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CROSSBAR SYSTEMS
NO. 5
ORIGINATING REGISTER CIRCUIT
DIAL PULSING AND "TOUCH-TONE®" CALLING

CHANGES

D. Description of Changes

D.1 A modification is made to bring CADs 6, 16, and 49 into agreement with WECO T drawings. This involves the FAC lead and options associated with IDDD operation. This change is made on a "D" no-record basis per agreement with WE.

D.2 A modification is provided, as a result of EC MSI-3007, which disables the TOUCH-TONE® receiver if the call is started with dial pulses. This will prevent trouble record cards due to mutilated digits caused by the mixing of dial pulse and TOUCH-TONE digits on the same call. Such cards can be generated where the initial digit of a call is "dial pulsed" via switchhook flashing and the rest are sent in the usual fashion from a TOUCH-TONE

station set. The modification consists of wiring changes that place the -48 volt battery supply to the TOUCH-TONE receiver under control of the P2A, STR, and MF relays. With this change, the receiver will be rendered inoperative by the operation and locking of the P2A relay if the first digit is received in dial pulse form. If instead, the first digit is sent in the TOUCH-TONE mode, the operation and locking of relay MF maintains battery to the receiver. A contact of relay STR is also included in this modification to insure continuity of battery to the receiver when the initial digit is received in TOUCH-TONE fashion. The new arrangement is denoted by option NP, rated after-date Standard. The former wiring is optioned NO, rated Mfr Disc. Also, where the Automatic Monitor, Register, and Sender Test Circuit - SD-25680-01, is used for monitoring originating registers, it will also require modification, per Drawing Issue 97D.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5241-AWM-RBC-TN

CROSSBAR SYSTEMS
NO. 5
ORIGINATING REGISTER CIRCUIT
DIAL PULSING AND "TOUCH-TONE®" CALLING

CHANGES

B. Changes in ApparatusB.1 Added

LOLP1 Resistor, KS-19150,L3,10K,
Option NM, Fig. 29

D. Description of Changes

D.01 On Drawing Issue 31D, the register was arranged for -72 volt operation with the Range Extension for Unigauge Cabling feature, and modifications for monitoring and testing this feature were subsequently provided in the Automatic Monitor, Register and Sender Test (AMRST) Circuit. A problem has been reported in which the register, when seized for service over a short loop (-48 volt operation) after just having served a long loop call (-72 volt operation), falsely signals the monitor to prepare for monitoring another long loop call. As a result, the monitor fails to detect the digits dialed into the register over the short loop and causes a trouble record card due to number mismatch. The service call, however, is not affected by this monitor failure. This problem is caused by the -72 volt charge retained from the previous long loop call, on the LW capacitor in registers equipped with the LW diode option TY. This diode, required where the register functions with 24V4 repeaters or toll diversion, blocks discharging of the LW capacitor to the -48 volt level when the registers LOLP relay releases at the end of a long loop call. Consequently, if this same register is then seized for -48 volt service and the monitor is also seized, the -72 volt charge on this capacitor causes operation of the LOLP relay in the monitor when the monitor-register connection is established. As a result, the monitor erroneously prepares for monitoring another long loop call. This trouble is corrected by a modification which relocates connection of the LW capacitor to the opposite side of the LW diode thereby permitting the capacitor to discharge to the -48 volt level

when the register releases following long loop service. In addition, the LW diode is shunted by a 10K resistor to provide a path for discharging the station ringer capacitance during dialing to prevent bell tapping. This change must be applied to all registers arranged for operation with the Unigauge Cabling feature that are also arranged for operation with the AMRST circuit, on an AR basis.

D.02 In CAD 31, a strap is added from TS(G)22 to TS(G)15 for agreement with WE drawings. This change is made on a "D" no-record basis.

F. Changes in Description of Operation

F.01 In SECTION II, change 15.11 to read as follows:

15.11 Where the PICTUREPHONE® call is originated from a PBX station for completion over the wideband network, the customer must initially key the PICTUREPHONE prefix signal followed by the directing digit 9. These signals are used by the PBX equipment for selection of a trunk, from a trunk group handling PICTUREPHONE calls, to the No. 5 crossbar office serving the PBX. Consequently, the dial tone marker will operate the SSR relay over lead P in setting the dial tone connection between the calling line and originating register.

F.02 In 17., make the following changes:

17. BUSY TONE FROM REGISTER

GENERAL

17.01 The BT relay is an all-paths-busy or a trouble release relay and may be operated by the completing marker to effect release of the connection between the register and the completing marker but to retain the dial tone connection between the register and the calling line. Relay BT causes busy tone to be transmitted to the customer. In registers manufactured

prior to Drawing Issue 20D, 60-IPM line-busy tone was provided via lead LBT and option VS, since rated Mfr Disc. In registers per Issue 20D and later, 120-IPM equipment busy tone is provided via lead OFT and option VT, under the standard arrangement.

NONCOIN CALL - ALL BUSY CONDITION

17.02 On a noncoin call, if the completing marker cannot set up a connection to a busyback, overflow, partial dial, or vacant code trunk due to a shortage of trunks or channels it will attempt to connect the calling line to a common overflow trunk. If these trunks, or the channels to them, are all busy, the marker will operate relay BT in the register. The BT releases the marker connector and the completing marker by operating lead ST, grounds lead ST to the interrupter circuit to start it and supplies busy tone through the TN coil to the calling customer. When the customer disconnects or the register times out, the register restores to normal.

COIN CALL - ALL BUSY CONDITION

17.03 On a coin call, if the completing marker cannot set up a call to a busyback, overflow, partial dial, or vacant code trunk due to a shortage of trunks or channels, it cannot use one of the common overflow trunks because they are not arranged for coin operation. It, therefore, operates the BT relay, which releases the marker connector and completing marker by opening lead ST, grounds the ST lead to the interrupter circuit to start it and supplies busy tone through the TN coil to the calling customer. When the customer disconnects, the coin is returned as on any abandoned call.

PERMANENT SIGNAL - ALL BUSY CONDITION

17.04 On permanent signal calls, if the marker cannot set up the call to a permanent signal trunk, it will attempt to connect the calling line to a common overflow trunk. It is satisfactory to connect a coin line to a common overflow trunk on permanent signal calls because the register will have returned the coin before selecting a marker on this type of call. If the marker cannot connect the calling line to

a common overflow trunk due to a shortage of trunks or channels, it will operate relays RL and BT in the register. Relay RL releases the dial tone connection and relay BT releases the marker. With both the dial tone connection and the marker released the register restores to normal. Busy tone is not transmitted to the line because the dial tone connection has been released.

17.05 With the above described operation, a cable failure, which causes a shortage of permanent signal and common overflow trunks, will not hold registers out of service for the stuck register time-out interval. Faulty lines in excess of those held by permanent signal and common overflow trunks will originate calls in completion with legitimate calls. A register will be held for about 12.2 seconds on each seizure by one of these excess faulty lines.

TROUBLE RELEASE

17.06 If the marker is unable to complete a connection because it has encountered a trouble, it will operate the BT relay under certain circumstances in order to free itself. If the call has not progressed far enough to operate the RL relay, the customer will receive busy tone as described above, and the register will restore to normal when the customer disconnects. On calls from coin lines the coin will be returned as on any abandoned call.

F.03 In 19., make the following changes:

ABANDONED PARTIAL DIAL REGISTER

19.02 If a call is abandoned after at least one digit has been dialed or keyed, but before dialing or keying has been completed, the ON relay will release as usual. Under these conditions relay PD will still be operated and TML unoperated, and a circuit will be closed from ground through a break-contact of ON, make of PD, and break of TML to lead APD, on a dial pulse call, or lead APPB, on a TOUCH-TONE® call, for operating a peg count register. The release of ON releases P2A and PD. The PD is made slow in releasing, so that it will

not open the operating circuit of the peg count register until it has had sufficient time to operate. The PD keeps the FT and BT leads open so that the register appears busy until PD releases.

19.03 If a partial dial time-out occurs, both PD and TMI will be operated when ON releases, and the APD or APPB lead will not be grounded. The TMI locks to a contact of PD so that TMI cannot close the

APD or APPB lead. The BT lead is also controlled by the TMI relay so that the register cannot be reselected until TMI releases.

19.07 The back contact of CMC is wired in the FAPD lead to prevent a false operation of the FAPD traffic register in case the APD or APPB traffic register is operated by another originating register at the time KS is operated.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5241-AWM-RBC-JNC

CROSSBAR SYSTEMS
NO. 5
ORIGINATING REGISTER CIRCUIT
DIAL PULSING AND TOUCH-TONE® CALLING

CHANGES

D. Description of Changes

D.1 Contacts 3, 6, 8, and 11, of the 11A relay, option WK, were reassigned on Drawing Issue 41D by options PD, PE, PF, and PG, in conjunction with modifications for international direct distance dialing (IDDD). These options were referenced in Circuit Notes 171 and 172, however, in Note 171, a statement requiring the replacement of option PD by option PE where the PPCS feature is added in registers manufactured prior to Drawing Issue 41D, was inadvertently omitted. Also, an omission was made in Note 172 for indicating that option PF must be removed, if equipped, when modifying the register for IDDD. This change is made on a D no-record basis per agreement with WE.

D.2 Miscellaneous errors and omissions on the drawing are corrected to bring the SD- into agreement with WE "T" drawings.

D.3 The cross-connection information of parts 20, 21, 22, and 24 of the cross-connection tables, pertaining to IDDD operation, is revised to remove reference to use of the TOUCH-TONE® end-of-dialing signal. Accordingly, part 8 of these tables, pertaining to operation with the TOUCH-TONE special signals, is also revised to reflect the cross-connections required where these signals are used on IDDD operation. Also, certain cross-connections shown in part 8 pertaining to the handling of LXX centrex codes are deleted since they are also indicated in part 10 of the tables which applies to such codes.

D.4 A modification is made which provides for supplying ground potentials P and Q to contacts of the line memory relays from

a ground bar located on the originating register line memory ORIM frame. Previously, these ground potentials were cabled to the ORIM frame from the originating register OR frame. This modification reduces the number of leads between the OR and ORIM frames.

D.5 To provide additional maintenance facilities for testing TOUCH-TONE originating registers with the register test set, both an IRT jack per SD-25574-01, Fig. 62, and an ORT jack, per SD-25574-01, Fig. 61, are added to the Originating Register TOUCH-TONE Receiver and Control Frame, J27962C.

D.6 It has been determined that a -48 volt signal battery instead of a -48 volt talking battery is required for the TOUCH-TONE receiver, J99289B. Accordingly, the talking battery per SD-25574-01, Fig. 24 is removed from the Originating Register TOUCH-TONE Receiver and Control Frame, J27962C.

D.7 An addition is made to the J- Spec information for permitting the U and Y TOUCH-TONE Control Unit, J27958AA, to be mounted on the Originating Register TOUCH-TONE Receiver and Control Frame, J27962C. Previous to this change, only the wire spring TOUCH-TONE Control Unit, J27962AU, was mounted on this frame.

D.8 The SD is modified to indicate replacement of the code 420-type diodes with 446-type. Manufacture of the 420-type has been discontinued. On J27962BB, the component assembly, ED-94823-01, GRP584 is replaced by ED-94823-01, GRP960. The new component assembly incorporates the change in diodes. All other aspects are the same as appearing on ED-94823-27, GRP584.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5241-AWM-RBC-PKM

CROSSBAR SYSTEMS
NO. 5
ORIGINATING REGISTER CIRCUIT
DIAL PULSING AND TOUCH-TONE[®] CALLING

CHANGES

D. Description of Changes

D.1 Changes are made to include in the CADs the "MF AUX CONT BAY" as a terminating point for this circuits outgoing leads.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5141-AWM-RBC-PK

CROSSBAR SYSTEMS
 NO. 5
 ORIGINATING REGISTER CIRCUIT
 DIAL PULSING AND TOUCH-TONE® CALLING

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 When a customer originates a call, a dial tone marker causes a connection to be established between the customer line and an originating register. The originating register transmits dial tone to the customer and records the called number. The originating register then transfers to a completing marker the called number information and information of identification of the calling line which is received from the dial tone marker. The completing marker then uses this information for establishing an intraoffice connection between the calling line and the called line or a connection between the calling line and an outgoing trunk to the called office. In the latter case an outgoing sender is used to transmit the called number information over the trunk to the called office.

1.02 The originating register receives, from the dial tone marker, information as to the type of line connected whether centrex, individual, 2-party, coin, or Unigaue.

1.03 On 2-party message rate lines and 2-party flat rate lines in offices equipped with automatic message accounting the register makes a party identification test and transfers the result to the completing marker so that the proper party can be charged for the call.

1.04 On calls from loop start coin lines where the check for the presence of the coin is not made in the line circuit the originating register makes a coin test.

1.05 The originating register will cause the coin to be returned on permanent signal and abandoned calls from coin lines. Provision is also made for return of the coin on calls to operators and other free trunks under certain conditions.

2. GENERAL DESCRIPTION OF OPERATION

2.01 When a customer lifts the receiver to originate a call, the line circuit line relay operates and starts a series of events which results in the establishment of a connection from the calling line, through the link line switch, the link junctor switch, trunk link junctor switch,

and trunk link trunk switch to an idle dial pulse originating register circuit. This connection is established under control of a dial tone marker and is known as a dial tone connection. Each register has a tip, ring, and sleeve appearance on a trunk link frame just as a trunk does and the operation of selecting a register and connecting a calling line to it is much the same as selecting a trunk and connecting a line to it. Figures 1, 2, and 3 in Information Note 301 on the SD show the connections in block diagram form.

2.02 This connection between the calling line and register is called the dial tone connection, and gets its name from the fact that dial tone is supplied to the calling line over this connection when the register is ready to receive dial pulses or TOUCH-TONE® signals.

2.03 While the dial tone marker is in the process of establishing this dial tone connection, it determines and transfers certain information concerning the identity of the calling line to memory relays in the register, because the completing marker, which will be used to set up the originating connection from calling line to trunk, will need this. The dial tone marker causes this information to be passed to the register via the trunk link and connector circuit. This information consists in the class of service of the calling line, its location on the line switches, the line link used in the dial tone connection (the marker will consider this path available for the originating connection), and for AMA purposes a record is made of whether the calling line is connected to a service observing line or not.

2.04 When the dial tone connection is being established the dial tone marker informs the register if the calling line is centrex, coin, 2-party, or manual. In each of these cases the register may be required to take special action. This special action is described later.

2.05 The class and line identification relays operated as described above will lock to an off-normal relay in the register, which is operated and held by a slow-release relay operated by the dial tone marker. When the dial tone connection has been established the marker releases

and allows the register line relay to operate over the dial tone connection and customer loop. The line relay operates its auxiliary relay which supplies a circuit for holding the off-normal relays and, thus, the register and the dial tone connection. At this point the register is ready to receive dial pulses or TOUCH-TONE signals and transmits dial tone to the calling customer.

2.06 The customer dials or keys all of the digits required for the identification of the wanted line or operator trunk, and the register engages a completing marker via the marker connector circuit. The register recognizes when all of the digits have been registered in one of several ways.

2.07 If a zero is dialed for the A digit, counting relays corresponding to a ten will be operated. If the digit zero is keyed for the A digit, translating relays corresponding to a zero will be operated. If the register is not arranged for person person collect special service a circuit through the counting or translating relays will operate the manual relay which indicates that the zero operator is wanted and no further dialing or keying should be expected.

2.08 If the register is arranged for PPCS service the zero prefix counting relay OP will be operated. The OP relay starts the digit timer to time for further digits to be dialed or keyed. If another digit is dialed or keyed before the timer times out, the register will wait for the remaining digits, and then call for a marker to complete the call. If no further digits are dialed or keyed after the zero prefix, the digit timer operates causing the manual relay to operate indicating that the zero operator is required and no further dialing or keying should be expected.

2.09 If an X11 service operator is called, all of the relays of the local X11 translator circuit operate because one has been registered in both the B and the C digit, and this causes the marker to be engaged. If a pretranslator circuit is used, the local translator is omitted and the pretranslator translates the X11 codes.

2.10 If an 11X service operator is called, the 1-1 prefix counter relays operate as a result of the two preliminary

one-pulse digits, and establish a circuit through a contact of the B-digit steering relay to cause operation of the marker start after the A digit has been registered. The X of the 11X code will be registered on the A-digit register and the B-digit steering relay will be operated when the A digit is registered.

2.11 The digit steering relays are used to determine when particular digits have been registered. Where all customers are called by dialing or keying the same number of digits a service cross-connection from the appropriate steering relay contacts to the marker start relay winding will cause operation of the marker start relay when this number of digits has been received and, therefore, when dialing or keying has been completed and a marker required.

2.12 Where calls to a different customer require a different number of digits, it is necessary to have some distinguishing mark in the called code which will indicate the total number of digits for the call being served. In relatively simple cases the number registered on the A digit will furnish this distinguishing mark and will indicate the total number of digits required. In these cases an A digit will operate in the same pattern as the A register relays. These translator relays close a separate circuit for each number which may be registered and can connect different digit steering relay contacts to the marker start relay winding for different numbers on the A register. In this manner different numbers on the A register can mark different digits as the last digit. Unused A digits will cause the marker to be engaged immediately for connection of the line to a vacant code trunk.

2.13 In more complex cases an A-digit translator and a B-digit translator will be provided. In these cases some of the A digits will make the last digit, and the remaining A digits (not exceeding three A digits) in combination with the B digit will mark the last digit. Unused A digits and A- and B-digit combinations will cause a marker to be engaged immediately for connection of the line to a vacant code trunk.

2.14 As far as possible the last digit will be marked by one of the above means. However, the called office may not require

the same number of digits for all customers. For example, manual offices may have party letters for some customers and not for others and some step-by-step offices may have party digits in some connector groups and not in others. For such cases the A or A plus B digits will mark the last digit for the minimum number of digits by connection to the winding of a delay relay instead of the marker start relay. This causes the register to time for the extra digit. If dialing or keying does not start within this interval the register engages a marker to set up the connection. If dialing or keying does start, the register waits for the digit to be completely registered.

2.15 In certain cases where all local calls are 7 digits, the B-digit translator is used alone to indicate 10-digit foreign area calls. A C-digit-equals-zero translator may also be provided to detect DDD codes of the form NNO. In both these cases vacant codes require 7 digits before routing.

2.16 Where a single 1-, 2-, or 3-digit code is used to call a straightforward operator, the single-digit translator may be used. The windings of the relays of the single-digit translator are connected to operate in the same pattern as the corresponding register relays. When the particular code is dialed or keyed all the relays of the translator will operate and close a circuit to cause operation of the marker start relay.

2.17 In some areas it will not be economical to perform the translating function in the register and pretranslators will be used for this purpose. In these cases each register circuit will be equipped with a group of relays which will cause a pretranslator connector to associate the register with a pretranslator as soon as the third or C digit has been received. The register will transmit the A, B, and C digits to the pretranslator which will perform the translation and operate relays in the register to indicate how many digits to expect on the call. Cross-connections from these relays to the marker start relay and the register steering relays cause the marker to be selected when the dialing or keying is completed.

2.18 The register can be arranged in two ways to handle centrex service.

(a) Two separate groups of registers are necessary for this arrangement. One group of registers serves central office customers only, while the other group of registers serves centrex customers only. In the group of registers serving centrex customers only tie line and special codes are of the 11X type.

(b) Only one group of registers is necessary for this arrangement. All the registers within this group are arranged for centrex service, but may also serve central office customers on a class basis. In this group the PBX tie line and special codes are of the 1XX type.

2.19 In addition to the 11X- and 1XX-type tie line and special codes, intracentrex calls may consist of 4 or 5 digits (depending on the size of the PBX), and centrex zero operator.

2.20 The centrex customer (attached to a register with either arrangement) must dial or key a directing digit 9 prior to dialing or keying any number outside of the centrex group. When a central office customer is attached to a register also serving centrex customers the directing digit relay is operated by the marker so the register can distinguish this call from an intracentrex call.

2.21 The registers of the combined group may also be arranged to provide service for a private line network. This service is furnished on a class basis for centrex customers. In this case, a PLN centrex customer must dial or key a directing digit 8 prior to the called number if the call is to be completed within the private line network.

2.22 When the register is connected to a completing marker, the register transfers to the marker, over a multitude of wires through the marker connector, all of the information recorded on its memory relays, all of the digits dialed or keyed by the customer, and other information pertaining to 2-party lines, coin lines, or time-out conditions. The completing marker selects an idle trunk and a path from the calling line to the trunk (originating connection). However, before it can set up the originating connection, it must release the dial tone connection. The marker accomplishes this by operating a release relay of the register, which opens the tip,

ring, and sleeve toward the calling customer. The register does not release at this time, however, because it is held by the marker connector. With the dial tone connection released, the marker sets up the originating connection, and operates the register marker release relay to release the marker connector and return the register and marker to normal.

2.23 On calls from 2-party message rate lines or from 2-party flat rate lines in offices arranged for AMA, the register receives a 2-party class indication and a 2-party identification test is made before dial tone is transmitted and again just before the marker is engaged after dialing or keying has been completed. The distinction between parties is that the switchhook of the tip party customer set connects ground through its ringer to the tip wire at the station when the receiver is off-hook, whereas the ring party customer set retains the capacitor in series with the ringer. The register connects 48 volts through a relay winding to the tip and ring wires at the central office end for a measured time interval long enough for allowing the test relay and its auxiliary relay to operate. Two tests are made as stated above to reduce the possibility of charging the wrong party, and the results of these two tests are transmitted to the marker. The marker informs the trunk or the AMA equipment which party should be charged. The conditions encountered on a dial tone connection to a 2-party line are shown in Fig. 7 in Information Note 303 on the SD.

2.24 Various optional coin-test and coin-return features are provided in the register. The particular combination used depends on the type of coin service required and on the type of line circuit line relay provided for coin lines. Line link frames in early No. 5 offices are equipped with line relays which can be used on coin lines only on a loop-start basis. Later offices are equipped with a universal coin line relay which can be used either on a loop-start or a ground-start basis.

2.25 Offices providing dial-tone-first coin service make a coin test upon completion of dialing. This is fundamentally a loop-start service although a wiring option permits ground start coin lines to be handled in the same office.

2.26 Coin-first service in the earlier offices with loop-start coin line relays may require an initial deposit of 5 or 10 cents. For 5-cent service App Fig. 9 and 11 are provided where coin test is made in the register. For 10-cent service App Fig. 11 is provided and an auxiliary line circuit is inserted in each coin line ahead of the line relay. This auxiliary line circuit operates on a ground start basis and no coin test is made in the register.

2.27 Coin-first service in later offices with universal line relays may also require an initial deposit of either 5 or 10 cents. Apparatus Fig. 11 is provided for 5-cent service and App Fig. 8 for 10-cent service or for 5-cent service where 10-cent service is anticipated. In all cases the line relays are wired for ground start operation and no coin test is made in the register.

2.28 When App Fig. 11 is used, coin return is provided on abandoned calls and, before the marker is selected, on permanent signal, operator, and 11X or X11 service calls. When the completing marker finds that other calls are for free trunks it returns the call to the register with a request for a return of the coin. After returning the coin the register again selects the completing marker for completion of the call. A check for coin clearance is made on all but permanent signal and abandoned calls.

2.29 When App Fig. 8 is provided the register returns the coin only on abandoned calls and permanent signals and no test for coin clearance is made. When coin return is required on operator and other free calls this will be done by the trunk to which the call is connected. The condition encountered on a dial tone connection to a coin first ground-start coin line is shown in Fig. 4 in Information Note 302 in the SD.

2.30 When App Fig. 9 is used, coin test is made on coin lines before dial tone is transmitted. The customer line circuit of the No. 5 system is arranged so that the switchhook closure will cause a register to be attached even though the coin is not deposited. The coin deposit closes contacts which connect ground through the

coin magnet to the tip wire at the station. The coin test circuit, App Fig. 9, has a supervisory relay which operates on the current through the customer loop and holds the register, and a ground test relay which will operate only if the ground is connected at the station. Operation of the ground test relay allows the call to proceed and dial tone to be transmitted. If the ground test relay does not operate, the call will be treated as a permanent signal. If the supervisory relay releases due to a customer disconnect the register will release as on any abandoned call. The conditions encountered in a dial tone connection to a coin first loop-start coin line are shown in Fig. 5 in Information Note 302 in the SD.

2.31 Coin test is made on dial-tone-first coin lines after dialing has been completed but before the marker is engaged. The deposit of a coin closes contacts which connect ground through the coin magnet to the tip wire at the station. The coin test circuit, App Fig. 7 and 10, has a supervisory relay which operates on the current through the customer loop and holds the register and a ground test relay which will operate only if ground is connected at the station. Operation of the ground test relay allows the call to proceed and a marker to be engaged. If the ground test relay does not operate, "no-such-number tone" will be transmitted to the calling customer after a timed period of 12 seconds, nominal. If the customer deposits a coin during the tone interval the call will be completed. However, if the customer does not deposit a coin, a register time-out will occur in 25 seconds, nominal, after dialing was completed, and the register will be released. The customer will be reconnected to the line circuit which will originate a dial tone connection and the customer will receive dial tone from a new register. If

at any time during coin test the customer disconnects, the supervisory relay will release and the register will restore to normal as on any abandoned call. The conditions encountered on a dial tone connection to a dial-tone-first coin line are shown on Fig. 6 in Information Note 302 in the SD.

2.32 On calls from a dial-tone-first station to a zero operator, a coin need not be deposited. No coin test is made in this type of call.

2.33 The most recent version of dial-tone-first coin service is provided by App Fig. 33. This is basically a loop-start service but also provides for ground-start service through wiring options. With this figure, coin test is made on all calls after dialing is completed. The marker is then summoned and given a coin present or not present indication to aid in determining disposition of the call. Figure 33 also provides coin return on permanent signal and abandoned calls. No test is made for coin clearance. When coin return is required on operator and other free calls, this will be done by the trunk to which the call is connected.

2.34 When the register has determined that all the required digits have been dialed or keyed, it causes a connection to be established through the marker connector to a completing marker and transfers to the marker all the information necessary for the completion of the call. This includes the called number, the identification of the calling line, and certain class marks. The marker translates the code, determines the destination of the call and then sets up the proper trunk connection. After the trunk connection has been established, the marker transmits a release signal to the register to cause its release.

SECTION II - DETAILED DESCRIPTION1. SEIZURE OF REGISTER

GENERAL

1.01 When a customer, who desires to originate a call, lifts the handset, the line circuit line relay operates and starts a series of events which results in the line being connected to an idle originating register. This connection is established under the direction of the dial tone marker and is called a dial tone connection.

1.02 A marker which is serving a call examines all the trunk link frames to find out which ones are unoccupied and which have one or more idle originating registers. The dial tone marker selects one of these frames and connects to it, and tests the individual registers on that frame to see which are idle. It selects one of the idle registers and connects to it via the trunk link and trunk link connector circuits, and the contacts of the F, FlA, and FlB relays of the register. By means of this multiple lead connection the dial tone marker operates memory relays which record the class of service and location of the calling line and the line link selected for use in the dial tone connection. Also the dial tone marker may operate one or more class relays (DD9, PBX5, 2P, CN, MAN, RV, or PLN) to indicate that the calling line has noncentrex, 5-digit centrex, 2-party, coin, manual, line requiring a reversal, or private-line network service. In a centrex register serving both centrex and regular telephone customers the DD9 relay is operated over the NPBX lead for the regular telephone customer. The marker also causes operation of one of the off-normal ground supply relays under control of a slow-release relay. These relays hold the operated memory and class relays and supply ground to the sleeve lead to hold the dial tone connection when the marker has set it up. The slow-release function is required to hold the register from the time the marker releases after setting up the dial tone connection, until the line (L) relay has had an opportunity to operate and take over the supervisory control of the register.

BUSY TEST BY MARKER

1.03 When the register is idle, ground is connected through normally closed or break-contacts of the relays ON, PD, and MB in series to lead FT. This lead is multiplied at the trunk link frame to the FT leads of other registers connected to the same trunk link frame, and ground on this lead indicates to the marker that at least one register on the trunk link frame

is idle. The marker has other means (described in the marker CD) of recognizing which trunk link frames are unoccupied, and will select and connect to an unoccupied trunk link frame with at least one idle register. The marker makes a busy test of the individual registers by means of the F and BT leads which are closed through the low-resistance winding of relay F and through series break-contacts of relays ON, PD, TML, and MB. The F lead of all the registers are connected together at the trunk link frame and the marker connects ground to this lead to mark the group of circuits which it wants to test. The BT leads of the individual registers are extended through the trunk link circuit to the marker circuit, where a high-resistance test relay is connected to each busy test lead. This ground on the F lead is connected through the winding of the F relay and the busy test relay to battery. The F relay will not operate due to the high-resistance of the busy test relay, but the test relay in the marker will operate, indicating which registers are idle. The marker selects one of the idle registers and connects low-resistance battery to the corresponding BT leads thus operating relay F which operates FlA and FlB and establishes a multilead connection from the marker through the trunk link and trunk link connector circuits to the register.

