STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A OR 35E97
OUTGOING TRUNK CIRCUIT
LOOP OR E&M LEAD SIGNALING
SPECIAL TOLL OR OPERATOR ASSISTANCE
ANI TYPE B OR C FOR NO. 1, 350A, 355A OR
ANI TYPE C FOR 35E97 OR OPERATOR
IDENTIFIED TO CAMA OFFICE

24

CHANGES

D. Description of Changes

D.1 FS1 has been revised to show the addition of "ZN" option which provides a parallel combination of a make contact of relay B and relay W1 in series with the W1 relay coil to allow the MB relay to make this circuit busy when the -48 volt battery supply fails. Wiring formerly not designated has been designated "ZM" option and is rated Standard.

D.2 Circuit Note 106 has been added and Note 103 has been revised to show the addition of options "ZM" and ZN.

D.3 SC4 has been modified.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5245 - LCB
WECO DEPT 5152-NCR-WEA

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A OR 35-E-97
OUTGOING COIN TRUNK CIRCUIT
LOOP OR E&M LEAD SIGNALING
ARRANGED TO HANDLE SPECIAL TOLL
OPERATOR ASSISTANCE AND STATION TO STATION
SENT PAID CALLS
ANI-B OR C FOR NO. 1, 350A OR 355A OR
ANI-C FOR 35E97 OR OPERATOR IDENTIFIED
TO CAMA

CHANGES

B. Changes in Apparatus

	Superseded	Superseded By
B.1	MB Res - FS1, App. Fig. 1 ZH Option	MB Res - FS1, App. Fig. 1, ZI Option

C. Changes in Circuit Requirements Other Than Those Caused by Changes in Apparatus

C.1 Note 2 is added to page 2 (sheet F1) and reference to note 3 changed to note 2 for relay "S".

C.2 Test clip data was changed to show battery connected to 6, relay (S) for test of secondary winding.

D. Description of Changes

D.1 The following changes are made on a "No Record Basis" per agreement with WECo.

1. RCVR test cord in App. Fig. 5 is changed from code M7C to code W7C.
2. Contact 10 and 12 relay P4 reversed.
3. Contact 11 relay P1, changed from a break to a make on FS5.
4. The location of contact 4, relay C, App. Fig. 1 corrected.
5. Capacitor B App. Fig. 1 changed from 535AG to 535GC.
6. The location of contact 1, relay W, App. Fig. 1 corrected.
7. Rerate App. Fig. 5 and Option "R" "Mfr. Disc."

D.2 Option ZJ is added and rated "Standard."

D.3 Option ZH is designated and rated "Mfr. Disc." and option ZI is added and rated "Standard." to increase the holding current to relay MB.

D.4 Option ZK is designated and rated "Mfr. Disc" and option ZL is added and rated "Standard" to improve the longitudinal balance in the trunk circuit.

D.5 Circuit Note 103 is changed to reflect changes.

F. Changes in Body of CD

F.1 Add to connecting circuits:
(m) Totalizer Circuit SD-95965-01.

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit is used for routing dial-0 assistance traffic, special toll traffic 0+, and station-to-station sent paid toll traffic 1+ from coin lines served by a local step-by-step office to a crossbar tandem office arranged to function with the traffic service position.

1.02 This circuit is arranged for controlling the disposal of coins and reringing the calling subscriber. This circuit is also arranged for ANI-B, ANI-C, or temporary non-ANI.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The circuit operation here described is assumed to be for a regular call from seizure through the talking period and to release, without discussion of any variations. Other possible conditions are introduced in Section II.

SEIZURE AND PULSING

2.02 This outgoing coin trunk handles three types of traffic: dial-0 assistance, special toll 0+, and station-to-station sent paid 1+. The 0 and 0+ traffic enters this circuit through one access. The 1+ traffic enters this circuit through another access.

2.03 Both accesses converge to form one transmission, supervisory, and pulsing path. In order to distinguish the difference between 0- and 1-type traffic, an identification arrangement based on the access is used. On a 0-type seizure, OC and A operate in series to the customer bridge. OC prepares OC1. When OC1 operates, it prepares a start-prime signal (-48 volt resistance battery) for transmission to the outpulser later in the call. The start-prime signal is the identification signal for a 0-type call. On a 1-type seizure, A operates to the customer bridge. OC remains normal. With OC normal, the identification signal for a 1-type call is a direct ground, referred to as a start signal. This signal is transmitted to the outpulser later in the call.

