (L) relay has not removed ground from lead 16. Pulsing ground is furnished on leads 1 and 7 and pulses to the fundamental are received on lead 8 and to the counters on lead 2.

To provide slow pulses ground is connected to lead 37 and battery to lead 12. This test is restricted to class one or where specified.

5.172 Class of Service Distinction

5.1721 Traffic Arrangement

When any of the senders under test are equipped to connect resistance battery or ground to the FR lead during district group selection, W wiring and apparatus are used. If the testing equipment is cabled to permit testing of each sender group as a unit and it is desired to stop the test in order to change the talking selection key, one transfer key CR, Fig. D is connected, in order to stop the test at the twenty-first sender selector terminal of the preceding sender group. This key permits the testing circuit to stop and bring in the group signal, thus avoiding sticking a working sender due to a changed zone indication.

5.1722 Checking the Charging Resistances - R3 or R4 Pos. 2

When the district brush selection checks OK in position 2, relay (ZC) operates, connecting the fundamental ring to the checking relays and lighting the lamp MR. If talking selection key, zero high resistance (OH) is depressed, for example, the sender is expected to momentarily connect 48-volt battery through 580 ohms resistance to the FR lead and to later check for one pulse as zero talking selection. This battery should operate relay (ZC1) and relay (ZC2) should remain normal operating relay (ZC4) which locks and transfers the selection ground to the R magnet. If one low resistance (1-L) key is depressed the sender is expected to momentarily connect 48-volt battery to the FR lead through 52.5 ohms resistance and both relays (ZC1) and (ZC2) should operate in turn operating relay (ZC4). If part of the senders does not connect ground to the (FR) lead during district group selection for class 0 or 1, these senders may be tested by the use of 0 or 1 talking selection key. If all the senders connect ground to the (FR) lead the OG or 1G key may be used throughout the test. The key, lamp and relay combinations are as follows:

Key No.	Class No.	TS Pulses	Lamp	Relays Opr.	FR Lead
0	None	1	None	None	Open
1	"	2	"	"	"
2	"	3	"	"	"
3	"	4	"	"	"
OG	"	1	G	ZC5 ZC3	Grd.
1G	1	2	G	ZC5 ZC3	"
OH	2	1	H	ZC1	580 Ohms Bat.

5.179 Fundamental Test - R1 Pos. 5 or 14, R2 Pos. 14, R3 Pos. 16 - "OF" or "FG" Lamp - Fig. AH

The (TF1) relay is connected from 24-volt potential to the fundamental tip and the (TF) relay is connected from 48-volt battery to the fundamental ring. If any false ground or cross is connected to the fundamental circuit by the sender one or both of these relays will operate, in turn operating the (FG) relay and lighting the "FG" lamp. Ground is connected to the (TG) interrupter from cam SS1-Y3 and the first closure operates the (IN) relay. The following open period operates the (INA) relay. The second closure operates the (INI) relay and closes the path for the advance of the check switch from the release of the (SC1) relay if the (FG) relay is not operated. In the sender the operation of the (AV1) relay resulted in an increased resistance of the SC lead which in turn caused the release of the (SN) and (SC1) relays in the test circuit. Ground from the back contact of the (SC1) relay through the normal contacts of the (NT) relay advances the mechanical check switch from position 16 disconnecting the test for fundamental ground and releasing the third interrupter closure; the operation of the (INT) relay opens the advance path.

5.20 (SC) Relay Release (Rotary Link) - R1 Pos. 5 or 14, R2 Pos. 14/16, R3 Pos. 17 - "FR" Lamp - Fig. AH

The advance of the R3 check switch to position 17 closes a path for advancing the dial control switch to positions 15 and 16, connecting a soak current to lead SC. The first closure of the TS interrupter causes the operation of the (W3) relay and the next open period of this interrupter immediately following permits the operation of the (Z3) relay, and the (TS) relay. The (TS) relay remains locked during position 16/17, grounds the SC lead and removes the shunt from the (HO) and (LD) relays. This should release the (SC) relay in the sender and the succeeding sender operations should result in the connection of a relay to the SC lead. Battery through this relay will cause the operation of the (HO) and in turn the (DT) relays in the test circuit, advancing the R2 switch to position 17. If this does not take place before the next open period of the interrupter following the closure which operated the (W4) relay, the (Z4) relay will operate and will open the path for operating the (DT) relay. If the sender (SC) relay is released etc., and the test circuit (DT) relay is operated from the operated (HO) relay through the normal (Z4) relay within a minimum time of 0.5 sec., ground from the locked (DT) relay advances the R2 switch to position 17.

5.201 Advancing the R2 Switch for Disconnect (Sender Selector) - R1 Pos. 5 or 14, R2 Pos. 14/17, R3 Pos. 17 - Fig. AH

The arrival of the R3 switch at position 17 advances the R2 switch from position 14 to position 16. Local ground advances it to position 17.

After talking selection the R2 switch advances to position 18 from where it advances to normal when the R1 switch arrives in position 6 or 15.

5.21 Talking Selection - R1 Pos. 5 or 14, R2 Pos. 17, R3 Pos. 17 - "TS" Lamp

The release of the (SC1) relay in the sender closes the fundamental tip through the (STP) relay and a one thousand ohm resistance to ground in the sender and permits the checking of talking selection by the test circuit in a manner similar to the district selection, and under control of the depressed TS key. If this check is satisfactory the (R1) relay connects ground to the armature of the (LD) relay (rotary link) or advances switches R2, then R3 (sender selector).

5.211 Check for Cross between Contacts of (BO) Relay F.S. Class

If there is a cross between the front and back contacts of the sender (BO) relay and the strap has been added between the armature and front (BO) contact, the sender will not open the fundamental after talking selection and the testing circuit will block with the "TS" lamp operated. With fast revertive pulses and slow sender switches this failure may occur on an earlier selection.

5.22 Link Dismissal (Rotary Link) - R1 Pos. 5 or 14, R2 Pos. 17, R3 Pos. 17 - "LD" Lamp

After talking selection the sender connects 48-volt battery through 150 ohms to the SC lead for the purpose of dismissing the link. The connection of this battery will result in the operation of the (LD) relay which advances the dial control switch to position 1, and in turn the R3 switch to position 18.

5.23 (SG) Relay Release Test (Rotary Link) R1 Pos. 5/8, R2 Pos. 18, R3 Pos. 1

When the R2 switch advances to position 18 the normal checking path is closed

through the normal "TA" key to the "SG1" interrupter. The first "B" closure operates the (SG1) relay and substitutes the (SG2) relay for the (T3) and (T4) relays in the TR lead. When the sender (SB) relay has released, the (SG) relay is locked to the TR lead and the resistance of the (SG2) relay acts as a holding test. The (SG2) relay having operated on the first or a later B closure the (SG1) relay remains locked. The following F closure advances the R1 switch from position 5 or 14, and switch R2 to position 1. If the (SG) relay does not hold, 150 ohm battery is connected to the (T4) relay as soon as the (SG1) relay releases, leaving position 5 or 14 and operates this relay opening the path for advancing from position 6 or 15. The (AD) and (C1) relays release when leaving position 5 or 14. In position 7 or 16 the (SGR) relay is operated and released by the "SGR" interrupter. During the passover period between contacts 1T and 3T the TR lead is momentarily opened and eventually releases the (SG) relay. The reconnection of 150 ohm battery operates the (T4) relay advancing the R1 switch to position 8 or 17. Ground through the (MS) and (CA) relay normal advances it to position 9 or 18. If the repeat key is operated the same operations result in position 2 or 11 as described for position 7 or 17 as the (SG) relay would not release if the (CA1) or (S) relay was operated in position 7 or 16.

5.24 Restoration of Sender (Sender Selector) R1 Pos. 5/7 or 14/16, R2 Pos. 18, R3 Pos. 1

The arrival of the dial control switch in position 18 closes ground through the same normal checking path which was used following the operation of the start key to advance the connector switch and is now used to advance the connector switch from position 5 or 14, then switch R2 to position 1. The connector switch is passed by position 6 or 15 as the (MS) relay is at normal, position 7 or 16 when meter "CT" operates and position 8 or 17 as the (CA) and (MS) relays are normal.

6. ADVANCING THE SENDER SELECTOR AND SELECTING THE NEXT IDLE SENDER - R1 POS. 8/14-17/5, R2 POS. 18/1, R2 POS. 18/1

In position 9 or 18, ground is connected to the magnet of the sender selector and as soon as this magnet energizes and breaks its interrupter contact, the (AX) relay is operated and the connector switch is advanced to position 10 or 1. The advance of the connector switch results in the de-energizing and stepping of the sender selector, and the release of the (AX) relay. The connector switch is advanced from position 1 or 10 by the normal checking path previously described and completes the test for an idle sender in position 2 in the same manner as previously described. In position 5 the test of the next idle sender is continued in the same manner. The battery is not connected to the counting relays until the connector switch arrives in position 5 to assure that the connector switch does not fail to advance to that position.

7. TESTING A CALL DURING WHICH AN INCOMING SELECTOR IS SENT TO THE OVERFLOW POSITION - R5 POS. 2

No. 1 class key should be depressed resulting in the advance of the class switch to position 2. In establishing this class of call the desired code and numerical digits, compensating resistance and talking selection keys are depressed for the particular route of a full selector call which is to be checked. The talking selection key should always be No. 3 in order to check the overflow selection for the district. The dialing and checking of this call continues in the same manner as in an FS call and all digits are dialed in the identical manner. The R2 switch is advanced from position 13 by ground from SS2-I5. When the check switch has satisfactorily checked the incoming group selection in position 9, it is immediately advanced to position 15. This results from the class ground through cam SS3-H3 which is connected to the locking contact of the (R) relay holding this relay operated and permitting the ground which normally advances the check switch from positions 9, 10, 12 and 14 to advance the switch to a position wherein reverse fundamental battery is connected to the sender which is now in the final brush position. The fundamental path of the (L) relay is held open during the advance of the check switch assuring that no false pulses are transmitted to the sender stepping relay. In R3 position 13 relay (OF) operates opening ground from the (SC1) relay. In R3 position 15 relay (OF1), (OF2), (OF7) and (F4) and (OF3) operate connecting the counting relays and 170-A interrupter in a time counting function. The counting relay pairs are operated from the ABC or CHK interrupter in the following order: 3, 2, 1, 0, 9, 8. When relay (BO') operates, ground is connected to the FT lead through interrupter DEF or FND. Relay (OF5) operates when relay 9 operates grounding the FT lead during the first open period of the interrupter. After the second DEF interrupter closure, ground is removed from the FT lead by the operation of relay (8). Relay (OF4) opens the FT lead and advances the R3 switch to position 16. If a compensating resistance of 1600 ohms is used the sender overflow relay is given a speed

Key No.	Class No.	TS Pulses	Lamp	Relays Opr.	FR Lead
1H	3	2	H	ZC1	580 Ohms Bat.
OL	4	1	L	ZC1-2	52.5 Ohms Bat.
1L	5	2	L	ZC1-2	52.5 Ohms Bat.

Relay (ZC5) will test for the circuit through sender relay (ZC3) when key "OG" or "1G" is used but will not operate the sender relay.

5.173 District Group Selection - R1 Pos. 5 or 14, R2 Pos. 7/8, R3 Pos. 3 - DG Lamp

The district group selection is checked in a manner identical with that used in the district brush selection, the success or failure of the check being recorded in the same manner except that the number of counting relays to be operated is determined by the depressed DG key.

5.174 Office Brush & Group Selection - R1 Pos. 5 or 14, R2 Pos. 7/8, R3 Pos. 4-5 - OB or OG Lamp

The fundamental path is traced from the (L) relay to the overflow relay in the sender as in district brush selection, except for SS4-N3. From that point a new path is established through the compensating resistance that may be connected by the code settings of the sender and the fundamental ring lead to the test circuit through the FR arcs of the sender selector and master selector, terminals 1 and 1' contacts of the (CI) relay, FR lead, normal contacts of relay (FR), through the depressed office compensating resistance key, to ground through cam SS4-E3, and the (SC1) relay contact. The compensating resistance keys used for this and later selections are assumed to give a total resistance of at least 900 ohms, this resistance including the compensating resistance in the sender itself. With this change in the fundamental path the checking of office brush and group selections is continued in the manner identical with that for district brush and group except that the progress lamps indicate office brush and office group positions respectively, and the checking path is under control of the respective keys.

5.175 Trunk Guard Test: (MTG) Relay - R1 Pos. 5 or 14, R2 Pos. 8/9, R3 Pos. 6 - "MTG-OPR" Lamp

Having satisfactorily completed the check of office group position, the R3 switch advances to position 6 and as the "MTG" key is assumed to be operated, applies the non-operate current flow requirement to the (MTG) relay in the sender. The (TC) relay of the test circuit will operate in turn operating relay (TC1) indicating the closure by the sender and will connect ground to the "TG" interrupter. The first closure of the "TG" interrupter operates the (IN) relay, the following open period the (INA) relay, the second closure the (INI) relay, and the following open period the (INB) relay. The third closure operates the (INT) relay, shunting part of the resistance in the fundamental circuit and applying the operate requirement to the (MTG) relay in the sender. All relays remain locked. If the sender (MTG) relay has previously operated falsely, the sender switch will have advanced and reduced the resistance of the fundamental. This will cause the test (MTG) relay to operate in turn operating the (FG) relay and preventing the advance of the check switch also lighting the "MTG-NO" lamp. If the sender (MTG) relay did not operate during the non-operate test the (MTG) relay of the test circuit will not operate until after the (MTG) relay in the sender has operated and advanced the sender switch thus reducing the fundamental resistance. The operation of the (MTG) relay will advance the R3 switch from position 6, and all relays release. If the (MTG) relay fails to operate, the R3 switch remains in position 6 with the "MTG-OPR" lamp lighted.

5.1751 Trunk Guard Test: (TG) Relay - R1 Pos. 5 or 14, R2 Pos. 8/9, R3 Pos. 6 - TG Lamp

If the "MTG" key is normal the fundamental is closed by 48-volt battery through the J5 cam, (TC) relay, (BK) relay contacts, "TTG" resistance, (TTG) relay, key contacts, cam F3, FT lead, through the (TG) relay circuit of the sender, FR lead, cam G3, compensating resistance key to ground through SS1-W3. This path applied the test operate requirement to the (TG) relay, as the total compensating resistance of the sender and test circuit is 900 ohms. When this path is closed the (TC) and (TC1) relays operate and ground the "TG" interrupter. The first closure of the TG interrupter operates the (IN) relay which locks, the following open period operates the (INA) relay, the second closure operates the (INI) relay, the following open period the (INB) relay. The third closure operates the (INT) relay. All relays lock. The sender must operate the (TG) relay and advance the sender switch, closing the fundamental for incoming brush position, and the test circuit (TTG) relay must operate after the sender had advanced and reduced the resistance of the fundamental in turn advancing the R3 switch from position 6. If this does not occur before the (INT) relay operates, the

circuit is stuck and the (TG) progress lamp will remain lighted. All relays release when the R3 switch advances from position 7.