REGISTRATION OF CLASS, LOCATION, ETC

1.04 With relay FlA and FlB operated, circuits are established for recording information concerning the calling line. A group of relays are provided for recording each of the following:

- (a) Class-of-service group.
- (b) Class-of-service tens digit.
- (c) Class-of-service units digit.
- (d) Line link frame tens digit.
- (e) Line link frame units digit.
- (f) Horizontal group number.
- (g) Vertical group number.
- (h) Vertical file number.
- (i) Line link number used on the dial tone connection.

The memory units each consist of a dry reed relay, with five independent coils enclosed in a can with each coil associated with two make-contacts. One side of each of the coils is wired internally to one of its

associated contacts for locking purposes and a single lead wired to a terminal. One contact of the locking contact pair, one side of the coil, and both contacts of the load contact pair are wired to individual terminals. These terminals extend to both front and rear of each relay. For ease of wiring, three sets of terminals are strapped internally. These are the battery side of the coils, the locking contact of the relay, and one side of the load contact.

1.05 The OBS relay is controlled through a contact on F1B and is used to indicate that the calling line is connected to a service observing circuit.

1.06 Additional circuits are provided through contacts of the F relays for the marker to operate the 2P relay on calls from 2-party message rate lines or from 2-party flat rate lines in AMA or ANI offices, the CN relay on calls from coin lines, the MAN relay on calls from manual lines, the PLN relay on calls from PLN-centrex lines, the PBX5 relay for 5-digit centrex calls, and the DD9 relay for non-centrex customers.

1.07 A path is also provided through contacts of the F relay to operate the RV relay for certain class treatments in centrex that require a reversal of tip and ring to recognize that a register is attached.

OPERATION OF OFF-NORMAL RELAY

1.08 Relay S1 is operated by the marker through a contact of the F relay. Relay S1 operates ON which returns ground on the RC lead to inform the marker via the trunk link and connector that locking ground is supplied for the memory relays and other relays which may operate later. The ON opens the operating circuit of relay F but F remains operated on a locking contact. When F releases, as described later, the BT lead will be open as an indication that the register is busy. Relay ON also opens the frame busy test lead FT.

DIAL TONE CONNECTION ESTABLISHED

1.09 When F operates, it grounds lead FA to the trunk link circuit to operate an FA relay. With the FA relay operated the

tip ring and sleeve leads for the connector through the links are connected to the marker. The marker sets up the dial tone connection and makes certain tests of the tip, ring, and sleeve leads, and if they are satisfactory, releases F and, in turn, F1A and F1B of the register and the FA relay of the trunk link frame. The release of F, F1A, and F1B relays disconnect the register from the common leads of the trunk link and trunk link connector circuits so that they may be used for other calls, and the release of the trunk link frame relay FA transfers the tip, ring, and sleeve leads of the dial tone connection to the corresponding leads of the register. The ON relay being operated, supplies a holding ground through a 10- Ω resistor to the sleeve, thereby holding the dial tone connection.

1.10 The L relay operates through a circuit over the tip and ring leads of the dial tone connection, the customer loop, and the windings of the tone coil in the register. Relay L operates relay SR. Relay SR extends the circuit from the back contact No. 4 of the L relay to the winding of the Pl pulse counting relay, and operates relay ON1. The ON1 supplies grounds for the digit register relays and other relays which may be operated later, closes the dial tone supply to the tertiary winding of the tone coil, thereby causing dial tone to be transmitted to the calling customer, and closes a circuit to hold ON. The circuit to S1 is opened when F releases but S1 is slow-release so that it holds ON until ON1 has operated and established a holding circuit for ON. On calls from coin first coin lines, when App Fig. 9 is provided, and coin test is made in the register, the coin line supervisory relay CLR and the coin test auxiliary relay CNT2 must operate before L. The S1 is made slow enough to cover the release of the trunk link FA and the operation of CLR, CNT2, L, SR, and ON1. On calls from 2-party lines, a locking circuit is provided for S1 while the first party identification test is in progress, so that the release time of S1 does not have to include this test interval.

2. DIAL PULSE COUNTING AND REGISTRATION

GENERAL

2.01 For any digit, a train of pulses consisting of 1 to 10 equally spaced

momentary line openings is generated by the calling customer dial. The number of opens correspond to the number dialed, one for the number 1, two for the number 2, etc, and ten for the number 0. These pulses may be at the nominal rate of 10 or 20 per second. Between these trains of pulses there is an interdigital interval during which the line remains closed. The pulsing relay responds to these pulses and the counting circuit counts the number in each digit and, during the interdigital interval, transfers this count to the proper digit register unit. When this transfer is completed the counting relays are released and the counting circuit is ready to count the pulses of the next digit. The end of a digit is recognized by means of a slow-release register advance (RA) relay which operates during the first open pulse and releases during the interdigital interval. This relay controls the transfer of the count for each digit to the digit register unit.

PULSING RELAY

2.02 The L relay is a magnetically biased polarized mercury contact relay with three windings. The primary is used as a line winding and is used to operate the relay on a circuit which includes the customer loop. The tertiary is used as a pulse aiding winding and is wired in series with the pulse help capacitor PH to the L front contact No. 1. This contact also is wired to the winding of the slow-release supervisory (SR) relay. When L operates and closes ground to the No. 1 contact, the PH capacitor charges through the tertiary winding and the current is in a direction to hold L operated. This current is reduced to zero as the capacitor becomes charged and the other windings exercise full control. When the circuit to the primary winding is opened, the L releases to open ground from the No. 1 front contact. The PH capacitor then discharges through the winding of the SR relay and the current in the L tertiary winding is in a direction to hold the No. 1 contact open. The tertiary winding and the PH capacitor thus act to insure that once L operates it will remain operated for a definite minimum interval and that once it releases it will remain released for a definite minimum interval. This pulse correcting action makes possible longer maximum loops and higher capacity ringing

bridges than would otherwise be possible. The tertiary winding is also used to hold the L through the marker connector when the marker is engaged and is also used for slightly weakening the L relay when operating with ground start coin lines. When the coin (CN) relay operates it closes a circuit to energize the tertiary winding in a direction to aid the primary winding. This is necessary to prevent "showering," a condition which exists when the line circuit relay operates on a loop which will not hold the register L relay. If a leak condition exists on the line, which will cause operation of the line circuit relay, the dial tone marker will be called to connect the line to a register. Then if the register relay does not operate the register will release and reconnect the line to the line circuit relay to start the marker action again. To prevent this showering the register L relay is biased to hold on any line which will operate the line circuit relay.

2.03 The secondary winding is used for slightly altering the sensitivity of the L as it operates and releases. This winding is also connected to the No. 1 front contact of L and is so poled that its ampere turns oppose those of the primary winding when L is operated. This has the effect of making L, once it operates, slightly stiffer or easier to release and once it releases, slightly weaker or easier to operate. The value of the LA resistor is chosen to give the optimum benefit from this winding.

2.04 The contacts of the L relay consist of a common armature spring No. 3 making contact with two independent front contacts numbered 1 and 2, and two independent back contacts numbered 4 and 5.

2.05 The LW capacitor and resistor network connected to the line side of the primary winding of the L is for the purpose of preventing a premature release of L, when working with customer lines which have high-capacity ringing bridges. On each open pulse on these lines the line current momentarily dips and then increases as the bridged capacitor charges in series with the inductive ringer. The LW capacitor holds the L relay over the dip in the line current. This network is also used to

prevent a false momentary release of L when an inductor holding bridge is inserted into the loop after the dialing of each digit at a PBX.

2.06 The winding of the supervisory relay SR is connected to the No. 1 front contact of the L and is energized whenever L is operated. This relay is slow-release and will hold over the momentary opens of the L front contact which occurs during the dialing of a digit. It will release, however, to cause release of the register if the customer abandons the call.

TIP AND RING REVERSAL

2.07 The tip and ring polarity is reversed when used for centrex attendants or tie line circuits to signal a register attached condition.

SUPERVISORY CONTROL

2.08 The winding of the RA relay is connected through an ON1 contact to the No. 5 back contact of L and is energized whenever the L is released with ON1 operated. This relay is made slow-release by the action of its secondary winding which is short-circuited whenever the relay is operated. This secondary is a precision winding with a resistance tolerance of only ± 3 percent so that the variation in release time of the relay is held within reasonably close limits. Since this winding is open during the operation of the relay, the relay is reasonably fast in operating. Relay RA will operate during the first dial open pulse when L releases and will remain operated until the interdigital interval when L is held operated.

2.09 The auxiliary register advance (RA1) relay is controlled from a back contact on RA and works in reverse to RA, operating when RA releases and releasing when RA operates. The RA1 is a fast-operate and a fast-release relay.

DIAL PULSE COUNTERS

2.10 The dial pulse counting circuit consists of relays P1 to P5 and P2A. Relay P1 and P2 are used in a pulse dividing capacity with each relay functioning from L but at half the speed. These relays are controlled by the No. 4 back contact and the No. 2 front contact of L. When L releases on the first dial open with SR operated, P1 is operated through the back of a continuity contact on P2. Relay P1 locks through this continuity contact on P2, through its own make-contact to ON ground. When L reoperates at the end of the first open pulse, ground through L contacts 3 and 2 and through contacts of P1 operated, operates P2. Relay P2 locks to the ON ground through P1 operated and opens its operating circuit on a continuity contact, transferring the holding circuit for P1 from the ON ground to the ground at the L No. 2 contact. On the next release of L, P1 releases. The P1 in releasing opens the holding circuit to the ON ground for P2, but P2 is held to the ground at the L No. 4 contact. The locking circuit of P2 to a contact of P1, will hold P2 over any stagger that may occur between the opening of the L back contact No. 4. On the next operation of L, P2 releases. This cycle is then repeated with P1 and P2 remaining operated at the end of each odd-numbered pulse and remaining normal at the end of each even-numbered pulse. Relays P3, P4, and P5 are used in various combinations to count and remember the number of operations of P1 and P2. Relay P3 operates when P1 releases at the start of the second open pulse; P4 operates when P2 operates at the end of the third open pulse; and P5 operates when P2 releases at the end of the sixth open pulse. The sequence of operation of these relays is given in the sequence chart on SC36. The following table gives the sequence in tabular form.

TABLE A

Pulse	L	P1	P2	P3	P4	P5	Remaining Operated	Output Leads Grounded
1BK MK	R O	O	O				P1, P2	0,1
2BK MK	R O	R	R	O			P3	0,2
3BK MK	R O	O	O		O		P1, P2, P3, P4	1,2
4BK MK	R O	R	R				P3, P4	0,4
5BK MK	R O	O	O	R			P1, P2, P4	1,4
6BK MK	R O	R	R			O	P4, P5	2,4
7BK MK	R O	O	O				P1, P2, P4, P5	0,7
8BK MK	R O	R	R	O			P3, P4, P5	1,7
9BK MK	R O	O	O		R		P1, P2, P3, P5	2,7
10BK MK	R O	R	R				P3, P5	4,7
11BK MK	R O	O	O	R			P1, P2, P5	0
12BK MK	R O	R	R				P5	0

2.11 Although the number of dial pulses never exceeds 10, the counting circuit is arranged to give a distinctive signal if the count exceeds 10. This distinctive signal is a ground on the single output lead 0. This is used under certain conditions to cause a premature time-out and this operation is discussed in a paragraph under register time-out. The auxiliary counting relay P2A is operated at the start of the second pulse when P3 operates. Relay P2A locks on a continuity transfer contact and opens its operating circuit. This relay is used to recognize when the counting circuit counts the first digit greater than one and causes the digit to be transferred to the A-digit register. The reason for excluding

ones is covered in the paragraph on the preliminary pulses. Relay P2A opens the dial tone circuit, closes the 0 and 1 output leads of the counting circuit and opens the operating circuit of the first steering relay AS.

DIGIT STEERING

2.12 The digit steering circuit serves to connect the output of the pulse counters to the digit registers successively as the digits are received. The steering circuit is also used to indicate when dialing is completed. This circuit consists of one relay per digit and its advance is under the control of the RA1 relay.

2.13 The A digit steering relay AS is operated when ON operates at the start of the call. Relay AS locks through a back contact on BS. When RAL operates at the end of the first digit with P2A operated, BS operates through a front contact of AS. The BS locks through a back contact of CS and opens its operating circuit on a continuity transfer contact to the RAL contact so that when RAL releases at the start of the next digit AS releases. This action repeats for each digit with the steering relay for the next digit operating when RAL operates at the end of a digit and the steering relay for the digit just registered releasing when RAL releases at the start of the next digit. The five output leads of the pulse counter are carried through individual transfer contacts on the steering relays and are closed to the digit register associated with the lowest lettered operated relay. For example, with both AS and BS operated the leads are associated with the A digit register. The transfer from one digit register to the next takes place on the release of the lower lettered relay.

DIGIT REGISTER

2.14 The digit register unit for each digit consists of a dry reed relay, with five independent coils enclosed in a can with each coil associated with two make-contacts. One side of each of the coils is wired internally to one of its associated contacts for locking purpose and a single lead wired to a terminal. One contact of the locking contact pair, one side of the coil, and both contacts of the load contact pair are wired to individual terminals. These terminals extend to both the front and rear of each relay. For ease of wiring, three sets of terminals are strapped internally. These are the battery side of the coils, the locking contact of the relay, and one side of the load contact. Eleven or twelve of these digit register units are provided.

OVERALL OPERATION

2.15 The counting and registration of a digit takes place as follows. The L relay responds to the customer dial and the counting circuit counts the number of pulses. After the last pulse of the digit, L remains operated and RA releases. Relay RA closes

an ON ground, connected through an MST1 break-contact, through two separate break-contacts to the translating contacts of the counting relays. This ground emerges through separate break-contacts of RAL on two of the output leads 0, 1, 2, 4, and 7 and is connected by the steering relay to a digit register to cause operation of two of the five digit-register relays. Relay RA released also operates RAL which operates the next steering relay and, with five individual contacts, opens the five output leads of the counting relays. With this type of operation the digit register relays are required to operate during the operate time of RAL. Two other break-contacts on RAL release the counting relays. The circuit is then ready for the next digit.

REGISTRATION OF A "1" ON THE A-DIGIT REGISTER

2.16 All registers are arranged so that an initial single 1 pulse cannot be registered in the A-digit register. The 1 is used as a prefix indicating an extra-charge call as a prefix to a centrex 2-digit code (LXX) or as the first prefix of a 11X service code. Prevention of registration is accomplished by the P2A relay which keeps the 0 and 1 output leads of the counting relays open and the steering relays from advancing until it has operated. A count of two or greater is required to operate the P2A relay except in those registers arranged for LXX type special PBX and tie line codes. In this case if two successive 1s are received the second 1 will operate the P2A relay allowing the 1 to be stored on the A-digit register.

PREFIX COUNTER

2.17 Either a single 1 pulse or two 1-pulse digits may be dialed before the other digits as an indication that some special action is to be taken. Where it is required that the register recognize these prefix digits, the prefix counter, consisting of the relays 11A, 11B, and 11C, is provided.

2.18 The detailed operation of the prefix counter is as follows. When RA releases after the first 1-pulse digit is counted a circuit is closed for operating 11A. Relay 11A locks, and closes a circuit for operating 11B when P1 releases as a result of the operation of RAL. If a second

1-pulse digit is counted, 11C operates through front contacts of 11B after RA releases at the end of the digit. Additional 1s will have no effect.

A. Prefix Counter Arranged for Prefix Digits 1-1 Only

2.19 Two 1-pulse digits may be used for either of two purposes. First, they may be used in combination with a registration on the A digit for 11X service codes (information, repair clerk, etc). The X will be some digit other than 1 and will be registered on the A-digit register. For this purpose, ZA wiring is provided and a circuit for operating the marker start (MST) relay to cause a marker to be selected is closed when the BS relay operates as the A digit is registered.

2.20 Two 1-pulse digits may also be used to indicate that the code registered on the A-, B-, and C-digit registers represents an office in another numbering plan area. In this case the prefix counter will be provided, but ZA wiring will not be provided and the operation of MST will be under control of cross-connections described in the section on determination of the number of digits. The marker will be informed that the 1-1 prefix area code has been received by the action of the 11C relay in removing ground from the local translator lead LT and connecting it to the 11 lead. A single 1 will have no effect since the control relay 11C will not be operated.

2.21 Relay 11C locks, opens the dial tone supply circuit, removes ground from the local translator (LT) lead and connects ground to the 11 translator lead. The 11C also provides for determining the number of digits required for the call. The number of digits may be determined as follows. If the prefix counter is used in connection with 11X service codes, ZA wiring will be provided and MST will be operated when BS operates. If the prefix counter is used in connection with a foreign area code, the number of digits may be determined either directly by connections to the 11A, 11B, 11C, and 11D terminals associated with contacts of the 11C relay or indirectly by connections through the contacts of the

A- and B-digit translator relays or may be determined by the pretranslator. The 11C also opens the circuit to PST to prevent engaging the pretranslator when pretranslation of 1-1 codes is not required.

B. Prefix Counter Arranged for Digit 1 Access Codes

2.22 A single 1-pulse digit preceding the called number is used to provide digit 1 access codes which indicate calls outside the local service area. The 1 is registered on the 11A and 11B relays. The operation of the marker start (MST) relay is under control of cross-connections as described in the section on the determination of the number of digits. Action of the 11B relay, which removes ground from the local translator lead LT and connects it to the LT1 lead, informs the marker that a digit 1 access code has been received.

2.23 A prefix counter arranged for digit 1 access codes may also be arranged to recognize a second 1-pulse digit to indicate 11X service codes. When the second digit 1 is counted 11C operates and disconnects ground from the LT1 lead and connects it to the 11 lead to the marker.

DIRECTING DIGIT FOR PBX CLASS

2.24 When the register is arranged for centrex service, the centrex customer must dial a directing digit 9 in order to make a call to a point outside the centrex group. As the ninth pulse of the directing digit is counted, the DD9 relay is operated. This relay immediately opens the operating path of the 2 and 7 leads to the A-digit register and releases the P2A relay. As the pulse counting relay P3 releases at the end of the digit 9, the DD9A and DD9B relays operate. The DD9A relay recloses the 2 and 7 leads and the operating path to the P2A relay so that the next digit of 2 or greater will be registered on the A-digit register. Options YH and YG are provided to remove or supply dial tone after the 9 directing digit has been received. Option YH can be used only when a separate group of registers is provided for centrex customers.

2.25 If a 9 is dialed and not followed by any other digits, a register time-out will occur. Since the P2A relay is released, which, in turn, releases the PD relay, a permanent signal (PS) marker is sent to the marker.

2.26 When the register is arranged for private line network PBX service, the PLN customer must dial or key a directing digit 8 to make a call within the private line network. Relay DB8 operates as the eighth pulse is counted and releases relay P2A. These relays open the operating path of the 1 and 7 leads to the A-digit register. When pulse counting relay P3 releases at the end of the digit 8, relay DB8A operates and recloses the operating paths of the P2A relay and the A-digit register.

ZERO PREFIX COUNTER

2.27 The zero prefix counter (relays OP and OP1) is required where PPCS service is provided. If the first digit dialed is a zero it is stored on these two relays. If further digits are dialed the OP relay releases. A PPCS call is indicated when OP is normal and OP1 is operated. If no further digits are dialed OP and OP1 both remain operated indicating that the initial zero meant zero operator.

2.28 The OP relay operates during the tenth open dial pulse through contacts of P3, P5, and AS operated and P1 and P4 normal. Relay OP locks to an ON ground through contacts of P2 and STRA.

2.29 The OP1 relay operates at the end of the digit through contacts of OP operated and P3 normal. Relay OP1 locks to an ON ground.

2.30 If a second digit is dialed the OP relay is released when P2 operates at the end of the first open pulse.

3. "TOUCH-TONE" CALLING DETECTION AND REGISTRATION

GENERAL

3.01 For any digit, a combination of two audio frequencies is generated by the calling customer TOUCH-TONE set. Each combination of frequencies consists of one frequency out of a "high" group of three

audio frequencies and one frequency out of a "low" group of four audio frequencies. Twelve such combinations are thus available with this arrangement. Ten of these are used to represent the digits 0 through 9. The remaining two combinations may be used for special purposes.

3.02 Associated with TOUCH-TONE each originating register is a TOUCH-TONE calling receiver circuit which detects the presence of TOUCH-TONE keyed digits and causes translating relays to operate corresponding to the frequencies of the keyed digit. Operation of the translating relays transfers the digital information into digit register units. The end of a digit is recognized by the STRA steering relay which operates when a key is depressed at the customer set and remains operated until the key is released. This relay controls the transfer of digital information into the proper digit register.

"TOUCH-TONE" CALLING RECEIVER

3.03 The TOUCH-TONE calling receiver is bridged across the incoming T and R leads of the register circuit. Each keyed digit causes the TT receiver to ground one of the four LG1-4 leads, one of the three HG1-3 leads and the STR lead. The receiver is arranged to maintain these output grounds for a sufficient length of time to insure that the digit has been registered and the digit register has been advanced. This action prevents a digit from being lost should a customer depress a key for a very short interval.

3.04 The grounded LG- lead operates one of the Y0, Y3, Y6, or Y9 translating relays and the grounded HG lead operates one of the Z1, Z2, or Z3 translating relays. The frequencies received for each digit, the output leads grounded by the TT receiver, and the translating relays operated are as follows. Note that the numerical designation of the operated Y0, Y3, Y6, or Y9 and Z1-3 relays may be added to obtain the corresponding digit for digits 1 through 9.

3.05 The receiver is arranged to detect TOUCH-TONE signals and to ignore other signals. It will provide an output of two digit signals and the steering signal for each digit received. The TOUCH-TONE receiver acts as a discriminator and will

ground two of the digit leads when it detects a digit. In all other cases it will provide no output.

3.06 The MF relay also operates as soon as the first keyed digit is received. The P2A operates also if the first digit is greater than one. The reason for excluding 1s is covered in the paragraph on preliminary pulses. The MF locks to an off-normal ground and informs the register that the call is being originated by a TOUCH-TONE customer. The P2A locks through a continuity transfer contact to an off-normal ground and causes the digit to be registered in the A-digit register unit. The P2A operated also opens the dial tone circuit, closes a ground supply for the output leads of the translating circuit and opens the operating circuit of the AS steering relay.

DIGIT TRANSLATION

3.07 The digit translation circuit consists of the Y0, Y3, Y6, Y9, Z1, Z2, and Z3 relays. These relays are under control of the TT calling receiver output leads LG1-4 and HG1-3 and function to translate the 4 by 3 encoded information received from the TT receiver into 2-out-of-5 information required by the digit register units. The outputs of the translating relays appear on the 0, 1, 2, 4, and 7 leads which are connected to the proper digit register unit by the steering relays. The output leads are grounded as indicated in the table.

3.08 If for any reason an unused combination of translating relays should operate, namely, Y9 and Z1 or Z9 and Z3, the TBL punching will be grounded which will cause TBL to operate. The TBL operates BT which will cause busy tone to be returned to the customer from the register.

TABLE B

Digit	Frequencies		TT Receiver Output		Translating		Output Leads Grounded
	Cycles Per Second		Leads Grounded		Relays Operated		
0	1336	941	HG2	LG4	Z2	Y9	4, 7
1	1209	697	HG1	LG1	Z1	Y0	0, 1
2	1336	697	HG2	LG1	Z2	Y0	0, 2
3	1477	697	HG3	LG1	Z3	Y0	1, 2
4	1209	770	HG1	LG2	Z1	Y3	0, 4
5	1336	770	HG2	LG2	Z2	Y3	1, 4
6	1477	770	HG3	LG2	Z3	Y3	2, 4
7	1209	852	HG1	LG3	Z1	Y6	0, 7
8	1336	852	HG2	LG3	Z2	Y6	1, 7
9	1477	852	HG3	LG3	Z3	Y6	2, 7

DIGIT STEERING

3.09 The digit steering circuit serves to connect the output of the translating relays to the digit registers successively as the digits are keyed. The steering

circuit is also used to indicate when keying is completed. This circuit consists of one relay per digit and the STS relay which grounds the M7 lead to the marker if a digit is stored in the L register. The advance of the steering circuit is under control of relay STRA.

3.10 The A-digit steering relay AS is operated when ON operates at the start of the call. The AS locks through a back contact on BS. The STRA operates at the beginning of the first digit. When P2A operates (if the digit is 2 or greater) BS operates through a front contact of AS. The BS locks through a back contact of CS and opens its operating circuit to the STRA contact on a continuity transfer contact so that when STRA releases at the end of the digit, AS releases. This action repeats for each digit with the steering relay for the next digit operating when STRA operates at the beginning of a digit and the steering relay for the digit being registered, releasing when STRA releases at the end of the digit. The five output leads of the translating relays are carried through individual transfer contacts on the steering relays and are closed to the digit register associated with the lowest lettered operated relay. For example, with both the AS and BS operated, the leads are associated with the A-digit register. The transfer from one digit to the next takes place on the release of the lower lettered relay.

DIGIT REGISTER

3.11 The digit register units are described under dial pulsing.

OVERALL OPERATION

3.12 The translation and registration of a digit takes place as follows. The TT receiver responds to the customer TOUCH-TONE set and furnishes output grounds to operate the translating relays in the translating circuit in accordance with the frequencies of the keyed digit. At the beginning of a digit the TT receiver also causes STR to operate. Off-normal ground, through the contacts of the operated translating relays, appears on two of the 0, 1, 2, 4, and 7 output leads which are connected by the steering relay to a digit register to cause operation of two of the 5-digit register relays. The STR operated also operates STRA which in turn operates the next steering relay. At the end of a digit the output of the TT receiver is removed thereby releasing the translating relays and STR. The STR released releases STRA which in turn releases the steering relay of the digit just registered. The circuit is then ready for the next digit.

REGISTRATION OF A "1" ON THE A-DIGIT REGISTER

3.13 The situation with respect to a 1 on the A-digit register is the same as described for dial pulsing.

PREFIX COUNTER

3.14 A single 1 or two successive 1s may be keyed before the other digits as an indication that some special action is to be taken. When it is required that the register recognize these prefix digits, the prefix counter, consisting of relays 11A, 11B, and 11C, is provided. The prefix digits are used for the purposes described in PREFIX COUNTER under 2. DIAL PULSE COUNTING AND REGISTRATION.

3.15 The detailed operation of the prefix counter when a TOUCH-TONE customer keys a single 1 or two successive 1s is as follows. When the TT receiver receives the first keyed 1 it causes the translating relays corresponding to a 1 to operate and also operates STR which, in turn, operates STRA. When STRA operates a path is closed for operating 11A. The 11A locks and closes a circuit for operating 11B when STRA releases at the end of the digit. When STRA operates at the beginning of the second digit 1, 11C operates through a front contact of 11B. Additional 1s will have no affect. A single 1 will have no affect unless digit 1 access codes are used since the control relay 11C will not be operated. Further keying of digits will cause the register to function in the same manner as described under dial pulsing.

DIRECTING DIGIT FOR PBX CLASS

3.16 When the register is arranged for centrex service a special directing light 9 must be keyed in order to make a call outside of the PBX.

3.17 When a directing digit 9 is keyed, the directing digit 9 relay, DD9, is operated when STRA and the Z3 and Y0 translating relays operate at the beginning of the digit. The DD9 locks to an off-normal ground, operates DD9B, and prepares a path to operate DD9A, when STRA releases at the end of the keyed digit.

3.18 The digit 9 will not be registered in the A-digit register since there is no operating path for P2A, and the digit registers are disabled until P2A operates. The P2A relay operates on the next keyed digit of 2 or greater.

3.19 If a 9 is keyed and not followed by any other digits, a register time-out will occur. Since P2A is released, which in turn releases the PD relay, a PS permanent signal marker is sent to the marker.

3.20 Option YH provides for the removal of dial tone while option YG allows the return of dial tone after the 9 directing digit has been received. Option YH can be used only when a separate group of registers is used for centrex service.

3.21 When the register is arranged for PLN centrex class of service a directing digit 8 must be keyed by the PLN customer to make a call within the private line network.