2.04 Seizure continues with the operated A signaling the distant office incoming trunk. A operates A1, which operates B. B grounds the S lead to hold the switch train, makes the other idle input access busy, and operates B1 and W1. On a 0-type call, OC operates OF. OF starts an arrangement which dismisses a 1-type call in the event of a simultaneous seizure. The circuit has a built-in preference toward 0-type calls.

2.05 When seizure to the distant office is completed, the circuit is ready for pulsing. Pulsing only occurs on 0+ and 1+ type calls.

SUPERVISION AND ANI

2.06 At the conclusion of pulsing or immediately after seizure, the incoming trunk sends back an off-hook signal and takes control of this trunk. With loop signaling, the off-hook is a reversal of battery and ground. With E and M signaling, the off-hook is a ground on lead E. In both types of signaling, their respective S relays operate. S operates S1, thereby operating RV. RV reverses the battery and ground to the customer station to cut through the coin box trunk. If ANI is required, RV also sends a bid for an outpulser. The ANI operation consists of testing the customer line for abandonment; if the customer line is off-hook, it has an identification signal applied to the customer S lead. When the outpulser obtains the calling number information, it outpulses the information to the incoming trunk.

COIN CONTROL

2.07 The collection of coins in the coin box is under control of the operator and an automatic coin collect operation. If the call extends beyond a specified timed period, the automatic coin collect operation takes place. If special charges are required, as an example, the operator can control the coins. In both operations, the coins are controlled by signals over the customer T and R leads or T lead only.

2.08 With the loop signaling arrangement, coin control signals from the distant office incoming trunk are in the form of high-low voltages. For coin collect, the incoming trunk sends a high voltage on-hook, or +130 volts on the T lead and -48 volts on the R lead. For coin return, the incoming trunk sends a high voltage off-hook of +130 volts on the R lead and -48 volts on the T lead. In coin collect, S releases and CN operates. This combination causes coin collect voltage to be applied to the customer line. In coin return, CN operates and S remains operated. This combination causes coin return voltage to be applied to the customer line.

2.09 With the E and M signaling arrangement, coin control signals from the distant office incoming trunk are in the form of ac inband frequencies. For coin collect, the inband signal is a combination of 700- and 1100-Hz frequencies. For coin return, the inband signal is an 1100-Hz frequency.

2.10 In a coin disposal operation, the alerting signal from the incoming trunk is a 65- to 125-ms wink. At the end of the wink interval, a Receiver Circuit is connected to the outgoing T and R leads. The Receiver Circuit is basically an ac-to-dc converter. At the end of a quiet period the incoming trunk applies the coin disposal inband frequencies. The receiver, upon receipt of the signals, converts them to a dc signal to operate specific relays in this trunk. In

the case of coin collect, F1 and F2 operate; for coin return, F2 alone operates. These relays cause the proper coin voltage to be applied to the customer line.

2.11 All coin disposal operations are timed for 500 ms to ensure an adequate application. At the end of the coin disposal operation, the line is discharged and returned to normal for transmission purposes.

RINGBACK

2.12 A ringback arrangement is provided to enable the operator to ring the calling station, whether it is on- or off-hook.

2.13 If the trunk is provided with a loop signaling arrangement, the ringback signal from the distant office incoming trunk is an alternating reversal of signal battery and ground. The alternating reversals last for approximately 75 ms per reversal. Three cycles are necessary to start ringing.

2.14 If the trunk is provided with an E and M signaling arrangement, the ringback signal from the incoming trunk is an ac inband frequency of 700 Hz. When ringback is initiated, a wink signal alerts this trunk. At the end of the wink a Receiver Circuit is connected to the T and R leads. The 700-Hz tone is converted by the receiver to a dc signal. Relay F1 of this circuit operates, thereby causing ringback voltage to be applied to the customer line.

2.15 All ringback operations are timed for a 2-second period to ensure an adequate application.

DISCONNECT

2.16 There are two types of disconnect, calling party first or called party first.

2.17 In a calling party disconnect, the calling customer goes on-hook, thereby releasing A of this trunk. "A" sends an on-hook signal to the incoming trunk. The incoming trunk goes through a timed period to distinguish whether the on-hook signal is a legitimate disconnect signal or not. After a designated period, the incoming trunk starts a disconnect function. The distant office equipment disconnects so far, then sends an on-hook signal to the outgoing trunk.

2.18 In a called party disconnect, the called station goes on-hook, thereby sending an on-hook signal to the distant office incoming trunk. The incoming trunk goes through a 13- to 32-second timed disconnect period. At the end of this period, it sends an on-hook signal to the outgoing trunk.