5.1752 Cancel Trunk Guard "S" Option

The (CTG) key when operated, tests for momentary opens in the fundamental as the sender advances from trunk test to incoming brush position on a full selector call. These momentary opens cause false pulses and are indicated by an incorrect incoming brush selection.

5.176 Incoming Selections - R1 Pos. 5 or 14, R2 Pos. 9/11, R3 Pos. 8/9 - IB, IG Lamps

With the R3 switch in position 7/8 the counting relay path for checking the incoming brush selections is established through cams in the R6 sequence switch under control of the depressed thousands key. The check of this selection is similar to the preceding checks of the district and office selections and is indicated by the lighted IB progress lamp. If the check is satisfactorily completed the check switch is advanced to position 9. In position 9 the ground which is connected to the armature of the (BO') relay and used for the interrupter is obtained from cam SS2-X2 to insure that the check switch is not advanced until the dial control sequence switch has advanced to the tens position. This precaution is necessary as the synchronizing check records a failure if the (L) relay operates while dialing a digit. The path for determining the counting relays to be used in checking the incoming group selection is completed through cams in the R6 and R7 switches assuring the control of both the thousands and hundreds keys. Relay (RV4) is operated in R4 position 6, to reduce interrupter contact wear, with Fig. W.

With Fig. AB a plug in the IGT jack operates relay (IGT) and adds 5 to the incoming group check.

5.177 Final Brush, Tens and Units - R1 Pos. 5 or 14, R2 Pos. 11/14, R3 Pos. 10, 12 or 14 - FB, FT or FU Lamp

In the first position the FB progress lamp will be lighted and the check will be in accordance with the control established by the R7 sequence switch which is under control of the depressed hundreds key. After checking the final brush selection the R3 switch is advanced to position 12 and the final tens is checked in accordance with the path established through the tens numerical key. This check is not made until the ground for the armature of the (BO') relay is received as a result of the dial control switch having arrived in position 11. This check being found satisfactory, the R3 switch is advanced to position 14 where the check is under control of the depressed units key and the checking ground is established by the arrival of the dialing sequence switch in position 14. Following a satisfactory completion of this check the check switch advances to position 15.

5.178 Incoming Advance - R1 Pos. 5 or 14, R2 Pos. 14, R3 Pos. 15 - IA Lamp

In position 15, the (L) relay is connected to the fundamental ring instead of the fundamental tip as in previous selections and the ground formerly connected to the fundamental ring is now connected to the fundamental tip. This results in reversed battery to the sender fundamental which operates the overflow relay in the sender. When Fig. N is used the operation of the (L) relay in the test circuit occurs at the same time and ground from cam SS2-F5 through the operated contact of the (L) relay advances the check switch to position 16 and opens the fundamental circuit which advances the sender.

When Fig. O is used and class key 0 or 8 is depressed, the (IA) relay operates when R1 reaches position 5 and operates the (IA1) and (IA3) relays. When the (L) relay operates in position 15 of R3, the (IA2) relay operates and opens the circuit to the slow release (IA3) relay which in turn opens the circuit to the slow release (IA1) relay which releases and advances the R3 check switch to position 16 if the contacts of the sender (IA) relay function correctly. If the sequence contacts of the sender (IA) relay do not make in the proper order or if they are open the sender will advance prematurely and release the test circuit relay. If this occurs before the (IA1) relay has released, the (IA2) relay releases and prevents the release of the (IA1) relay, thus blocking the test circuit. The (IA1) and (IA3) relays are made slow release to allow time for the premature advance of the sender.

When Fig. O is used and neither class key 0 or 8 is operated, the (IA) relay will remain normal. When the (L) relay operates in position 15, the (IA2) relay operates and locks and advances the R3 switch to position 16.

test by resistance at SS3-V5. The connection of the reverse fundamental battery causes the sender to function as in an overflow call. If the sender (OF) relay operates the release of the (SC1) relay results in the advance of the check switch to position 17. If the (SC1) relay does not release the R3 switch remains in position 16, with the (OF) lamp lighted. The advance of the check through position 10 to 15 is not dependent upon the grounds which were received from the dialing switch during the full selector call as the ground to the armature of the (BO') relay is also furnished through cam SS3-03 from the class switch in position 2. After the release of the (SC1) relay following the operation of the (AV1) relay in the sender, the check of the release of the sender (SC) relay and of the talking selection under control of the TS3 key, as well as restoration of the sender to normal, and the selection of a succeeding sender continue in the same manner as described under a full selector call.

8. TESTING A CALL DURING WHICH THE OFFICE SELECTOR IS SENT TO THE OVERFLOW POSITION - R5 POS. 3

Appropriate class, code selection, numerical, compensating resistance and talking selection keys are depressed and the class switch is advanced to position 3. With the R2 switch in position 8 the check switch advances from position 5 to position 15 by ground from the class switch through cam SS4-H3. The fundamental is opened in R3 position 6 at SS1-J5. The dialing and checking up to the time of the advance of the check switch was in the same manner as in the FS call previously described. In position 15 reverse battery is connected to the fundamental through the (L) relay of the test circuit and causes the operation of the (OF) relay in the sender. The (OF1) relay in the sender substitutes the sender stepping relay in the place of the (TG) relay or the (MTG) relay and in case of the FS call the 14,500 ohm resistance. In the FS class the (L) relay will not operate if the 14,500 ohm resistance and trunk test relay are not shunted down. This check is effective only in a FS call as the resistance is not used in the sender in other classes of call although this test with the exception of the check of this feature, may be made by dialing other codes. The dialing continues with ground from the W3 and X3 cams. Ground from SS2-I5 advances the R2 switch from position 13. The release of the (SC1) relay advances the checking switch through position 16. From this point the check continues in the same manner as previously described for FS calls.

9. TESTING CALL WHEREIN THE SENDER IS SENT TO THE PERMANENT SIGNAL POSITION - R5 POS. 4

The depression of the No. 3 class key advances the class switch to position 4 and the proper selection control keys (no office selections), talking selection key No. 3 and a suitable (zero) beyond office compensation resistance key is also operated. Any numerical keys may be used to close the normal checking path as no numerical digits are dialed or checked in this class of call. Ground from the class key advances the dial control switch from position 4 to 13 without dialing. The dialing switch is immediately advanced to position 14 by ground from cam SS2-I5. The R3 switch checks the positions of district brush and district group and as the (SKO) key was the only depressed key in the office brush and group rows the check switch is advanced from position 4 to position 6 without checking as a result of the ground which was received through cam SS2-H3 in position 3/5. Ground through cam SS4-H3 advances the check switch to position 15 where reverse battery is connected to the sender. If the sender closes the fundamental premature advancing switch R3 to position 3 before the R2 switch has passed position 13 the (SY) relay will operate through cams SS3-R3 and SS3-U5 blocking the test. The sender completes the trunk test and as a result of the reversed battery raises the resistance of the SC lead releasing the (SC1) relay which advances the check switch through position 16. From this point the check of the release of the (SC) relay, of talking selection No. 3 and the restoration of the sender to normal are made in the same manner as in the case of the full selector call which has been previously described. The (PS) relay is operated during this test only, increasing the time alarm period by 30 seconds.

10. TESTING A CALL TO A SPECIAL SERVICE OPERATOR - R5 POS. 5

After the sender has been selected and the SC lead tested, the dial control switch dials zero in position 4 and advances to position 13 from ground cam SS2-E2 which holds the (AV) relay operated in the usual manner. This ground is received from class key No. 4 which has also advanced the class switch to position 5. The R2 switch is advanced to position 14 by ground from SS2-I5. The R3 switch checks the proper district brush and district group selections as indicated by the depressed selection control keys and advances to position 6 where it makes an operation test of the (TG) relay, but does not check it by the

operation of the (TTG) relay. The (R) and (R1) relays remain locked from positions 5 through 14 cam SS4-H3. The ground for advancing the R3 switch from position 6 to 15 is not connected to the armature of the (BO') relay until the (SC1) relay releases, following the operation of the (AV1) relay in the sender. The release of the (SC1) relay also furnishes ground in positions 15 and 16 for advancing the check switch to position 17 from where the check is continued in the manner previously described. In this class of call it is frequently necessary to use different district and office selection control keys for different sender groups; and to permit the resetting of these keys without failure of the sender under test, a group key is installed as required between the various sender groups. When a group key is operated the master selectors will not advance the test circuit from one sender group to the following group until the group key is restored to normal thus permitting the necessary changes in the setting of the control keys. After the last sender of a group is tested the "GR" lamp is lighted to indicate that the test has been suspended due to the operated group key and remains lighted until the "GR" key is restored to normal.

11. CHECKING A CALL TO A 3-DIGIT OPERATOR - R5 POS. 6

In this call the No. 1 code keys are always used in the B and C rows and any numerical keys are depressed to close the normal checking path. The dial control switch advances from position 6 to position 13 by ground through cam SS3-E2. The check switch advances from position 5 to position 15 under the same control as in the case of the call of the special service operator. Talking selection and restoration to normal are checked as described under full selector calls.

12. TESTING A CALL DURING WHICH THE DIALED CODE WAS EITHER OF A CLASS FOR WHICH SERVICE IS RESTRICTED OR A CODE WHICH HAS NOT BEEN ASSIGNED - R5 POS. 7

The depression of class key No. 6 results in the advance of the class switch to position 7 and the desired code and numerical keys are depressed. All digits except thousands are dialed under control of cam SS4-E2. The R3 check switch checks the district and office selections under the control of the depressed district and office keys and advances to position 6 where the TG or MTG test is made and the thousands and later digits are dialed. From position 6 the advance is similar to that of the special service operator class, the (R) and (R1) relays remaining locked up to the same ground in the class switch. The release of the (SC1) relay advances the check switch through position 15 to position 17. Check of talking selection and the associated operations continues in the same manner as described under full selector calls. The testing circuit will check the operation of the (TC) relay (trunk guard test) before the dialing is completed, as the sender is assumed to await all digits. If the sender is not arranged to await all digits, the translator should be tested for unassigned code with the R5 switch in position 6.

13. CHECKING A CALL IN WHICH A RELEASE CONDITION IS APPLIED TO THE SENDER AFTER DIALING THE THOUSANDS DIGIT - R5 POS. 6

Class key No. 7 is depressed for this test and the class sequence switch is advanced to position 8. Any desired code numerical, selection control and compensating resistance keys are depressed. The dial control switch dials the required digits by ground from SS1-H5. The check switch checks the district and office selections in the same manner as in a full selector call. The holding path for the sender (L) relay when the dial control switch is in position 14 is usually closed through cams SS1 and SS2-L5 of the class switch. In calls where release conditions are encountered these cams are opened in the appropriate position of the class switch but the dialing loop is held closed until after check position 5, by cams SS1 and SS2-D3. When the check switch arrives in position 6 the dialing loop is opened, releasing the sender (L) relay. Ground over the SC lead operates the (LR2) or (LR3), the (LR) and in turn the (LR1) relays, connecting ground to the armature of the (TTG) relay and trunk test is completed as described under a full selector call. The operation of the (TTG) or (MTG) relay advances the R3 switch to position 7/8. In position 8 of the check switch the sender holds the fundamental closed to drive a selector to tell-tale and the (BO') relay is operated. The (L) relay remains locked to the fundamental. Ground through the operated (BO') relay, cams SS4-S3, SS4-M5, and the operated contact of the (L) relay operates the (R) relay which locks through cam SS2-I3 and operates the (R1) relay releasing the (BO') relay. Ground through SS2-O3, normal contact of the (BO') relay, operated contacts of the (R1) relay and class key No. 7, to SS2-C3 advances the check switch to position 15, where reversed battery is connected to the sender. The (L) relay operates and advances the check switch to position 16. The release of the (SC1) relay advances it from position 16 through cam SS3-N5. The R2 switch is advanced from position 17

by ground from the class switch and talking selection is not made in a call during which a release is given to the district selector.

"AD" wiring: When the (LRC) relay is used in this class, a failure is recorded if the ground from the sender does not operate the (LR) relay promptly.

14. TESTING THE REGISTER CONTROL CIRCUIT OF THE SENDER - R5 POS. 9

Class key No. 8 is depressed which advances the class sequence switch to position 9. Any desired code is arranged for and the zero numerical keys depressed in each row for checking purposes. After dialing the code digits the operating path for the (AV) relay is transferred through cams S and T of the class switch and the dial control switch is advanced to position 14 where relay (RC) operates and 4 zero digits are dialed during 4 successive revolutions of the dialing interrupter. Relay (RC) is operated with switch R2 in position 14 and R5 in position 9 and connects ground to operate relay (PU). The "DPLB" and "MAX LINE" keys should always be operated in this class of call as the B interrupter gives the longest open periods resulting in the most severe test of the (SR) relay in the sender and permitting in this particular test a maximum saturation of the (RA) relay. Each revolution of the dialing interrupter is checked by the counting relays (W3), and (W4), (Z3) and (Z4), (W3) and (Z3) relays, operates the (AV) relay and prevents further dialing. The digits are checked in accordance with the depressed selection and zero numerical keys. If the check is correct the check switch is advanced through talking selection to normal in the usual manner.

15. TESTING A CALL INDICATOR CALL TO A DIRECT OR TANDEM OFFICE HAVING NO LINES WHOSE NUMBERS ARE ABOVE 9,999 AND HAVING NO STATION DESIGNATIONS - R2 POS. 1, R4 POS. 1, R5 POS. 10 OR 11

15.1 Connection and Seizure

The sender is seized in the same manner as during a full selector call.

Class sequence switch positions 10 and 11 may be used interchangeably.