3.22 When a directing digit 8 is keyed, relay DD8 operates when STRA and the Z2 and Y6 translating relays operate at the beginning of the digit. The DD8 locks to off-normal ground and prepares a path to operate relay DD8A, directing digit 8 registered, when STRA releases at the end of the digit. Registration of this digit in the A-digit register is prevented, however, in a manner similar to that of the directing digit 9.

3.23 If a directing digit 8 is keyed and followed by the digit zero, the MAN relay will operate to summon the marker for routing. If an 8 is keyed and followed by the digit 1, prefix counter relays 11A and 11B are prevented from operating by contacts of relay DD8A, and the circuit remains unchanged until either register time-out occurs or a digit 2 or greater is keyed. If an 8 is keyed, and not followed by any other digit, register time-out will occur.

ZERO PREFIX COUNTER

3.24 The zero prefix counter (relays OP and OPl) is required where PPCS service is provided. If the first digit

keyed is a zero, it is stored on these two relays. If further digits are keyed the OP relay releases. A PPCS call is indicated when OP is normal and OPl is operated. If no further digits are keyed, OP and OPl both remain operated indicating that the initial zero meant zero operator.

3.25 The OP relay operates when zero is keyed as the first digit through contacts of Z2A, Y9, and AS operated. The OP locks to an ON ground through contacts of P2 and STRA.

3.26 The OPl relay operates at the end of the digit through contacts of OP operated and STRA released and locks to an ON ground.

3.27 If a second digit is keyed OP releases at the start of the digit when STRA operates.

4. DETERMINATION OF NUMBER OF DIGITS TO BE RECEIVED

GENERAL

4.01 When all digits have been received, the register operates the MST and MST1 relays to start seizure of a completing marker. The steering relays are used to indicate when particular digits have been received. As these relays operate they ground, in turn, terminals B to L. The ground at these terminals, either by direct connection or under varying degrees of intermediate control, is used to operate MST. Since the register may not receive the same number of digits on all calls, the operation of MST may be controlled either directly or indirectly by the contacts of intermediate relays such as those of the A- and B-digit translators and the prefix counter.

4.02 If the register is arranged for centrex service, a PBX cross-connection terminal is provided. For intracentrex calls of four digits, this PBX terminal is cross-connected to the D terminal for marker start after four digits. For intracentrex calls of five digits, the PBX terminal is cross-connected to the E terminal. Where registers are arranged for combined 4- and 5-digit intracentrex calls (PBX5 class of service), terminal PBX is cross-connected to terminal D, and terminal PBX5 is cross-connected to terminal E.

4.03 If the register is arranged for PLN centrex customers, cross-connection terminals MST8, PST, and PSTG are provided. Terminal MST8 is cross-connected to terminal G for marker start after seven digits on calls within the private line network. Terminals PST and PSTG are cross-connected if pretranslation is required on these calls.

A-DIGIT TRANSLATOR

4.04 When the number of digits to be received depends on the A code digit, the A-digit translator may be used. This translator consists of the digit translator relays TAO, 1, 2, 4, and 7 and the cut-in relays TAA and TAB. The TAO, 1, 2, 4, and 7 relays operate directly from the load contacts of the A-digit register relays. Two groups of ten paths each are provided through the TA2/5 relays and the groups are under control of the TAA and TAB relays. One path of each group is closed by each 2-out-of-5 combination of operated relays. The TAA and TAB are provided when two groups of A digits are translated in different manners. Such a case might be for the office code and for LXX codes. In this case one group comprising the ten circuits between the AAO-9 and ABO-9 terminals, used in connection with TAA for translation for one group, and the other group comprised of the ten circuits between the ACO-9 and ADO-9 terminals is used in connection with TAB for the other translation. If TAA and TAB are not provided their controls are bypassed and either group may be used. These terminals are cross-connected between the terminals corresponding to the digits registered and the MST or DL terminals for operation of the appropriate relay when the required number of digits, as determined by the A digit, have been registered. When this translator is used, the terminals representing unused A digits will be connected to the vacant code (VC) terminal which is grounded by the operation of P2A. If an unused code is registered the marker will be seized as soon as the A digit is registered. The call is then routed to a vacant code trunk.

A. Repetitive Digit Timing

4.05 Where the digit translator is unable to translate LXX type special PBX and tie line codes, the repetitive digit

timer can be used. This circuit is used for timing for a variable number of additional digits which follow the LXX code. On such calls the TDL relay operates the DL relay of the digit timing circuit through front contacts of the RAL relay.

4.06 With the cold cathode digit timer, the DL relay starts a 2.8 to 5.3 second timing interval. If no digit is received during this interval, the DT relay operates to operate the MST relay. If a digit is received before the timing interval is completed, the RAL relay releases releasing the DL relay which, when released, discharges the timing capacitor. When the RAL relay reoperates at the completion of the digit, the DL relay reoperates and another timing interval is started. This process will continue until no digit is received and DT operates to operate the MST relay to cause selection of a marker.

4.07 When the transistor digit timer is used, operation of DL initiates a 3.2 to 3.8 second timed interval. If no digit is received during this interval, DT operates to cause operation of MST. If a digit is received during the timed interval, relay RAL releases which, in turn, releases DL to reset the transistor timer. When RAL reoperates at the end of the digit, DL reoperates to start another timing interval. As in the cold cathode timer, this process will continue until no digit is received and DT operates to operate relay MST.

A- AND B-DIGIT TRANSLATOR

4.08 In some cases it is necessary to translate both the A and B digits to determine the number of digits to be received. For this purpose the B-digit translator consisting of the TBO, 1, 2, 4, and 7, TBA, TEB, and TBC relays, is used in conjunction with the A-digit translator. The TAO, 1, 2, 4, and 7 and TBO, 1, 2, 4, and 7 operate directly from the load contacts of the A- and B-digit registers, respectively, and for each call two of the five relays of each group will be operated.

4.09 Two groups of ten paths each are provided through the TA2/5 relays and these groups are under control of the TAA and TAB relays, and one path of each

group will be closed for each of the 2-out-of-5 combinations of operated relays.

4.10 Three groups of ten paths each are provided through the TB2/5 relays and these groups are under control of the TBA, TBB, and TBC relays. One group, comprising the circuits between BAO-9 and BBO-9 terminals, is under control of the TBA relay; a second group, comprising the circuits between BCO-9 and BDO-9 terminals, is under control of the TBB relay; and the third group, comprising the circuits between the BEO-9 and BFO-9 terminals, is under control of the TBC relay.

4.11 By cross-connecting the proper AAO-9 terminals, for home area office codes, to the TBA, TBB, or TBC terminals for operation of the corresponding relay and cross-connecting the associated ABO-9 terminals to ground, a particular group of B-digit leads can be selected and enabled for each A digit. Thus, by cross-connecting the BAO-9 and BBO-9, BCO-9 to BDO-9, or BEO-9 to BFO-9 terminals between the terminal corresponding to the digit registered and the MST or DL terminals, the appropriate relay can be operated whenever the correct number of digits has been registered for the particular combination of A and B digits. For example, if it is desired to seize the marker immediately after six digits have been registered for an A digit of 2 and a B digit of 4, terminal AA2 would be connected to TBA and terminal AB2 would be connected to ground so that TBA would operate for an A digit of 2. If the TAA relay were provided, terminal TAA would be connected to terminal 11B, and 11A connected to ground so that TAA would operate with 11C normal. The BA⁴ terminal would be connected to F and the BB⁴ terminal would be connected to MST for operation of MST for a B digit of 4 and an A digit of 2. Other combinations of A and B digits would be handled in a similar manner.

4.12 Since there are three groups of B-digit leads three different treatments can be given to the A digits, and since each group of B-digit translators has 10 paths a combination of 3 times 10, or 30, different codes can be translated. However, since the 0 and 1 are not normally used for the B digit for home area codes the combinations of A and B digits is reduced to 24.

4.13 The B-digit translator can be used for translating DDD codes of the NO/LX type. In this case vacant codes require 7 digits before routing. In these cases the IS and STS relays remove ground from the OR lead and connect it to the FAC lead to the marker connector to inform the marker that the call is a DDD call. This lead is used by the marker if intercept of unauthorized customer 10-digit DDD calls is required and/or trunk service observing is required.

NNO NUMBERING PLAN AREA CODE TRANSLATION

4.14 Where pretranslators are not provided in the marker group, numbering plan area codes of the type NNO require a translating circuit be provided in the register to detect a zero as the C digit. This provision is necessary to inform the marker that an NNO prefixed call will be a DDD call either consisting of ten digits or of the NPA-411 foreign area information type.

4.15 The C-digit-equals-zero translation is accomplished by relays SCZ and SC⁴. When a zero is dialed as the C digit both SCZ and SC⁴ are operated. A back contact of SCZ disables a marker start path through the B-digit translator which would ordinarily operate relay MST after registration of the seventh digit providing that the B digit was 2 to 9. The register will now await dialing of the eighth, ninth, and tenth digits before seizing a marker by operation of relay MST through a make-contact of steering relay LS.

4.16 Where NPA-411 information service is provided and NNO numbering plan area codes are used and no conflict exists between the local office and NPA codes, connections are made to start the marker after six digits. When relay SCZ is operated indicating a zero as the C digit and digits 411 are then dialed, relay A411 will operate. This will cause operation of relay MST to initiate marker action.

DIGIT TIMING

A. Cold Cathode Digit Timer

4.17 The digit timing circuit consisting of the delay, DL, relay and DT tube

timing circuit is used for timing for one additional digit to be dialed or keyed. Where the terminating office has some stations identified by party numbers or letters, the stations digit may or may not be dialed or keyed. On such calls the digit timer will allow approximately 3.5 seconds for the extra digit to be started. If it is not dialed or keyed the marker start relay will be operated by the timer. If it is dialed or keyed the marker start relay will be operated when the digit has been registered. The operation of the cold cathode digit timer is as follows.

4.18 When the DL terminal is grounded, as a result of the operation of a steering relay after the last digit for the call with the minimum number of digits is registered, the DL relay will operate through operated contacts on RAL. The DL locks and starts the DT timer by removing a short from the DT capacitor and connecting the DT tube and capacitor to an ONL relay ground through the DT relay winding. The DT capacitor starts to charge to 130 volts through the DT3 resistor, and when the capacitor reaches a charge of approximately 72 volts the DT tube will ionize between terminals 1 and 4. This will cause current to pass between terminals 1 and 4 to cause operation of the relay DT. The time required for the DT tube to ionize is dependent on the tube constants and the value of the capacitor and the charging rate. These are chosen to give a delay from operation of DL to the operation of DT, of maximum 4.8 seconds, nominal 3.5 seconds, and maximum 3.4 seconds. If the additional digit is not started during this interval, DT operates to transfer the DL operating ground to cause operation of MST. The DT locks on a continuity transfer contact to the 130-volt battery through the current limiting resistor DT4 and opens the circuit to the DT tube to conserve its life.

4.19 If a digit is received during the timed interval, RAL releases to cause operation of DT to the 130-volt potential through resistor DT4, RAL normal, and DL operated. When RAL operates at the end of the digit, with DT operated, MST will be operated.

4.20 The cold cathode digit timer is also used to time for a second digit after zero prefix when the register is arranged for PPCS service.

4.21 Where the A-digit translator is unable to translate LXX type special PBX and tie line codes, the cold cathode timer can be used for repetitive digit timing. This process is described in 4.05 through 4.07.

B. Transistor Digit Timer

4.22 The transistor digit timer is a more precise low-voltage timing circuit which is used in place of the cold cathode tube timer where such precision is required. In addition to timing for an extra digit on stations delay calls, for a second digit following a zero prefix on PPCS calls, and for timing for additional digits on LXX centrex codes, the transistor timer can be used to time for a seventh digit following the digits NPA-411 on foreign NPA information calls in cases where a conflict exists between an NPA and local code. Also in these cases, the timer can be used to time an interval for dialing an eighth digit so as to distinguish a local code from an NPA code.

4.23 The transistor timer is designed to provide a timed interval of minimum 3.2 seconds, nominal 3.5 seconds, and maximum 3.8 seconds. In the normal condition timing capacitor DT2 is charged to 48 volts minus the small voltage drop across diode CR1 and resistor R3. Current flows in the base-emitter circuit of transistor Q1 which drives the collector current into saturation. The saturation collector voltage of Q1 is approximately 0.25 volts fixing the base-emitter voltage of transistor Q2 below the nominal turn-on value of about 0.7 volts. In this condition no current flows in the collector circuit of Q2.

4.24 When relay DL is operated to initiate the timing cycle, ground is removed from the charging path of capacitor DT2. DT2 discharges through the high-impedance circuit of resistors DT5 and R2, and the base-emitter circuit of transistor Q1. At the completion of this discharge delay the voltage drop (approximately 0.5 volts) across diode CR1 will permit conduction in the charging circuit of capacitor DT2. This decreases the base-emitter current of Q1 thus bringing it out of saturation. The collector voltage of Q1 then increases raising the base voltage of Q2 above the

0.7 volt turn-on potential. Current then flows in the collector circuit of Q2 which operates timing relay DT. The values of capacitor DT2 and resistor DT5 are chosen to give a delay of 3.5 ± 0.3 seconds from the time relay DL operates to the operation of relay DT.

4.25 When relay DL releases the timing circuit returns to normal by reestablishing ground to the charging circuit of capacitor DT2. Since the charging circuit is of low impedance, DT2 is quickly recharged causing an increased base-emitter current in transistor Q1. This current is sufficient to drive Q1 into saturation and thus return transistor Q2 to its normal cutoff condition.

4.26 The following is an example of the transistor timer operation in timing for a stations delay digit.

(a) After registration of the seventh digit relay DL operates to start the transistor timer. If a stations digit is received during the timed interval, where options TM and TR are provided, relay RA1 releases at the beginning of the digit. This causes operation of relay DT through S1 normal, RA1 normal, and DL operated. (The purpose of the S1 contact is to isolate relay DT during testing.) The DT locks through a front contact of relay DL to provide a path to operate the MST relay when RA1 reoperates at the completion of the stations digit.

(b) If no stations digit is received, the timer will cause operation of DT after approximately 3.5 seconds. Contacts of DT will transfer the operate ground of relay DL to cause operation of MST.

C. Premature Time-Out of Transistor Digit Timer

4.27 The transistor timer may be prematurely set into operation due to a defective or dirty DL contact. If this occurs the timer will be timed out while the register is idle, where option PO is equipped.

4.28 When this register is seized to handle a call, relay DT will operate immediately after operation of relay ON1 and

release of relay S1 during dial tone marker action. Operation of DT will operate relay MST through a back contact of relay RA1 to seize a marker before any digits are registered or, in case the first digit is quickly keyed or dialed, after registration of this first digit. In either case, unless the single digit is zero, the marker will cause a trouble record and release the register because of insufficient digits. If the single digit received is a zero the marker will proceed with a zero operator call.

CONNECTION TO PRETRANSLATOR

4.29 In offices where the determination of the number of digits required for various codes is uneconomical or, in some cases, impossible when using the translators built into the individual registers, a pretranslator circuit will be provided. This circuit can translate as many codes as required, and is common to the group of registers. This translation is transferred to the register so that the register can connect to the marker after the proper number of digits have been registered. The register makes a multiple lead connection to the pretranslator by means of the pretranslator connector. The register will connect to the pretranslator after three digits have been registered.

4.30 If the register is arranged for centrex service, the operating path for the pretranslator start (PST) relay is opened by the DD9 relay and all 4- or 5-digit intracentrex calls will not be referred to the pretranslator. When an "outside the PBX" central office call is desired and a "9" preliminary directing digit is dialed, the DD9 relay operates and the path of the PST relay is reclosed as before.

4.31 The following description assumes that the connection is made to the pretranslator after the third digit has been registered and S wiring is provided for this type of operation.

4.32 When the C digit has been registered the DS relay will operate. The DS operates the pretranslator start relay PST which locks and starts selection of pretranslator by connecting battery to the

start (ST) lead to the pretranslator connector circuit originating register part. The PST grounds the TM lead to the pretranslator connector pretranslator part to start its timer, and opens the operating circuit of the overload timing (OVL) relay to insure that register timing during the pretranslator stage of the call will be at the 25-second nominal rate.

4.33 When a connection has been established to the pretranslator it translates the code recorded in the A, B, and C positions of the register to determine the number of digits to be expected on the call. The pretranslator then operates none or one of the CMA, CMB, CMC, and CM3 relays, and also sometimes the SD relay. On completion of this function the pretranslator grounds the PRL lead to operate the PRL relay which locks to PST. The PRL supplies a locking ground for any of the SD and the CM-relays which may have been operated. The PRL opens the ST lead but the connector is held by the pretranslator until it checks that the proper CM- and SD relay combination has operated and locked. The RLK lead is used by the pretranslator to check that PRL locks, and also as an emergency release path.

4.34 The PRL also releases DMS, which had operated at register seizure from ON. The release of DMS recloses the operating path of OVL to permit short interdigital timing to start if an overload condition exists and closes a point in the MST circuit which has been established through the CM- and SD relays. The DMS is slow release and the MST circuit is wired through its normal contacts to insure that the marker and pretranslator are never connected to the register at the same time.

4.35 The pretranslator can be arranged with SS option rated "Mfr Disc." to translate the A digit of 11 foreign area codes. For these codes the register prefix counter grounds the 11 lead to the pretranslator whereas the 12 lead will be grounded for codes requiring the home area 12 translator. If a pretranslator is provided and translation of 11 codes is not required, as it will not be for 11X service codes, ZB wiring is not provided and the operation of relay 11C will open the operating circuit of PST to prevent seizing the pretranslator following a 11 prefix.

4.36 Typical cross-connections for the CM-terminals of the pretranslator operated relays are illustrated in the cross-connection figures. A general explanation of their use is as follows. The CM3 is operated if the marker is to be seized after the third digit as in the case of a 3-digit service, straightforward, or vacant code. If the coin App Fig. 11 is provided and if a coin is to be returned before selecting the marker on the calls, the SD relay is operated in addition to the CM3. In this case the coin return relay is operated to cause coin return prior to operation of MST.

4.37 In cases where a connection is made to the pretranslator after two digits, the CM3 relay is used to cause seizure of the marker after two digits. For the local office codes which are used for the majority of the calls, the pretranslator will not operate any CM-relays. This is considered the basic setting and a cross-connection is made from the CMI terminal to the digit terminal corresponding to the last numerical digit to be registered. For the 7-digit condition the CMI terminal is connected to the G terminal and, in this case, the CM2 terminal is connected to the H terminal. For calls which may have a party letter or fifth numerical digit added to the basic setting just described, the pretranslator will operate only the stations delay (SD) relay. Stations delay timing will then be started at the point determined by the cross-connection from the CMI terminal. If, due to a delay in reaching the pretranslator, the stations digit is dialed or keyed before pretranslation has been completed, the cross-connection from the CM2 terminal will provide for operation of MST without the DF relay having been operated.

4.38 In addition to the basic arrangement, three code variations can be handled by the CMA, CMB, and CMC relays and their associated terminals. These terminals are cross-connected according to the procedure described for the CMI and CM2 terminals, with stations delay being inserted for each case, if necessary, by operation of the SD relay.

4.39 Where foreign NPA customer-originated calls are handled and no conflict exists between a foreign area and local code, relay CMC will be assigned. Operation

of CMC transfers ground from the OR to the FAC lead of the marker connector circuit to indicate a DDD call.

4.40 Relay CMB is assigned for interchangeable NPA and local office codes.

INTERCHANGEABLE CODES

4.41 Interchangeable codes are NXX type codes assigned as both NPA and local area codes. The NPA codes require the dialing of ten digits while local codes require only seven digits. Since the number of digits required on a particular call is determined from translation of the NPA or local code (first three digits registered), additional means are required for handling the call when a conflicting or interchangeable code is received by the register. Several methods are available for registers that function with the pretranslator circuit. The latest method involves use of the prefix digits zero and one for differentiating between 7- and 10-digit calls. These methods are described as follows:

4.42 With the standard NPA arrangement equipped (applicable in any NPA), if the dialing format used does not require dialing of the prefix digits 0 or 1 on any toll call, the register must be cross-connected to provide timing on all interchangeable codes. If instead, the dialing format requires the use of these prefix digits on toll calls, timing can be eliminated on interchangeable local (nontoll) calls. This arrangement has been expanded to provide for the elimination of timing on all interchangeable codes, or for providing timing on (O+) interchangeable calls only. Where this expanded version is used, the dialing of the prefix 0 or 1 on all 10-digit calls is required. Where timing is not used on any call, home NPA toll calls require ten digits (home NPA code must also be dialed). Where timing is used on O+ traffic, O+ calls within the home NPA can be handled on a 7-digit basis, with timing if an interchangeable code is dialed, and without timing on noninterchangeable codes. All 1+ traffic requires ten digits. For these arrangements, the pretranslator circuit must provide the following translations to the register.

- (a) Basic Setting - on all noninterchangeable local codes.
- (b) CMB - on all interchangeable local and NPA codes.
- (c) CMC - on all noninterchangeable NPA codes.
- (d) CM3 - on all N11 codes.

4.43 In operation, the register functions as follows. For the case where prefix digits 0 or 1 are not involved in the dialing format, the register is cross-connected to cause operation of the DL relay after 7 digits are received on all interchangeable codes (relay CMB operated). The DL starts the DT digit timer. If another digit is not received within 3.5 seconds (nominal), the timer times out causing operation of relay DT and in turn MST for marker start. If instead another digit is received before time-out, the register must receive ten digits before calling for the marker. Where prefix digits are required for initiating toll calls, and home NPA toll traffic is handled on a 7-digit basis, back contacts of the 11B and/or OPl relays can be cross-connected to cause the immediate operation of relay DT on locally assigned interchangeable codes. In this case, the operation of DL via the operated CMB relay will close an operate path to DT after seven digits on local calls. If instead, the interchangeable code dialed is a toll code within the home NPA, the call must be prefixed by 0 or 1, thus opening this operate path to DT. In this case, the operation of DL will cause timing as previously explained. For operation with the arrangement requiring the dialing of prefix digit 0 or 1 on all 10-digit calls and where digit timing is not used on interchangeable codes, two sets of transfer contacts on the OPl and 11B relays are involved. These contacts are equipped with cross-connection terminals designated OPl-OP6, and 11F-11K, respectively. Only the back contacts of these transfers are involved in operation. The first set of these contacts is cross-connected to provide two separate operate paths for the MST relay after seven digits. One path is controlled by front contacts of the HS, CMB, RA1, and DT relays, for normal 7-digit treatment of interchangeable local codes without timing. The other path is controlled by contacts of HS and CMC relays to cause marker start after seven digits if an area code is dialed without prefix zero or one. The second set of OPl and 11B contacts provide an operate path for relay DT under control of front contacts on relay DL. On noninterchangeable local codes, MST is operated after 7 digits over the basic setting path involving back contacts of the CM3, CMC, and CMB relays. On nonprefixed interchangeable local codes, relay DL is operated over the path involving front contacts of CMB and back contacts of OPl and 11B, to the 7-digit ground source at HS. The operation of DL causes the immediate operation of relay DT. In turn, the operating ground for DL is transferred, causing the operation of MST. On prefixed interchangeable codes, all MST operate paths via the 7-digit ground source are opened by

operation of the OPl, 11B, or CMB relays, and ten digits must be dialed for marker start. With the CMC indication from the pretranslator, noninterchangeable NPA codes require ten digits if the prefix 0 or 1 is dialed. Without this prefix, MST operates from the 7-digit ground source via front contacts of CMC and the back contacts of OPl and 11B. Where this arrangement is provided with timing on O+ interchangeable calls, the operate path for MST on noninterchangeable local codes is over the basic setting path as previously described. On nonprefixed interchangeable local codes, relay DL operates via the operated CMB relay after seven digits, causing DT and in turn MST to operate. On interchangeable codes prefixed by 0, the operate circuit of DT is opened by OPl and timing for additional digits occurs instead.

4.44 Another register arrangement, which also requires dialing of the 0 and 1 prefix digits on 10-digit POTS calls, is provided on an "A&M Only" basis without digit timing on interchangeable codes. With this arrangement, the register must inform the pretranslator whether or not the prefix digit has been dialed prior to the code. The register signals the pretranslator over lead CMA if no prefix has been dialed, or lead CMB for prefix dialed. This ground signal over lead CMA operates pretranslator relay LT, and over lead CMB, relay 11X. Contacts of these relays are arranged in the pretranslator for returning one of two possible translations for each local or NPA code.

4.45 These translations to the register are as follows:

- (a) CM3 - on N11 codes; nonprefixed non-interchangeable NPA codes; and prefixed noninterchangeable local codes (3-digit calls).
- (b) CMC - on all prefixed NPA codes (10-digit calls).
- (c) Basic Setting - on all nonprefixed local codes (7-digit calls).

4.46 For operation, transfer contacts of the OPl and 11B relays are inserted in the CMA and CMB leads for providing the

appropriate prefix or no prefix indication to the pretranslator circuit. This circuitry also includes contacts of DDBA, where CCSA traffic, having network office codes similar to those of the Bell System, is handled. Transfer contacts of the ID and IDA relays are included here, if the register functions with an IDDD pretranslator, for preparing the normal operate paths of relays CMA and CMB on IDDD calls. The translation leads grounded to the marker with this arrangement are FAC and LT1 or LT2 for 10-digit calls, and OR and LT for local calls. With this arrangement, home NPA toll calls require ten digits.

LOCAL SERVICE CODES X11

4.47 Where X11 local service codes are used and a pretranslator is not provided, the X11 translator consisting of relays SBO, SB1, SCO, and SC1 is provided in the register. All four of these relays are operated if the digit 1 is dialed or keyed for both the B and C digits. Relay SC1 is the last of the four to operate.

4.48 In circuits with option XM provided, operation of SC1 transfers ground from the LT lead to lead X11 of the marker connector circuit. A front contact of SC1 also operates relay MST to cause a marker to be seized.

4.49 With option XN provided, the LT lead remains grounded. In this case, translation of the X11 service call takes place in the local translator of the marker.

4.50 The operate circuit of SC1 may include a break-contact of relay 11B; a break-contact of relay 11C; or neither of the two depending on the option provided. In the first two cases, the break-contacts of 11B and 11C are used to disable the X11 translator when an access digit 1 or foreign area prefix digits 1-1, respectively, are keyed or dialed. This prevents the call from reaching a service operator in some foreign area if the X11 code is erroneously preceded by access digit 1 or 1-1.

4.51 Where TC option is provided, however, both the 11B and 11C contacts are omitted in the operate path of SC1. This is required for dialing 1-411 local NPA information.

SERVICE CODES 11X

4.52 As explained in the paragraph on the prefix counter 11X service codes require the use of the prefix counter relays 11A, 11B, and 11C and ZA wiring. Relay 11C will operate to provide an operating circuit for MST when relay BS operates at the end of the A digit.

INFORMATION CODES

4.53 Determination of the number of digits to be received on 1-411 local numbering plan area, NPA, information and NPA-411 foreign NPA information calls is as follows.

(a) The digits 411 following access digit 1 are translated by the X11 translator as described in X11 LOCAL SERVICE CODES. Operation of relay SCl of the X11 translator will ground terminal MST1 through relay RA1 operated to initiate marker action.

(b) On NPA-411 information calls where no conflict exists between a local and foreign area code, relays MSTA and A411 perform the translation as described in 10.14 through 10.18. After the sixth digit is registered, a marker is seized by operation of relay MST through a front contact of A411 and relay GS operated.

ZERO OPERATOR CALLS

A. Call Originated by Dial Customer
(No PPCS)

4.54 If the customer dials zero for the A digit, ten pulses will be transmitted, and when counting relay P1 releases at the start of the tenth open pulse with P3 and P5 operated, the manual (MAN) relay will operate through AS operated. When RA1 operates to record the digit on the A-digit, register MST will operate.

B. Call Originated by TOUCH-TONE
Customer

4.55 If the customer keys zero for the A-digit, the PB receiver will cause the operation of the Y9 and Z2 translating relays and the STR steering relay. These relays operated close a path to operate MAN. When RA1 operates at the end of the keyed digit, MST will operate.

C. When Zero Prefix Counter, PPCS, is
Provided

4.56 Where the zero prefix counter is provided, OP and OP1 operate if the first digit is zero. The OP provides ground to operate the DL relay when RA1 operates at the end of the digit. In order to obtain zero operator service the customer must wait for the DT time-out. When DT operates the MAN relay operates through a front contact of OP to the DT ground. When the MAN relay operates, the A4 and A7 leads are grounded and the circuit to operate MST is closed.