2.19 In the called or calling party disconnect, the on-hook signal from the incoming trunk alerts the outgoing trunk to a coin cleanup cycle to follow. Coin signals are applied by the incoming trunk. For the loop signaling arrangement, these are high-low voltage signals. For the E and M signaling arrangement, these are the ac inband frequencies.

2.20 When the coin disposal voltages are applied to the customer line, the outgoing trunk sends an off-hook signal to the distant office. At the end of coin disposal, the outgoing trunk removes the off-hook signal and replaces it with an on-hook. The incoming trunk, upon receipt of this signal, finishes its remaining release function. The outgoing trunk proceeds to release by winking off the customer switch train. After the customer has been freed, the outgoing trunk releases completely.

MISCELLANEOUS TRUNK OPERATION

2.21 A number of other trunk operations, such as call abandoned before completion of dialing or at the end of dialing; a partial dial and the customer remains off-hook; trunk make busy; return of initial coin; and fuse failure, are treated in detail in Section II.

SECTION II - DETAILED DESCRIPTION

1. SEIZURE (SC1)

SEIZURE BY OPERATOR ASSISTANCE (0) OR SPECIAL TOLL (0+) OR STATION-TO-STATION SENT PAID (1+) CALL - LOOP OR E AND M LEAD SIGNALING

1.01 When this trunk is seized by a customer making a 0 or 0+ type call, A and OC operate over the customer loop. If the seizure is by a customer making a 1+ call, A alone operates over the customer loop.

1.02 The operation of A:

(a) With loop signaling, closes a loop to seize the distant office incoming trunk.

(b) With E and M signaling, connects battery through lamp M to lead M to seize the distant office incoming trunk.

(c) Operates A1.

1.03 The operation of A1:

(a) With loop signaling, opens the secondary winding of S and closes a path in parallel with the A pulsing contact. This serves to prepare the customer flashing circuit.

(b) Operates B.

1.04 The operation of B:

(a) Depending on the type of call, grounds the 0 or 1 incoming S lead to hold the preceding circuits, thus making this circuit appear busy to idle ROTS.

(b) Depending on the type of call, grounds the 0 or 1 incoming S lead to busy that access to incoming calls.

(c) Operates W1, which prepares circuit paths that will be described later.

(d) On a 1-type call, grounds the R lead through a break contact of OC1 released to the outpulser circuit. This indication is called a start signal and identifies a 1-type call.

(e) Operates B1.

1.05 The operation of B1:

(a) Supplements the ground on the incoming S lead.

(b) Prepares the operate path for RV and C.

(c) Prepares its lockup path to a make contact of S1.

(d) With E and M signaling, removes the idle line termination network that is across the outgoing T and R leads.

(e) Operates D.

1.06 D prepares the coin control and ringback arrangement. Its operation is described in those sequences.

1.07 With the operation of B1, the circuit is ready to receive and transmit pulsing information. Before pulsing is described, other relay operations that occur on a 0-type seizure must be described.

1.08 On a 0-type seizure, OC operates with A.

1.09 The operation of OC:

(a) Prepares an operate path for OC1.

(b) Operates OF, which in turn operates OF1.

1.10 With B and OC operated, OC1 will operate to ground on the incoming S lead.

1.11 The operation of OC1:

(a) Releases OC by removing it from the R lead.

(b) Prepares a start prime signal, -48 volt resistance battery, for transmission to the outpulser later in the call. It is this signal that identifies a 0-type call.

(c) Connects the 1 access T lead to low tone busy.

(d) Connects the 1 access R lead to relay OF.

(e) Connects the 1 access S lead to ground provided by OF.

1.12 The purpose of disconnecting the 1 access T, R, and S leads from the 0 access T, R, and S leads and connecting them as just described, is to separate 0 and 1 traffic in the event of a simultaneous seizure by 0 and 1 customers. (Refer to SC2.) This procedure is automatic on all 0 seizures. If a simultaneous seizure has occurred, OF will stay operated over the customer loop. OF holds OF1 operated. OF also maintains ground on the 1 access incoming S lead. OF1 has connected low tone busy superimposed on ground to the T lead. When the 1 customer disconnects after hearing the busy tone, OF will release.

1.13 Release of OF:

(a) Removes ground from the 1 access incoming S lead. This releases the preceding switch train.

(b) Releases the slow-to-release OF1.

1.14 OF1 will release in 37 to 95 ms, thus giving sufficient time for the switch

train to release completely before regrounding the S lead. If by chance a new seizure should take place before OF1 releases to reground the S lead, then OF and OF1 will reoperate. The new 1 customer upon hearing busy tone should disconnect. OF and OF1 will release as described to free the customer and reground the S lead to block against seizure.