15.2 Dialing - R5 Pos. 10, R1 Pos. 5 or 14, R2 Pos. 1/4, R4 Pos. 1

The operation of the (AD) relay closes through the tip and ring dialing leads and a path is established through the (L) relay of the sender to 48-volt battery over the dialing ring, also over the dialing tip through the 1000 ohm resistance to ground which closes the circuit for operating the (DY) relay in the dial control circuit. If the DT key is not operated the operation of the (DY) relay advances the dial control switch to position 3. If the DT key is operated for the purpose of permitting a listening test of dial tone the (DT) relay is energized from ground at cam SS1-P1 in position 3 or 12. It may also be operated from SS2-K1. The operation of the (DT) relay opens the path for advancing the sequence switch and lights a lamp signalling the attendant that the dial tone is ready for the listening test.

After listening it is necessary for the attendant to momentarily depress the DTA key which will release the (DT) relay and permit the advance of the sequence switch. After dialing one pulse or without dialing if the "PP" key is operated the R2 switch advances to position 4 where the A code digit is dialed. Ground from SS4-I5 through a normal contact of the over ten thousand (OT) relay to cam SS2-F2 causes the operation of the (PU) relay at a moment when the operating winding of this relay is not shunted through its back contact and the PU segment of the slow speed interrupter. The (PU) relay when operated locks through the contacts of the (DSS) relay to ground through the PU interrupter. The operation of this relay also short-circuits the winding of the "TT" tone coil which has been connected in the dialing loop for the purpose of furnishing tone to the sender monitor if the sender under test remains stuck in any position except R2 position 1, long enough to give a signal to this operator. As soon as the D interrupter has broken its contact, pulses are given to the dialing circuit including the sender (L) relay every time an opening occurs in either the A or B interrupter. The dialing interrupter makes ten revolutions before the D interrupter again closes, short-circuiting the dialing interrupter. During these revolutions a path is closed through one of the interrupters designated E to N inclusive and the depressed key in the A row. This shunts out a number of the pulses from the interrupter, leaving only the number corresponding to the number of the depressed key and the sender is primed with this number of pulses as the first or A letter of the desired code. The (AV) relay operated immediately after the (PU) relay operated, from the same ground and transferred the locking path of the (PU) relay, leaving it under the control of the (AV) relay, and "P" interrupter. The break of the P segment of the slow speed interrupter immediately after the closure of the D segment permits the release of the

(PU) relay. A path from ground on the normally closed contacts of the (PU) relay, the operated contacts of the (AV) relay, normal contacts of the (SY) relay and normal contacts of the (LR1) relay advances the dial control sequence switch from position 4. The (AV) relay when operated had locked to the same class ground which had originally operated the (PU) relay and its locking path was opened at cam SS2-F2. The release of the (AV) relay permits the sequence switch to stop in position 5. In this position the second of the code digits is dialed in the identical manner of that of the first digit except that the path for shunting out the undesired digits is under the control of the depressed key in the B row. The C digit is then dialed in the identical manner but as cam SS2-F2 is closed from position 6 to position 7 the (AV) relay remains locked through these positions advancing the dial control switch to position 8 and omitting any dialing in the 10,000 position. The (SS) relay is operated in position 6 when 10,000 digit is not used and the R2 switch advances from position 6 to position 7 while dialing the C code digit, to save time. The thousands, hundreds and tens digits are dialed in the identical manner, the (PU) relay being operated over the same path. The ground for the operation of the (PU) relay in position 11, or units dialing, is not furnished until the RCI check switch has arrived in position 6 closing cam SS4-W4. As no station designations are used in this class the zero stations row key is depressed indicating that no stations are desired and ground through the contacts of this key from the same source as that used in position 11 is connected to cam SS4-D2 holding the (AV) relay operated and advancing the sequence switch to position 13. If this test is for a non-coin sender the (CN) relay will be normal and ground from its 4-T contact will advance the dial control switch to position 14. If for a coin test it will advance through position 13 in accordance with paragraph 23.

With the relay interrupter HS control must be used, with "J" wiring to #3 ctg. relay to prevent failure with false stations delay per paragraph 27.1 condition C.

15.3 Checking the District and Office Selections - R5 Pos. 10 or 11, R1 Pos. 5 or 14, R2 Pos. 7/14, R4 Pos. 1/5

When the dial control switch arrives in position 7, ground through cam SS1-05 advances the RCI (R-4) check switch to position 2. As soon as the sender fundamental is closed for district brush selections a path for operating the (L) relay of the test circuit may be traced from battery through the winding of the (L) relay, the normal contacts of the (P1) and (R) relays, closed cam N3, 6000 ohms, cam F4, fundamental tip lead, contacts of (CI) relay, FT arcs of master and sender selectors, FT lead of the sender through the stepping relay, back contacts of the (BO') relay, the overflow relay and a 1000 ohm resistance to ground in the sender. When this path is closed by the sender the (L) relay operates connecting ground supplied through normal contacts of the (R) and (BO') relays to the interrupters (fast pulsing) which are intended to simulate pulses which are normally received from the commutator segments of a panel type selector. This interrupter (Fig. W) consists of two sets of 3 cams, each set of 3 closing in sequence. The pulses are of different lengths but the start of the open period of the corresponding cams A and D, for example, will coincide. The first closure of the ABC interrupter which is of sufficient length, energizes the (P) relay and the following open period permits the (P1) and (P2) relays to operate, locking to ground through the normal contact of the (R1) relay from cam SS2-Q4. Similar pulses are provided with Fig. X. The (P1) relay in operating, opens the operating path for the (L) relay which has closed a locking path through its own contact to the fundamental tip load shunting the operating path through the normal contacts of the (P1) relay. The operation of the (P2) relay connects ground from the ABC or CHK set of interrupter contacts which is connected through the SS1 and SS2-D4 cams and the depressed key in the DB row, to a lead of the counting relays corresponding to the particular key which depressed and which will indicate the number of pulses which should be required to satisfy the sender and cause the sender stepping relay to operate the (BO') relay and open the fundamental circuit. As soon as the number of pulses which is necessary to satisfy the sender has been transmitted through the DEF or FND interrupter, 37 ohms and the operated (P1) relay, the sender will open the fundamental circuit and the test circuit (L) relay will be released. If the corresponding number of pulses transmitted over the ABC or CHK interrupter contacts has resulted in the operation of the (BO') relay at the same pulse period that the (L) relay released, ground through the operated contact of the (BO') relay and the normal contact of the (L) relay will operate the (R) and in turn the (R1) relay through the normal contact of the (BK) relay. The operation of these relays removes the locking grounds from the counting relays permitting them to release. The (R) relay when operated is locked to ground from cam SS2-Q4 holding the (R1) relay and permitting ground from the back contact of the (BO') relay, when

released, to advance the R4 sequence switch to position 3. The path for this ground may be traced through the normal contact of the (LR1) relay to cam SS2-C4. The closure of this ground through the normal contact of the (BO') relay assures that that relay has been released and also that sufficient time has elapsed to permit the release of the remaining counting relays as the locking path for the (BO') relay is the last path to be opened by the operation of the (R) and (R1) relays. If the number of pulses required to satisfy the sender and cause it to open its fundamental is greater or less than the number of pulses which is transmitted to the test circuit counting relays through the depressed DB key, the path for operating the (R) relay will not be closed. If the number of pulses is less the (BO') relay will not operate. If greater, when the (BO') relay operates the ground will be removed from the interrupter contacts and if the sender is not satisfied the fundamental will remain closed and the (L) relay will not release. The DB lamp which lighted when the checking switch advanced to position 2 will remain lighted as an indication of the position where the failure occurred and after a predetermined period the time alarm will give a visual and an audible signal to the attendant, supplementing the progress lamp, and blocking the circuit. The attendant by the depression of the "PL/LP" key and resulting operation of the (PL) and (PL1) relays, can determine by the number of pulse lamps which are lighted the number of counting relays which has been operated. If the zero lamp is lighted and the switch does not advance it indicates that the sender was not satisfied. Following the satisfactory check of the district brush selection the reclosure of the fundamental by the sender permits the checking of the district group selection in an identical manner except that the path to the counting relays of the testing circuits is through cam SS3-D4 and the depressed key in the DG row. The failure or success of this check is recorded in the identical manner and the check of the office brush and group selections is continued in the same way using the associated keys for each selection. If the (SKG) key is depressed instead of an office brush and group key, ground through cams SS3- and SS4-L4 will hold the (R) relay locked from position 3 through position 5 and the R4 switch advances from position 3 to position 6 without stopping. The fundamental is closed through SS1-F4 during office selections. For slow pulsing see paragraph 41.

15.4 Check of Trunk Test and Stations Delay - R5 Pos. 10 or 11, R2 Pos. 7/14, R4 Pos. 6/8

As no stations are dialed in this class of call (zero stations key depressed) and (SD) key will remain normal and when the (SD2) relay operates following the operation of the (TC) relay the assignment relay will operate as explained under stations delay. A check is made at this time to insure that the sender does not wait for the dialing of the stations digit. If the sender does not await the dialing of the stations digit it will close the fundamental circuit for trunk test and after completion of the delay check and assignment will close the PCI pulsing circuit, and the check for slow display. If the fundamental is not closed promptly the test is blocked except when key (TGO) is operated.

15.5 Checking Call Indicator Pulses - R5 Pos. 10 or 11, R2 Pos. 1, R4 Pos. 9/17

When the assignment (AS) relay operates after the holding test the (TG) relay train in the sender is released and the sender advances connecting the impulser switch to the testing circuit. If the first digit to be dialed does not contain a positive pulse in the first quarter the (GT) and (GR) relays will be connected to the fundamental tip and the fundamental ring respectively through the normal contacts of the (F1) relay. The operation of these relays checks the connection of a momentary ground to each side of the sender fundamental circuit for the purpose of discharging the cable capacity of the trunk loop before sending the polarized battery pulses. These relays should operate and cause the operation of the (GT1) and (OG) relays. As this ground is not connected to both sides of the loop this test cannot be used when the first pulse is positive, and the (OG) relay is operated by a path which may be traced through either the R station key or the No. 1 or No. 3 A code keys, also through the operated contacts of the over ten thousand (OT) relay which, however, is not operated in this class of call. If class key No. 13 is used to test a tandem call, and either the 1 or 3 A code key is depressed, or the "R" station key depressed in a class of call using station designations the (OG) relay is immediately operated and the pulsing leads are connected to the polarized relays. If the call is over a direct route the (DR) and (DR1) relays

operate through contacts on the class key which results in the direction of the first pulse to the contacts of the (ST) and (ST1) relays, or if the (DR) and (DR1) relays are normal due to the use of the No. 13 class key the results from first pulse are directed to the contacts of the (TH) and (TH1) relays. The first pulses to be transmitted and recorded on a direct call are for the stations digit which in this case is zero, but if for a tandem call the pulses for the first digit would correspond to the depressed key in the A code row. If zero is dialed for the second or third code digit, six will be checked. The strength and polarity of the pulses from the sender will be checked by the (SN+), (SN-), and (MG) relays. Ground from cam SS4-Q4 operates the (G) relay as soon as the R4 switch arrives in position 6. This furnishes a ground for the locking contacts of all of the register relays and also for the armatures of the polarized relays and the pulse counting relays (W) and (Z). The detailed operation of the control circuit and the station registers as described under "Detailed Description of Checking" results in the operation of certain relays in each of the digit groups. These relays when operated are locked to ground until the completion of the test. The negative pulse, which is always transmitted as the second segment of each digit, results in the operation of one of the steering relays. In this class the first of these relays to operate will be the (TH) for a tandem call or the (ST) for a direct call. Following the release of the pulse checking (Z) and (W) relays at the end of the first digit the (TH1) or (ST1) relay operates, all relays remain locked. As soon as the (TD) steering relay is operated a checking path for the STAT digit will be closed. This path may be traced from cam SS2-N4 through the contacts of the (TD) relay operated, normal contacts of the (C3), (B3) and (A3) relays, a zero pulse being recorded and no stations register relays being operated, the zero lead, operated contact of the zero key stations row, through cam SS2-K4, the normal contact of the (LR1) relay, and the winding of the RCI relay to battery. This path may also be traced through the zero terminal of the (TR) relay, through the normal contact of that relay and the zero pulse lamp to battery, indicating the pulse which is received. If the stations register relays were normal showing that the same pulse was checked as was indicated by the depression of the zero stations key, the (RCI) relay will operate and advance the R4 switch from position 12 to position 13 on a direct call. The R4 switch was advanced through positions 9, 10 and 11 by ground from the 4-T contact of the (DR2) relay. If the call which is being checked is a tandem call this relay is not operated, and the first digit is checked in position 9 of the R4 switch, the registering and checking conditions being similar except that the path is traced through the depressed key in the A code row. The like numbered leads which are enclosed in circles at the various keys and at the (TR) and (TH1) relays and each set of register relays are connected together. The remainder of the pulses for either the tandem or direct call is checked in the same manner and if the path through the normal or operated register relay does not connect to the same number as the one which is indicated by the depressed key of the particular digit which is being checked the circuit will fail and the progress lamp will remain lighted. When a 3/2 digit tandem code is checked zero is checked as the second code digit. The audible and visual signals will be given by the time alarm in the usual manner and the lighted RCI pulse lamp that is connected by the (TR) and (TR1) relays will indicate the pulse which is received. This should agree with the match lamp under control of the depressed key. After the units pulse has been received, the operation of the (U1) and (U2) relays will reverse the connection of the polarized and marginal relays to the fundamental circuit. If "O" wiring is used indicating that the particular exchange does not send the final heavy positive pulse which is needed only in areas where 2-wire office selectors are used, the (F) relay will operate as soon as the (U) relay is operated. The operation of the (U1) relay will open the operating path for the (F) relay and the (F1) relay will operate and lock in series with the (F) relay. If "P" wiring is used indicating that the final heavy positive pulse is to be checked, the (F) relay will not operate and the (F1) relay will not operate until after the final heavy positive pulse has been checked. As soon as the pulse is recorded by the (MG) relay the operation of the (F1) relay will transfer the fundamental tip and the fundamental ring to the (TF) and (TF1) relays. If the final heavy positive pulse is split sufficiently to permit the operation of the (F1) relay or if the false pulse is transmitted in any manner by the sender immediately following the call indicator pulses, the (TF) and the (TF1) relays will record this pulse in turn operating the (FG) relay which will lock in position 17. The (IN) relay will operate from the first closure of the TG interrupter and the (IN1) relay from the second closure, closing the path from the back contact of the (SC1) relay to advance the switch. If this ground is not available due to failure of the (SN) relay to release before the (INT) relay operates, the switch will not advance. If the (TF) or (TF1) and the (FG) relays do not operate the (INT) relay will operate from the next interrupter closure.