MANUAL CALLS

4.57 Certain lines may be equipped for manual calls in which case the register receives no dialing or keying. Instead, it creates an artificial zero for the A digit and connects to a marker.

4.58 The MAN class relay operates from the dial tone marker through the F relay. The MAN locks and connects ground to the A4 and A7 leads to the marker connector. When the marker has established the dial tone connection, relay F is released allowing operation of L, SR, and ON1. With MAN operated, ON1 operates MST to cause the connection to the completing marker for setting up the call to the operator. The connection through the ON1 contacts insures that the call is not abandoned and that the dial tone marker has released before the connection is made to the completing marker. The connection through S1 insures that on a test call the master test frame connector will have released from the dial tone function before it is needed for the completing marker function.

STRAIGHTFORWARD CALLS TO MANUAL A OR
B POSITIONS

4.59 If a manual office is not equipped with call indicator equipment, calls may be completed from the number 5 office to the manual office on a straightforward basis, that is, the customer may dial or key a 1-, 2-, or 3-digit code which will cause his line to be connected to a trunk to the manual switchboard, and in response to the operator request, he will then announce the called number over the trunk. The operator will complete the call.

4.60 One plan for establishing these calls makes use of otherwise unused X11 or 11X service codes. The circuit operates as previously described for these codes engaging a marker after the X11 or 11X service code has been registered.

4.61 On calls from coin lines to X11 or 11X service trunks, or straightforward trunks the register will return the coin before engaging the marker if App Fig. 11 is used.

4.62 A second plan makes use of the connection through the contacts of the A- and B-digit translator relays. For example, ground would be connected to the AA2 to AA9 terminals corresponding to the single digit number assigned for calling the manual switchboard, and the corresponding AB2 to AB9 terminals would be connected to terminal MST or MST1. The MST1 terminal would be used if, on coin lines with App Fig. 11, the coin were to be returned by the register before engaging a marker and MST if the coin were not to be returned.

4.63 Two-digit codes would make use of the A- and B-digit translators and as soon as the TA2/5 and TB2/5 relays operated in the combination assigned as a code for calling the manual switchboard, either terminal MST or MST1 would be grounded. Ground on MST causes marker starts, whereas, ground on MST1 on coin lines with App Fig. 11, causes a coin return to precede operation of MST.

4.64 A third plan makes use of the single code translator of either App Fig. 22, 23, or 24 to recognize one straightforward code of either 3, 2, or 1 digit. In App Fig. 22, six relays are provided, two for each of the digits A, B, and C. The relays and associated leads should be designated with numerical suffixes such that they represent the numbers of the code assigned for calling the manual switchboard. For example, if 248 is the code assigned, the relays would be designated TAO, TA2, TBO, TB4, TC1, and TC7 and the leads AO, A2, BO, B4, C1, and C7. The leads would be connected to the similarly designated digit register leads. When the assigned code has been registered, all of the relays will operate, thus closing a circuit from ground through

series contacts on all six relays to terminal ST. Terminal ST is connected to MST to cause seizure of a marker for establishing a connection from the calling line to a trunk to the manual switchboard or the MST1 to cause coin return on coin lines when App Fig. 11 is equipped prior to the connection to the marker. If any code, other than the assigned code, is registered, one or more of the translator relays will be unoperated to keep this path open.

4.65 Figure 23 and 24 perform the same function as Fig. 22 except that they are used for a 2-digit or 1-digit code, respectively.

SPECIAL SERVICE AND TIE LINE CODES (REGISTER ARRANGED FOR CENTREX FEATURES)

A. Special Codes 11X Within the Centrex

4.66 Where a separate group of registers is required to serve centrex customers and 11X is used for both central office service codes and centrex special codes, the SC1 relay (Fig. 19 and option ZW) is provided. When the preliminary 1-1 has been dialed or keyed, the 11C relay operates, opens the X11 lead to the marker, and causes the SC1 relay to operate. This relay, providing the next digit is a digit 2 through 9, grounds the LT lead to the marker. The SC1 also connects ground to the B0 and B1, C0 and C1, and D7 leads to the marker. If the X digit is a 0, then X11 translator mark plus a 011 will be sent to the marker, where it is treated as a vacant code.

4.67 Where a separate group of registers is required to serve centrex customers and centrex special codes are of the 11X type and central office service codes are of the X11 type, the SC1 relay is not required to translate the centrex special codes. When the preliminary 1-1 has been dialed or keyed, the 11C relay operates, grounding the 11 lead to the marker.

B. Special Codes 1XX Within the Centrex

4.68 Where a single group of registers is required to serve both centrex and central office customers, the centrex special codes are of the 1XX type and the

central office service codes are either the 11X or X11 type. When the one of the 11X code has been dialed or keyed, the 11A relay operates, grounding the 2DT lead to the marker. No provision is made for using the ten codes starting with 10-.

C. Telephone Company Service Codes 11X

4.69 Where the register is arranged for either type of centrex code and telephone company service codes are of the 11X type a directing digit 9 is dialed or keyed initially followed by 11X. The operation of the 11A, 11B, and 11C relays is the same as detailed in a preceding paragraph under PREFIX COUNTER.

D. Telephone Company Service Codes X11

4.70 Where the register is arranged for either type of centrex codes and telephone company service codes are of the X11 type, a directing digit 9 is dialed or keyed initially followed by X11. The operation of the SBO, SB1, SCO, and SCL relays is as described in a preceding paragraph under X11 LOCAL SERVICE CODES. Option YR provides for grounding the 11 lead to the marker for 11X centrex codes.

E. Digit 1 Access Codes

4.71 Where the register is arranged for either type of centrex codes and digit 1 access codes are used to indicate calls outside the local service area, a directing digit 9 is dialed or keyed initially followed by the digit 1 access code and called number. The operation of the 11A and 11B relays is the same as described previously.

ZERO OPERATOR CALLS WITHIN THE CENTREX GROUP

4.72 With the register arranged for centrex service and if a centrex customer dials a 0, at the beginning of the ninth pulse the DD9 relay will operate. This momentarily disables the A2 and A7

leads to prevent the 9 from being registered and also releases the P2A relay. However, on the tenth pulse the MAN relay operates. This relay releases the DD9 relay previously operated on the ninth pulse and reoperates the P2A relay.

SUMMARY OF SPECIAL CODES, SERVICE CODES, AND CENTREX DIALING OR KEYING

4.73 Where a separate register group is required for centrex customer (special centrex and tie line codes are 11X type) X refers to any number 0 to 9; N refers to any number 2 to 9.

TELEPHONE COMPANY SERVICE CODES ARE 11X			
Option in Register	Code Dialed or Keyed	Translator Mark	Marker Receives Digit A B C D
Fig. 19 Options	11N	LT	N 1 1
ZU	911N	11	N
YS	TH,H,T,U	X11	TH H T U
	9N11	LT	N 1 1
	9ABC	LT	A B C
Fig. 19 Options			
ZU	91ABC	LT1	A B C
YS			
XS			
TELEPHONE COMPANY SERVICE CODES ARE X11			
Option in Register	Code Dialed or Keyed	Translator Mark	Marker Receives Digit A B C D
Fig. 19 Options	11N	11	N
ZU	911N	11	N
ZR	TH,H,T,U	X11	TH H T U
YR	9N11	LT	N 1 1
	9ABC	LT	A B C
Fig. 19 Options			
ZU	91ABC	LT1	A B C
YR			
XS			

4.74 Where same register serves both centrex and regular telephone customers:

TABLE C

	Type of Code	Code Dialed or Keyed	Translator Marks	Marker Receives Digits											
				A	B	C	D	E	F	G	H	J	K		
FROM CENTREX CUSTOMERS	Centrex Tie Line or Special Code	1XX (except 10X) + variable number of digits.	2DT, OR	X	X	(+ variable number of digits)									
		10	2DT, OR	O											
	Centrex Extensions	TH H T U N TH H T U	X11, OR FVD, OR	TH	H	T	U								
	Centrex Private Line Network	8 NNXXXXXX 8 N O/1 XNNXXXXX	LT3, OR LT3, FAC	N	N	X	X	X	X						
FROM CENTREX OR REGULAR TELEPHONE CUSTOMERS (CENTREX LINES REQUIRE PREFIX 9)	Telephone Company Customer Codes	NNXXXXX N O/1 XNNXXXXX	LT, OR LT, FAC	N	N	X	X	X	X						
	Digit 1 Access	1 NNXXXXXX 1 N O/1 XNNXXXXX	LT1, OR LT1, FAC	N	N	X	X	X	X						
	Person-Person Collect Special	O N N XXXXX O N O/1 XNNXXXXX	LT2, OR LT2, FAC	N	N	X	X	X	X						
	Telephone Company Service Codes Incl Local Info	11N or N11	11, OR LT, OR	N											
	Local NPA Info	1 4 1 1	LT1, OR	4	1	1									
	Foreign NPA Info Special Code	N O/1 X 4 1 1 O-0	X11, FAC LT2, OR	N	O/1X	4	1	1							
	Unassigned Codes	1-0 0-1	LT1, OR LT2, OR	0 1											

Note: With certain options NNO codes and/or NNX codes may be used as NPA codes as well as NO/1X.

5. SELECTION OF COMPLETING MARKER - RELEASE OF REGISTER

GENERAL

5.01 A connection is made to a completing marker by means of a marker connector when all the digits for the call have been registered or as a result of a permanent signal or partial dial time-out. In some

cases a 2-party test or a coin test is made before the connection is established. The register transfers to the completing marker information concerning the locations and class of service of the calling line and the called code and number. The completing marker then proceeds with the set up of the connection. When the completing marker has selected a path between the calling line and a trunk it causes the register to release the dial tone connection between

the calling line and the register. However, the marker holds the register so that it can retain the calling line location. The connection between the calling line and the trunk is then set up and followed by the operation of the marker release (MRL) relay of the register, causing the connection between the marker and the register to be released, and the register to be restored to normal.

SEIZURE OF COMPLETING MARKER

5.02 When all the digits for the call have been registered, ground will be connected to the lead associated with terminal MST or, in certain cases, to the lead associated with terminal MST1. If the connection is to MST the MST relay will operate but this will be preceded by coin test for calls from dial-tone-first loop-start coin lines or by the second 2-party test for calls for 2-party lines. If the connection is made to MST1 and the coin return Fig. 11 is provided a coin return cycle will be made and followed by the operation of MST. If a loop-start dial-tone-first coin line is being served, a coin test will precede the coin return cycle.

5.03 Relay MST releases TMB to recycle the TM timer and starts the connection to the marker by connecting ground to lead TM to start the marker connector timer and battery to the connector battery supply (CBS) lead and the ST lead. The battery on the ST lead causes the connector to establish a multiple lead connection between the register and the completing marker.

5.04 Relay MST also closes a circuit to RAL to prevent any further release of RAL due to additional dialing or keying and operates the auxiliary relay MST1. The MST1 opens the path from the front contact of L to the counting relays to prevent any further registration due to additional dialing; opens the circuit to STRA to prevent any further operation of STRA due to additional keyed digits; disconnects the ground from the translating contacts of the P- relays; disconnects ground from the translating contacts of the Y- and Z- relays; opens the circuit to OVL to insure that the timer functions on a nonoverload basis; opens the circuit to release the partial dial (PD); relay and grounds through the steering relay chain the single lead 7 for

the digit 1 beyond the last registered digit. The MST1 also prepares a circuit for operating RL from a contact of TM so that a time-out will cause operation of RL and release of the register.

5.05 The MST1 will operate prior to MST on calls from 2-party lines, when it operates at the start of the second party test and, on dial-tone-first loop-start coin lines, when it operates at the start of coin test and, on calls when a coin return with App Fig. 11 is made, when it operates at the start of coin return. In these cases MST1 operates to prevent any further dialing or keying from being registered.

RELEASE OF DIAL TONE CONNECTION

5.06 When the completing marker has performed its other functions and is ready to set up the connection between the calling line and the trunk, it must first release the dial tone connection between the calling line and the register. The completing marker grounds lead RL causing operation of the release relay RL. The RL locks, opens the tip and ring leads so that an inductive load will not be broken at the crosspoint contacts used in the dial tone connection, and opens the sleeve lead to release the dial tone connection. Shortly after seizure of the marker connector, the ground on lead TM was returned on lead L to hold the L relay which, in turn, holds SR to prevent release of the register.

RELEASE

5.07 When the completing marker has completed the connection it grounds lead MRL operating relay MRL. The MRL locks under control of MST, opens the TM lead to start release of L and opens the ST lead to cause release of the connector and the completing marker. The L releases, releasing SR and, in turn, ON1 and ON which open the off-normal ground leads, thus releasing all of the relays of the register. In some cases several relays release in cascade; for example, ON will release a digit steering relay, which releases MST, which releases MRL. The register is now ready for another call, and indicates that it is idle by closing the FT and BT leads.

6. TWO-PARTY IDENTIFICATION TEST

GENERAL

6.01 On calls from 2-party message rate lines, or 2-party flat-rate lines in offices arranged for AMA, a party identification test is made before dial tone is transmitted and another test is made after dialing or keying has been completed before the completing marker is engaged. Two tests are made to reduce the possibility of a false identification. The register informs the marker of the results of the two tests and the marker then indicates to the trunk or the transverter, by way of the sender, which party to charge. If the results of the two tests do not agree, the marker blocks and causes a trouble record.

6.02 The distinction between the parties is that the switchhook contacts of the tip party subset connect ground through the ringer winding to the tip wire when the receiver is off the hook, whereas no direct current ground is connected at the ring party station. The register tests for the presence of this ground are made by applying 48 volts through a relay winding to both tip and ring wires at the central office.

6.03 Apparatus Fig. 12 is used when the resistance of the tip party station ground is approximately 1000 ohms, and App Fig. 13 is used when the resistance of the tip party station is greater than 100 ohms.

FIRST TEST - APP FIG. 12

6.04 This test is made using a single timed interval, with the test relay connected to the line on register seizure and any operation of the test relay construed as a tip party call.

6.05 When the register has been selected by a dial tone marker on a call from a 2-party line, the marker will operate relay 2P, by grounding the 2P lead through the trunk link connector circuit and a contact of the F relay, 2P locks to an ON ground. The 2-party test (TPA) relay operates through a contact of 2P and a contact of F, and locks under control of a break-contact of the timing relay TPT. The TPA disconnects the L relay and tone coil from the ring and tip leads and connects these leads through the winding of the test

relay TP to battery. When the dial tone connection is established, the calling line will be connected to the TP relay instead of to the L relay and tone coil. However, the S1 relay will be held by a contact of TPA, so that the register will not release while the party test is being made.

6.06 If the line is grounded, indicating that the tip party is calling, TP operates, operating TPT1. The TPT1 locks and connects ground through a winding of the tone coil to the tip and ring of the line to reduce the current in the tip party ringer, so that when the current is interrupted by disconnection of the TP relay, the self-induced voltage will not be high enough to cause bell tapping at the ring party station.

6.07 The TPT tube, TPT relay, and associated network constitutes a timer which times the application of the test relay to the line. The TPT tube has characteristics such that it will not pass current until its gas becomes ionized and the application of 130 volts across terminals 2 and 4 is insufficient to cause ionization. It will ionize, however, if a voltage of 72 volts, nominal, is applied across the control gap terminals 1 and 4. The voltage at the control terminal is equal to that on the capacitor TPT and the charging time of the capacitor is proportional to the size of the capacitor and the size of the charging resistor. Once the gas is ionized current will flow between terminals 2 and 4 to cause operation of the associated relay. After ionization the control terminal no longer can exercise any control and the circuit must be opened or the voltage reduced to stop the current flow.

6.08 The TPA connects the grounded TPT relay winding to the No. 4 terminal of the TPT tube and to one side of the TPT capacitor thus completing a charging path. At this time, however, F is operated and maintains a 1000- Ω discharge shunt on the capacitor preventing any charge. When F releases after the dial tone connection has been established this shunt is removed allowing TPT to charge to the 130-volt potential through the TPT3 resistor. The charge on the capacitor will reach 72 volts in approximately 250 ms and the tube will

ionize causing operation of the TPT relay. The TPT releases TPA to disconnect the TP from the tip and ring leads and to connect these leads to the tone coil and the L relay. The L operates over the loop and operates SR and ON1 and takes over supervision of the register. The TPA also opens the circuit to TPT, thus extinguishing the tube, closes a discharge path for the TPT capacitor, and opens the circuit to S1. When S1 releases, the register is under supervision of L and SR.

6.09 The time of the TPT timer is 190 ms minimum, 350 ms maximum, which is sufficient to allow the release of the FA-relay of the trunk link circuit and for operation of TP and its auxiliary TPl. If TPl operates, the TP lead to the marker will be grounded indicating a tip party station and if TPl remains normal, the RP lead will be grounded indicating a ring party station.

SECOND-PARTY TEST - APP FIG. 12

6.10 The circuit for operating the MST relay is wired through transfer contacts of the 2P relay, so that on non 2-party calls the operation of MST is not interfered with, but on 2-party calls, the TPB relay is operated instead of MST when dialing or keying has been completed. The TPB operates MST1 to prevent further digit registration and to cause ground to be connected to the proper -7 lead as a digit-end signal, transfers the circuit from the contact of TP from the TPl winding to the TP2 winding, closes a holding circuit for the L relay through the HL2 resistor to ground, and operates TPA. The TPA disconnects the L relay and tone coil from the tip and ring leads and connects these leads to the TP winding for a second 2-party identification test. If the tip lead of the line is grounded, TP operates to operate TP2. The TP2 performs the same functions described for TPl. The reoperation of TPA again starts the TPT timer by removing the discharge shunt from the TPT capacitor and connecting the tube and capacitor to the grounded TPT relay. The TPT relay will operate in approximately 250 ms. The TPT locks on an early make-contact to a make-contact of TPB and releases TPA to extinguish the tube and discharge the capacitor and to disconnect the TP from the tip and ring leads and reconnect these leads to the tone coil

and L relay. With TPB and TPT operated and TPA normal, the operating ground for TPB is closed to operate MST. The MST opens the local holding circuit for L, again placing L under control of the customer line and causes a completing marker seizure in the usual manner.

FIRST-PARTY TEST - APP FIG. 13

6.11 Since the tip party station ground may be a reasonably high resistance, the test relay must be quite sensitive and for this reason a polarized relay with an electrical bias is used. In earlier registers, this relay has a biasing spring to cause the armature to make with the back contact with no current in either the primary or secondary windings. In later registers, this relay is of the mercury contact type requiring no mechanical adjustments. In either case, operation of the relay depends on the balance of the ampere turns in the two windings. The secondary winding is connected in a direction to hold the relay unoperated while the primary winding is connected in a direction to cause the relay to operate. The resistor, in series with the secondary or bias winding, is such that the primary winding will cause operation of the relay when it is connected to a line which has a 3640 ohm \pm 10-percent ringer connected to ground at a customer station. Since the TP relay is quite sensitive it may falsely operate initially when connected to the line through the capacitor in the ringing bridge of the ring party station. For this reason the test is made in two stages. First the TP is connected to the line and then, after a timed interval during which TP may operate and release if a ring station is originating the call, the contacts are enabled and, if TP is operated, its auxiliary relay TPl is operated and locked as an indication that the tip party station originated the call.

6.12 When the register has been selected by a dial tone marker on a call from a 2-party line, the marker will operate relay 2P by ground over the 2P lead through the trunk link connector circuit and a contact of the F relay. The 2P locks to an ON ground. The TPA relay operates through a contact on 2P and a contact of F, and locks under control of TPT. The TPD is operated through contacts of F and 2P. The TPD operates TPT. When the dial tone connection has been established the F relay is released

to cause release of the FA- relay of the trunk link circuit to connect the tip and ring of the calling line to the primary winding of the TP relay. The F also opens the circuit to the winding of relay TPD. The TPD is made slow-release by the shunting resistor TPD and allows time for TP to falsely operate on a capacitor surge and to release. When TPD releases, ground is closed to the armature contact of TP and if TP is operated the auxiliary relay TPI will operate and lock indicating that a tip party station originated the call. The TPD in releasing opens the circuit to the winding of TPT. The TPT is made slow-release by its short-circuited secondary winding to allow time for operating TPI, if TP is operated. The release of TPT releases TPA to disconnect the tip and ring leads from the TP relay and to connect these leads to the tone coil and the L relay. The L relay will operate over the loop and will operate SR and ON1 to transmit dial tone and to take over supervision of the register. The TPA releases S1 to allow L and SR to assume supervision. The TPA which, in turn, operates TPT to prepare these relays for the second party test.

6.13 If TPI operates during the test it connects ground through a winding of the tone coil to the tip and ring leads of the line to reduce the current in the tip party wires so that when the current is interrupted by disconnection of the TP relay, the self-induced voltage will not be high enough to cause beeping at the ring party station.

SECOND-PARTY TEST - APP FIG. 13

6.14 The circuit for operating the MST relay is wired through transfer contacts on the 2P relay so that on non 2-party calls the operation of the MST relay is not interfered with, but on 2-party calls the TPB relay is operated instead of MST when dialing or keying has been completed. The TPB operates MST1 to prevent further digit registration and to cause ground to be connected to the proper -7 lead as a digit-end signal, and transfers the front contact of the TP relay from the winding of the TPI relay to the winding of the TPB relay. The TPB closes ground through the RL2 resistor to hold the L relay in local circuit and operates TPA to disconnect the L and tone coil from the ring and tip leads

and to connect these leads to the primary winding of the TP relay. The TPA opens the circuit to TPD which is slow-release to allow TP to falsely operate on a line surge and to release. When TPD releases, it connects ground to the armature of TP to cause operation of TP2 if TP remains operated to the tip station ground and opens the circuit to TPT. The TPT is slow-release to allow time for the operation of TP2. When TPT releases, it operates TPC to connect the ground which operates TPB to the MST winding causing MST to operate and start the connection to the completing marker. The TPC releases TPA to disconnect the TP from the tip and ring leads and to reconnect these leads to the tone coil and L relay. The TPA, in releasing, reoperates TPD to disconnect the local circuit holding path of the L relay to again place L under control of the subscriber line. The TPD also reoperates TPT. If TP2 operates it duplicates the functions described for TPI.

TWO-PARTY INDICATIONS - APP FIG. 12 AND 13

6.15 The marker will be informed of the results of the two tests by means of the TP and RP leads. If both tests indicate that the tip party is calling, lead TP will be grounded and RP open. If both tests indicate that the ring party is calling, lead RP will be grounded and TP open. If the tests do not match both leads will be grounded and the completing marker will not complete the call but will cause a trouble record instead.

TESTS OF TP RELAY - APP FIG. 12 AND 13

6.16 In order to make sure that the TP relay retains its adjustment, an operate test and an open circuit release test of the relay is made on all calls from 2-party lines. The locking path of ON1 is closed through front contacts of 2P and back contacts of TP2 and TPI so that if 2P is operated either TPI or TP2 must operate to allow release of ON1. If neither of these relays has operated during the call, an operate current flow test is applied to TP before the release of the register to cause operation of TPI or TP2.

6.17 When the RL relay has operated to release the dial tone connection and the L relay has released after the completing

marker has released, ground is connected through the TP resistor to the winding of TP. The TP operates if its adjustment is within requirements to operate its auxiliary relay. The TP usually will operate relay TP2, but on abandoned calls may operate TP1. If the relays fail to operate, ON1 will remain operated and the register TM timing circuit functions to cause an alarm. However, if TP had already operated on the first line test, TP1 would be already operated, and the current flow test of the TP relay would not be required. When App Fig. 13 is used, the ON1 relay is also locked to a back contact of TPT so that a check is made that TPT operates on each 2-party call.

6.18 The open circuit release of the TP relay is checked as follows. The TP relay armature contact is connected to solid ground and if TP is operated it will hold TP1 operated at the end of the call. The locking circuit of TP1 is supplied by ON1 and by the same contact which holds ON so that the ground through the falsely operated TP will hold TP1 and through the contacts of TP1 will hold ON. This will prevent release of the register and the register TM timer will function to cause an alarm.

7. COIN LINES

COIN-FIRST - GROUND START - APP FIG. 8

7.01 When the register functions with coin first ground start coin lines, on which the register returns coins only on abandoned calls and permanent signals, the coin option of App Fig. 8 is provided. When the register is connected to a coin line by the dial tone marker the CN class relay operates from the marker through the trunk link circuit and the F relay. The CN locks and controls two functions. First it provides for reducing the line current required for operating the L relay and, second, it provides for application of coin return battery to the tip of the line on abandoned calls and on permanent signal calls. The presence of the coin initially is detected by the line circuit, hence, the register does not make a coin test.

7.02 The change in the current requirement of the L relay is made in order to prevent showering, a condition which exists if the line circuit line relay operates on

a value of current lower than that which will operate the register L relay. If this condition exists and a critical leak condition appears on the line, the line circuit will operate to cause the dial tone marker to connect the line to a register. The register L relay will not operate and the register releases, reconnecting the line back to the line circuit and the action repeats. To prevent this recurring action, the L relay is arranged to operate on any line that will operate the line circuit line relay. To compensate for the differences in the line circuit relays for coin lines, the CN relay is arranged to close ground to the LB resistor so as to provide a limited number of ampere turns in the L tertiary winding in a direction to aid the operation of the L when connected to coin lines.

7.03 Relay CN also establishes circuits for operating the coin return (CR) relay in case the call is abandoned or a time-out occurs without any digits having been recorded. On an abandoned call the CR will operate from ground through a back contact of SR. On a permanent signal time-out CR will operate from ground through a front contact of TM1 and a back contact of PD.

7.04 On a partial dial time-out the customer will be connected by the marker to a tone trunk which will cause the coin to be returned when the customer hangs up.

7.05 Relay CR causes operation of MST1 to prevent any further registration; opens the circuit to MST to prevent marker seizure during the coin return cycle; disconnects the L relay from the ring lead and connects L to the local holding circuit through the secondary winding of the tone coil if SR is operated; and connects the tip lead to the coin return circuit. The coin return battery is not connected to the tip lead until MST1 operates in order to insure that this battery will not be connected momentarily to the L winding during the operation of CR.

7.06 Relay CR also starts the coin return timer which consists of the CR1 tube, CR1 relay, and associated network. The CR1 tube has characteristics such that no current will pass between terminals 2 and 4 unless the gas in the tube is ionized and a voltage of 130 volts across these terminals

is insufficient to cause ionization. The tube will ionize, however, if a voltage of 72, nominal, is connected across terminals 1 and 4. Once the gas is ionized current flows between 2 and 4 creating a voltage drop of 75 volts, nominal, and the control anode No. 1 loses control. The tube can be extinguished only by opening the circuit or by reducing the voltage across terminals 2 and 4. The voltage across the control gap is equal to that on the CRL capacitor and this is controlled in time by the size of the capacitor and the charging resistor. The CR disconnects a discharge shunt from the CRL capacitor and connects one side of the capacitor and the No. 4 tube terminal to the grounded CRL relay. The capacitor starts the charge to the 130-volt potential. After an interval of 460 minimum, 590 nominal, and 900 maximum ms, the CRL relay operates. The CRL locks to 130 volts through resistor CR9 which drops the voltage across the tube sufficiently to extinguish it, disconnects the coin return potential from the tip lead, and starts the CR2 timer which times an interval during which the line is left open to allow release of the coin magnet. Operation of the CR2 timer is similar to that of CRL, and CR2 operates 440 minimum, 560 nominal, and 870 maximum ms, after CRL. The time of the CRL timer is slightly longer to allow for the delay in the connection of the return battery to the line by the operating time of MST1.

7.07 The CR2 locks to 130 volts through resistor CR8, and extinguishes CR2 tube, releases CR and causes the operation of RL to release the register if the call had been abandoned, or causes operation of MST if the coin return had been made as a result of a permanent signal time-out. The CRL is released by CR, but CR2 holds to ON1 until release of the register.

7.08 The CR capacitor and CR resistor are connected to the tip lead during coin return to absorb the inductive energy of the coin magnet so as to prevent an excessive voltage rise when the coin return potential is disconnected.

COIN-FIRST - LOOP-START - APP FIG. 9

A. General

7.09 When the register is required to function with coin-first coin lines in an office where a register is connected

to the coin lines as a result of a switch-hook closure, even though the coin is not deposited, the coin option of App Fig. 9 is provided and the test for the presence of coin is made in the register. Dial tone will not be transmitted until the register is satisfied that the coin has been deposited.