15.6 (SC) Relay Release (Rotary Link) - R4 Pos. 18, R5 Pos. 10 or 11, R1 Pos. 5 or 14, R2 Pos. 14/16 - Fig. AH

Ground from cam SS2-L4 in position 18 will advance the dial control switch to position 16, connecting a soak current to lead "SC". The first closure of the TS interrupter will permit the operation of the (Z3) and (TS) relays. The (TS) relay locks and disconnects the (SC1) relay from the SC lead connecting a solid ground to the SC lead, retaining the (HO) and (LD) relays in the circuit, and removing the shunt. This should cause the sender (SC) relay to release and result in a later connection of battery through a relay to the SC lead. The following closure of the TS interrupter will cause the release of the (W3) relay and the operation of the (W4) relay. The (HO) relay operates from battery through the relay in the sender (SC) relay has released in turn releasing the (SC1) relay. If the battery through the relay in the sender is not connected until the TS interrupter has opened following its second closure, a period of minimum 0.5 second, or does not remain connected, the (Z4) relay will operate and open the path for the operation of the (DT) relay. If the (SC) and its associated equipment in the sender has functioned within its normally assigned time period and the (HO) relay in the test circuit has operated, ground will be connected through the (Z4) relay normal, operating the (DT) relay, which locks and advances the R2 switch to position 17.

15.7 Talking Selection - R5 Pos. 10 or 11, R1 Pos. 5 or 14, R2 Pos. 17, R4 Pos. 18 - TS Lamp

The last point of fundamental closure in the sender being at the normal contacts of the (SC1) relay, the sender will now complete the talking selector path and the check will continue in the same manner as the previous district selection. The release of the (L) relay and the operation of the (R1) relay in the test circuit connect ground to the armature of the (LD) relay (rotary link) or advance switch R2 (sender selector).

15.8 Link Dismissal (Rotary Link) - R5 Pos. 10 or 11, R1 Pos. 5 or 14, R2 Pos. 17, R4 Pos. 18 - "LD" Lamp

When the sender connects battery through 150 ohms to the SC lead the (LD) relay operates furnishing ground to advance the R2 switch to position 18, and the R4 switch to position 1.

15.81 Advancing the R2 Switch for Disconnect (Sender Selector) - R1 Pos. 5 or 14, R2 Pos. 14/17, R4 Pos. 18

The arrival of the R3 switch at position 18 advances the R2 switch from position 14 to position 16. Local ground advances it to position 17.

After talking selection the R2 switch advances to position 18 from where it advances to normal when the R1 switch arrives in position 6 or 15.

15.82 (SG) Relay Release Test (Rotary Link) - R1 Pos. 5/8, R2 Pos. 18, R4 Pos. 1

This test is similar to that described under paragraph 5.23.

15.9 Restoring the Sender to Normal (Sender Selector) - R5 Pos. 10 or 11, R1 Pos. 5/10 or 14/1, R2 Pos. 18/1, R4 Pos. 1 - SDR. NOR. Lamp

If the test is to be advanced to the next sender the connector is advanced from position 5 or 14 by a circuit from R magnet battery through cam SS4-J2 and SS1-J2 through the normal checking path of the check switches and the correct position checking path of the thousands and hundreds switches, to the normal contacts of the (MS) and (S) relays and to ground on the (S) relay contact 5T. The connector switch is advanced past positions 6 and 7 as the (MS) relay is normal. The (CA) and the (MS) relays normal immediately advance the connector switch to position 9 or 18. In this position ground is connected to the sender selector magnet through the #3 arc, M2 contacts of the operated ST key, normal contact of the (REP) relay, cam G, terminals 5 and 5' and the #4 arc M1 and #1 arc M2. This path assures that the master selectors are in step and energizes the sender selector. As soon as the sender selector has broken its interrupter contact the shunt is removed from the (AX) relay, which operates and advances the connector switch from position 9 or 18 permitting the sender selector to release and step and the (AX) relay to release. The connector switch is advanced for the test of the next sender in the same manner as described under "SEIZURE".

16. TESTING A CALL INDICATOR CALL TO AN EXCHANGE HAVING NO LINES WITH NUMBERS ABOVE 9,999 BUT WITH STATION DESIGNATIONS - R5 POS. 10 OR 11

The depression of class key 9 or 10 or 13 or 14 results in the advance of the class

switch to position 10 or 11, the correct code, selection and numerical keys for the class of call to be tested are depressed and the stations key not zero. The call is dialed in the same manner as the previously described relay call indicator call except that the path for locking the (AV) relay to advance the control switch through position 12 will not be closed. Ground through the (SD1) relay operated will be connected to cam SS4-D2 which will cause the stations digit to be dialed after a delay of 2 seconds in accordance with the depressed stations key. The switch will then advance to position 13 and immediately to position 14, if a non-coin test. If a coin test the dial control switch will advance as explained under Coin Test.

The fundamental check is identical with that previously described and the check switch R4 is advanced to position 6 for trunk test and for stations delay. In this class the sender is assumed to wait for at least three seconds if no stations digit is dialed. When the check switch arrives in position 6 ground is connected through the SD2 relay normal, and the "R" interrupter to the No. 1 counting relay. As soon as 3 closures of the interrupter have been checked, a minimum period of slightly over 2 seconds, the (SD1) relay will operate. The stations digit then being dialed the sender will advance to the trunk test position. If the sender falsely advances to the trunk test position before this time has been counted the (TC) and (TC1) relays will operate, in turn operating the (SD2) relay and blocking the test with the "SD" progress lamp remaining lighted as an indication of the cause. The time alarm gives an audible and visual signal in the usual manner after a predetermined period. After checking stations delay the R4 switch advances to position 9 and makes a fast assignment (operate test of (TG) train) the test circuit will then operate the assignment relay and if the (TG) relay train operates during the brief closure the pulses will be delivered to the test circuit. If the (TG2) relay fails to lock no pulsing will ensue. The remainder of this call is checked in the same manner as the preceding class.

17. CHECKING A CALL INDICATOR CALL TO AN OFFICE HAVING MORE THAN 10,000 LINES BUT WITHOUT STATION DESIGNATIONS - R5 POS. 12 OR 13, R1 POS. 5 OR 14

Class sequence switch positions 12 and 13 may be used interchangeably.

Assuming that the No. 11 or No. 15 class key is depressed for this class of call the class switch will be advanced to position 12. Also assuming that the No. 1 key in the stations row is depressed permitting the dialing of a ten thousands digit, the remaining numerical, code and selection keys, the talking section and compensating resistance keys are depressed as desired. The preparation for the test is identical with that in the preceding class but when the dial control switch arrives in position 2 ground from cam SS4-S2 through the contacts of the depressed No. 1 stations row key (10,000) will operate the (OT) relay. The operation of the (OT) relay transfers the class ground from SS2-F2 to SS4-F2 resulting in the dialing of a digit in each one of the control positions to and including the hundreds digit. The (SS) relay is prevented from operating by the operation of the (OT) relay. The ground for dialing the tens digit is connected to cam SS3-D2 through the operated contact of the (OT) relay, cams SS1 and SS4-Q5 from cams SS4-W4. This prevents the dialing of the tens digit until the check switch has arrived in position 6. Ground for dialing the units digit is not available until the (SD1) relay has operated, as in a class where the tens thousand digit is dialed the sender waits for the units digit for the same period that it waits for the stations digit in a class below ten thousand. The checking of the test from this point is the same as in a call for an exchange having no lines above 9,999 but having the station designations. Station designations cannot be used on lines whose first two digits are 1 and 0 respectively in exchanges having more than 10,500 lines or whose first three digits are 100 to 104 inclusive, if the exchange has 10,000 to 10,500 lines.

18. CHECKING A CALL TO A CALL INDICATOR EXCHANGE HAVING MORE THAN 10,000 LINES AND USING STATION DESIGNATION - R5 POS. 12 OR 13, R1 POS. 5 OR 14

The dialing and checking of this call is similar to any call in which the number of lines in the exchange does not exceed 10,000 and station designations are used, except that one may be dialed as a 10,000 digit, and if 1 is dialed as the first digit and 0 is dialed as the second digit, a stations designation cannot be used for the particular call. With one form of wiring in the sender this restriction is not effective if the third numerical digit dialed is 5 to 9 inclusive. With another form of wiring the sender is restricted regardless of the third numerical digit. If the 10,000 key is not depressed, a stations or zero key must be used. Delay will be checked if the (SD) key is operated. The check for a split heavy positive pulse is not made in class positions 12 and 13.

19. CHECKING A RELEASED DIRECT CALL INDICATOR CALL OVER A ROUTE WHERE DISTANT OFFICE SELECTORS ARE NOT USED - R5 POS. 14, R1 POS. 5 OR 14

The preparation and dialing of this call will be similar to that of class 10. The dialing proceeds until all digits are dialed. The dial control switch advances to position 14 where the dialing loop is normally closed through cams SS1 and SS2-L5. The No. 17 class key which was depressed for this class of call advanced the class switch to position 14 where these two cams are not closed but the dialing loop will be held closed through cams SS3 and SS4-H4 until the R4 switch is advanced from position 6 by the operation of the (SL) relay. As soon as the stations delay feature has been checked, the operation of the (TC) relay in connection with the trunk test furnishes a ground through the cams SS1 and SS3-M3, the normal contact of the (CN) relay, the (SD2) relay to battery at SS4-I4. This in turn connects ground from the (SY) relay normal to the (SL) relay. The R4 switch advances to position 8 from the operation of the (SL) relay but the (AS) relay is not operated and the trunk loop is held closed until the (SC1) relay releases. When the R4 switch advanced from position 6 the dialing loop was open at cam SS3 and SS4-H4 and the sender recorded a release, increasing the resistance of the "SC" lead. The release of the (SN) and (SG1) relays advances the R4 switch to position 18 from where it advances to position 1 when the R2 switch advances to position 18 after link dismissal.

20. CHECKING A RELEASED CALL TO A CALL INDICATOR OFFICE USING A ROUTE THROUGH A DISTANT OFFICE SELECTOR - R5 POS. 15, R1 POS. 5 OR 14

The depression of key No. 18 advances the class switch to position 15. The dialing and checking of this call is similar to that of a regular call indicator call and the release conditions are applied after dialing is completed, but before assignment. The delay which is introduced before checking commences insures that the sender does not immediately release. In class position 15 ground is connected to the armature of the (RCI) relay to insure the advance during the checking of the zero digits, as the (LR) relay is operated. The R4 switch advances from position 6 by ground through the (SL) relay operated. The (LR) relay operates in check position 7 and advances the R4 switch to position 8. After counting time for a delay, relay (SLA) operates, advancing R4 to position 9 where the (AS) relay is operated, after a delay to assure that the sender has not prematurely advanced, and the check switch is advanced to position 12, if for a direct call. From then on the checking of zero digits is accomplished by the transfer of the checking lead through the (LR1) relay. Talking selection is omitted and the restoration of the sender is checked in the usual manner. Any combination of (SD) and (TGO) keys may be used but preferably both should be operated with the 0 stations key.

21. CHECKING A CALL TO A 3-DIGIT TANDEM OPERATOR - R5 POS. 16, R1 POS. 5 OR 14

The depression of the No. 19 class key advances the sequence switch to position 16 where ground is furnished through cam SS3-E2 for dialing. The first code key may be any desired digit but the second and third code keys used are always one in this class. The zero key is depressed in each row of numerical keys including the station key, but these keys are for checking purposes only and the dialing switch is immediately advanced after the last code digit has been dialed. The dial control switch stops in position 14. This call is used only as a tandem call and therefore the tandem digits are checked in positions 9, 10 and 11 of the RCI check switch in the same manner as in a regular tandem PCI call. The remainder of the call is checked in the same manner as the previously described relay call indicator calls, the only distinguishing feature being the checking of the zero numerical pulses furnished by the sender when no pulses are dialed into it.

22. DETAILED DESCRIPTION OF THE METHOD OF CHECKING REGULAR AND FALSE RELAY CALL INDICATOR PULSES

The (MG), (SN+), and (SN-) relays are connected to the fundamental tip and the fundamental ring for the detection of regular pulses which are of sufficient strength to operate the control circuit relays at the manual RCI position. The regular pulses received and checked by these relays are as follows:

1. A light positive pulse from 48.5 to 50 volt battery through a resistance of 6500 ohms in the sender, the battery being connected to the fundamental tip.

2. A light negative pulse through the same resistance battery being connected to the fundamental ring.

3. A heavy negative pulse of 52.5 ohms in multiple with the light pulse resistance.

4. A heavy positive pulse received only at the end of a call and only in areas where 2-wire office selectors are used.

Each digit consists of four sections or segments, the first being either a light positive battery or an open period, the second section being either a light or a heavy negative battery, the third section being either light positive battery or an open period, the fourth being either light or heavy negative battery. The relays which operate during one segment or closure release at the start of the next segment due to reversed battery or to open circuit conditions. Negative current must always be sent in the second segment to operate the transfer or steering relays in the control circuit. Heavy negative battery when sent in the fourth segment is used to add 5 to the same combination except for a light negative in the last segment. The order of relay operations in the control circuit is as follows: First segment open, no relay operation. First segment light positive operates the (SN+) relay operating the (A) register relay, which locks. In the second segment if a light negative, the previously operated (SN+) relay releases. The (SN-), (W) and the appropriate transfer or steering relays are operated. If in the second segment the pulse is a heavy negative, the previously operated relay is released and the (SN-), (MG), (W) and (B) relays are operated, the (B) relay remaining locked. If the third segment has an open period, the previously operated (SN-) and (MG) relays release and the (Z) relay operates. If the third segment is a light positive pulse the previously operated relays release, the (Z) and (SN+) relays operate and the (C) relay operates and locks. In the fourth segment if a light negative is sent the previously operated (SN+) relay released. The (SN-) relay operates and the (W) relay releases. If the fourth segment is a heavy negative the (SN+) releases and the (SN-) and the (MG) relays operate. The (W) relay releases and the (D) or in the case of the thousands digit, the (D) and (E) relays operate. All of the register relays when operated remain locked until the end of the call. At the end of this segment the (SN-), and the (Z) relays release. The second transfer or steering relay also operates. This operation occurs during the first period of the following pulse, if any. The fundamental tip and fundamental ring are reversed by the operation of the (U1) and (U2) relays and the final heavy positive pulse when used as recorded by the reversed (MG) and (SN-) relays and registered by the (F) and (F1) relays, thus checking the strength, polarity and continuity of the pulse.