7.10 The presence of a coin at the coin station causes the coin magnet of 1020- Ω resistance to be connected to the tip conductor. Some telephone sets have an additional relay in series with the coin magnet. The line is tested by the coin line supervisory relay which operates on a circuit through the loop with or without the ground connection and the ground test relay GT which operates only if the line is grounded. If the GT relay does not operate the call is treated as a permanent signal.

B. Supervision - CLR Relay - App Fig. 9

7.11 When the register is connected to a coin line by the dial tone marker, the CN class relay, shown in App Fig. 11, is operated from the dial tone marker through the trunk link circuit and the F relay. The CN locks to an ON ground and operates the coin test relay CNT1. The CNT1 disconnects the L relay and tone coil from the ring and tip leads and connects these leads to the GT and CLR relay windings and associated resistor network and connects the negative 130-volt potential to this resistor network. The resistor network, consists of two bridge circuits so proportioned that a potential of approximately -90 volts is connected to the ring windings and approximately -40 volts is connected to the tip windings. The currents through both windings of CLR tend to operate the relay and CLR will operate if the switch-hook contacts are closed with or without the coin magnet ground. The tertiary winding of CLR is a bias winding and is energized in a direction to hold the relay normal. This winding aids in releasing CLR when the switchhook contacts are open even though some current flows in the windings due to line leakage.

7.12 The operation of CLR causes the operation of CNT2 which, in turn, operates L, SR, and ON1; CNT2 opens the dial tone supply circuit to prevent transmission of dial tone until the coin test is satisfied and the local operating and holding circuit for L is disconnected. The CNT2 is made

slow-release to prevent its release if the contact on CLR is momentarily opened due to frame vibration or to transients when the coin is deposited. The L and SR hold the register as on a noncoin call. If the customer disconnects CLR will release to release CNT2 which releases L and SR to release the register as on any abandoned call.

C. Ground Test - GT Relay - App Fig. 9

7.13 The windings of the GT relay have equal turns and are connected differentially so that with no ground connected to the line the ampere turns of one winding will cancel those of the other winding. However, when the coin magnet is connected to the tip lead by the deposit of the coin at the station this balance is upset and the current in the ring or secondary winding is increased while that in the tip or primary winding is decreased, causing the relay to operate. The GT operates its auxiliary relay GT1 which locks. The GT1 is slow-operate to prevent its operation if GT falsely operates momentarily on a line surge. The GT1 recycles the TM timer and releases CNT1 which disconnects the line test relays from the tip and ring leads and connects these leads to the tone coil and to the L relay. The GT and CLR release and CLR releases CNT2 to disconnect the local circuit operating and holding path for L and to close the dial tone circuit. Since GT1 is a slow relay, a make-contact is wired to the ON winding to insure that GT1 releases before the register releases. This insures that the register cannot be resealed with GT1 operated.

7.14 A back contact of CN paralleled by a front contact of GT1 is inserted in the part of the MST operating circuit controlled by the MAN operator relay to insure that a coin has been deposited before MST is operated on a manual coin class of call.

7.15 If the coin is not deposited, the register timing circuit will function to cause the marker to connect the calling line to a permanent signal trunk.

DIAL-TONE-FIRST - LOOP-START - APP FIG. 7 AND 10

A. General

7.16 This coin option is assigned to two apparatus figure numbers because of a separated equipment mounting arrangement.

When the register is required to function with dial-tone-first loop-start coin lines, the register is connected to the coin line as a result of a switchhook closure even though no coin is deposited and the customer receives dial tone and can dial the desired number.

7.17 The call from the coin line proceeds in the same manner as a noncoin call until dialing has been completed. At this point the ground which normally operates MST is transferred by the operated CN relay, shown in App Fig. 11, to cause operation of the coin test (CNT) relay. The CNT closes a circuit to hold RAL to prevent any further registration and operates CNT2 which, in turn, operates MST1. The circuit to CNT2 is closed through a make-contact of TMB to insure that the TM timer is recycled at the start of the coin test. The CNT2 closes a local circuit holding path for L through contacts of SR and operates CNT1. The CNT1 disconnects the tip and ring leads from the tone coil and L relay and connects these leads to the windings of the GT and CLR relays and recycles the TM timer.

7.18 The presence of the coin at the coin station causes the coin magnet of 1020-Ω resistance to be connected from ground to the tip conductor. Some telephone sets have an additional relay in series with the coin magnet. The CLR is the coin supervisory relay and will operate on the current through the switchhook contacts with or without the ground connection. The GT is the ground test relay and will operate only if the line is grounded.

7.19 An option is provided to permit the use of registers equipped with coin App Fig. 10 to function with ground-start coin lines in addition to loop-start coin lines. The operation with ground-start coin lines which have more sensitive line circuit relays requires that the L relay be made more sensitive so as to operate on a lower value of line current and thus prevent showering. With option V the CN relay closes ground to the LB resistor to provide a limited number of ampere turns in the tertiary of L in a direction to aid the operation of L. A coin test cycle is made on these lines just as it is made on the loop-start lines.

B. Supervision - CLR Relay - App Fig. 10

7.20 The resistor network connected to the CLR and GT relays consists of two

bridge circuits so proportioned that a potential of approximately -90 volts is connected to the ring winding and approximately -40 volts is connected to the tip winding. Current through both windings of CLR tends to operate the relay and CLR will operate if the switchhook contacts are closed with or without the coin magnet ground. The tertiary winding of CLR is a bias winding and is energized in a direction to hold the relay normal. This winding aids in releasing CLR when the switchhook contacts open even though some current flows in the line windings due to line leakage.

7.21 When CNT1 operates as a result of the operation of CNT and CNT2 it opens the operating circuit of CNT2 but CLR operates to hold CNT2. The CNT2 is slow-release and will hold over an open interval between operation of CNT1 and operation of CLR. If at any time during coin test and before the coin is deposited, the customer abandons the call, CLR will release CNT2 and, in turn, L and SR to effect the release of the register.

C. Ground Test - GT Relay - App Fig. 10

7.22 The windings of the GT relay have equal turns and are connected differentially so that with no ground connected to the line the ampere turns of one winding will cancel those of the other winding. However, when the coin magnet is connected to the tip lead by the deposit of the coin at the station, this balance is upset and the current in the ring or secondary winding is increased while that in the tip or primary winding is decreased to cause the relay to operate. The GT operates its auxiliary relay GT1 which locks. The GT1 is slow to operate, to prevent its operation if GT falsely operates momentarily on a line surge.

7.23 The GT1 transfers the operating ground for CNT to MST to cause marker start and to release CNT. The CNT releases both CNT1 and CNT2; CNT1 disconnects the tip and ring leads from the GT and CLR relays and reconnects these leads to the tone coil and L relay and CNT2 opens the local holding circuit for L. The CNT2 is slow-release so that the tip and ring leads are connected to L before the local holding circuit is disconnected. Since GT1 is a slow relay, a make-contact is wired to the ON winding to

insure that GT1 releases before the register releases. This insures that the register cannot be resealed with GT1 operated.

7.24 The operating circuit for MST is wired through TMB contacts to insure that TMB is operated before MST operates. This insures that the operation of MST can recycle the timer.

D. Coin Test Timing - App Fig. 7

7.25 The CT timing circuit, under control of the CNT relay, is provided to time an interval for the deposit of the coin. Upon time-out, it converts the coin station to no-such-number tone or, in later registers, to an announcement system to indicate to the customer that the customer should deposit the coin or abandon the call. If the customer does neither, the TM timing circuit will function to cause release of the register. In this event, the line will be reconnected to the line circuit and will be connected to another register. If the customer takes no further action a time-out by the second register will result in the line being connected to a permanent signal trunk.

7.26 When CNT operates, it enables the CT timer by disconnecting the shunt resistor from the CT capacitor and connecting the capacitor and the CT tube to the grounded CNT3 relay. The CNT3 operates in 3.0 through 4.5 seconds with option RN provided or in 9.3 through 17.5 seconds with RM provided, and locks to the 130-volt potential through the CT resistor, thus extinguishing the tube. This connects the calling station, via the register, to either no-such-number tone, or to the announcement system. If the customer deposits the coin after receiving the no-such-number tone or the announcement before TM operates, relay GT1 operates to complete the connection.

E. Failure of GT Relay to Operate - App Fig. 10

7.27 If a coin has been deposited but the CT relay fails to operate due to poor adjustment or low coin test voltage, the register will remain stuck in the coin test condition. In this case the register will function as described above under 7.25 and

7.26. If the customer does not abandon the call, the register will release when the overall timer TM times out. If the customer abandons the call, the operation of CRA releases CNT1 which extends the tip and ring leads to the coin return circuit so that the coin can be refunded in the usual way. If the customer does not abandon the call, the register will time out and release without returning the coin. The customer will then be connected to another register which will return the coin when the customer abandons the call.

F. Manual or Zero Operator Calls -
Special App Fig. 30

7.28 Where Fig. 30 is provided, coin test is made on calls to manual or zero operators and the marker is summoned with a coin or no-coin-deposited indication.

7.29 Relay MCN of Fig. 30 operates in parallel with MAN when the digit zero is received in the A position and provides a path for operating the CNT relay through a back contact of CNT3. If the coin is present when zero is dialed, the ground test (GT1) relay operates during coin test and starts the marker. If the coin is not present, CNT3 operates after timing 4.5 seconds maximum and causes marker start. The CNT3 grounds lead L0, when normal, and lead L2, when operated, to provide a coin deposited or coin-not-deposited indication, respectively, to the marker.

7.30 Where Fig. 30 is not provided, coin test is bypassed on calls to manual or zero operators.

7.31 Coin test on service calls and to certain free trunks is provided on an optional basis. With option RX provided, the coin test must be satisfied on such calls before the marker can be started. With alternative option RW provided, coin test is bypassed.

G. Dial-Tone-First - Loop-Start -
Special App Fig. 31

7.32 Where this feature is provided by Fig. 31, all other coin apparatus figures must be removed from the register. With Fig. 31, coin test is made on all calls from coin lines at the end of dialing

and the marker summoned whether or not a coin has been deposited. Where the coin has been deposited and detected, as indicated by the operation of the GT and GT1 relays, GT1 provides a coin present indication to the marker by grounding the SCK lead. Where the coin has not been deposited or detected and GT and GT1 remain normal, a coin-not-present indication is provided to the marker by ground on the SCN lead. The marker then takes appropriate action to either complete the call or set the call to a tone trunk which returns the coin.

7.33 After the called number has been dialed, the ground which normally operates MST is transferred by the operated CN relay to cause operation of coin test relay CNT. The CNT holds RAL operated to prevent further registration and operates CNT2 through a make-contact of TMB which insures that the TM timer is recycled at the start of coin test. The CNT2 closes a path to hold the L relay and operates the MST1 and CNT1 relays. The CNT1 disconnects the tip and ring leads from the tone coil and L relay, connects these leads to the windings of the GT and CLR relays, recycles the TM timer, and starts the CT timer.

7.34 The CT timer times for 0.6 to 1.0 second and operates CNT3. The CNT3 then transfers the operating ground of CNT to MST for marker start. The CT timing interval provides time for relays GT and GT1 to operate where the coin is present and detected.

7.35 Figure 31 also provides coin return on permanent signal and abandoned calls. These are the only coin return features provided by the register when Fig. 31 is equipped. Relays CR, CR1, and CR2 are provided for this purpose and the circuit operation is similar to that provided by Fig. 8.

7.36 The CN establishes circuits for operating the coin return relay CR in case the call is abandoned or time-out occurs without any digits having been recorded. On an abandoned call the CR will operate from ground through a back contact of SR. On a permanent signal time-out CR will operate from ground through a front contact of TM1 and a back contact of PD.

7.37 On a partial dial time-out the customer will be connected by the marker to a tone trunk which will cause the coin to be returned when the customer hangs up.

7.38 The CR causes operation of MST1 to prevent any further registration, opens the circuit to MST to prevent marker seizure during the coin return cycle, disconnects the L relay from the ring lead and connects L to the local holding circuit through the secondary winding of the tone coil if SR is operated, and connects the tip lead to the coin return circuit. The coin return battery is not connected to the tip lead until MST1 operates in order to insure that this battery will not be connected momentarily to the L winding during the operation of CR.

7.39 The CR also starts the coin return timer which consists of the CR1 tube, CR1 relay, and associated network. The CR1 tube has characteristics such that no current will pass between terminals 2 and 4 unless the gas in the tube is ionized and a voltage of 130 volts across these terminals is insufficient to cause ionization. The tube will ionize, however, if a voltage of 72, nominal, is connected across terminals 1 and 4. Once the gas is ionized current flows between 2 and 4 creating a voltage drop of 75 volts, nominal, and the control anode No. 1 loses control. The tube can be extinguished only by opening the circuit or by reducing the voltage across terminals 2 and 4. The voltage across the control gap is equal to that on the CR1 capacitor and this is controlled in time by the size of the capacitor and the charging resistor. The CR disconnects a discharge shunt from the CR1 capacitor and connects one side of the capacitor and the No. 4 tube terminal to the grounded CR1 relay. The capacitor starts to charge to the 130-volt potential. After an interval of 460 minimum, 590 nominal, and 900 maximum ms, the CR1 relay operates. The CR1 locks to 130 volts through resistor CR9 which drops the voltage across the tube sufficiently to extinguish it, disconnects the coin return potential from the tip lead, and starts the CR2 timer which times an interval during which the line is left open to allow release of the coin magnet. Operation of the CR2 timer is similar to that of CR1, and CR2 operates 440 minimum, 560 nominal, and 870 maximum ms, after CR1.

The time of the CR1 timer is slightly longer to allow for the delay in the connection of the return battery to the line by the operating time of MST1.

7.40 The CR2 relay locks to 130 volts through resistor CR8, extinguishes the CR2 tube, releases CR and causes the operation of RL to release the register if the call had been abandoned, or causes operation of MST if the coin return had been made as a result of a permanent signal time-out. The CR1 is released by CR, but CR2 holds to CN until release of the register.

7.41 The CR capacitor and CR resistor are connected to the tip lead during coin return to absorb the inductive energy of the coin magnet so as to prevent an excessive voltage rise when the coin return potential is disconnected.

H. Dial-Tone-First - Loop-Start - App Fig. 33

7.42 This arrangement provides dial-tone-first coin features relative to the coin service improvement project. The coin test features of this figure differ from those provided by the other coin figures in several respects. For one, the coin test is made over the tip lead only, with the ring lead opened. For another, timing of the coin test cycle is performed by slow-release relays rather than with an electron tube timing circuit. In addition, coin test is made on all coin calls and the marker called immediately afterward. A coin-present (ground on lead SCK) or coin-not-present (ground on lead SCN) indication is given to the marker on all coin calls.

7.43 The circuit functions as follows. Initially, when the register is seized for coin service, relay CN operates followed by the operation of the CNT2 and subsequently CNT3 relays. The CNT2 is held operated over its operate path and a lock path controlled by the CNT1 relay. The CNT3 is held operated under control of the CNT2 relay. The primary function of relays CNT2 and CNT3 is to release, in sequence, after the called number has been dialed and before the marker is called, thereby timing the coin test interval. Relays CN and CNT3 operated, prepare the register for coin test

by transferring the normal operate path of MST relay to CNT relay. At the end of dialing, CNT operates over this path. The function of CNT is to hold the L relay operated and then start the coin test cycle. The hold on L is needed to prevent its release during coin test. The CNT operated also locks relay RAl and operates relay MST1. This action disables the digit counting and registration circuits. In addition, CNT operates CNT1. With both these relays operated, CNT2 begins to release. The CNT1 operated, transfers the tip lead to ground test relay GT; opens the ring lead to prevent the holding ground on L from backing up through the loop to the GT relay; and recycles the TM timing circuit.

7.44 When GT is initially connected to the external tip circuit, it may falsely operate due to line surge. If a coin has been deposited at the coin station, thereby grounding the tip lead, GT will operate or remain operated if it has falsely operated. If a coin has not been deposited, GT will not operate or will soon release if falsely operated. Since the final state of GT (operated or nonoperated) at the end of the coin test cycle determines the coin-present or not-present indication to the marker, the slow-release of CNT2 covers the period during which GT may falsely operate and release. Relay GT1 records the final state of GT during the slow-release interval provided by CNT3. The operation of GT1 is under control of both GT and CNT2. Once operated, GT1 locks. When CNT3 releases, it reestablishes the marker start circuit, causing operation of relay MST and summoning the marker. The GT1, if operated, grounds lead SCK to the marker and, if normal, grounds lead SCN.

7.45 An operate test of the GT relay is made before the register releases to check that GT is capable of operating under service conditions. This test is made on all coin calls when L releases and RL operates. The register will remain off-normal if GT does not operate. The locking path of ON1 is closed through a front contact of CN and a back contact of GT1 so that if GT and GT1 fail to operate, ON1 will remain operated and the register TM timing circuit functions to cause an alarm.

7.46 Registers equipped with coin Fig. 33 can function in the same marker group having registers equipped with coin Fig. 8 under the following conditions:

(a) Separate coin register groups are provided in the marker group; Fig. 33 registers used in one group for dial-tone-first loop-start coin lines, and the Fig. 8 registers are used in a separate register group for coin-first ground-start coin lines.

(b) Where a single coin register group is provided in the marker group with some registers equipped with Fig. 8 and others with Fig. 33, and all coin lines are coin-first ground-start.

Where tests are performed with the automatic monitor register and sender test (AMRST) circuit, the AMRST circuit must be modified for testing the coin features of Fig. 33 in either of the above cases.

Ground-Start Coin Lines - App Fig. 33

7.47 An option is provided to permit the use of registers equipped with Fig. 33 to function with ground-start coin lines. The operation with ground-start coin lines which have more sensitive line circuit relays requires that the L relay be made more sensitive so as to operate on a lower value of line current and thus prevent showering. With options V and QL, the CN relay closes ground through series resistors LB and LC to provide a limited number of ampere turns in the tertiary of the L relay in a direction to aid the operation of L. A coin test cycle is made on these lines just as it is made on the loop-start lines.

I. Coin Return - App Fig. 33

7.48 Figure 33 provides coin return on permanent signal and abandoned calls. These are the only coin return features provided by the register when Fig. 33 is equipped. Relays CR, CR1, and CR2 are provided for this purpose and the circuit operation is similar to that provided by App Fig. 8 or 31.

7.49 The CN establishes circuits for operating the CR relay in case the call is abandoned or a time-out occurs without any digits having been recorded. On an abandoned call the CR will operate from ground through a back contact of SR. On a permanent signal timeout CR will operate from ground through a front contact of TM1 and a back contact of PD.

7.50 On a partial dial time-out the customer will be connected by the marker to a tone trunk which will cause the coin to be returned when the customer hangs up.

7.51 The CR causes operation of MST1 to prevent any further registration, opens the circuit to MST to prevent marker seizure during the coin return cycle, disconnects the L relay from the ring lead and connects L to the local holding circuit through the secondary winding of the tone coil if SR is operated, and connects the tip lead to the coin return circuit. The coin return battery is not connected to the tip

lead until MST1 operates in order to insure that this battery will not be connected momentarily to the L winding during the operation of CR.

7.52 The CR also starts the coin return timer which consists of the CRI tube, CRI relay, and associated network. The CRI tube has characteristics such that no current will pass between terminals 2 and 4 unless the gas in the tube is ionized and a voltage of 130 volts across these terminals is insufficient to cause ionization. The tube will ionize, however, if a voltage of 72, nominal, is connected across terminals 1 and 4. Once the gas is ionized current flows between 2 and 4 creating a voltage drop of 75 volts, nominal, and the control anode No. 1 loses control. The tube can be extinguished only by opening the circuit or by reducing the voltage across terminals 2 and 4. The voltage across the control gap is equal to that on the CRI capacitor and this is controlled in time by the size of the capacitor and the charging resistor. The CR disconnects a discharge shunt from the CRI capacitor and connects one side of the capacitor and the No. 4 tube terminal to the grounded CRI relay. The capacitor starts to charge to the 130-volt potential. After an interval of 460 minimum, 590 nominal, and 900 maximum ms, the CRI relay operates. The CRI locks to 130 volts through resistor CR9 which drops the voltage across the tube sufficiently to extinguish it, disconnects the coin return potential from the tip lead, and starts the CR2 timer which times an interval during which the line is left open to allow release of the coin magnet. Operation of the CR2 timer is similar to that of CRI, and CR2 operates 440 minimum, 560 nominal, and 870 maximum ms, after CRI. The time of the CRI timer is slightly longer to allow for the delay in the connection of the return battery to the line by the operating time of MST1.

7.53 The CR2 relay locks to 130 volts through resistor CR8, extinguishes the CR2 tube, releases CR and causes the operation of RL to release the register if the call had been abandoned, or causes operation of MST if the coin return had been made as a result of a permanent signal time-out. The CRI is released by CR, but CR2 holds to CN until release of the register.

54 The CR capacitor and CR resistor are connected to the tip lead during coin return to absorb the inductive energy of the coin magnet so as to prevent an excessive voltage rise when the coin return potential is disconnected. A break-contact of CR2 is included in the operate path of CNT2 and CNT3 to prevent their reoperation at the end of the coin return cycle.

7.55 No test is made for coin clearance. When coin return is required on operator and other free calls, this will be done by the trunk to which the call is connected.

COIN RETURN - APP FIG. 11

A. General

7.56 The coin return option of Fig. 11 is provided in connection with the coin test options of Fig. 9 or Fig. 7 and 10, or alone where the coin test feature is not required. The register will recognize any one of the following types of calls and will return the coin before releasing or engaging a marker:

- (a) Abandoned call.
- (b) Call to zero.
- (c) 11X or X11 operators.
- (d) Permanent signal. Calls to certain free trunks.

The coin return may also be made in instructions from the pretranslator. On calls to operators the register makes a test to determine if the coin has cleared the trap and, if it has not, the completing marker will be so informed so that the line can be connected to a stuck coin trunk. This test is canceled on abandoned calls and permanent signal calls because line troubles, which cause permanent signals, may also have the appearance of stuck coins. In case of real stuck coin on a permanent signal the operator can take the necessary action.

7.57 In the case of a stuck register time-out the register releases and the customer is connected to another register by a new dial tone connection where the customer receives permanent signal treatment.

7.58 On calls to straightforward manual operators using App Fig. 14, 15, 22, 23, or 24 for translation, the coin may be returned or not, depending upon whether the cross-connection is made to the MST1 or MST terminal. If the coin is returned, the circuit operation is the same as for X11 or 11X service calls.

7.59 The register may also be required to return the coin on calls, other than those listed above, on which the register cannot recognize the need for returning the coin and must depend upon information from the completing marker for this purpose. Examples are calls to free trunks which are not arranged for coin return and whose code designation does not permit the register to recognize this. In these cases the marker will signal the register to return the

coin and will then release. When the register has successfully returned the coin or has found a stuck coin, the connection to a completing marker will be reestablished and the calling line will be connected to the wanted trunk or to a stuck coin trunk as required.

7.60 Where the special coin Fig. 30 is provided in the register, coin return is optional on calls to 11X and 11L operators, and to certain free trunks as determined by the pretranslator. With option QC provided, the coin return feature is enabled at the end of dialing and following coin test, if provided. Where option W is furnished instead of QC, the coin will not be returned by the register.

7.61 The coin is returned by applying 130 volts to both tip and ring leads for approximately 0.5 seconds. Either positive or negative potential is used as required in the area. This energizes the polarized magnet at the coin station in the direction to move the coin into the return chute. The circuit is then opened for about 0.5 seconds, and then -48 volts through the winding of the S-type relay LT is applied to both leads of the line. This relay will operate if the coin is still in the trap because the coin contact will be closed, connecting ground through the coin magnet winding to the line. It will not operate if the coin has been cleared. About 0.5 seconds after the stuck coin test relay has been connected to the line, ground will be connected to its armature, and will operate either of two relays which will cause the completing marker to be engaged and a connection made to the wanted trunk or a stuck coin trunk as required. On abandoned calls the register and dial tone connection will be released at this point.

B. Coin Return Current Applied

7.62 The CN class relay of App Fig. 11 is operated at the start of the call by the dial tone marker and CN operates the auxiliary relay CN1. The CN1 transfers the part of the circuit, for operating MST, controlled by the operator code translator relays, the pretranslator operates SD relay, and the MST1 terminal, to cause operation of the CR relay instead of MST; transfers

the part of the circuit for operating MST from TMI to cause operation of CRA instead of MST; and transfers the part of the circuit for operating RL from the SR to cause operation of CRA instead of RL. The CRA operates CR and opens the circuit to the LT relay so that no test for stuck coin will be made on abandoned and permanent signal calls.

7.63 Relay CR provides a local holding circuit for L through contacts of SR and connects the tip and ring leads together through contacts of SR and disconnects L from the ring lead on two continuity transfer contacts. The CR also operates MST1 to prevent any further dial pulse registration. The holding circuit of L is closed through contacts of SR to prevent reoperation of L on abandoned calls. The CR operates CRI which disconnects the tone coil from the tip lead and connects the tip and ring leads together and through the CRI resistor and CR resistance lamp to the coin return potential. This energizes the coin magnet at the station in a direction to return the coin. The CRI is slow-operate so that any click, due to the removal of the L relay, will have subsided before the tone coil is disconnected and coin return potential connected.

7.64 The CRI also starts the coin return timer consisting of the CI relay, CRI and CR2 tubes, and the associated capacitor resistor network. The CRI and CR2 tubes have characteristics such that will not pass current unless the gas is ionized and the application of 130 volts across terminals 2 and 4 will not cause ionization. However, the application of 72 volts, nominal, across terminals 1 and 4 will cause ionization and current will then pass between terminals 2 and 4. Once the tube is ionized the control terminal No. 1 loses control and the tube can be deionized only by opening the circuit or by reducing the voltage across its terminals below the sustaining value. The voltage across terminals 1 and 4 is equal to the charge on the associated capacitor and this is controlled in time by the value of the capacitor and the charging resistor. The CRI connects ground to terminal 4 of the CR2 tube, to the winding of the CI relay, and to one side of the CRI and CR2 capacitors, and disconnects the discharge resistor

The CR3 from around the CR1 capacitor. The CR1 capacitor charges through the CR4 resistor, and in 440 minimum, 560 nominal, and 870 maximum ms the tube ionizes and CI operates. The CI recloses the discharge circuit to the CR1 capacitor, opens the discharge circuit to the CR2 capacitor, connects the 130 volts through the CR8 resistor to the CR2 tube and operates CR2. The CR2 locks under control of CR1 and disconnects the tip and ring leads from the coin return potential. The 1- μ F capacitor CR and 1000- Ω resistor CR are connected to the tip and ring leads to absorb the inductive energy of the coin magnet and thus prevent an excessive voltage rise is disconnected from the line.

C. Line Open Interval

7.65 When CI operates, the CR2 capacitor charges through the CR7 resistor, and in 560 ms, nominal, the tube ionizes and conducts current between terminals 2 and 4. This current is drawn through the CR8 resistor which also supplies the CR1 tube and the result is that the voltage across the CR1 tube is reduced to such an extent that the tube will not sustain current. The CI capacitor is connected around the CI relay to maintain the cathode terminal No. 4 of the CR1 tube positive with respect to ground for sufficient time to cause the tube to be extinguished and to absorb the inductive energy of the CI relay winding so that the tube will not reionize due to a negative induced voltage across the control gap terminals 1 and 4. The CI capacitor also slows the release of CI so that it will not open the circuit to the CR2 tube until sufficient time has elapsed to allow CR1 to deionize.

7.66 When the CR1 tube deionized CI released, CI in releasing closes the discharge circuit of the CR2 capacitor, opens the discharge circuit of the CR1 capacitor, opens the circuit to the CR2 tube to deionize it and operates the CR3 relay. The CR3 starts a stuck coin test on calls where CRA remains normal.

D. Test for Stuck Coin

7.67 If the coin were returned as a result of a call to a free trunk, CRA remains normal and the operation of CR3 connects

the LT relay to the tip and ring leads to test for a stuck coin. If the coin has not left the trap at the station, ground through the coin magnet will still be connected to the line and will operate the LT relay. The release of CI starts the CR1 capacitor to charge, and after 560 ms, nominal, the CR1 tube is again ionized to cause reoperation of the CI relay. This operation, causes operation of line test relay LT1 if LT is unoperated or LT2 if LT is operated. With LT1 operated, the CR lead is grounded and with LT2 operated the stuck coin (SCN) lead is grounded. When no coin return cycle is made both LT1 and LT2 will be normal and the marker will receive a ground on the coin check lead SCK.

E. Coin Cleared

7.68 The LTL1 operates from LT normal if the line test has not detected a stuck coin or if the return has been made as a result of an abandoned call or a time-out and no line test has been made. The LTL1 locks and opens the circuit to CN1. The CN1 in releasing, releases CR or CRA which, in turn, releases CR and CR1. Release of CR disconnects the local holding circuit for L, disconnects the line test relay from the tip and ring leads, and the release of CR1 reconnects the tone coil and L relay to the tip and ring leads. The release of CN1 also closes the circuit to operate MST for marker start or if the call has been abandoned closes the circuit to operate RL to release the register. The release of CR1 disconnects the ground from the coin return timing circuit allowing it to return to normal and opens the circuit to CR2 and CR3 allowing these relays to release.

F. Stuck Coin

7.69 If a stuck coin is detected LT2 operates from LT operated. The LT2 locks, releases the CR relay, and operates the MST relay. The MST will cause a completing marker to be engaged and LT2 will ground lead SCN to indicate that the line should be connected to a stuck coin trunk. Release of CR disconnects the local holding circuit for L and disconnects the line test relay from the tip and ring leads and releases CR1. The CR1 reconnects the tip and ring leads to the tone coil and L relay.

G. Completing Marker Requests Coin Return

7.70 Under certain conditions the completing marker will request that the register make a coin return and then reselect a completing marker for connection to the desired trunk. For this action the completing marker grounds the CNR lead causing operation of the CR⁴ relay. The CR⁴ locks under control of break-contacts of LT1 and LT2 and operates CR. After CR⁴ has operated, the completing marker operates MRL to cause disconnection of the marker in the usual manner. The operation of CR causes the application of the coin return potential and the line test as described above. When CR³ operates to start the line test with CR⁴ operated, MST is released. The MST releases MRL to prepare for a reseizure of the completing marker. Either LT1 or LT2 will operate at the end of the line test to release CR⁴. Release of CR⁴ releases CR and CR1 which releases CR2 and CR3 and restores the coin return timer to normal. The release of CR⁴ with LT1 operated or the operation of LT2 will cause reoperation of MST to cause the marker to be engaged. Either the CR lead or the SCN lead will be grounded and the marker will connect the line to the proper trunk.

H. Failure to Set Up to Stuck Coin Trunk

7.71 If the register discovers a stuck coin and the marker cannot establish a connection to a stuck coin trunk or alternately a coin tone trunk, it operates the busy test (BT) relay of the register. This releases the marker connector, the completing marker, and transmits line-busy tone to the calling customer. When the customer replaces the receiver on the switchhook, CRA operates as on any abandoned call, and causes the coin return cycle to be performed. The CRA relay releases relay LT2, so that LT1 can be operated at the end of the coin return cycle and cause the release of the register. If the customer does not disconnect, the register will time out and release. The customer will then be connected to another register.

I. Coin Option - App Fig. 11

7.72 The coin option combination of App Fig. 11 alone is provided for modifying registers originally installed for

operation with loop-start coin lines for operation with ground-start coin lines. On ground-start coin lines the presence of the coin is detected in the line circuit, hence, no test is required in the register. The CN class relay operated from the dial tone marker, locks and closes a ground to the LB and LC resistors to provide a limited number of ampere turns in a direction to aid the operation of the L relay so as to prevent showering. The CN operates the auxiliary relay CN1 to make the coin return circuit effective.

RANGE EXTENSION FOR UNIGAUGE CABLING

7.73 Under an optional arrangement, the register will permit operation with PBX trunks, individual, and 2-party lines over external loops up to 2700 ohms. Calls originated by customers in the extended loop range are detected by the dial tone marker. The marker then operates register relay LOLP which causes the register to shift into a high-voltage mode of operation. In the high-voltage mode, the voltage at the primary winding of the L relay is changed from -48 to -72 volts, nominal, to assure satisfactory operation of L in the extended loop range. Relay FA is provided to prevent the early operation of SR should L pulse falsely due to the operation of LOLP when the voltage to L is changed from -48 to -72 volts.

PBX TOLL DIVERSION

7.74 The register may be arranged for blocking of PBX toll calls dialed by restricted stations over the same dial "9" trunk group used for toll completion by PBX operators and certain nonrestricted stations. Marker screening is used to detect specific calls which should invoke toll diversion, on a per customer group basis. Where the completing marker desires to invoke toll diversion, it passes a diversion signal to the register operating reversal relay RV1. The RV1 operated, reverses the tip and ring connection to the calling PBX trunk. The RV1 operates RV2 to transfer the holding circuit from the L relay to the SR relay. This prevents release of the L relay during the reversal and subsequent current buildup.

7.75 Operation of the trunk diversion relay depends on the calling extension remaining off-hook to provide an operate path for the diverting relay which is in

series with the line. This makes it necessary to guard against flashing by the calling station which could mask the reversal interval, thereby preventing operation of the diverting relay. Relay ABN serves this purpose. Relay ABN is placed in series with a break-contact of L and make-contacts of SR and RV1. If L releases before the marker operates RL, ABN operates and causes premature release of the completing marker. As a result, the call cannot complete.

8. RELEASE OF REGISTER BY CUSTOMER

MARKER NOT ATTACHED

8.01 If the customer abandons the call and replaces the receiver on the switch-hook the closure on the tip and ring conductors is opened. If this occurs before the dial tone marker has completed the dial tone connection L will not operate to operate SR and ON1 and when S1 releases after the release of F, ON will release to release the connection. On a 2-party line the first party test will be made before S1 and ON release. If the abandonment occurs after L, SR, and ON1 have operated, L and SR will release. If the abandonment occurs during coin test CLR and CNT2 will release to cause release of L and SR. On noncoin calls release of SR operates the release relay RL directly. On a coin call with coin App Fig. 8, 31, or 33, release of SR will operate CR to cause coin return followed by operation of CR2 to operate RL. On a coin call with coin option App Fig. 11 release of SR will operate CRA and, in turn, CR to cause coin return followed by release of CN1 to operate RL.

8.02 The RL opens the tip and ring leads to avoid breaking current at the cross-points of the switches and opens the sleeve

lead to release the dial tone connection. The RL locks to an ON ground and opens one part of the circuit for holding ON1. On 2-party calls an auxiliary circuit is closed through front contacts of the 2P relay and back contacts of the TP2 and TP1 relays. One of the relays TP1 or TP2 must be operated on each 2-party call and this operation is described in the paragraph on the test of the TP relay.

8.03 The ON1 releases ON to cause release of all the relays of the register and causes the register idle indications.

COMPLETING MARKER ATTACHED

8.04 If the completing marker has been engaged before the customer disconnects, the L relay will be held over the L lead to the connector where it is connected to the TM lead which is connected to ground through front contacts of MST. The connection to the trunk will be set up in the usual manner but, since the customer loop is open, the trunk connection will immediately release.

9. REGISTER TIME-OUT

GENERAL

9.01 The register TM timing circuit consists of the TM timer tube and the associated network, the timing relay TM, the auxiliary relay TM1, and the control relays TMA, TMB, and, with XB option, TMC. This circuit times for various functions of the register to be completed and if they are completed within this time, recycles itself for timing the next function. If the function is not completed the timer times out and causes the action indicated in the following table:

TABLE D - ORIGINATING REGISTER TIMER (TM)

Times For	Time Allowed (Seconds)						Action Taken
	Nonoverload			Overload			
	Min	Nom	Max.	Min	Nom	Max.	
Dialing or Keying of First Digit (Permanent Signal)	19.6	25	37	9.6	12.2	18	Engage completing marker for connection of line to permanent signal trunk.
Dialing or Keying of Digits other than first (Partial Dial)	19.6	25	37	4.4	5.7	8.4	Engage completing marker for connection of line to partial dial trunk.
Release of Register after operation of MST Relay (Stuck Register)	19.6	25	37	19.6	25	37	Release register except for condition where TP fails to operate or release in which case register will be held. (See tests of TP relay.)
Coin Deposit (Loop-Start Coin First) Line. App Fig. 9)	19.6	25	37	9.6	12.2	18	Engage completing marker for connection of line to permanent signal trunk.
Coin Deposit (Loop-Start Dial-Tone-First line. App Fig. 7 and 10)	19.6	25	37	19.6	25	37	Release register.

9.02 In case the register is connected a coin line and a permanent signal time-out occurs, the register will make a coin return as described in the section on coin lines.

9.03 The timing intervals are as given in the table. The overload timing intervals are used when the office is functioning on an overload basis, meaning that a shortage of idle originating registers has been encountered. When this occurs the group busy circuit functions to ground the OVL leads to all originating registers to cause overload timing. The group busy circuit maintains ground on these leads for the overload period and for a timed interval thereafter. The reduction in timing intervals aids in reducing the

number of registers held out of service due to dialing or keying before dial tone is received.

DESCRIPTION OF TIMER OPERATION

9.04 The TM tube has characteristics such that it will not pass current unless its gas is ionized, and a potential of 130 volts between the cathode terminal No. 4 and the main gap anode terminal No. 2 is insufficient to cause ionization. A potential of, nominally, 72 volts between the cathode terminal No. 4 and the control gap anode terminal No. 1 will cause ionization. Once the gas becomes ionized, the tube will conduct between terminals 2 and 4 and maintain a voltage drop of 75 volts, nominal. When this occurs the control anode no longer exercises control

and the tube can be restored to the non-conducting state only by opening the circuit to the main gap or by reducing the voltage across the main gap below the sustaining value. The voltage across the control gap is equal to that on the timing capacitor TM and this is controlled in time by the value of the capacitor and the charging resistor. The protective resistor TM1 prevents any appreciable current from flowing through the control gap when ionization occurs. The various times of the timer are obtained by using various charging resistors.

9.05 The timer is started by operation of the control relay TM which removes the discharge shunt from the capacitor and connects the grounded relay TM to the capacitor and to the cathode terminal No. 4 of the tube. This completes the charging path for the capacitor and it charges through one of the three resistors TM3, TM4, or TM5. When the charge reaches 72 volts, nominal, the tube ionizes and current flows in the main gap to operate the TM relay.

9.06 The timer is recycled by the release of TMA, which disconnects the ground from the capacitor and tube and connects the TM2 resistor around the capacitor to cause its discharge.

9.07 The TMA and TMB relays control the recycle. The TMA operates from an ON ground on its primary winding and locks on its secondary winding through contacts of a number of control relays. The locking ground operates the TMB relay. The TMB opens the primary winding operating circuit of TMA. In order to recycle the timer one of the control relays opens the TMA locking circuit. This causes the release of TMA and TMB in parallel. The TMA releases to discharge the TM capacitor and TMB, which is slow-release to allow time for this discharge, releases to cause reoperation of TMA on its primary winding to restart the timing cycle. With option QS, the TMB slide in the operate path of the TMB relay reduces the interaction between the TMA and TMB windings and increases the release time margin between the release of TMA and TMB. This is to insure that TMA is released long enough to cause deionization of the TM tube before reoperating upon the release of TMB. The control contacts then are reclosed to lock TMA and

reoperate TMB in preparation for the next recycle, if one is required.

9.08 For TOUCH-TONE operation the TMC relay is inserted into the sequence. If the keyed digit is of short duration, relay TMB may not release in time, but TMC is fast release and insures that the timer is recycled during the digit.

9.09 If a time-out occurs the auxiliary relay TM operates and locks and, in most cases, causes a recycle of the timer.

PERMANENT SIGNAL TIMING

9.10 The timer is started on the seizure of the register by the operation of TMA from relay ON. If the register is arranged to function with TOUCH-TONE customers, TMC is also operated at this time and locks under control of STRA. The TMA operates TMB. The TMB at this time is under control of a back contact of P2A and a front contact of RAl.

9.11 During a keyed call, RAl is released while a digit is being dialed. When a digit of two or greater is counted by the dial pulse counting circuit, P2A operates.

9.12 During a keyed call, MF is operated at the beginning of the first keyed digit which transfers control of TMB from the front contact of RAl to a front contact of TMC. While a digit is being keyed, STRA is operated which releases TMC. When a digit of two or greater is keyed and recognized by the translating relays, P2A operates.

9.13 When P2A operates under either of the two conditions described above, TMA and TMB release to recycle the timer for partial dial functions. The P2A also operates PD.

9.14 If the timer functions before PD operates, TM operates to operate TM1 which locks. The TM1 causes operation of MST although on coin class calls this is preceded by a coin return cycle. Operation of MST opens the locking circuit of TMA releasing TMA and TMB to recycle the timer. With MST operated the TMB operating circuit remains open and no further recycle is made. Release of TMA releases TM to operate MST1 to prevent any registration. With TM1 operated and PD normal the PS lead to the

marker is grounded as an indication that a connection to a permanent signal trunk is desired. On a coin class call the recycle would have been made at the start of the coin return by the operation of CR or CRA, instead of at the operation of MST.

PARTIAL DIAL TIMING

A. Dial Pulse Operation

9.15 With P2A operated, the locking winding of TMA and the operating circuit of TMB is under control of RAL. At the end of each digit RAL operates to operate TMB and at the start of each digit RAL releases to release TMA and TMB to recycle the timer.

9.16 If the customer fails to dial a sufficient number of digits to cause operation of MST, the timer will function to cause operation of TM. The TM operates TML which, in turn, operates MST to cause a marker to be engaged. The TML will close a locking circuit to PD to prevent its release when MST1 operates. With PD operated the marker receives a ground on lead PD as an indication that a connection to a partial dial trunk or a coin tone trunk is required. Coin return is not made by the register since the coin tone trunks are arranged for coin operation.

9.17 Under certain dialing interrupter test conditions where the interdigital interval is short, the TMB relay may not have sufficient time to operate so as to cause a recycle of the timer at the start of each digit. Due to this limitation, it may not be possible to test the register during periods of office overload conditions (when the OVL relay in the register is operated) and using a large number of digits with each digit a high number. Under these conditions the TM timer may function before the entire number is dialed. With OVL relay unoperated, any number of digits, each of any number, may be dialed.

9.18 The TML relay is locked to a contact on PD so that a peg count can be made on abandoned partial dial calls. This is described in the section on traffic registers.

9.19 If all digits are dialed, MST1 operates to allow the release of PD. Operation

of MST1 and release of PD changes the condition from partial dial timing to stuck register timing.

B. TOUCH-TONE Operation

9.20 With P2A and MF operated, the locking winding of TMA and the operating circuit of TMB are under control of TMC. At the end of each digit STRA releases to operate TMC and, in turn, TMB. At the start of each digit STRA operates to release TMC which, in turn, releases TMA and TMB to recycle the timer. Subsequent circuit action is the same as described in 9.15 through 9.19.

STUCK REGISTER TIMING

9.21 Timing for release of the register is usually started by the operation of MST although in some cases the actual time required to dial or key the last digit is included in the timer period. When RAL or TMC operates at the end of the last digit it closes the circuit for locking TMA and operating TMB. If a coin return is made (as it may be under certain conditions), if App Fig. 11 is used, if a second party test is made on a 2-party line, or if the MST operation is a result of the time-out of the digit timer, TMB will operate. If MST operates directly from RAL, TMB will not have time to operate and in this case MST cannot recycle the timer and the time required to dial or key the last digit will be included in the stuck register timing period. If a dial-tone-first coin line is connected to the register, the timer will be recycled at the start of the coin test by the operation of CNT1. The operating circuit for MST from QT1 of App Fig. 10 is wired through TMB contacts to insure that TMB is operated before MST so that MST can recycle the timer. This is necessary since the coin test may require an indeterminate amount of time.

9.22 If the register does not release as a result of the completing marker action or some trouble prevents the register from gaining access to a completing marker, the timer will function to cause operation of relay TM. The TM operating, with MST1 operated, operates RL. The RL opens the tip and ring leads to release the L relay and the sleeve lead to release the dial tone

connection. The L releases SR which, in turn, releases ON1 and ON to cause release of the register. On 2-party lines either TP1 or TP2 must be operated before ON1 is released. This is described in the section on 2-party lines.

9.23 The TM will also operate TML. On coin lines, operation of TML will not cause a coin return cycle prior to release of the register since RL opens the circuit to CR or CRA.

AWAITING COIN DEPOSIT TIMING - COIN-FIRST - APP FIG. 9

9.24 If the register functions with coin-first loop-start coin lines, a permanent signal timing interval is allowed for the deposit of the coin and the timer recycled after completion of the coin test.

9.25 The first timing cycle starts when TMA operates from ON on the seizure of the register. When coin test is satisfied both GT1 and CNT2 will be operated to allow release of TMA and TMB to cause a recycle of the timer. Release of CNT2 recloses that circuit to lock TMA and operate TMB so that the regular recycle occurs when P2A operates during the dialing of the first digit. The PD is normal during both of these timing intervals so they are both of the permanent signal rate and a time-out during either interval will cause the reaction described under permanent signal timing.

AWAITING COIN DEPOSIT TIMING - DIAL-TONE-FIRST - APP FIG. 10

9.26 On calls from dial-tone-first coin lines, a test for coin is made prior to the operation of MST. The MST1 is operated from the auxiliary coin test (CNT2) relay after completion of dialing and releases PD to change the timing conditions from partial dial to stuck register. A full timing cycle is allowed for the deposit of the coin. After coin test is satisfied TMB reoperates followed by MST to recycle the timer for the regular stuck register timing interval.

9.27 A time-out during either interval will cause the reaction described under stuck register timing.

LINE TROUBLE TIME-OUT

9.28 If the customer line becomes crossed with a power line or ringing feeder the counting circuit may count more than ten pulses for the A digit. The counting circuit is arranged so that, if a count of eleven or more is made, the only lead enabled to the A register is the zero lead. Consequently, if an interdigital interval occurs after 11 or more pulses the release of RA will connect ground to the zero lead and through contacts of the MAN or OP and OP1 relays to operate TML.

9.29 If the zero prefix counter is not provided the MAN relay operates when the tenth pulse is counted. The TML is then operated through a contact of MAN at the interdigital interval.

9.30 If the zero prefix counter is provided the OP relay operates when the tenth pulse is counted and locks through a contact of P5 to an ON ground. After TML operates through OP at the interdigital interval the MAN relay is operated through contacts of TML and OP to an ON ground.

9.31 In either case MAN operated opens the circuit to the PD relay so that the completing marker will receive a permanent signal indication. The TML operated operates MST for connection to a completing marker and MST operates MST1 to prevent any further registration. The marker will receive a PS indication and grounds on leads A0, A4, and A7. Under this condition a trouble record card may or may not be provided depending on the number of lines with permanent signal conditions in the office and the position of the PS record control key at the maintenance center.

REGISTER ALARMS

9.32 Whenever TM is operated it grounds the lamp (LP) lead and the alarm (AIM) lead to the master test frame, jack, lamp and key circuit. The LP lead terminates in a lamp individual to the register to indicate which register has timed out. The AIM lead is common to all registers and a ground on this lead will start a common timing circuit. In most cases the ground on the AIM lead is of short duration since TM, in operating, starts a chain of events which

eventually results in the release of TM. However, if some trouble prevents TM from accomplishing its usual function and TM remains operated, the common timing circuit will function to cause the office alarm to operate. The maintenance force will be directed to the register by the lighted lamp.

9.33 The alarm may be silenced by making the register busy. This causes operation of the MB relay which disconnects the ground from the ALM lead, thus cutting off the alarm from this particular register, but leaving the lamp lighted.

10. SERVICE CALLS

GENERAL

10.01 Service calls may be of the X11 or the 11X type. Where a pretranslator is not provided and service calls are of the X11 type, the translator relays of App Fig. 19 are provided. The 11X service calls require the prefix counter of App Fig. 18 which is also used when the register is required to recognize 1-1 foreign area prefix codes. Two special service codes are 1-411 local numbering plan area (NPA) information and NPA-411 foreign NPA information.

CODES X11

10.02 The X11 translator consists of relays SBO, SBI, SCO, and SCl which are associated with the output leads of the B- and C-digit registers. Relays SBO and SBI will operate if the B0 and B1 leads, respectively, are grounded. With SBO and SBI operated, SCO will operate if the CO lead is grounded. Operation of SCO will then allow SCl to operate when lead C1 is grounded. Thus, SCl operates only if a digit 1 is present in both the B- and C-digit registers. With option TA provided, the operate circuit of SCl is wired through relay 11C normal so that a customer cannot reach a service operator in a foreign area by dialing or keying the digits 11X11. With option TB provided, the operate circuit of SCl contains a back contact of 11B. Both options TB and TA are rated "Mfr Disc." Standard option TC provides neither contact 11B nor 11C in the operate circuit of SCl to permit dialing of local NPA information code 1-411.

10.03 With SCl and RAl operated, a ground is connected to the MST1 terminal. This will cause operation of MST for noncoin individual lines, operation of TPB for 2-party lines; for the second party test, operation of CR for coin lines with coin option App Fig. 9 and 11 or App Fig. 11 alone for coin return, or operation of CNT for coin lines with coin option App Fig. 7 and 10 for coin test. After the appropriate action, the completing marker will be engaged.

CODES 11X, 11 FOREIGN AREA DIRECTING CODES OR DIGIT 1 ACCESS CODES

10.04 The prefix counter consists of relays 11A, 11B, and 11C and is used to register an initial 1 or two initial 1s.

10.05 For dial pulse calls, if the counting relays count a single pulse, initially, P2A will not operate and when RA releases at the end of the digit 1, ground is connected to the "1" lead through a back contact of P2A to operate 11A. The 11A locks and when P1 releases as the result of the operation of RAl, 11B is operated and locked. Where digit 1 access codes are used the operation of the 11B relay removes ground from the LT translator lead and grounds the LT1 translator lead to the marker.

10.06 For TOUCH-TONE calls, if the translating relays, corresponding to the digit 1, are operated initially, P2A will not operate and ground is connected to lead 11A through a back contact of P2A to operate 11A. The 11A locks and when STRA releases at the end of the digit 1, 11B is operated and locked.

10.07 If a second 1 is dialed or keyed, 11C is operated through 11B operated. Any additional 1s are not registered.

10.08 If the prefix counter is used for service codes, the completing marker must be engaged after the registration of the A digit which will be the first digit greater than 1. In this case ZA wiring is provided and will cause the MST1 terminal to be grounded when the B-digit steering (BS) relay operates. This will cause operation of MST for noncoin individual lines; operation of TPB for 2-party lines for the second party test; operation of CR for coin lines with coin option App Fig. 9 and 11, or App Fig. 11 alone for coin return,

or operation of CNT for coin lines with coin option App Fig. 7 and 10 for coin test. After the appropriate action the completing marker will be engaged.

10.09 If the prefix counter is used for 1-1 foreign area directing codes ZA wiring will not be provided and the completing marker will be engaged as a result of cross-connections.

LOCAL NPA INFORMATION CODE 1-411

10.10 Access digit 1 preceding the information code 411 is used to indicate an information call outside the local area but within the same NPA.

10.11 As the access digit 1 is dialed or keyed, it is registered on relays 11A and 11B. Contacts of 11B transfer ground from the LT lead of the marker connector to lead LT1.

10.12 The 411 digits are translated by relays SBO, SBI, SCO, and SC1. If one is dialed or keyed for both the B and C digits, all four of these relays will be operated. When RAI operates at the end of the final digit 1 and SC1 is operated, ground will be placed on terminal MST1 to initiate marker action.

10.13 Where a pretranslator is provided the 411 code is translated by the pretranslator.

FOREIGN NPA INFORMATION CODE NPA-411 (MFR DISC.)

10.14 To permit direct distance dialing of foreign area information operators, provision is made to translate information code 411 after a foreign area code.

10.15 Relays A411 and MSTA are used to translate digits 411 in the D-, E-, and F-digit positions, respectively. The operate path for A411 is wired such that digits 411 in these positions will provide continuity through contacts of the D-, E-, and F-digit registers. This continuity path includes break-contacts of MSTA before the D, between the D and E, between the E and F, and after the F-digit registers to provide isolation of the registers after a marker is seized. Make-contacts of MSTA are also included in the ground circuits of the three registers.

10.16 When a foreign area code plus the digits 411 are dialed or keyed, relay A411 will operate to ground lead X11 of the marker connector circuit. Operation of A411 also supplies ground to lead FAC which in combination with X11 grounded informs the marker that an NPA-411 foreign area information call has been dialed. The marker is seized after the sixth digit operation of relay MST through a front contact of A411 and relay GS operated.

10.17 Operation of the circuit when an interchangeable NPA code is encountered is as described in 4.41 through 4.46.

10.18 Various cross-connections are available in the operate path of relay A411 to provide NPA-411 information service with digit 1 access code, zero prefix PPCS, and any of the NOX, N1X, or NNO foreign area codes. Appropriate connections are detailed in the cross-connection notes.

11. ZERO OPERATOR CALLS

ZERO PREFIX COUNTER NOT PROVIDED

11.01 If a customer with a dial set dials zero as the initial digit, the P3 and P5 counting relays will be operated and the P1 and P4 counting relays will be normal during the tenth open pulse.

11.02 If a TOUCH-TONE customer keys a zero as the initial digit the Y9 and Z2 translating relays will be operated.

11.03 For either of these two conditions, MAN will operate through the operated AS. The circuit to MAN is wired through 11C normal where digit 1 access codes are not used or through 11B normal where digit 1 access codes are used so that a customer will not reach the zero operator in the foreign area by dialing or keying 110 or 10, respectively, and so that coin test on loop-start dial-tone-first coin lines will not be canceled if 110 is used as a service code. When the zero digit is registered and RAI operates, a ground is closed through the MAN contacts to cause operation of MST on noncoin individual lines, operation of TPB for 2-party lines for the second party test or operation of CR for coin lines with coin return option App Fig. 11 for coin return. After the appropriate action the completing marker will be engaged.

ZERO PREFIX COUNTER PROVIDED

11.04 Where the zero prefix counter is provided OP and OP1 operate if the A digit is zero. The OP provides ground to operate the DL relay when RAI operates at the end of the digit. In order to obtain zero operator service, the customer must wait for the DT time-out. When DT operates, MAN operates through a front contact of OP to the DT ground. When MAN operates, the A4 and A7 leads are grounded and the circuit to operate MST is closed.

12. MANUAL CALLS

12.01 Lines which have manual originating and dial terminating service are in the manual class. They may be either coin or noncoin. When such a line originates a call, the dial tone marker recognizes from the class number that it is a manual line and operates the MAN class relay. The MAN locks, opens the dial tone circuit and grounds the A4 and A7 leads to the marker connector so that the marker will function as if a zero were dialed as the A digit. The MAN also prepares a circuit for operating MST as soon as the marker has completed the dial tone connection and released the F relay to allow operation of L, SR, and ON1. The ON1 contact insures that the dial tone marker will have released before the completing marker is engaged. On loop-start coin-first coin lines with App Fig. 10 the test for coin must be satisfied and GT1 operated before this circuit is effective. On coin lines with the coin return option of App Fig. 11 the CR relay is operated so that a coin return cycle is made prior to the operation of MST.

13. PERSON-PERSON COLLECT SPECIAL SERVICE

13.01 Where person-person collect special service (PPCS) is provided the dialing or keying of zero for the first digit indicates that the customer desires one of two services, the zero operator or PPCS. In order to determine which service is desired an interval is timed by the digit timer and:

(a) If no further digits are dialed or keyed it is assumed that the zero operator is requested and connection to a completing marker is made.

(b) If additional digits are dialed it is assumed that the call is PPCS.

13.02 In order to determine whether an initial zero is prefixing a PPCS call or whether zero operator service is desired the zero prefix counter is provided. Operation of the zero prefix counter is explained in ZERO PREFIX COUNTERS.

13.03 When an initial zero is dialed OP operates on the tenth open pulse. The OP operated, opens the 4 and 7 leads to the A-digit register to prevent registering zero, releases P2A to prevent the steering relays from advancing at the end of the digit, opens the dial tone supply, and starts the digit timer.

13.04 When the initial zero is keyed from a TOUCH-TONE set OP is operated. Zero is not registered on the A-digit register because the P2A relay is not operated by the Y9 and Z2A translating relays. With P2A normal the steering relays will not advance at the end of the digit.

13.05 At the end of the initial digit zero, relay OP1 operates to reclose the operate path of P2A.

13.06 If further digits are not dialed or keyed after the initial digit the digit timer will time out to operate DT. The DT provides a path to operate MAN through a front contact of OP. The MAN operated, grounds the A4 and A7 leads in the digit register and operates MST (after necessary coin and 2-party tests). A back contact of OP prevents the DT ground from also operating MST and, thus, short-circuiting the coin functions.

13.07 If the customer wishes PPCS service the next digit must be started before the time-out occurs. When the next digit is started OP releases on the first pulse when P2 operates from dial sets or when STRA operates if the digit is keyed from a TOUCH-TONE set.