PCI PULSING CHART

TD	STAT.	OTHER	(Operates Releases) 1st SEG. + IF ANY	(2nd Seg. Light or Heavy Neg.	(3rd SEG. (4th SEG. + IF ANY Light or Heavy Neg.
0	0	0			
2	1	1	(SN+ (A		
4	W-9	2		(MG (B	
6	R-7	3	(SN+ (A	(MG (B	
8	J-5	4			(SN + (C
1	M-6	5			(MG (D
3		6	(SN+ (A		(MG (D
5		7		(MG (B	(MG (D
7		8	(SN+ (A	(MG (B	(MG (D
9		9			(SN+(C(MG(D

All operated (SN) and the (MG) relays release during the following segment. The (ST) and (ST1) may be any set of steering relays. The (SN-) (W) and (ST) relays always operate during the second segment. The (Z) relay always operates during the third segment. The (SN-) and (ST1) relays operate and the (W) relay releases during the fourth segment. The (Z) relay releases and relay (ST1) operates at the end of the fourth segment.

22.1 Reversed Order of Pulses Due to Transfer in Sender

In calls to exchanges having not over 10,000 lines and in some other instances the digits are sent in the following order: stations, thousands, hundreds, tens, units, that is, the last dialed digit, if stations is dialed, or zero, if no stations is dialed, is sent first. When all of the following conditions apply this order is changed and the digits are sent in the following order as dialed: ten thousands, thousands, hundreds, tens and units only when:

1. The exchange to which the call is direct has more than 10,000 lines.

2. The particular call has registered 1 as the first and 0 as the second numerical digit.

3. The fifth numerical digit has been dialed. (The sender waits four seconds if necessary, for this digit.)

4. The highest numbered line in the called exchange is not higher than 10,499 and the dialed third numerical digit (hundreds) is 0 to 4. The hundreds numerical digit has no effect if the highest numbered line in the called exchange is over 10,499.

The above classifications make it impossible to use a station designation on a line whose first three digits are 100 to 104 in an exchange having not over 10,499 or whose first two numerical digits are 10 in an exchange having lines numbered higher than 10,499.

22.2 Check for Grounding Closures

The "CAP. RCI" key may be operated, connecting a 1.5 mf condenser across the center of the compensation which should be 1300 ohms for the purpose of checking the effects of capacity upon the sender pulses and detecting the absence of the grounding cam closures in the sender impulse switch. The value of the capacity and resistance network is designed for maximum efficiency, and the use of a different compensating resistance in the sender and the test circuit reduces the efficiency of the combination.

Upon finding an open rather than a grounding closure following a pulse, the condenser which has been charged by this pulse discharges through the (SN+) relay which should operate and register a wrong number. With "G" option a more sensitive checking relay arrangement is provided.

23. COIN TEST

As this circuit does not test any coin senders and the apparatus described in note 129 is not adapted for use with relay interrupters, its description is omitted.

24. SYNCHRONIZING TESTS

24.1 Check of (S) relay or Other Synchronizing Feature

These tests are for the purpose of checking the operation of the (S) relay in the sender or a similar synchronizing feature. The operation of the (SY) relay in the test circuit accomplishes the following results:

1. Opens the path for advancing the dial control switch.

2. Opens the path for operating the stations delay feature.

3. Lights the S lamp and operates the (BK) relay.

The operation of the (SY) relay between digits is prevented by the operation of the (SY1) relay which may operate after the (AV) relay has operated during the dialing of a digit under the following conditions:

1. During the dialing of the first or later digits in classes 1 to 9 and also class 16.

2. While the dialing units in all regular CI calls if the number dialed is below 10,000.

3. While the dialing tens in all regular CI calls when the number is above 10,000.

When operated in any of the above classes the (SY1) relay locks to ground at the R3 switch in positions 6 to 8, 9 to 10, 12 and 14 and also to ground at the R4 switch in position 6 to 9. The operation of this relay prevents the operation of the (SY) relay between the dialing of the digits but the path for operating the (SY) relay is closed irrespective of the position of the (SY1) relay while the (PU) relay is operated during the dialing of each digit.

The (SY) relay may operate from any of the following causes:

(a) During the dialing of each digit, if the (L) relay operates in any position from incoming test to final units inclusive with the class switch in position 1, 3, 8 or 9.

(b) During coin test if the (L) relay operates for final units check, or the (TC) relay for PCI trunk closure before the (CN4) relay has operated.

As the class ground for the full selector call is not available for dialing the thousands digit until the checking switch has arrived in positions 6 to 16, for dialing hundreds until positions 9 to 16, for dialing tens until the checking switch has arrived in positions 11 to 16 or for dialing stations until the checking switch is in positions 13 to 16, it is apparent that the operation of the (L) relay during dialing indicates a false advance of the sender. The same conditions would apply if the (SY) relay operates during final units or PCI trunk test before the coin test is completed.

24.2 Check of Transfer Relay Contacts in Sender - R5 in Pos. 3

The cancel synchronizing key (CAN. SY.) when operated cancels the synchronizing

check by the test circuit and permits the numerical digits to be dialed before any selections are checked. The purpose of this is to detect crossed contacts on the relays in the sender which transfer the dial registration to the selection register for incoming and final selections. This check should be made with R5 in position 3. If necessary, the (SKO) key may be depressed when R5 is in position 3 if required by the selections.

The (CAN. SY.) key performs the following functions:

1. It grounds three leads to operate the (PU) relay in several positions of R2 so that the code and thousands, hundreds, tens and units may be dialed before any selections are checked.

2. It opens the circuit to the winding of the (SY) relay.

3. It transfers the advance path for the R3 switch from SS3-S2 to a make contact of the (CSC) relay so that the check switch is not started until after units has been registered.

The relays shown in Fig. M operate as follows:

The (CSC) relay operates from ground at SS1-V2 when R2 reaches position 12, lights the (STA) lamp and furnishes a ground to advance the check switch from normal. Since this check is made using a code which will not have a station digit, position 12 is passed by, and as SS1-V2 breaks, the (CSP) relay operates and extinguishes the (STA) lamp.

To detect all crosses on transfer relays in the sender which might cause wrong numbers, the numerical digits 3333 and 9999 should be used with each code set up for this test so that all the dial register relays in the sender will be operated, and the following selections should be obtained by using several codes if necessary: DBO, DGO, OBO, OGO and DB3. Should any of the selections mentioned not be available codes giving selections which would result in wrong selections if a cross were present should be used. If a cross is present the test circuit will block in district or office selections.

Those contacts on the transfer relays which normally synchronize selections with registration will be detected when the (CAN. SY.) key is normal. If a cross is present on one of these contacts the test circuit will block with the (S) lamp lighted.

25. CONTROL ADVANCE WITH REMOTE CONTROL

The control advance (CA) relay may be operated by the operation of the "CA" key during R1 positions 2/9 or 11/18. If the "ST" key is operated and the (S) and (MS) relays are normal, it may also be operated by the operation of the (PB) meter in R1 position 2 or 11 if ground is connected to that meter through the APB lead. Also from ground which may be connected to the ring of a remote control jack, with the "REP" key operated. When operated, the (CA) relay locks through positions 2/7 or 11/16 and advances the R1 switch to position 8 or 17. If the operating ground has been removed the release of the CA relay in position 8 or 17 advances the R1 switch to position 9 or 18 from where the test proceeds in the usual manner. The operation of the (CA) relay prevents the operation of the (CT) meter in R1 positions 3/4 or 12/13 and the (AD) and (CI) relays in positions 3/5 or 12/14. The latter feature is to prevent possible interference with a sender that may become idle just after the PB meter has operated the (CA) relay. Ground is connected to the ring of a remote control jack by the use of a standard make busy plug or the depression of the red key of a 32-A test set whose plug is inserted in the remote control jack. The ground is supplied to the sleeve of the remote control jack from the test set. If the operating ground is retained on the ring of the control jack the sender is returned to normal and held guarded. The (CA1) relay which is operated from the same ground retains the holding ground on the "TR" lead as a make busy feature.

26. SPECIAL FUNDAMENTAL TESTS

After the sender has received reverse battery over the fundamental circuit, the (TF1) and (TF) relays are connected to the fundamental tip and the fundamental ring respectively and time is allowed for their operation in certain classes, the (TF) relay being connected to 48-volt battery and the (TF1) relay to 24-volt potential for the purpose of detecting any crosses or grounds on the fundamental circuit. These crosses or grounds would be likely to cause a false talking selection. This test is disconnected before the SC lead is grounded by the test circuit this being the signal that causes the sender to release the (SC) relay and close the fundamental tip for talking selection.

On call indicator calls when the first pulse is an open segment the sender connects ground to both the fundamental tip and the fundamental ring to discharge the trunk. The (GT) and (GR) relays are connected from 48-volt battery to the fundamental tip and

the fundamental ring respectively. If both relays operate the (GT1) relay operates and relay (GT) releases when ground is removed from the FT lead. Relay (OG) operates in turn and transfers the fundamental tip and the fundamental ring leads to the pulse checking circuit. This indicates that the discharge grounds have been properly connected by the sender.

After the units digit has been received a final heavy positive pulse is sent in areas where it is required in connection with the operation of distant office selectors. When the (Z) relay releases at the end of the units pulse the (U1) and (U2) relays operate. These relays reverse the fundamental tip and the fundamental ring so that a final heavy positive pulse will operate the (SN-) and (MG) relays. If the pulse is received the (F) relay operates and transfers the leads to the (TF) and (TF1) relays. If the pulse is split or a false pulse follows, the (TF) and (TF1) relays will operate and block the circuit. This test is made only in class positions 10 and 11.

27. STATIONS DELAY AND TRUNK TEST

27.1 Checking Delay

The following description includes conditions for various call indicator classes. There are four stations delay conditions which may be tested.

A - Offices with numbers above 9999 and stations. R5 Pos. 12 or 13
B - Offices with numbers above 9999, no stations. R5 Pos. 12 or 13
C - Offices with numbers below 10,000, no stations. R5 Pos. 10 or 11
D - Offices with numbers below 10,000 and stations. R5 Pos. 10 or 11

The sender waits following the dialing of a fourth numerical digit for at least 3 seconds for conditions A and D before closing the trunk test loop but it closes this circuit immediately following the dialing of the units digit for condition C and waits for 3 seconds in some cases for condition B.

Stations delay is checked by the (SD) key, (SD1) and (SD2) relays. The (SD) key is operated when a delay is expected. The (SD1) relay is used to measure a short time interval following the dialing of the fourth numerical digit. Following the dialing of that digit the (R) interrupter closes a path from ground at the normal contacts of the (SD2) relay, cam Y4, R interrupter, (SY1) relay operated, (CN3) relay normal, to the armature of the (1') or (3') or (3) relay and the winding of the (1) relay which operates. The opening of the (R) interrupter permits (1') or (3') or (3) to operate and lock in series with (1). The third closure of the (R) interrupter operates the (SD1) relay which locks approximately 2 seconds after the end of the fourth numerical digit. The (SD2) relay operates when the sender closes the trunk by ground at the (TC1) relay which operates from ground at relay (TC).

The (SD) key should always be operated for conditions A and D and should be operated for condition B when a delay is expected. The test circuit should have time enough to dial the last digit for these conditions before the sender indicates by the closure of the (TG) loop that it has timed past the stations delay positions. This is checked by taking the operating circuit for relay (SD1) through the normal contacts on relay (SD2) so that if (SD2) operates before (SD1) it prevents the latter from operating and with (SD2) operated and (SD1) normal the operating circuit for the (FA2) or (TGH) relay is open and the test is blocked.

When condition C is tested the (SD) key should be normal and the (SD2) relay will operate before the (SD1) if the sender advances to close the fundamental without undue delay. The (SL) relay will then operate to continue the test.

The TG operating test should follow a station delay check whenever possible as the fundamental is not closed until just before assignment.

27.2 Operating Test of (TG) Train - (TGO) Key Operated

The (TGO) key is operated to test the ability of the (TG) train to assign following the equivalent of a short closure in the trunk. This test may be made under any one of three conditions:

1. When a stations digit is dialed.
2. When the sender awaits a stations digit which is not dialed.
3. When a stations digit is not dialed and the sender does not await this digit.

When a stations digit is dialed the test is made as follows: Relay (SD1) operates as previously described. Ground through the 5B contact of the (SY) relay, the operated (SD) key and (SD1) relay, the normal (SD2) relay and operated (TGO) key, operates relay (FA2), which operates

relay (FA) and, in turn, operating relay (FA1) by ground from SS1-04. The operation of relay (FA1) opens the fundamental circuit. Relay (FA1) advances R4 to position 7 from ground at SS4-V4. Position 7 is passed by. In position 8, R4 is advanced through the operated contacts of the (FA2) and (SLB) relays after the counting relays starting with (9) have been counted down from ground at SS4-X2 through contacts of relays (SLB), (FA), (FA1), (OF3), (RV4) if used, (OF), (OF2), the (ABC) or (CHK) interrupter, relays (FA), (OF7) and (9'). In position 9 ground through interrupter (IP) operates relay (IP3) followed by (IP4) in the open period (IP) and (IP1) operate on the next closure and opening. (IP1) places ground on the fundamental ring for making an operate test of the (TG) relay. The next interrupter closure, .2 sec. later, operates the (4) relay and the (AS) which opens the fundamental circuit and assigns. If the sender (TG) train has functioned properly within the time allowed, the cable discharge closure and the call indicator pulses will be checked.

When the sender awaits a stations digit which is not dialed, a delay must be introduced to insure that the sender is ready for assignment before the test circuit assigns. This delay is introduced in position 8 of R4 by transferring from the rev. interrupter to the (SD) interrupter through contacts of the zero station (OS) relay which operates when the stations (0) key is depressed.

When the operate test is made on a call which does not have stations delay the operation of the (OTC) relay prevents (TG) test from being made until R4 reaches position 9 where a momentary operating circuit is furnished for the (TG) relay. The check for stations delay is ineffective in this case.

27.3 Holding Test of (TG) Relay or Train-(TGO) Key Normal

This test also can be made under any one of the three conditions under which the operate test is made. Under all conditions following the operation of the (TC) and (TC1) relays, relay (SD2) operates and closes a circuit which operates relay (SL) after relay (TGH) has operated through the (TGO) key normal. R4 advances to position 8 by ground through relay (SL) when the (FA) and (FA1) relays are operated. Ground is connected to the fundamental ring through cam 04, 1B of the (FA) relay and contacts of the (7) counting relay. The 14,500 ohm (TG) resistance used to make an operate test of the (TG) relay is shunted by the (BE) and (BF) resistances to increase the current through that relay. Ground through the rev. interrupter operates the counting relays starting with (9). After the (7) counting relay operates, the rev. interrupter opens, holding the fundamental open until it again closes .015 sec. later. The (TG) train is expected to be slow enough in releasing not to assign from this interval. The fundamental is held closed by the operation of the (SL1) relay following the operation of the (6) counting relay before the rev. interrupter is again opened. Coil (SL2) is used to make relay (SL1) fast in operating. After relay (BO') has operated relay (SLA) operates and locks soaking the (TG) relay and advancing R4 to position 9 where relays (IP3), (IP4), (IP) and (IP1) operate followed by relay (AS) which opens the fundamental for assignment.

The delay in assignment following the open in the fundamental is to cause a wrong display if the (TG) train is falsely released during the .015 sec. open period.

The TG hold relay, (TGH) awaits the operation of relay (SD2) on calls where the (SD) key is normal, but operates following the operation of (SD1) where the (SD) key is operated. In any case the (SL) relay does not operate until relay (SD2) has operated.

27.4 Checking Slow CI Impulses - R4 Pos. 9 to 16 R5 Pos. 10/13 Direct CI

Inpulse relays (IP) and (IP1) operated from interrupter "IP" in R2 position 9 start a time count when assignment has been completed. If relay (F) has not operated, showing that the final heavy positive pulse (or last negative pulse if no F.H.P. pulse is sent) has been received within 2-1/2 seconds relay (IP2) operates blocking the test and lighting lamp "IMP".

27.5 Stations Delay and Trunk Test

STATION DELAY - No Slow Rev. Pulses

Cond	R5 Pos.	Class of Call	Keys Oper.	Relays Oper.	Sdr. Waits	S.D. Fails From Operation of	Dial Cont.
C	10	-10,000 no stat	TGO-O-ST	OTC,TC,SD2,FA2,FA,FA1	-	None	Any
			-O-ST	TC,TC1,SD2,TGH,SL	-	SD1/SD2	"
D	11	-10,000 + stat	SD-TGO-W/M	SD1,FA2,FA,FA1	4"-	SD2/SD1	HS Min BR
			SD- - "	SD1,TGH,TC,TC1,SD2,SL	4"-	" "	" " "
			SD-TGO-O-ST	SD1,FA2,FA,OS,FA1	4"-	" "	Any
			SD- - O-ST	SD1,TGH,TC,TC1,SD2,SL	4"-		HS Min BR
B	12	+9999 no stat	SD-TGO-TT	SD1,FA2,FA,FA1	4"-	SD2/SD1	HS Min BR
			- TGO	SD1,FA2,FA,FA1,OTC	-	None	Any
			- -	TC,TC1,SD2,TGH,SL	-	SD1/SD2	"
A	13	+9999 + stat	SD-TGO-W/M	SD1,FA2,FA,FA1	4"	SD2/SD1	HS Min BR
			SD - W/M	SD1,TGH,TC,TC1,SD2,SL	4"	" "	" " "
			SD-TGO-O-ST	OS,SD1,FA2,FA,FA1	4"	" "	" " "

Note: SLB always operates in R4 pos. 8.
IP4, IP3, IP and IP1 always operate in R4 pos. 9.

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28. TEST OF THE TR LEAD AND AUTOMATIC PASS BUSY FEATURE (ROTARY LINK)

The (T3) and (T4) relays are connected to the TR lead to test the busy or non-busy condition of the sender after the master and sender selectors have selected a particular sender. In the sender circuit 48 1/2 to 50 volts negative battery through a resistance of 150 ohms is connected to the TR lead of an idle sender. With the TR lead battery circuit closed, the test circuit (T3) relay will operate through its primary winding which is in series with the winding of the (T4) relay and the (T3) relay when operated will hold over a circuit which is established through its secondary winding as soon as it breaks its own back contact. The (T4) relay will not operate when in series with the primary winding of the (T3) relay but operates as soon as the (T3) relay has closed its front contact and shunted its primary winding. If the test circuit and a service link circuit seize the same sender at the same instant the test relays of both circuits will start to chatter but due to the lower resistance of the (T4) relay in the test circuit the link test relay will receive less current than the test circuit relay and the test circuit will take precedence.

If the (T3) and (T4) relays do not operate before the time alarm has connected a ground to the "APB" lead the (PB) meter will operate, in turn operating the (CA) relay and advancing the connector switch to position 8, preventing the operation of the (AD) and (CI) relays. From position 8 the connector switch will advance the test circuit to the next sender in the usual manner. The "APB" key should not be operated until the test circuit has started the testing cycle of the connector switch. The use of this key prevents the detection of an open lead. If the sender (SG) relay is locked through the test relays in R1 position 2 or 11 the (SGR) relay operation will release that relay.

29. REPEAT TESTS

29.1 The Repeat (REP) Key Operated

The following conditions are established:

1. The (REP) relay is operated if the "REP" key is operated in R1 position 3/9. This closes a path to advance switch R1 from position 7 and also prevents the operation of the sender selector in position 9 which would advance the test to the next sender.

2. Closes a path to permit operation of the (CA1) relay. The (CA1) relay when operated connects holding ground to the TR lead to prevent loss of the sender while advancing for a retest.

During repeat test when the R2 switch enters position 18 a path is closed through the normal positions of the R3 and R4 checking switches, and the correct positions of the R6 and R7 thousands and hundreds switches thus preventing the succeeding test if the test switches are not in the correct positions. When the R1 switch advances from position 5 the (AD) and (CI) relays release opening the test leads except the TR lead (rotary link). This operation immediately follows the operation of the (LD) relay from 48-volt battery through 150 ohms which is connected to the SC lead (rotary link). The R1 switch advances during a repeat test in the same manner as during a single test. A path is established for the operation of the repeat signal test "RST" meter while the R2 switch is passed through positions 3 to 5.

29.2 (REP-2) Key Operated

When the (REP-2) key is operated the (RE1) relay is operated by the normal checking ground, locks, operates the (REP) relay and advances R1 from position 5. In the next test the (RE2) relay operates and opens the (REP) relay operating path. The test circuit then advances to the next sender at the end of the second test. The (REP) key shall be normal when the (REP-2) key is operated. This test shall not be made when the (SGT-O) key is operated.

30. STAGE-BY-STAGE ADVANCE WITH REMOTE CONTROL FEATURE

To permit the dialing of one digit at a time the dial stage-by-stage "DSS" key is left in the operated position before starting the test. This key opens the operating and shunting paths of the (PU) relay and closes a path from the class ground which normally operates the (PU) relay. This ground is used to operate and lock the (DA) relay after the (SA2) relay has operated. When the attendant is ready to dial a digit the advance dialing "AD" key is operated and released or the same result is obtained by the use of a 32-A test set for connecting ground to the tip of the remote control jack at the sender frame. Either of these actions results in the operation of the (SA2) relay which is followed by the operation and locking of the (DA) relay. The (SA2) relays release immediately as a result of the removal of the ground or the release of the "AD" key. These functions first restore the shunting path and then the operating path of the (PU) relay which permits the operation of the relay and the dialing of the digit in the usual manner. The advance of the dial control switch at the end of the digit, which is accomplished in the usual manner, causes the release of the (DA) relay.

30.1 Checking: Stage-by-Stage Advance

The stage-by-stage advance "SS" key is left in the operated position. This removes the ground from the armature of the (BO') relay, this being the normal method of connecting ground to the pulsing interrupters and also of advancing the test circuit after the completion of a satisfactory check. The operation and release of the advance "SA" key causes the operation of (SA) relay followed by the operation of the (SA1) relay, assuming that the synchronizing grounds which normally control the checking circuit are available, a condition which will apply unless the dialing and checking have become out of step. The operation and release of the "SA" key permit the checking of the particular digit or combination of digits, but the release of the (SA) and (SA1) relays which follows the advance of the checking switch from a position during which a check is made will prevent any further checking until the "SA" key is again operated. The operation of the (DA) and the (SA2) relay, under the control of the DSS key and the AD key or the remote control feature permits control of both the dialing and checking, assuming that the DSS and SS keys are left in the operated position.

31. ADVANCING THE SENDER SELECTORS AND MASTER SWITCHES

After the completion of the (SG) relay release test (rotary link) or trouble test (sender selector) the connector switch is advanced through position 17 or S without stopping as the (MS) relay is not operated. In position 18 or 9 the sender selector is energized by a path through the #3 arc (M2), terminals 10' and 10, key "TA" normal, operated contact of the ST key, normal contact of the "REP" relay, cams SS3-L1 and SS2-L1, terminals 5 and 5', arcs 4-M1 and 1-M2 ground on the feeder brush of the #1 arc M2. The two arcs of the master switch are used to assure that the two master selectors are in step before attempting to advance the sender selector to the next sender. At this instant the (AX) relay is shunted by a path which may be traced through cams SS1 and SS4-M1 terminals 9 and 9', the AX arc and the interrupter contact of the sender selector. As soon as the sender selector is energized this shunting path is broken and the (AX) relay is operated. This results in the advance of the connector switch to position 1 or 10. During the advance of this switch the sender selector is de-energized and steps and the (AX) relay releases. If the point to which the sender selector is

advanced is connected to a working sender, the normal checking path remains closed and the R1 switch advances from position 1 to 10. If the sender selector advances to the first spare terminals, the (S) relay will be operated by a path through the TR arc sender selector #1 arc #2-M2, terminal 7' and 7, (RL) relay normal (if used) "PC" key, (T2) relay to ground (sender selector) or (RL) relay operated, contacts of (SD1) and (SGR) relays, the winding of the (T4) relay, the primary winding of the (3) relay, normal contact of the PC key to ground (rotary link). The operation of the (S) relay opens the normal checking path and connects ground to the TR lead through the selectors, resulting in the locking of the (S) relay until the selector switch steps from the first spare terminal. Ground through the normal contact of the (MS) relay and the operated 3-B contact of the (S) relay advances the R1 switch to position 8 or 17 from where it is advanced to position 9 or 18 by ground from the (MS) relay normal. The sender selector is again energized in position 9 or 18 as previously described and advances the sender selector to the next terminal at the same time advancing the connector switch to position 1 or 10. The (S) relay is held operated over its primary winding through the 9 and 9' terminals, the AX arc, the spare terminal strap, the TR arc terminal 7 and 7' to ground at the 3 contact of the (S) relay. The connector switch will not advance from position 1 or 10 as the normal checking path is open at the 5T contact of the (S) relay. The sender selector is connected through its interrupter contact and the spare terminal strap to the ground which has just been traced through the TR arc and the sender selector will continue to step until it has passed from the last spare terminal when the (S) relay will release and the R1 switch will be advanced to position 2 or 11. If the next terminal following the spare terminals is connected to a working sender the (T) and (T1) or (T3) and (T4) relays will function to test the sender for the idle condition in the usual manner, but if this terminal is the 21st terminal of any arc except the last, the (MS) relay is operated through terminals 14 and 14', Fig. C or "GR-" key normal Fig. D the TR arc winding of the (T3) and (T4) or (T2) relays, normal contact of the (PC) to ground. The (T4) or (T2) relay will not operate through the high resistance of this path. If the 21st terminal is connected to a group "GR-" key which is in the operated position, the (BY) relay is operated and the lamp is lighted by the ground over the path through the (T3) and (T4) relays or the (T2) relay as soon as the (T) relay operates. This removes ground from the armature of the (AX) relay, preventing the advance of switch R1. Restoration of the "GR-" key to normal releases relay (BY) and causes the operation of the (MS) relay. The R1 connector switch is advanced to position 3 or 12 and immediately to position 4 or 13 in the usual manner. In position 4 or 13 ground through the 3-B contact of the (MS) relay and the SM arc energizes the sender selector, and in turn the (AX) relay which causes the R1 switch to advance to position 5 and the sender selector to advance to terminal 22. The connector switch passes through position 5 or 14 without stopping and in position 6 or 15. The master selectors are energized, and the (AX) relay is operated through the 3-B contact of the operated (MS) relay advancing the master selectors to the next sender selector and the connector switch to position 7 or 16 then immediately to position 8 or 17, from ground through the operated contact of the (MS) relay, terminals 7 and 7', TR arc, normal contact of the sender selector, terminals 12' and 12 advances the connector switch to position 9 or 18. The sender selectors are energized and the (AX) relay operates advancing the connector to position 10 or 1, and the sender selector takes one step.

If the master selector advances to a terminal to which no sender selector is connected ground through the feeders of the #1 arcs will be connected directly to each selector, buzzing both of the master switches past all of the spare terminals to normal or to a connected sender selector (ST key operated).

32. SENDER LAMP CHECK

If the sender is adapted to give a different signal for partially dialed calls or for stuck senders with completed dialing (lamp at S.M. position) the "SL" key may be operated in class position 2 for a "partial dial" test. The R2 switch advances to position 8 dialing to the thousands digit and the R3 switch remains in position 2. When the sender monitor primes the sender, the (LR) relay operates and locks advancing the R3 switch to position 16. The release of the (SC1) relay advances it to position 17. Ground from SS3-W3 advances the R2 switch to position 16 from where it advances to normal in the usual manner.

If a stuck sender test is to be made the "SL" key may be operated in class

position 6. The R2 switch will remain in position 14 after dialing all digits and the R3 switch will remain in position 2. After priming, the advance will be identical with that of the "partial dial" class.

If either of the preceding tests is made on a coin sender the FC key should be operated.

If the coin lamp is to be tested for a non-coin ground test the "SL" key is operated in class position 12. The R2 switch advances to position 13 and the R4 switch to position 8. After priming the sender the (LR) relay operates, advancing the R4 switch to position 17. The release of the (SC1) relay advances it to position 18. Ground from SS2-L4 advances the R2 switch to position 16 from where it advances as in a regular call.

33. RESTORING THE TEST CIRCUIT TO NORMAL

When the ST key is restored to its normal position the R2 switch is advanced to position 16, connecting ground to the armature of relay (LD). The sender and testing circuits then advance to normal. If the ST key is restored too late to record a release, the CA key must also be operated. If the test is complete the restoration of the R1 switch may await the (MS) or (S) relay normal. The (TA) relay releases when the R1 switch advances from position 9 or 18 and the time alarm selector will advance to its next normal position. Ground from the R1 switch in position 6/10 or 15/1 restores the R2 and check switches to normal if the ground from SS3-V2 has not already done so. The master and sender selectors remain as used, also the various control keys, and switches R5, R6 and R7. If it is desired to restore the sender and master selector to their normal positions, the PC key is operated and the sender selector and master switches are advanced by the depression of the appropriate sender and master keys.