13.08 With the cold cathode digit timer release of OP releases relay DL to stop the digit timer. A back contact of AS in the digit timer circuit prevents the operation of DT when RAI releases at

the start of the digit. This prevents a premature operation of MST when RAL reoperates at the end of the digit. With OP normal and OPl operated, indicating a PPCS call, the LT2 class mark is grounded.

13.09 Where the transistor digit timing circuit is used, the back contact of relay AS is not provided to prevent this premature operation of DT. In this case, the lockup path of DT is through DL operated. When OP releases at the start of the next digit, thus releasing DL to stop the digit timer, relay DT will also release. This action takes place before relay RAL reoperates at the completion of the digit. Since both DT operated and RAL operated are required for operation of MST, a premature marker start cannot occur.

13.10 If the second digit is a zero, MAN operates causing a completing marker to be attached. The LT2 lead is grounded and zero in the A digit is passed to the marker.

13.11 If the second digit is a 1, the 11A relay will operate to ground the AO and A1 leads and to cause operation of relay MST. If the second digit is 2-9, it will be stored on the A-digit register and a completing marker will be engaged as a result of cross-connections.

13.12 Where the register is arranged for centrex service, the circuit to OP is wired through the front contact of a DD9A transfer. If the centrex customer does not dial or key a "9" directing digit the MAN relay will operate on an initial zero and cause connection to the centrex operator.

13.13 Where the zero prefix counter is provided, the circuit to OP is wired through the back contact of 11B. If a 1 is dialed or keyed as the first digit and then followed by a zero, the MAN relay will operate. In this case the LT1 class lead to the marker will be grounded along with the A4 and A7 leads.

OVERSEAS DIALING

13.14 Special provision is made for limited overseas dialing in registers equipped with the person-person collect special and prefix digit 1 features, and where the registers also function with pretranslators.

13.15 This arrangement allows dialing ten digits preceded by the digits 0-1 (person-to-person) or 0-1-1 (station-to-

station) to reach locations in certain foreign countries. However, an information operator in the foreign country cannot be reached by dialing the country code plus 411.

13.16 On overseas dialing the MST relay operates following ten digits preceded by 0-1 or 0-1-1 through contacts of the OPl and 11A relays operated, and cross-connection terminals K and OSD. The register gives the marker translator indications FAC + FVD on 0-1 type calls and FAC + 11 on 0-1-1 type calls. The register must not be arranged for 11X type service calls.

14. THREE-DIGIT INTERCOMMUNICATIONS

14.01 Provision is made on a special basis for using a separate group of originating registers in a 3-digit intercommunication system. For this type of call the register will transfer, by means of contacts on the 3DCA and 3DCB relays, to the marker on the B2/5, C2/5, and D2/5 leads the digits dialed, generate an arbitrary 1 in the A digit, and ground the X11 translator lead to permit the marker to handle the call as a 4-digit centrex call.

15. SPECIAL "TOUCH-TONE" SIGNALS

END-OF-DIALING SIGNAL

15.01 The button to the right of the zero button on 12-button TOUCH-TONE sets can be used for sending an end-of-dialing (EOD) signal after the last digit of the called number on calls involving a variable number of digits such as international direct distance dialing (IDDD) calls or LXX centrex tie line code calls. The handling of such calls by the register normally involves operation with the repetitive digit timer for determining when the last digit of the called number has been received. This timer is started after a predetermined minimum number of digits have been dialed, recycled by each succeeding digit, and causes a marker to be called following a 3- to 4-second time-out interval in which no digits have been received. With use of the EOD signal, the marker is summoned immediately. Two arrangements are provided for handling the EOD signal; one rated Special and the other feature Standard. Only the Standard arrangement can be used on IDDD. Operation with these arrangements is as follows.

STANDARD EOD SIGNAL ARRANGEMENT

15.02 The Standard arrangement involves the use of relay EOD of Fig. 36 and relay TDL, option PN. When enough digits have been received on the IDDD or LXX centrex call to start the repetitive digit timer, TDL operates and partially completes an operate path for the MST relay involving front contacts of the unoperated EOD relay. When the EOD signal is received, EOD operates causing the marker to be called for routing of the call. If the EOD signal is received before TDL is operated, relay TBL operates over a path that includes a back contact of TDL. In turn, relay BT operates and returns reorder tone to the calling customer.

15.03 If permitted, keying of the EOD signal would cause the steering relays of the register to advance as in normal operation, and ground an improper end 7 lead to the marker. To avoid this, a front contact of the EOD relay is placed in the operate path of the steering chain and prevents the steering relay operated during the previous digit from releasing at the end of the EOD signal, thereby maintaining ground on the proper end 7 lead.

15.04 In registers arranged for both PICTUREPHONE® and IDDD operation, keying of the button to the right of the zero button on the 12-button TOUCH-TONE set in various digit positions will cause the following register actions.

- (a) Keyed Initially - Operates SSR relay; accepted by the register as PICTUREPHONE prefix signal.
- (b) Keyed in the A-G Digit Positions - Causes operation of TBL and BT relays; returns reorder tone to customer.
- (c) Keyed in the H-L Digit Positions - Causes operation of relay EOD and is accepted as end-of-dialing signal on IDDD call; if call is PICTUREPHONE only causes operation of TBL and BT relays.

SPECIAL EOD SIGNAL ARRANGEMENT

15.05 The Special EOD arrangement is provided by Fig. 28, and involves operation with relays SSC, SSR, and TDL. This version was developed before IDDD to handle EOD signals after LXX centrex tie line code calls only. It cannot be used with IDDD calls. Operation is as follows. When the LXX code is received, relay TDL operates and sets the register to receive further digits on a repetitive digit timing basis. Relay SSC also operates at this

time, partially completing an operate path to the SSR relay. When the EOD signal is received, SSR operates, causing MST to operate to call in the completing marker. If the EOD signal is not received, the marker is called after time-out of the digit timer. If the EOD signal is received before relay SSC can operate, relays TBL and BT are operated, returning reorder tone to the customer.

"PICTUREPHONE®" SIGNAL

15.06 Provision is made on a special basis for using the TOUCH-TONE button to the right of the zero button as a prefix signal to indicate a PICTUREPHONE call. Operation of this button before any digit will cause operation of the SSR relay through a back contact of the SSC relay.

15.07 Relay SSR operated provides a PICTUREPHONE indication to the marker. This indication is given over leads LO and L1 where the register handles a maximum of ten digits (prefix digits excluded) on any call, or over leads CR and SCK where the register handles up to 11 digits (prefix digits excluded) and coin Fig. 11 is not equipped. Ground on lead L1 or CR indicates that PICTUREPHONE service is requested on the call. Nonoperation of this button before the initial digit will cause lead LO or SCK to be grounded, indicating PICTUREPHONE service is not requested.

15.08 Operation of the button at any other time or of the button to the left of the zero button at any time will operate the TBL relay. The TBL relay will cause busy tone from the register.

"PICTUREPHONE" - APP FIG. 34

15.09 Provision is made for PICTUREPHONE service by App Fig. 34, rated feature Standard. For PICTUREPHONE operation, the register must be equipped for TOUCH-TONE operation and the customer must key the call from a 12-button TOUCH-TONE set.

15.10 A prefix signal, generated by the button to the right of the zero button, must be keyed initially on a PICTUREPHONE call. Register relays Y9 and Z3 operate on translation of this signal by the TOUCH-TONE receiver, and cause operation of the SSR relay through a back contact of relay SSC. At the end of this prefix signal, SSC operates from the release of relay STRA, and establishes an operate path for the TBL relay. Consequently, if this signal is keyed again, TBL and BT will operate and return reorder tone to the customer. Relay SSR, operated, grounds

lead SPLP to provide for selection of a completing marker handling PICTUREPHONE calls, and transfers ground from lead PK to PK1 to request that the marker establish a PICTUREPHONE connection.

15.11 Where the PICTUREPHONE call is originated from a PBX station for completion over the POTS network, the customer must initially key the PICTUREPHONE prefix signal followed by the directing digit 9. These signals are used by the PBX equipment for selection of a trunk, from a trunk group handling PICTUREPHONE calls, to the No. 5 crossbar office serving the PBX. Consequently, the dial tone marker will operate the SSR relay over lead P in setting the connection between the calling line and originating marker.

16. INTERNATIONAL DIRECT DISTANCE DIALING

GENERAL

16.01 The IDDD feature allows the register to handle overseas calls in LAMA equipped local offices or offices that function with a TSPS. Two versions of this feature are provided which permit register operation with or without an IDDD pretranslator circuit.

16.02 This IDDD feature will allow customers to make direct calls to countries previously accessible only by operator assistance. The dialing format consists of the prefix code 0-1-1 for station-to-station or 0-1 for person-to-person calls, followed by a variable number of digits (7 to 12) comprising the country code and national number. An EOD signal can also be keyed by TOUCH-TONE customers using 12-button station sets.

16.03 Since calls to different countries involve the dialing of a variable number of address digits, the register is arranged to recognize when the last digit of the called number has been dialed so that processing can begin without undue delay. The TOUCH-TONE EOD signal and the repetitive digit timer are used for this purpose.

16.04 Local central offices equipped with LAMA facilities can handle a maximum of 11 digits. Therefore, in these offices, overseas calls of 12 digits or more still require operator assistance.

16.05 Local central offices that function with a TSPS can be arranged for handling up to 12 digits on IDDD. In accordance with this, the digit handling capacity of the register is increased from 11 to 12

digits by the addition of digit register MO,1,2,4,7, and the MS steering relay. New cross-connection terminal M is also provided. With 12-digit registers equipped, the MS steering relay is inserted between the LS and STS relays. Its operation is similar to that of the other steering relays. Existing cross-connection terminal L is grounded by the operation of MS and terminal M by the operation of STS. If desired, this increased digit capacity can be provided in existing registers undergoing modification for IDDD service in LAMA offices if eventual operation with a TSPS is anticipated. Since the IDDD-LAMA arrangement is limited to a maximum of 11 digits, provision is made for cross-connecting terminals of the M-digit register to the TBL terminal to cause reorder tone to be returned to the customer if 12 digits are received.

16.06 Existing features which must be provided in the register for operation on IDDD include the person-person collect special PPCS feature, the prefix counter feature (Fig. 18 with option XP), the repetitive digit timer (option PN, or under certain conditions, WG), and at least 11-digit registers.

16.07 Where it does not function with an IDDD pretranslator circuit, the register can be cross-connected to provide IDDD service to certain customers as follows:

- (a) Dial pulse customers only.
- (b) Twelve-button TOUCH-TONE set customers only.
- (c) Dial pulse and 12-button TOUCH-TONE customers only.
- (d) Dial pulse and, 10- and 12-button TOUCH-TONE customers.

Where the register is cross-connected for providing service to 12-button TOUCH-TONE customers under conditions (b) and (c) above, the EOD signal is mandatory after the last digit in the call if less than a full complement of digits (less than 11 with LAMA operation, or 12 with TSPS operation) are keyed. Where the register is equipped with only 11-digit registers in LAMA offices and all TOUCH-TONE customers have 12-button sets, the EOD signal is mandatory after 11 digits, if option OA is provided. Otherwise the call receives partial dial treatment. The EOD signal is not required after 11 digits if 12-digit registers are equipped in LAMA offices.

It is also not required after 12 digits with TSPS operation. Where operation with an IDDD pretranslator is provided, the register can be cross-connected for service with dial pulse customers only, TOUCH-TONE customers only (with 10- and 12-button sets), or all customers.

16.08 In registers arranged to provide IDDD service for TOUCH-TONE customers only, the register will summon the marker immediately if the IDDD prefix code is received from a dial pulse customer. In registers equipped with the B-digit translator, a back contact of the ID relay is cross-connected in series with the operate path of relay TBC to disable the translator function on IDDD calls.

16.09 In IDDD equipped registers, dialing of the prefix code 0-1 before the called number will cause the register to ground translation leads FVD and FAC to the completing marker. Dialing of the code 0-1-1 before the called number will ground leads 11 and FAC instead. Provision is made for returning reorder tone to customers dialing the invalid IDDD codes 0-1-1-1 or 0-1-1-0. Previously, on the initial IDDD modification, the third "1" of the 0-1-1-1 code was ignored by the register and the second "0" of the 0-1-1-0 code called for a marker with "0" in the "A" digit position. With the new arrangement the third "1" or second "0" will instead cause operation of relay TBL and, consequently, BT to return reorder tone in the usual manner. Relay 11D operates on dialing of the code 0-1-1, and prepares an operate path for the TBL relay. The TBL relay was formerly only provided in registers equipped for TOUCH-TONE. It can now also be provided for IDDD irrespective of the TOUCH-TONE feature.

OPERATION WHERE IDDD PRETRANSLATOR IS NOT PROVIDED

16.10 This arrangement can be used for handling up to 11 digits in a LAMA equipped central office or up to 12 digits in central offices functioning with TSPS. The register functions as follows. Relays OPl and 11A are operated by the initial dialing of the prefix digits 0 and 1, respectively, causing operation of the ID relay. Contacts of the ID relay prepare the register for handling the call on an IDDD basis. Relays OPl and 11A also prevent the regular pretranslator from serving this call, if provided. Contacts of the ID and MF relays are wired to individual cross-connection terminals to provide for operation with dial pulse and/or TOUCH-TONE customers as previously described.

16.11 On calls from dial pulse or 10-button TOUCH-TONE sets, the register must provide repetitive digit timing to determine when the last digit has been dialed. For this, the DT timer is enabled after the seventh G digit is registered, and recycled by each additional digit received. Relay HS operates during dialing of the G digit, operating the TDL relay. At the end of the G digit, relay DL operates to ground through contacts of TDL operated, RAl operated, and DT released, beginning a 3.5-second (nominal) timing period awaiting the H digit. If the H digit is dialed, relay RAl releases, causing DL to release, ending the timing cycle. At the end of the H digit, RAl will reoperate causing DL to reoperate and start a new 3.5-second timing interval. If further digits are dialed, this action is repeated. If no further digits are dialed, the DT timing period will expire, causing operation of the DT and, in turn, MST relays, calling the marker to complete the call. If the full complement of digits are dialed, the marker is called immediately after the eleventh digit with LAMA or twelfth digit with TSPS operation.

16.12 On calls from 12-button TOUCH-TONE stations, the customers can key the EOD signal after the last digit of the call to cause an immediate marker start. This is accomplished via the front side of a transfer contact of relay 8D if the EOD signal is keyed in any digit position following the seventh G-digit position. Previously, this function was performed through a chain of contacts on the GS-ST5 steering relays. If the EOD signal is keyed prior to registration of the G digit, with the exception of the initial prefix digit position in registers also arranged for PICTUREPHONE, relays TBL and BT will be operated, causing the customer to receive reorder tone. Where TOUCH-TONE calls are initiated from either 10- or 12-button TOUCH-TONE sets, the register must be cross-connected to provide repetitive digit timing on all IDDD calls.

OPERATION WITH IDDD PRETRANSLATOR

16.13 The register is arranged to function with an IDDD pretranslator on IDDD calls. For this operation the register must also be equipped to function with the regular pretranslator on POTS type calls. The register bids for connection to an IDDD pretranslator when the third digit C of an IDDD call is received. This connection is established via the regular pretranslator connector circuit with ground on lead "11" instead of lead LT. The IDDD pretranslator returns one of seven valid answers to the register as follows.

REG RELAY OPER BY IDDD PRT	REG ACTION	PREFIX CODE DIALED	NUMBER OF ADDITIONAL DIGITS DIALED	TYPE OF CALL	TRANSLATION LEADS GROUNDED TO MARKER OR OTHER ACTION
None (Basic Setting)	Start Rep Digit Timing After 7 Digits				
CMB, SD	Start Rep Digit Timing After 8 Digits	0	7 or 10	POTS PPCS	LT2,FAC, A,B,C, etc
CMA, SD	Start Rep Digit Timing After 9 Digits	0-0	-	Special	LT2,OR, A=0
CM3	Call Marker After 3 Digits	0-1	7 to 12	IDDD PPCS	FVD,FAC, A,B,C, etc
CMA	Call Marker After 9 Digits	0-1-0	-	IDDD Operator	FVD,FAC, A=0
CMB	Call Marker After 10 Digits	0-1-1	7 to 12	IDDD Station-to-Station	11,FAC, A,B,C, etc
CMC	Call Marker After 11 Digits	0-1-1-0	-	Not Valid Code	Recorder Tone From Reg

16.14 Typical operation of the register and pretranslator on IDDD is as follows. When a call is initiated, relay IDA operates in parallel with ID when the IDDD prefix code (0-1) is dialed. As dialing progresses, the pretranslator is called and returns an answer to the register, normally before seven digits can be dialed. Relay 8D operates and locks if at least eight digits are received and relay 10D, if at least ten digits are received. An operating path for the TDL or MST relay is established through contacts of the CM-, SD, HS, KS, MS, STS, 8D, 10D, and EOD relays when the number of digits received agrees with the minimum number required on the call as determined by the pretranslator. If the pretranslator returns a timing answer to the register, relay TDL will be operated after 7, 8, or 9 digits are received. This enables the register to function with the repetitive digit timer on succeeding digits.

16.15 If, from the pretranslator answer, an exact number of digits is expected on the call, an operate path to relay MST is completed immediately upon receipt of the exact number of digits. Partial dial treatment of the call results if less than the exact number of digits is received, and reorder tone is returned if, for some reason, the release of relay DMS is delayed and more digits than expected are dialed into the register. Reorder tone will also be returned if the EOD signal is received in an improper digit position relative to the exact number of digits expected on the call.

16.16 The following table indicates the handling of various combinations of the IDDD prefix code dialed into an IDDD equipped register.

0-1-1-1 - Not Valid Code Recorder Tone From Reg

17. BUSY TONE FROM REGISTER

GENERAL

17.01 The BT relay is an all-paths-busy or a trouble release relay and may be operated by the completing marker to effect release of the connection between the register and the completing marker but to retain the dial tone connection between the register and the calling line. Relay BT causes busy tone to be transmitted to the customer.

NONCOIN CALL - ALL BUSY CONDITION

17.02 On a noncoin call, if the completing marker cannot set up a connection to a busyback, overflow, partial dial, or vacant code trunk due to a shortage of trunks or channels it will attempt to connect the calling line to a common overflow trunk. If these trunks, or the channels to them, are all busy, the marker will operate relay BT in the register. The BT releases the marker connector and the completing marker by opening lead ST, grounds lead ST to the interrupter circuit to start it and supplies line-busy tone through the TN coil to the calling customer. When the customer disconnects or the register times out, the register restores to normal.

COIN CALL - ALL BUSY CONDITION

17.03 On a coin call, if the completing marker cannot set up a call to a busyback, overflow, partial dial, or vacant

code trunk due to a shortage of trunks or channels, it cannot use one of the common overflow trunks because they are not arranged for coin operation. It, therefore, operates the BT relay, which releases the marker connector and completing marker by opening lead ST, grounds the ST lead to the interrupter circuit to start it and supplies line-busy tone through the TN coil to the calling customer. When the customer disconnects, the coin is returned as on any abandoned call.

PERMANENT SIGNAL - ALL BUSY CONDITION

17.04 On permanent signal calls, if the marker cannot set up the call to a permanent signal trunk, it will attempt to connect the calling line to a common overflow trunk. It is satisfactory to connect a coin line to a common overflow trunk on permanent signal calls because the register will have returned the coin before selecting a marker on this type of call. If the marker cannot connect the calling line to a common overflow trunk due to a shortage of trunks or channels, it will operate relays RL and BT in the register. Relay RL releases the dial tone connection and relay BT releases the marker. With both the dial tone connection and the marker released the register restores to normal. Line-busy tone is not transmitted to the line because the dial tone connection has been released.

17.05 With the above described operation, a cable failure, which causes a shortage of permanent signal and common overflow trunks, will not hold registers out of service for the stuck register time-out interval. Faulty lines in excess of those held by permanent signal and common overflow trunks will originate calls in completion with legitimate calls. A register will be held for about 12.2 seconds on each seizure by one of these excess faulty lines.

TROUBLE RELEASE

17.06 If the marker is unable to complete a connection because it has encountered a trouble, it will operate the BT relay under certain circumstances in order to free itself. If the call has not progressed far enough to operate the RL relay, the customer will receive line-busy tone as described above, and the register will restore to normal when the customer disconnects. On calls from coin lines the coin will be returned as on any abandoned call.

17.07 If the RL relay has operated before BT operates, the register will restore as soon as the marker releases. The customer will be connected to another register and receive dial tone.

MAKE BUSY

17.08 The register is made busy by inserting the proper plug into the make-busy jack at the maintenance center. This grounds lead MB and operates relay MB. The MB opens leads FT and BT so that the register appears to be busy to all markers.

17.09 The MB also removes ground from the ALM lead so that the alarm may be silenced if it has been operated by the register.

18. TEST CALLS

GENERAL

18.01 Provision is made for the register to be routine tested by test set-type test facilities or by the automatic monitor and register test circuit. For testing the dial pulse features of registers, the test set-type test facilities involve the use of a manually operated test box equipped with slow and fast dials and limiting line conditions which may be associated with a precision dial pulse generator for priming the register. For testing the TOUCH-TONE features of registers arranged for both dial and TOUCH-TONE operation, the test set-type test facilities involve the use of a manually operated test box for priming the register. For either case described above, the output is checked by a trouble recorder card or by visually observing the register. The automatic monitor, register, and sender test circuit can be used on a monitoring basis to monitor registers arranged for both dial pulse and TOUCH-TONE operation. When used for monitoring the monitor selects registers at random or may be associated with a particular one and independently records the number dialed by the customer and automatically checks this with the number transferred to the marker by the register. It can also be used as a test circuit for checking the various features of all registers.

TEST SET-TYPE TEST FACILITIES

18.02 When the register is to be maintained by use of the test set-type test facilities, App Fig. 21, consisting of the M relay, will be provided. The dial tone

marker sets up the call under the direction of the master test frame to an originating test line. The dial tone marker operates the M relay to indicate that the call is a test call and M, in turn, informs the completing marker that the call is a test call by grounding the MO1 lead, M locks to an ON ground and connects ground to the ON lead to the master test control circuit as an indication that the register has been seized. The M also connects the H lead to the winding of ON1 so that the register can be held for trouble tracing under certain conditions.

AUTOMATIC MONITOR REGISTER AND SENDER TEST CIRCUIT

18.03 The circuit, abbreviated "monitor," is associated with the register by the M relay of App Fig. 20. The M is operated by the dial tone marker on seizure of the register on both monitored calls and test calls. The M locks on the LK lead to the monitor and closes the circuit to the MON lead to inform the completing marker that the call is a monitored or test call. The M closes the following leads between the register and the monitor to permit the monitor to observe and control various operations:

- T, R Connect the monitor circuit to the tip and ring leads so that a check can be made of the number dialed by the customer on monitored calls.
- RG,FR, Are used for indicating on the CN recorder card; The position of the register in its marker connector, the frame on which the marker connector is located, and the position of the marker connector on that frame, respectively.
- H Enables the monitor to hold ON1 to prevent a return to normal under certain conditions of failure to check.
- ON Indicates to the monitor that the register is off-normal.
- MB Enables the monitor to operate the make-busy relay.
- MST Indicates when the marker start relay has operated.
- MST1 Indicates when the register has recognized the completion of dialing.
- LK Enables the monitor to hold the M relay.

MON Enables the monitor to inform the completing marker that the call is a test or monitored call. It also is used to inform the monitor that the calling party is a centrex customer with or without a private line class.

19. TRAFFIC REGISTERS

PERCENT LOAD REGISTER

19.01 With option XI, and with the circuit idle, ground is supplied through the GB 3200-Ω resistor to the LD lead which is common to all dial pulse originating registers. A relay connected to the LD lead in the traffic register circuit will be actuated when the current supplied to it through the 3200-Ω resistor falls below a value which represents a predetermined percentage of the registers in the idle condition.

ABANDONED PARTIAL DIAL REGISTER

19.02 If a call is abandoned after at least one digit has been dialed or keyed, but before dialing or keying has been completed, the ON relay will release as usual. Under these conditions relay PD will still be operated and TM1 unoperated, and a circuit will be closed from ground through a break-contact of ON, make of PD, and break of TM1 to lead APD for operating a peg count register connected to this lead. The release of ON releases P2A and PD. The PD is made slow in releasing, so that it will not open the operating circuit of the peg count register until it has had sufficient time to operate. The PD keeps the FT and BT leads open so that the register appears busy until PD releases.

19.03 If a partial dial time-out occurs, both PD and TM1 will be operated when ON releases, and the APD lead will not be grounded. The TM1 locks to a contact of PD so that TM1 cannot close the APD lead. The BT lead is also controlled by the TM1 relay so that the register cannot be reselected until TM1 releases.

ABANDONED AND PARTIAL DIAL REGISTER FOR DDD CALLS

19.04 With option TV provision is made in the register to record the number of foreign area customer dialed or keyed calls which are abandoned or timed out after nine digits have been registered.

A. Abandon Calls

19.05 If the customer abandons a call after nine digits have been registered, the KS steering relay will be operated.

Abandoning the call causes the release of the SR relay, followed by the operation of RL and the release of relay ON1. The ON1 releases the P2A and ON relays. The P2A opens the holding circuit of the slow-release relay PD. The ON relay releases the pre-translator (PST) operated relay followed by the release of PRL and CMC. The CMC, in releasing, closes a path to the FAPD traffic register circuit through a make-contact on KS, an operated contact on PD, to a normal contact on ON, to ground. This ground pulse to the traffic register circuit is under control of the slow-release relay PD in order to give the traffic register sufficient time to operate.

19.06 The KS relay is locked to PD to prevent the release of KS before PD releases.

19.07 The back contact of CMC is wired in the FAPD lead to prevent a false operation of the FAPD traffic register in case the APD traffic register is operated by another originating register at the time KS is operated.

B. Partial Dial Time-Out

19.08 If the customer dials or keys only nine digits on a DDD call but does not abandon, a partial dial time-out will result. The operation of TMA at the start of the ninth digit will start the TM timer to function. The time-out will cause the operation of the TM relay which operates TM1, which locks under control of the slow-release relay PD. The TM1 also closes a locking path for PD through a make-contact on CMC to ground. This circuit arrangement makes sure that TM1 will remain operated as long as PD is operated. The TM1 operates

the MST relay which starts the marker. With TM1 and PD operated, the marker is informed that this call should receive partial dial treatment. The marker performs its functions and transmits a release signal to the register to cause its release. On the release of the ON relay, the pretranslator operated relays PST, PRL, and CMC release in cascade. The CMC closes ground to the FAPD lead to cause operation of the FAPD traffic register and opens the circuit to the PD relay. The releasing time of PD allows sufficient time for the operation of the traffic register.

20. TRAFFIC USAGE RECORDER CONNECTIONS

20.01 The register busy for maintenance (RBM) lead to the traffic usage recorder is grounded whenever the MB relay is operated electrically and is used for indicating that the register had been made busy. This lead is also grounded whenever the automatic monitor register and sender test circuit is associated with the register on a monitored service call.

20.02 The register busy (RB) lead to the traffic usage recorder is grounded whenever the ON relay is operated indicating that the register is being used. Where the register is used in an office having all wire spring relay registers, the cross-connecting terminals RB and MB will be connected, thus, causing the RB lead to also indicate made-busy registers so that it will truly indicate "not-available-for-service" conditions. Where the register is used in an office having some U-type relay registers the cross-connection will be omitted so that the wire spring register will give the same indication as the U-type register.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Lines and Trunks

TABLE E - CUSTOMER LINES AND PBX TRUNKS

	DIALING						COIN TEST		2-PTY TEST			
	7-15 PPS Dials Cust Lines Incl Coin and 2-Pty MR		PBX Ext Lines		7-21 PPS Dials PBX Att Trks		App Fig. 9 or 10 Provided	App Fig. 33 Provided	App Fig. 12 (See Note A)		App Fig. 13 (See Note C)	
Ckt Volt Limits	45-50	66-75	45-50	66-75	45-50	66-75	125-135	45-50	45-50		45-50	
Max. Ext Ckt Loop Res	2000	2700	2000	2700	1650	2350		2000	2000	2700	2000	2700
Max. Line or Trk Cond Res	1800	2500	1800	2500	1550	2250	1420	1800	2500		2500	
Min Line or Trk Cond Res	1300		1300		1300							
Min Ins Res	10,000	20,000	10,000	20,000	15,000	20,000	10,000	10,000	10,000	20,000	15,000	20,000
Allowable Rated Bridged	2 μ F	2 μ F	3 μ F	3 μ F	None	None						
Capacity at Sub- sets	(See Note B)											
Allowable Capac- ity to Grd on Either Side of Line	2.5 μ F	2.5 μ F										
Max. Earth Potential	+10V	+10V					+10V	+10V	+10V	+10V	+10V	+10V

Note:

- A. The maximum allowable resistance of the ringer in the tip party subset is 1100 ohms (App Fig. 12). The resistance may be as high as 1940 \pm 10 percent ohms where earth potential is limited to \pm 3 volts.
- B. Allowable bridged capacity for side tone coin collector with anti-sidetone subset is 3 μ F.
- C. The maximum allowable resistance of the ringer in the tip party subset is 4000 ohms (App Fig. 13).