34. END OF CYCLE

The last sender selector advances to the 21st terminal and if the 20th terminal was "spare" the (S) relay releases advancing the R1 switch to position 2 or 11. If the previous terminal was connected to a working sender the normal checking path will be closed and following the operation of the (AX) relay the R1 switch will advance through positions 9 and 10 or 18 and 1. In position 2 or 11 the (MS) relay operates in series with the (T3) and (T4) or (T2) relays. The (MS) relay operated advances the R1 switch to position 3, the (T4) relay normal or unused to position 4. Ground from SS4-Q1 through the operated (MS) relay energizes the sender selector, the (AX) relay operates and the sender selector advances to normal and the connector to position 5 or 14. The (MS) relay operated advances the R1 switch to position 6 or 15 where the master selectors energize, the (AX) relay operates, and the master selectors advance to normal or to a spare terminal and the R1 switch to position 7 or 16 and to position 8 or 16 through the operated (MS) relay. If the next terminal on the master switch is a spare, ground from the #1 arc advances both master selectors to the normal terminal (#22) where ground from the #1 arc of the M2 switch advances the R1 switch to position 9 or 18, and the "EC" lamp is lighted by ground from the 1-M1 arc. Restoration of the "ST" key operates the (AX) relay and advances the R1 switch to position 19 or 1 where the (MS) relay releases, and the "EC" lamp is extinguished. If the cycle of tests is to be started again the ST key is reoperated.

35. TIME ALARM AND BLOCKING

With the TA key in its normal position the (TA) relay is operated by ground through the TA arc in any of its normal positions from the operated ST key. The relay is locked over a path through the TA key normal, its contacts 3 and 4-T to ground at SS2-K1. This ground is open each time the R1 switch advances through position 2, 9, 11 or 18, causing the (TA) relay to release and the time alarm stepper to buzz to its next normal position by ground through its number one arc and the 2 and 3-B contacts to the (TA) relay, if it has advanced from normal. If the time alarm selector has advanced to a connected terminal or arc #3, the (BK) relay will operate and lock to an off-normal check switch opening the trunk test lead and the path which is used to advance the check switches. The "TBL" meter is operated from the operation of the (BK) relay only if the R1 switch is in a trouble test position. The time alarm selector takes one step for each closure of the TA interrupter while the (TA) relay remains operated. The time alarm arcs are usually wired in accordance with the first figure as shown which gives either a busy or trouble alarm within a period from 1 to 1-1/2 minutes. If the time alarm is caused to function while the operator is working upon a sender it may be restored by operating the TA key and leaving it in the operated position until the test is resumed. The sender selector cannot be advanced to test the next sender until the time alarm key is restored to normal, thus insuring that the time alarm will be effective while the single test is going on. During permanent signal test, 30 seconds are added to the time alarm period by the operation of the (PS) relay which causes the time alarm to take an additional step from the interrupter.

A failure of the M. F. Adapter checking circuit will cause the "Blk" lead to be grounded, operating the (BK) blocking relay which prevents any further progress of the test and operates the "Tbl" meter. The time alarm will function in the regular manner.

36. DIAL TONE TEST

If the attendant wishes to check the intensity of the dial tone as given to the subscriber from the sender, the DT key is left in the operated position at the start of the test. The (DT) relay is operated by a path through the operated contact of the DT key to ground at cam SS1-P1 for the first test and by a path through the same operated key and SS4-I2 to ground at SS2-K1, if a repeat test is being made. The operation of the (DT) relay which is locked through the normal contact of the DTA key while the dial control switch is in positions 18 to 1, connects ground from the operated contact of the (DY) relay through the operated contact of the (DT) relay to the DT lamp. The (DY) relay is operated by battery through the (L) relay in the sender at the same time that the dial tone is connected and gives the (L) relay a current flow test. The attendants attention is called to the presence of dial tone by the lighting of the DT lamp and after having listened to this tone through the receiver which is closed across the dialing tip and ring through the operated contacts of the (DT) relay and the 1 MF condenser, the attendant then depresses the DTA key momentarily which results in the release of the DT relay and the connection of the ground through the armature of the (DY) relay to cam SS4-B2 advancing the dial control switch from position 1.

This receiver may be a part of the telephone for talking to the sender monitor.

37. METERS

37.1 Repeat Single Test "RST"

The repeat single test "RST" meter is operated when the "REP" key is operated each time the dial control switches pass through positions 3 to 5. This is for the purpose of recording the number of times which a test is repeated.

37.2 Circuit Test Meter "CT"

The circuit test "CT" meter is operated each time the connector switch passes through position 7 or 16 if the (CA), (S) and (MS) relays are normal and the ST key is operated. The circuit test meter is prevented from being operated by the operation of the various relays through which this circuit is connected as these relays when operated indicate that a test is being rechecked for a trouble condition or that the connector switch is being advanced at the end of the cycle or to advance the sender selector or master selector. None of these operations is recorded as they are not an indication of a circuit test.

37.3 Time Alarm Meter "TBL"

This meter is operated whenever the time alarm switch is advanced over the predetermined number of positions with the R1 switch in the test for trouble condition position unless the (TA) relay is released as a result of the completion of the test.

37.4 Pass Busy Meter "PB"

This meter is operated each time the time alarm connects a ground to the APB lead with the R1 switch in position 2 or 11 and the APB key operated.

38. GROUP KEYS

When different groups of senders require the depression of different district brush and group or office brush and group keys to establish a different route for the same dialed code it is necessary to stop the test before testing a succeeding group requiring the changed route. For this purpose keys are installed at the end of each sender group where a changed route is required for the following group. When these keys are in their normal positions the test continues without interruption but if any key is operated the test is stopped and a group lamp is lighted permitting the attendant to reset the necessary selection control keys and to release the group key before the test will continue. Any or all of the group keys may be operated at the start of the test for different link classes. If none of the dial codes requires a change of control keys and Telephone Companies Specifications so state, the group keys may be omitted.

39. THREE DIGIT SENDERS (3/2) ARRANGED TO OMIT THE SECOND CODE DIGIT

Fig. F is used and the normal "B" key causes the R2 switch to pass position 5 without dialing. A zero is checked in the tandem tens position of a CI call.

40. SLOW REVERTIVE PULSES - FIG. W

If a cross occurs between the normally closed contacts of a prime counting relay, a stepping relay protection condenser breaks down, or a high resistance occurs in the stepping relay contact lead, more than the expected pair of counting relays may be operated from a single revertive pulse if sufficient time elapses. As the normal fundamental test from the revertive interrupter is at a maximum speed the test circuit will not always detect such a trouble.

revertive pulses are caused by the operation of the SP key and the (RV), (RV1), (RV2) and (RV3) relays. When ground is supplied to the secondary winding of the differentialling connected polarized (RV) relay through the operated (RV3) relay, which is operated when key "SP" is operated during R4 positions 6 to 16 and R5 position 1, the (RV) relay operates, in turn operating the (RV1) and (RV2) relays. Grounding closures are simultaneously connected to the fundamental and counting relay leads through the operated (RV3) relay in a manner similar to that of the 170-A interrupter. The (RV) and (RV1) relays open the operating path of the (RV) relay and close another path in the opposite direction tending to release the polarized relay. The condenser RV delays both actions. Battery for the circuit is from off-normal cams and a jack is furnished to facilitate relay adjustment. Relay (RV3) operates during trunk test and slow revertive pulses are used only during numerical selections of a full selector class call. Similar pulses are provided by the relay interupter circuit.

41. CONTACT PROTECTION

Contact protection units M1 and M2 are connected to steppers M1 and M2 respectively and each consists of an 800 ohm resistance in series with 0.5 MF condenser connected to battery. Similar contact protection units numbered S1, S2, etc., up to and including S20 are used, are connected to each of the sender selectors. In the event that the same test circuit is connected to a second group of master and sender selectors the same conditions will apply in the second group. Contact protection units "K", "M" and "N" are also connected to the contacts of the (SN-), (SN+) and (MG) relays. Similar units (CA) and (CB) or (R1), (R2), (R3) and (R4) are connected to the R magnets of the R1, R2, R3 and R4 switches. These contact units each consist of a 1000 ohm resistance in series with a 0.5 MF condenser or a 200 ohm resistance in series with a 2 MF condenser and are connected to ground. A contact protection unit "AL", "AM" and "AN" consisting of a 2 MF condenser in series with a 600 ohm resistance is connected to each of the 3 ground leads which are used for locking the counting and (P) relays, and are connected to ground.

42. TIP POLARITY TEST AT DIALING COMPLETION - CHECK OF THE SUBSCRIBER SENDER RESTRICTED PBX CALL DIVERSION FEATURE. FIG. AI.

Fig. AI provides a test of the subscriber sender feature for the diversion of restricted PBX traffic on extra charge calls by checking the potential of the dialing tip lead after dialing completion. If the dialing tip lead (has battery on it) at this time, the sender has reversed the dialing tip potential.

The use of the feature in the sender is determined on a route translation basis; therefore, the (TDV) jack at the test circuit is plugged when the code keyed at the test circuit is one requiring the sender to reverse the dialing tip and ring potentials at dialing completion and not plugged when the reversal is not required. When the jack is not plugged Fig. AI provides a check of the dialing tip lead at dialing completion for a false reversal of the tip by the sender.

42.1 Progress of a Test Call When the Code Keyed Requires a Reversal of the Tip and Ring Potentials at Dialing Completion on P.C.I. Or Full Mechanical Classes - Jack (TDV) is plugged with a 184 Type Plug

A ground at SS3 cam W3, R3 switch in positions 16-3/4/18, or SS2 cam L4, R4 switch in positions 17-3/4/1, operates relay (TDC). The path from cam W3 is established in full mechanical classes and the path from cam L4 is established in P.C.I. classes. In either case (TDC) relay operates and closed the dialing tip lead to the primary winding of the (TDK) relay and the dialing ring lead to the (TDC) resistance. Also it closes off normal ground to 3T of the (TDK) relay and to the break springs of the (TDV) jacks. If the tip potential was reversed, the battery on the tip lead will operate the (TDK) relay which locks to off normal ground through its secondary winding. The (TDK) relay operated lights the (TDR) lamp indicating the expected reversal has occurred. At the same time it closses off-normal ground to advance the R2 switch out of position 14. If the reversal had not occurred relay (TDK) could not operate, thus the test frame would block with R2 switch in position 14 (Coin Test - Awaiting Ck. Sw.).

42.2 Progress of a Test Call When a Reversal of the Dialing Tip and Ring Lead Potentials at Dialing Completion is not Required - (TDV) Jack Not Plugged

As in the preceding paragraph, a ground at either SS3, cam W3, or SS2, cam L4, operates relay (TDC). The (TDC) relay operates and closed the dialing tip lead to the primary winding of the (TDK) relay and the dialing ring lead to the (TDC) resistance. Also, it closes off-normal ground to the (TDV) jack. With the (TDV) jack normal the off-normal ground is carried thru to advance the R2 switch out of position 14. The test circuit continues with its normal functions. If the dialing tip potential was reversed, the TDK relay would have operated. The (TDK) relay operated and locked lights the (TDR) lamp and closes off normal ground thru a second set of normal springs of the (TDV) jack to operate the (BK) relay. The test circuit blocks with lamp (TDR) lit.

43. DIRECT DISTANCE DIALING

43.1 General

The Direct Distance Dialing of toll calls and the need for a means of transmitting switching information quickly and efficiently to toll control switch points and crossbar types of local offices beyond the normal range compatible with the use of revertive pulsing, along with the need for a means of storing and using the additional dialed information necessary to Direct Distance Dial calls into "Foreign" areas has resulted in the development of an Auxiliary Subscribers Sender Circuit. This circuit is associated with the Subscribers Sender Circuit by means of an Auxiliary Subscribers Sender Link Circuit and is called in by either an 0 or 1 being dialed into the B register of the Subscribers Sender or by an indication from the Decoder that the particular code dialed requires multifrequency outpulsing of switching information.

The digits of the toll "Area" Code that have been dialed into the Subscriber Sender, along with the Office Code and numericals, are outpulsed to the Auxiliary Sender by means of P.C.I. pulsing and in the Auxiliary Sender, converted into multifrequency pulses which are outpulsed over the FT and FR leads on a two-out-of-six frequency basis in steps of 200 cycles (from 700 to 1700 cycles). The multifrequency receiver circuit is prepared for receiving digits by a KP or "gate opener" signal, preceding the digits, and composed of two frequencies (1100 & 1700 cycles). When all of the digital pulses have been sent, an ST (Start) pulse is sent to notify the Multifrequency Receiver that pulsing is completed.

The Auxiliary Sender also provides means for storing the tens, and units dialed digits on ten digit calls. The conversion of these digits to multifrequency pulses takes place entirely within the Auxiliary Sender itself.

The following sections describe the operation of the Subscribers Sender Test Circuit using a Multifrequency Adapter Circuit to test the ability of the Subscribers Sender and Auxiliary Subscribers Sender to function properly for the above mentioned types of calls.

43.2 Direct Distance Dialing of Ten Digit No-Skip Class of Call. (Used when directing a toll dialed call through Crossbar Tandem or numbers 4, A4A, 4M or 4A types of Control Switch Points (C.S.P.'s) to local offices in a distant area).

43.21 Preparation

Before operating the "ST" key to start the test the following preparations shall be made;

1. Insert plugs in the proper ACA-, ACB- and ACC- jacks of figure AK to establish the "Area" code required.
2. Keys depressed, corresponding to the "Office" code and numerical digits.
3. "0" Stations key depressed.
4. "0" Talk Selections key depressed.
5. District and Office selections keys depressed. (SKO when no office selections required).
6. A plug inserted in the "MF" jack of Fig. AK.
7. Class key 13 (M.F. Outpulsing under 10,000, no Sta.).
8. Operate the necessary keys for any special tests that may be required.

43.22 Operating Connector Relays in M.F. Adapter

The plug in the "MF" jack of Fig. AK causes the "MFC" lead to be grounded to the Adapter Circuit when the R1 sequence switch advances to position 2. Connector relays in the Adapter Circuit operate, closing through a number of leads, for multifrequency pulse checking of digits, from the Auxiliary Sender Circuit and at the same time arranging a number of leads for controlling the dial pulsing of the toll "Area" code from the Sender Test Circuit.

43.23 Dialing the Area Code - R1 Pos. 5 or 14, R2 Pos. 4, R4 Pos. 1, R5 Pos. 10 - "A" Lamp - Fig. Y

The advance of the R2 sequence switch to Pos. 4 closes a path to operate the (PU) relay; through a normal (AV) relay, normal "DSS" key, over lead "PU" to the Adapter Circuit and back on lead "PUC," SS4-G2 cam, SS2-F2 cam, normal relay (OT), SS4-15 cam to ground at SS1-F5 cam. Relay (PU) does not operate until the "P" interrupter cam is open. A shunt through its back contact through the closed contacts of cam "P" assures that dialing does not start until the dialing interrupter is positioned correctly. The operation of relay (PU) shunts the tone coil from the

dialing loop, this coil being normally connected except during the actual dialing of the digits, to inform the sender monitor that a sender signal is caused by the test frame. Ten pulses will be dialed as described in Section 5.11, and a number of these open periods will be shunted depending upon which lead 20 to 29 that is grounded from the Adapter Circuit and the Sender will receive only the number of pulses corresponding to the Area Code "A" digit established on the ACA- jacks of Fig. AK. Relay (AV) operates on the make of the interrupter "P" cam through the make contacts of relay (PU) and the (PU) relay operating path is transferred to the (AV) relay, leaving the (PU) relay locked to the interrupter "P" cam. Dialing does not commence until the "D" cam of the slow speed interrupter is broken and the end of the digit is controlled by the closing of this same interrupter cam. At the end of the digit relay (PU) releases, restoring the tone coil to the dialing loop and the circuit closes contacts in connection with the synchronizing feature as described in Section 24.

When the R2 Dial Control sequence switch entered position 4, it grounded lead "AD1" which operated relay (PP) Fig. AJ. This bridge leads "DAC" and "CO2" to the Adapter Circuit to partially close the control path for the relay chain sequence of the "Area" counting relays in that circuit. Relay (PU) released, grounds lead "CO1" to the Adapter Circuit, where the "Area" counting circuit is advanced to open the "PU-PUC" lead bridge. The (AV) relay is released and opens the "CO1" lead to the Adapter Circuit, advancing the "Area" counting circuit for the next digit, again closing the "PU-PUC" lead bridge allowing the (PU) relay to reoperate.

The same sequence of operation takes place for the second and third digits of the "Area" code, corresponding to the digits established by the insertion of plugs in the ACB- and ACC- jacks of Fig. AK.

43.24 Dialing the Area Code - R1 Pos. 5 or 14, R2 Pos. 4, R4 Pos. 1, R5 Pos. 10 - "A" lamp - Fig. Z

The advance of the R2 sequence switch to Pos. 4 closes a path to operate the (PU) relay; through relay (AV) normal, normal "DSS" key, over lead "PU" to the Adapter Circuit and back on lead "PUC," SS4-G2 cam, SS2-F2 cam, normal (OT) relay, SS4-I5 cam to ground at SS1-F5 cam. Relay (PU) operated closes a path to operate relay (AV) over the "AV" lead from the dial pulse relay interrupter circuit and at the same time operates the (PU1) relay in the relay interrupter circuit over lead "SY," which prepares the interrupter circuit to start pulsing under control of the lead 20 to 29 that is grounded from the Adapter Circuit corresponding to the first digit of the "Area" code established on the ACA- jacks Fig. AK. The tone coil is shunted from the dialing loop, this coil being connected except during the actual dialing of the digits to inform the sender monitor that a sender signal is caused by the test frame.

When the R2 Dial Control sequence switch entered position 4, it grounded lead "AD1" which operated relay (PP) Fig. AJ. This bridges leads "DAC" and "CO2" to the Adapter Circuit to partially close the control path for the relay chain sequence of the "Area" counting relays in that circuit. Relay (PU) released, grounds lead "CO1" to the Adapter Circuit, where the "Area" counting circuit is advanced to open the "PU-PUC" lead bridge. The (AV) relay is released and opens the "CO1" lead to the Adapter Circuit, advancing the "Area" counting circuit for the next digit and again closing the "PU-PUC" lead bridge, allowing the (PU) relay to reoperate.

The same sequence of operation takes place for the second and third digits of the "Area" code, corresponding to the digits established by the insertion of plugs in the ACB- and ACC- jacks of Fig. AK.

43.25 Office Code and Numericals

When the three digits of the "Area" code have been dialed, the "Area" counting circuit in the Adapter Circuit bridges leads "CO" and "CO1" and the Sender Test Circuit proceeds to dial the remaining digits in the regular manner as described in Sections 5.13 to 5.16. The digits are established by depressing one each of the A, B, C and numerical keys at the Sender Test Frame.

43.26 Dial Progress Indication

Dial progress lamps ADA, ADB and ADC are provided in Fig. AK, to acquaint the tester with the "Area" code digit being dialed. Progress of the remaining digits are indicated in the normal manner on lamps at the Sender Test Frame.

43.3 Direct Distance Dialing of Ten Digit Skip-3 Class of Call. (Used when directing a toll dialed call through a Crossbar Tandem Office that handles calls to local offices in only one "Foreign" area.)

43.31 Preparation

Preparation for this class of call will be similar to that for a ten digit no-skip class of call except that a plug will be inserted in the "SK-3" jack Fig. AK.

43.32 Dialing

Dialing for this class of call is identical to that for a ten digit no-skip class of call.

43.4 Dialing of Seven or Eight Digit No-Skip M.F. Class of Call. (Used when directing a toll dialed call through Crossbar Tandem or numbers 4, A4A, 4M or 4A types of offices to local offices in the same toll dialing "Area.")

43.41 Preparation

Before operating the "ST" key to start the test, the following preparation should be made;

1. A plug inserted in the "MF" jack Fig. AK.
2. A plug inserted in the "7 DG" jack Fig. AK.
3. Keys depressed corresponding to the "Office" code and numerical digits (also "Stations" digit if required - and "0" stations key if no stations or numbers over 9999).
4. Class key 13 M.F. - Below 10,000 No Sta.
   Class key 14 M.F. - Below 10,000 With Sta.
   Class key 15 M.F. - Above 10,000 No Sta.
   Class key 16 M.F. - Above 10,000 With Sta.
5. Operate "SD" key if a stations digit is required.
6. "0" Talk Selections key depressed.
7. District and Office selections keys depressed (SKO when no office selections required).
8. Operate necessary keys for any special tests required.

43.42 Operating Connector Relays in M.F. Adapter

See Section 43.22

43.43 Dialing Office Code and Numericals

Dialing of digits on this class of call progresses in the regular manner as described in Sections 5.13 to 5.16.

43.44 Stations Delay

While the R4 sequence switch is in position 6, a three second station's delay check will occur before the Sender Test Circuit is permitted to dial a station's digit when it is required. The sequence of testing operations are as described in Section 27.1.

43.5 Seven Digit Call to Crossbar Types of Local Offices in the Same Area. (Direct trunk groups - M.F. Outpulsing)

43.51 Single Unit Crossbar Office - Skip 3

On this type of call, plugs will be inserted in the MF, 7 DG and SK3 jacks of Fig. AK.

Dialing will be controlled in the same manner as the previously described calls.

43.52 Multi-Unit Crossbar Office Using a Common Trunk Group - Skip 2

On this type of call plugs will be inserted in the MF, 7 DG and SK2 jacks of Fig. AK.

Dialing will be controlled in the same manner as the previously described calls.

43.6 Checking Multifrequency Pulsing - R1 Pos. 5 or 14, R2 Pos. 14, R4 Pos. 9

43.61 Fundamental Transfer and Dial Pulse Completion

The plug in the MF jack, mentioned in the preceding sections, operated connector relays in the Adapter Circuit and prepared that circuit for checking multifrequency outpulsing from the Auxiliary Sender.

The Adapter grounds the "TR" lead to the Sender Test Circuit, operating relay (TRF1) Fig. AJ, which opens the "FT" and "FR" leads, preventing the possibility of a "false assignment" or two trunk tests at a later time when the fundamental circuit is transferred to the Adapter for multifrequency pulse checking.

The advance of the R2 Dial Control sequence switch to position 14, indicating that dialing is completed, closes a path to operate relay (DPC) over the "DPC" lead from ground at SS4-W2 cam. The operation of relay (DPC) causes the operation of relays (DPC1), (DPC2) and (DPC3), cutting off the dial pulse circuit from the multifrequency pulse checking circuit.

Upon the completion of District or Office Group selections as described in Section 15.3, the R4 check sequence switch, advances to position 6. Ground from SS1-S4 cam over lead "TF1" to the Adapter through a bridge at the Adapter and back over lead "TF2" operates the (TF2) (transfer fundamental) relay. This closes the "FT" and "FR" leads through the Adapter Circuit to resistance battery and ground, furnishing a trunk test to the Auxiliary Sender Circuit, when that circuit together with the Subscriber Sender receive all of the dialed

digits expected and close the fundamental circuit for trunk test and operate the (TGF) relay in the Auxiliary Sender.

Relay (TRF) operated also grounds the "TF" lead to the Adapter Circuit causing that circuit to open the "TR" lead to the Sender Test Circuit. The slow-release (TRF1) relay then starts to release. When fully released, relay (TRF1) restores the fundamental paths in the Sender Test Circuit which had been opened, as previously described, to prevent a false assignment. The Adapter Circuit upon receiving the signal that the fundamental transfer has been completed, grounds the "ADV" lead to the Sender Test Circuit, where upon receiving the indication that dialing has been completed, as indicated by the operated (DPC-) relays, the "ADV" lead is extended to advance the R4 check sequence switch to position 9.

43.62 Trunk Closure

The completion of trunk test in the Auxiliary Sender causes that circuit to make "trunk closure" to the Adapter and "assignment" to the Subscribers Sender.

43.63 Multifrequency Pulse Check - Ten Digit No-Skip Class of Call

The Subscribers Sender then proceeds to outpulse on a P.C.I. basis to the Auxiliary Sender, which in turn converts the pulses to multifrequency pulses and outpulses them through the Sender Test Circuit to the Adapter where the pulsed are filtered and identified and then checked against the digits established by the tester on the ACA-, ACB-, ACC- jacks and keys A, B, C, TH, H, T, and U. Pulse checking of the "Area" code digits is completed through operated relays in the Adapter, under control of the Area Code jacks Fig. AK. Progress lamps AMA, AMB and AMC Fig. AK, indicate the pulse being checked, while match lamps 0 to 9 of the main figure indicate the value of the digit. In the event of a failure, pulse check lamps P0 to P9 Fig. AK, indicate the value of the pulse actually received.

The "Office" code and numericals are checked from the Adapter over leads 20 to 29 and back over leads DA, P5, P6, P7, P8, P9, P10, PST and PTT. Match lamps 0 to 9 of the main figure indicate the value of the digit. Progress lamps TH, TT, TU, TD, H, T, U and STA indicate the digit being checked and pulse check lamps P0 to P9 Fig. AK indicate the actual value of the pulse received in the event of a failure.

Leads BA, CA, THA, HA, TA, UA and STA provide an operating path for relay (CI). The operated (CI) relay advances the R4 check sequence switch to the proper position for checking each digit in the correct sequence.

43.64 Checking M.F. Pulsed Digits on a Ten Digit Skip-3 Class of Call

Multifrequency pulse checking will proceed in the same manner as for a ten digit no-skip call except that upon the completion of dialing and the subsequent operation of relay (DPC3) which causes a bridge to be placed across the "SA1" and "SA2" leads of Fig. AJ to the Adapter, the Adapter Circuit "MFK" check switch is advanced to a position for checking the "Office" code "A" digit as a result of the plug inserted in the SK3 jack Fig. AK.

43.65 Checking Multifrequency Pulsed Digits on Seven or Eight Digit No-Skip Class of Call

Multifrequency pulse checking will proceed in the same manner as on a ten digit call except that upon the completion of dialing and the subsequent operation of the (DPC3) relay which causes a bridge to be placed across the "SA1" and "SA2" leads of Fig. AJ to the Adapter Circuit, the Adapter Circuit MFK check switch is advanced to a position for checking the "Office" Code "A" digit as a result of the plug inserted in the 7 DG jack of Fig. AK.

43.66 Checking Multifrequency Pulsed Digits on Seven Digit Skip-3 Class of Call

Multifrequency pulse checking will proceed in the same manner as a ten digit call except that upon the completion of dialing and the subsequent operation of the (DPC3) relay which causes a bridge to be placed across the "SA1" and "SA2" leads of Fig. AJ to the Adapter Circuit, the Adapter Circuit MFK check switch is advanced to a position for checking the thousands numerical digit as a result of the plugs inserted in the 7 DG and SK3 jacks of Fig. AK.

43.67 Checking Multifrequency Pulsed Digits on Seven Digit Skip-2 Class of Call

Multifrequency pulse checking will proceed in the same manner as a ten digit call except that upon the completion of dialing and the subsequent operation of the (DPC3) relay which causes a bridge to be placed across the "SA1" and "SA2" leads of Fig. AJ to the Adapter Circuit, the Adapter Circuit MFK check switch is advanced to a position for checking the "C" digit of the "Office" code as a result of the plugs inserted in the 7 DG and SK2 jacks of Fig. AK. (This type of call sends a mark in the form of the "C" digit

to the terminating office permitting the Marker Circuit in a multi-unit crossbar office to differentiate between units when a common incoming trunk group is used).

44. PARTICULAR AUXILIARY SENDER TEST

Figure AN provides keys PAS-0 to PAS-9 for the purpose of causing the particular Subscribers Sender under test to pick a particular Auxiliary Sender. By depressing one of these keys, all Auxiliary Senders in the group of ten will appear busy except the one preselected. This feature does not become effective until the seventh digit has been dialed. The advance of the R2 dial control switch to position;

1. Eight on ten digit calls grounds the TH lead to the Adapter from SS1-U2 cam.
2. Eleven on seven digit calls grounds the U lead to the Adapter from SS4-U2 cam.
3. Ten on eight digit over ten thousands calls grounds the T lead to the Adapter from SS3-U2 cam.

The make-busy feature is removed from all Auxiliary Senders, except the one selected, when the R2 dial control switch advances to the next position.

In the event of a failure of the Sender Test Circuit or the Adapter Circuit, grounding the BLK lead to the Adapter Circuit causes the Particular Auxiliary Sender Test feature to become inoperative.

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