1.02 Voltage Limits

VOLTAGE	MIN	MAX.
-48	-45	-50
-72	-66	-75
+130	+125	+135
-130	-125	-135

Designation

Meaning

CS	C-Digit Steering
CTO-2	Class-of-Service Tens
CU2/5	Class-of-Service Units
D2/5	D-Digit Register
DD8,DD8A	Directing Digit 8
DD9,DD9A,DD9B	Directing Digit 9
DL	Delay (Digit Timing)
DMS	Delay Marker Start
DS	D-Digit Steering
DT	Digit Timing
E2/5	E-Digit Register
EOD	End-of-Dialing
ES	E-Digit Steering
F,FLA-B	Frame (Cut-In)
F2/5	F-Digit Register
FS	F-Digit Steering
FTO-3	Frame Tens (Location of Line)
FU2/5	Frame Units (Location of Line)
G2/5	G-Digit Register
GS	G-Digit Steering
GT,GT1	Ground Test (Coin Line)
H2/5	H-Digit Register
HG2/5	Horizontal Group (Location of Line)
HS	H-Digit Steering
ID	International Direct Distance Dialing
IDA	ID Auxiliary
J2/5	J-Digit Register
JS	J-Digit Register
K2/5	K-Digit Steering
KS	K-Digit Steering
L	Line (Pulsing)
L2/5	L-Digit Register
LS	L-Digit Steering
LL2/5	Line Link (Used on Dial Tone Connections)
LOLP	Long Loop
LT,LT1,2	Line Test (For Coin Clearance)
M	Monitor or Test
MAN	Manual (Operator)
MB	Make Busy
MCN	Manual Coin
MF,MF1	Multifrequency TOUCH-TONE Call
MRL	Marker Release
MST,MST1,MSTA	Marker Start
OBS	Observed Call
ON,ON1	Off-Normal
OVL	Overload Condition
P1-5	Pulse Counting
P2A	Pulse Counting Auxiliary
PBX 5	5-Digit Intra-PBX
PD	Partial Dial
PLN	Private Line Network
PRL	Pretranslator Release
PST	Pretranslator Start
RA,RA1	Digit Register Advance
RL	Release Dial Tone Condition

1.03 Resistance Limits

(a) Model II TOUCH-TONE Receiver

- (1) The lead resistance from terminal 9 of the N socket to ground shall not exceed 0.62 ohms.
- (2) The lead resistance from terminal 16 of the N socket to battery shall not exceed 0.62 ohms.

(b) Model III TOUCH-TONE Receiver

- (1) The lead resistance from terminal 9 of the F socket to ground shall not exceed 0.62 ohms.
- (2) The lead resistance from terminal 15 of the F socket to battery shall not exceed 0.62 ohms.

2. FUNCTIONAL DESIGNATIONS

2.01 The functional meanings of the designation of the operating elements of the register are given in the following table.

2.02 Relays

Designation

Meaning

11A-C	1-1 Prefix Counter
2P	2-Party
8D	8-Digits Received
10D	10-Digits Received
11D	Prefix 11 Dialed
A2/5	A-Digit Register
ABN	Abandon
AS	A-Digit Steering
A411	DDD Area Information
B2/5	B-Digit Register
BS	B-Digit Steering
BT	Busy Tone
C2/5	C-Digit Register
CI	Coin Interrupter
CGA,B	Class Group
CLR	Coin Line Release
CM3	Call Marker (After 3 Digits)
CMA-C	Call Marker Choice A-C
CN,CN1	Coin
CNT,CNT1-3	Coin Test
CR,CRA	Coin Return
CRI-4	Coin Return

LOLP	Long Loop
LT,LT1,2	Line Test (For Coin Clearance)
M	Monitor or Test
MAN	Manual (Operator)
MB	Make Busy
MCN	Manual Coin
MF,MF1	Multifrequency TOUCH-TONE Call
MRL	Marker Release
MST,MST1,MSTA	Marker Start
OBS	Observed Call
ON,ON1	Off-Normal
OVL	Overload Condition
P1-5	Pulse Counting
P2A	Pulse Counting Auxiliary
PBX 5	5-Digit Intra-PBX
PD	Partial Dial
PLN	Private Line Network
PRL	Pretranslator Release
PST	Pretranslator Start
RA,RA1	Digit Register Advance
RL	Release Dial Tone Condition

<u>Designation</u>	<u>Meaning</u>
RV	Reversal (Centrex)
RV1, RV2	Toll Diversion Reversal
SI	Supervisory on Seizure
SBO,1	Service Code B Digit
SCO,1	Service Code C Digit
SCZ, SC4	C-Digit-Equals-Zero
SD	Stations Delay Timing
SR	Supervisory
STS	Stations Steering
STR, STRA	Steering
TA2/5	Translator A Digit
TAA, B	Translator A Digit
TB2/5	Translator B Digit
TBA-C	Translator B Digit
TBL	Trouble
TC2/5	Translator C Digit
TM	Time Measure
TML, A, B, C	Time Measure
TP	Tip Party - Line Test
TP1, 2	Tip Party Test Auxiliary
TPA-D	Tip Party Test Control
TPT	2-Party Test Timing
VFO-4	Vertical File Location of Line
VG2/6	Vertical Group (Location of Line)
YO, 3, 6, 9	TOUCH-TONE Translation
Z1-3	TOUCH-TONE Translation

2.03 Tubes

<u>Designation</u>	<u>Meaning</u>
CRI-2	Coin Return Timing
CT	Coin Test Timing
DT	Digit Timing
TM	Time Measure (Overall)
TPT	2-Party Test Timing

3. FUNCTIONS

3.01 This register is designed to perform the following functions, some of which may be omitted if not required.

3.02 To make itself busy under any of the following conditions.

- (a) Register engaged on a service call.
- (b) Register under test by the test circuit.
- (c) Register made busy by means of a plug in the make-busy jack.
- (d) Failure in the 2-party test.

3.03 When seized by a dial tone marker on a dial tone connection, to register via the trunk link connector the class number and line location of the calling party and the number of the line link used on the dial tone connection, and inform the marker when this registration is locked. Also to record whether there is a service observing line connected to the calling line. All of this information is transmitted to the completing marker via the marker connector after dialing or keying has been completed.

3.04 To record information received from the dial tone marker via the trunk link connector that the call is from a coin line, a 2-party message rate line, or a manual line.

3.05 To provide for holding the register by means of a slow-release relay from the time that the marker has completed the dial tone connection and disengaged itself, until the register line relay and its associated relays have been operated under control of the customer loop and switchhook.

3.06 To hold the dial tone connection by means of a ground on the sleeve lead under control of the customer switchhook, and to hold this connection during dialing or keying by means of a slow-release SR relay.

3.07 To transmit dial tone to the calling station when the register has been connected to the line and is ready to receive dial pulses or TOUCH-TONE signals. A 2-party identification test or a coin test may be made before dial tone is transmitted.

3.08 To disconnect dial tone after the second pulse of the first digit greater than 1 has been received during a dial pulse call, or after the first digit greater than 1 has been received on a TOUCH-TONE call.

3.09 To count the number of dial pulses in each dialed digit.

3.10 To receive the frequencies representing digits keyed during a TOUCH-TONE call.

3.11 To register the dialed or keyed digits on a group of five register relays per digit on a 2-out-of-5 basis.

3.12 To steer registration of each digit to the group of five register relays corresponding to the digit received.

3.13 To register a prefix 1 or 1-1 on the prefix counter and not on the regular digit registers.

3.14 If the prefix counter is omitted, to discard any digits, discard digit 1 until the digit 2 or greater has been registered on the A-digit register.

3.15 To determine by means of cross-connections in the register or by means of information from the pretranslator how many digits are expected on the call, and to cancel further registration when this number of digits has been received.

(a) To recognize that only one digit is to be received on calls to zero operator by operating the manual relay when zero is received for the A digit.

(b) To recognize that three digits are to be registered on calls to X11 operators (toll, information, etc) by means of the relays of the X11 translator which operate if one is registered in both B and C digits.

(c) To recognize that three digits are to be registered on calls to 11X operators (toll, information, etc) by means of the prefix counter and registration of a digit on the A register.

(d) To recognize that six digits are to be registered on NPA-411 foreign NPA information calls.

(e) To recognize from the A digit or from the B digit or from a combination of the A and B digits, by means of the A- and B-digit translators how many digits are expected and whether to wait for the customer to dial or key one additional digit, for example, a party letter, before canceling further registration.

(f) To recognize from the C digit, by means of the C-digit-equals-zero translator, that a DDD call is being dialed or keyed.

(g) To determine the number of digits to be registered when an interchangeable NPA or local code is keyed or dialed and a pretranslator is provided.

(h) To recognize a single 1-, 2-, or 3-digit straightforward code by means of the single code translator relays and to select a marker after the particular code has been received.

(i) To select a pretranslator after the third (or second) digit has been registered in those offices where the numbering plan is too complex to permit or economically justify translation and determination of the number of expected digits by means of connections within the register, to pass the registered code digits to the pretranslator, and to receive from the pretranslator the following information:

(1) The minimum number of digits expected on the call.

(2) Whether or not a party letter of the fifth numerical digit may follow the fourth numerical digit.

(3) Whether the three digits on the A, B, and C registers constitute an operator code such as 211 or a vacant code, in which case the register will select a marker immediately after release from the pretranslator.

(4) Whether on calls from coin lines the coin should be returned before establishing the connection from the calling line to a trunk.

3.16 To select a completing marker when dialing or keying has been completed. As described below, a 2-party identification test, or a coin test may be made between the end of dialing and the selection of a marker.

3.17 To transfer to the completing marker the following information:

(a) Class of service of the calling line: class group, class tens, and class units.

(b) Calling line location: frame tens, frame units, horizontal group, vertical group, and vertical file.

(c) Number of line link used on the dial tone connection.

(d) Whether the calling line is connected to a service observing line.

- (e) All digits dialed or keyed by the calling customer, including a 1-1 prefix if dialed or keyed.
- (f) Ground on lead LT, LT1, LT2, LT3, 11, FVD, 2DT, or X11 to indicate a local call, a digit 1 access call, a PPCS call, a private line network call, a 11 prefix call, a 5-digit centrex call, a 1XX code centrex call, or a 4-digit centrex call to cause the marker to use the proper translator.
- (g) Grounds lead 7 of the digit 1 beyond the last to provide a means for the completing marker to check that the entire called number has been transferred.
- (h) Grounds lead PS, PD, or PK to indicate a permanent signal, partial dial, or a regular call.
- (i) Grounds lead RP or TP to indicate that the ring or tip party of a 2-party line is calling. Lead RP is also grounded on calls from lines other than 2-party.
- (j) Grounds lead CR, SCN, or SCK to indicate that a coin has been returned, a stuck coin has been encountered, or that no coin return has been attempted with App Fig. 11, or grounds SCK or SCN on a coin line call with App Fig. 33 to indicate that a coin has been deposited or that a coin has not been deposited, respectively.
- 3.18 To open the tip, ring, and sleeve toward the calling customer upon a signal via the RL lead from the completing marker. This releases the dial tone connection and permits the completing marker to establish a connection from the calling line to a trunk.
- 3.19 To hold the register via the L lead to the marker connector, so that the calling customer cannot release the connection while the marker is engaged, and so that the release of the dial tone connection will not release the register.
- 3.20 To disconnect from the marker when the marker grounds the MRL lead and to return to normal.
- 3.21 To recognize an abandoned call by the customer at any time before a marker is engaged, and to restore the register and dial tone connection to normal.
- 3.22 To make a 2-party identification test on two party lines before dial tone is transmitted and again after dialing or keying has been completed. After the second test has been completed, to engage a marker and transmit to it the results of both tests. If the test results do not match, both TP and RP leads will be grounded, and the completing marker will cause a trouble record to be made.
- 3.23 To test the TP relay on its test operate current at the end of every call from a ring party on a 2-party class, and to test the TP relay for release on open circuit at the end of every call from a 2-party class. If the TP relay fails to operate or release the register will not restore to normal and a time-out alarm will be given.
- 3.24 To make a test for presence of a coin before dial tone is transmitted on calls from coin-first loop-start coin lines. If a coin is deposited the call is allowed to proceed. If the coin is not deposited within 25 seconds nominal a marker is engaged and the line is connected to a permanent signal holding trunk. This time interval is reduced to 12.2 seconds nominal during office overload periods. Switchhook supervision is maintained during coin test.
- 3.25 To make a test for presence of a coin after dialing has been completed but before a marker has been engaged on all calls except those to zero operator from dial-tone-first coin lines. If a coin is deposited a marker will be engaged and the call will proceed in the usual manner. If, on other than zero operator calls, the coin is not deposited, the register will, with Fig. 7, 10, or 11, transmit to the customer no such number tone after 11.9 seconds nominal, or an announcement after 4.5 seconds maximum. With Fig. 33 the marker will be engaged. If the customer abandons the call, the register will release. If the coin is deposited during the tone period, the call will be completed. If neither is done, a stuck register time-out will occur 25 seconds nominal after the end of dialing, and the register will return to normal. The customer will be reconnected to the line circuit which will function to cause a new dial tone connection to be established and the customer will receive dial tone as on a new call. Switchhook supervision is maintained during coin test.

- 3.26 To provide coin return features as follows:
- (a) To return the coin on abandoned calls and permanent signals.
 - (b) When App Fig. 11 is provided, to return the coin on calls to operator trunks, service trunks, and other free trunks on the trunk link frame.
 - (c) To check for coin clearance after coin return with App Fig. 11 and to inform the marker if a stuck coin condition is encountered.
- 3.27 To measure time while awaiting an additional digit, such as party letter, when this is required.
- 3.28 To measure time (25 seconds nominal during normal loads and 11.9 seconds nominal during heavy loads) while waiting for the first digit to be registered. If the digit is dialed or keyed the timer is recycled and the call proceeds. If the digit is not dialed or keyed, a marker is engaged and the line is connected to a permanent signal holding trunk.
- 3.29 To measure time between digits (25 seconds nominal during normal loads, and 5.7 seconds nominal during heavy loads). If the customer is too slow in dialing or keying, a marker is engaged and the line is connected to a partial dial trunk.
- 3.30 To measure time from the completion of dialing or keying (or PS or PD time-out) until the register restores to normal. This interval is 25 seconds nominal. If the register does not restore in this time, the timer circuit attempts to restore the register. If the timer is successful in this action, the calling line will originate a new call and receive dial tone from a new register. If the register does not release, a lamp will be lighted at the maintenance center to indicate the stuck register and a common timer will be started, which, after an interval, will cause an alarm.
- 3.31 To recognize a monitor or test signal from the dial tone marker while it is setting up the dial tone connection, and to connect to the automatic monitor register and sender test circuit or to the register

test circuit via the master test control circuit for that call, and to inform the completing marker that the call is a monitored or test call.

3.32 To recognize a manual originating line signal from the dial tone marker while it is setting up the dial tone connection, to open the dial tone lead, and to treat the call as if the customer had dialed or keyed zero. On noncoin calls the marker will be engaged immediately and zero will be transmitted for the A digit. On coin calls the coin will be returned, and then a marker will be engaged and the line connected to a zero operator trunk.

3.33 To start the associated interrupter circuit and to supply busy tone to the calling customer and to disengage the marker when it grounds the busy tone (BT) lead. The register will release when the customer disconnects in response to the tone. If the customer does not release, stuck register time-out occurs and the action described above takes place. Relay BT is operated by the marker where there are no trunks or no linkages for connecting the call, where the marker cannot operate the MBL relay, or where the marker cannot complete its functions.

3.34 To operate a percent load register when a predetermined percentage of the registers are busy (option XI provided).

3.35 To operate a traffic register to count the number of abandoned partial dial calls.

3.36 To operate a traffic register to count the number of DDD calls registering only nine digits.

3.37 To provide for grounding class lead OR for home NPA calls and for grounding lead FAC for foreign NPA calls.

3.38 To operate a traffic register to count the number of TOUCH-TONE originated calls.

3.39 To start the associated interrupter circuit and to supply busy tone to the calling TOUCH-TONE customer when non-used combinations of signal translating relays are operated.

- 3.40 To provide for operation with the centrex feature.
- 3.41 To provide for operation with the traffic usage recorder circuit.
- 3.42 Where zero prefix counter is provided, to determine whether an initial zero is a person-person collect special call (zero followed by additional digits) or a zero operator call (zero not followed by additional digits).
- 3.43 To provide for operation with the centrex private line network feature.
- 3.44 To indicate that an information operator in the local NPA is desired when the digits 1-411 are keyed or dialed.
- 3.45 To provide special coin features as follows.
- (a) To provide coin test without coin return by the register on zero operator calls, and to indicate to the marker, a "coin deposited" condition by ground on the L0 lead or a "coin not deposited" condition by ground on the L2 lead.
 - (b) To permit bypassing of the coin test and/or coin return features on service calls and calls to certain free trunks.
- 3.46 To provide 3.0- through 4.5-second timing on coin test.
- 3.47 To provide connection to an announcement system after time-out of the 3.0 through 4.5-second coin test timing interval.
- 3.48 To permit limited overseas dialing in registers equipped with the person-person collect special and prefix digit 1 features, and where the registers also function with pretranslators.
- (a) To provide to the marker on overseas dialing, translator indications FAC and FVD on person-to-person calls preceded by 0-1 or FAC and 1-1 on station-to-station calls preceded by 0-1-1.
- 3.49 To permit monitoring of 3-digit intercommunication calls.
- 3.50 To permit operation with individual and 2-party lines over external loops up to 2700 ohms when relay LOLP operates from the dial tone marker.
- 3.51 To provide -72 volts nominal to the primary winding of the L relay for long loop pulsing.
- 3.52 To provide for PBX toll diversion of toll calls dialed by restricted stations over dial "9" trunk groups used by PBX operators for toll completion.
- 3.53 To reverse the tip and ring connection to the calling line on signal from the completing marker when toll diversion is being invoked.
- 3.54 To prevent a false release of the L relay during tip and ring reversal, but to recognize an abandoned call after the reversal and cause immediate release of the marker.
- 3.55 To function as follows with coin Fig. 33 provided:
- (a) Test for presence of coin on all calls at end of dialing.
 - (b) Test for coin over tip lead only with ring lead open.
 - (c) Summon marker immediately following coin test on all calls.
 - (d) Ground lead SCK to marker to indicate coin-present condition or lead SCN to indicate coin-not-present condition.
 - (e) Return coin on permanent signal and abandoned calls only.
 - (f) Test operate the GT relay on every coin call. If GT and, in turn, GT1 fail to operate, the register will not restore to normal and a time-out alarm will be given.
- 3.56 To function as follows on IDDD calls with or without use of the IDDD pre-translator.
- (a) To recognize the prefix code 0-1 as the start of an IDDD call and accept additional digits in the usual way if dialed by an eligible IDDD customer.
 - (b) To immediately call for the marker on recognition of the 0-1 code if dialed to a register not equipped for IDDD.
 - (c) To provide ground on leads 11 and FAC to the completing marker on recognition of the prefix code 0-1-1, indicating an IDDD station-to-station call.
 - (d) To provide ground on leads FVD and FAC to the marker for the code 0-1, indicating an IDDD person-to-person call.
 - (e) To cause reorder tone to be returned immediately on keying of the invalid IDDD prefix codes 0-1-1-1 or 0-1-1-0.

(f) To summon a marker on keying of the prefix digits 0-1-0 with the digit "0" in the A-digit position.

(g) To recognize the TOUCH-TONE frequencies generated by the TOUCH-TONE button to right of the zero button as an end-of-dialing EOD signal.

3.57 To function as follows where the register does not use an IDDD pre-translator on the call.

(a) To time on a repetitive digit basis after the seventh digit of an IDDD call has been received if the call is initiated by a dial pulse customer, or on some IDDD arrangements, by any dial pulse or TOUCH-TONE customer.

(b) To immediately call for a completing marker if the EOD signal is keyed after registration of the G digit.

(c) To cause reorder tone to be returned if the EOD signal is keyed prior to registration of the G digit.

3.58 To function as follows where the register uses an IDDD pretranslator on the call.

(a) To ground lead 11 instead of 1T to the pretranslator connector circuit as a request for connection to the IDDD pretranslator.

(b) To recognize the absence of ground on all leads CMA, CMB, CMC, CM3, and SD as an indication that repetitive digit timing is required on this call after seven digits are received.

(c) To recognize ground signals on both leads CMB and SD as an indication that repetitive digit timing is required on this call after eight digits are received.

(d) To recognize ground signals on both leads CMA and SD as an indication that repetitive digit timing is required on this call after nine digits are received.

(e) To recognize a ground signal on lead CMA alone, as an indication that the marker should be summoned after nine digits are received.

(f) To recognize a ground signal on lead CMB alone, as an indication that the marker should be summoned after ten digits are received.

(g) To recognize a ground signal on lead CMC alone, as an indication that the marker should be summoned after eleven digits are received.

(h) To recognize a ground signal on lead CM3 alone, as an indication that the marker should be summoned after three digits are received.

3.59 To provide for the handling of interchangeable NPA and local area codes without timing on any interchangeable code under the following conditions:

(a) Prefix digit 0 or 1 must be dialed for initiating 10-digit calls.

(b) Calls within the home NPA must be dialed on a 10-digit basis.

3.60 To provide for the handling of interchangeable NPA and local area codes with timing provided only on 0+ traffic, and all 1+ traffic requires ten digits.

3.61 To permit use of the electron tube DT timer for timing on interchangeable codes.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

4.02 This circuit will function with the following crossbar system circuits.

Marker Circuit - SD-25550-01

Dial Tone Marker Circuit - SD-26001-01

Completing Marker Circuit - SD-26002-01

Originating Register Marker Connector - Register Part - SD-26024-01

Preference Control Circuit for Marker Connector - SD-26029-01

Originating Register Marker Connector, Marker Part - SD-26023-01

Marker Connector Circuit - SD-25586-01

Automatic Monitor Register and Sender Test Circuit - SD-25680-01

Master Test Control Circuit - SD-25800-01

Master Test Frame Jack, Lamp, and Key Circuit - SD-25762-01

Signal Circuit, No Such Number Tone Supply - SD-25791-01

Trunk Link and Connector Circuit - SD-25549-01

Trunk Link Connector Circuit - SD-26032-01

Master Test Frame Connector Circuit - SD-25805-01, SD-27718-01

60- or 120-IPM Interrupter Circuit - SD-25814-01

Miscellaneous Circuit Originating Register Frame - SD-25797-01

Group-Busy Circuit - SD-25795-01

Traffic Register Circuit - SD-25892-01

Pretranslator Connector Circuit - SD-25569-01

Pretranslator Connector Circuit - Originating Register Part - SD-26038-01

Pretranslator Circuit - SD-25568-01

Traffic Usage Recorder Circuit - SD-95738-01

TOUCH-TONE Calling Receiver, Model II - SD-95287-01

TOUCH-TONE Calling Receiver, Model III - SD-98148-01

Time Delay Control Circuit - SD-94820-01

Amplifier Circuit - SD-95281-01

Announcement Circuit - SD-95283-01

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The originating register shall be capable of performing all the service functions specified in this circuit description and meeting all the requirements of the Circuit Requirements Table and also shall be capable of functioning under test conditions listed below.

5.02 The pulsing and counting functions of the register shall be checked with the following conditions:

(a) A precision pulse generating circuit such as SD-25680-01, or equivalent, capable of generating dial pulses within the limits of accuracy given in Fig. 8 in Information Note 304 in the SD.

(b) Equivalent loop circuits such as shown in Fig. 9 in Information Note 304 in the SD. Figure 9A-F shows the condition for testing the register for functioning on noncoin and loop-start coin lines and Fig. 9G-J shows the condition for testing the register for functioning on ground-start coin lines.

5.03 Nominal circuit conditions may be employed in these tests except as specified in (a) and (b) below.

(a) The pulsing and counting features of the register circuit under test shall be checked using the pulsing and loop and leak conditions covered by Fig. 8 and 9. At least four digits; two digits of less than 5 pulses, preferably nines or zeros, shall be dialed under each condition and all digits dialed shall be correctly registered.

(b) The test circuit shall provide an interdigital interval of 183 ± 13 ms for the pulsing conditions of Fig. 8E. For other pulsing conditions this time may be exceeded.

5.04 Under certain dialing interrupter test conditions where the interdigital interval is short, the TMB relay may not have sufficient time to operate so as to cause a recycle of the TM timer at the start of each digit. Due to this limitation, it may not be possible to test the register with the OVL timing relay operated and using a large number of digits, each with a high number. Under these conditions, the TM timer may function before the entire number is dialed. With the OVL relay unoperated, any number of digits, each of any number may be dialed.

6. TAKING EQUIPMENT OUT OF SERVICE

A. Register Circuit or Any of Its Associated Apparatus

6.01 In order to take the register or any of its associated apparatus out of service, insert a No. 322A plug in the associated originating register make-busy (ORMB) jack at the jack bay of the master test frame.

B. General Precautions to be Followed When Working on the Apparatus

6.02 When working on the apparatus, the register should be made busy by inserting a No. 322A plug, in the associated ORMB jack at the jack bay of the master test frame. No further precautions are necessary other than those noted in the Circuit Requirements Table.

7. ALARM INFORMATION

TIME-OUT ALARM

A Condition

7.01 If an originating register encounters an extended delay in the performance of its functions the register timing circuit will operate and attempt to release the register as covered in 5. SELECTION OF COMPLETING MARKER - RELEASE OF REGISTER of the detailed description except in the case of a failure of the 2-party test or failure of the GT operate test in coin Fig. 33, in which case the register will be held off-normal.

B. Indication

7.02 If the register releases satisfactorily, the only indication of the condition will be the momentary lighting of the time-out (TO) lamp for the register on the master test frame. Should the

register fail to release, the TO lamp will remain lighted and the common alarm timing circuit will function and, after 10 to 15 seconds, operate the major alarm and light the register and sender time-out alarm (R-S-TOA) lamp.

C. Action Required

7.03 If, in response to a major alarm, a lighted time-out (TO-) lamp is found, insert a No. 322A make-busy plug in the originating register make-busy (ORMB) jack, associated with the TO- lamp to silence the alarm and to remove the register from service.

FUSE ALARM

7.04 If, in response to a major alarm, an FA lamp is lighted at an originating register frame, it is an indication that a fuse has operated at the associated frame. Replace the operated fuse to restore the alarm and extinguish the FA lamp.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 A trouble condition has been encountered which only occurs on the abandonment of foreign area calls after three digits are dialed in registers equipped with option OT (provided on Drawing Issue 41D), and which function with the pretranslator circuit. This trouble prevents the register from releasing and is caused as follows. When the pretranslator operates the register CMC relay for the foreign area code translation, relay PD, previously operated by relay P2A, is locked operated by contact 2 (CMC). Contact 4(PD), with options PS equipped, provides a holding ground for the steering relays in addition to the off-normal ground at contact 2(ON). When the call is abandoned after three digits, the normal relay sequence is as follows. The L releases, SR releases, RL

operates, ON1 releases, and ON releases. The release of ON should cause all operated relays to release. However, relay PST is held operated over its operate path, which includes a front contact of relay DS, to ground at contact 10 (STRA). Since PST cannot release, relays PRL, CMC, PD, and DS are also held operated and the register is locked out of service. This trouble is corrected by replacing option PS with option PT. In effect, this removes the holding ground provided by contact 4(PD) from the steering chain, permitting DS to release, and, in turn, the PST, PRL, CMC, and PD relays. Option PT was provided on Drawing Issue 42D, and rated after-date Standard, to correct a condition causing trouble record cards without line memory and digit information on some intracentrex calls. Option PS was rated Mfr Disc. on Issue 42D. Option PT must now be applied to all registers equipped with option OT and App Fig. 17, on an "AC" basis.

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