1.15 The arrangement of dismissing a 1 customer on a simultaneous seizure has a built-in preference always favoring the 0 customer.

2. PULSING - SPECIAL TOLL (0+) AND SENT PAID (1+) CALLS ONLY (SC1)

LOOP SIGNALING

2.01 The A relay follows the customer dial pulses. When it releases on the first open, A1 also releases, thus operating C. C closes a bridge across the outgoing T and R leads. In this bridge is the optional 1000-ohm resistor W. It is used to prevent oversaturation of the distant office pulsing relay on loops of less than 1000 ohms. As A and A1 pulse in response to the customer dial pulses, A interrupts the loop, thereby transmitting pulses to the incoming trunk in the distant office.

2.02 C is slow to release so that it holds during pulsing. However, it will release during the interval occurring between dialed digits.

E AND M LEAD SIGNALING

2.03 The A relay follows the customer dial pulses and repeats them to the incoming trunk at the distant office by transferring the M lead from battery to ground on each open of the customer loop. A1 follows A; on the first release of A1, C operates. C holds during pulsing and releases during the interval occurring between dialed digits. However, the operation of A1 and C does not have any use during pulsing. The importance of the interrelationship between A1 and C is seen during the abandoned call operation.

3. SUPERVISION (SC1)

SUPERVISION FROM DISTANT OFFICE INCOMING TRUNK

3.01 After the calling number is pulsed to the distant office and when the equipment in that office is ready to answer, an off-hook signal is sent back to this trunk circuit.

A. Loop Signaling

3.02 The off-hook signal from the distant office incoming trunk is in the form of a reversal that operates S. S in turn operates S1.

3.03 The operation of S1:

(a) Removes resistors G and H from the pulsing path. These resistors serve the purpose of preventing a false pulse from being sent to the incoming trunk during the interdigital period. When C releases the uncharged inductor, A is paralleled by resistors G and H, which hold the incoming trunk supervisory relay until the inductor charges.

(b) Removes resistor V from the outgoing T and R leads. This resistor is used to balance the T and R capacitors, thus eliminating inductive surges during pulsing.

(c) Connects the T and R capacitors to the transmission path.

(d) Prepares the operate path for R1.

(e) Prepares a locking path for W, CC, and CR.

(f) Operates RV.

B. E and M Lead Signaling

3.04 The off-hook signal from the distant office is in the form of a ground on lead E that operates S. S in turn operates S1.

3.05 The operation of S1:

(a) Prepares a lockup path for W, CC, and CR.

(b) Operates RV.

3.06 The operation of RV (loop or E and M lead signaling):

(a) Locks to its own contact under control of B1.

(b) Supplements the ground on the S lead provided by B and B1.

(c) Reverses the A relay battery and ground to cut through the coin box trunk (E option).

(d) Opens the C operate path.

(e) Prepares a lockup path for CC and CR.

(f) Operates CR when the initial coin return feature is provided.

(g) Operates IR upon completion of initial coin return to prevent false reoperation of CR during talking period.

(h) Operates OA when option B or ZG is provided.

3.07 If OA operates, it connects relay AA to the customer line for supervision, and

applies +48 volt battery to the R lead and ground to the T lead.

3.08 If this circuit is furnished with the non-ANI option T, the call becomes operator identified.

3.09 If this circuit is furnished with the non-ANI options M and K, return of initial coin will take place automatically.

3.10 If this circuit is furnished with the ANI option Z, the call is then identified by the ANI method. Refer to 4.01 through 4.17 for ANI details.

3.11 If this circuit is furnished with the ANI options H and K, return of initial coin will take place automatically.

CUSTOMER SUPERVISION

3.12 After answer supervision is received from the incoming trunk, the outgoing trunk is in position to respond to customer flashing.

A. Loop Signaling

3.13 If the customer wishes to flash the operator, the operation of the switchhook releases A or AA and A1. A or AA and A1 remove the low-resistance bridge through transformer A. A1 alone inserts the secondary winding of S as a high bridge to the incoming trunk. The sequencing of the A1 make and break contacts is such as to permit the insertion of the high bridge just before the removal of the low bridge. This prevents possible false operation of S.

3.14 When the switchhook is released, A or AA and A1 reoperate. A or AA inserts the low bridge, and A1 removes the high bridge and supplements the low-bridge path.

3.15 The foregoing is one operation of the switchhook; subsequent operations are repetitions of this description.

B. E and M Lead Signaling

3.16 If the customer wishes to flash the operator, the operation of the switchhook releases A or AA and A1. A or AA changes the potential or lead M from battery to ground. A1 follows A or AA but does not contribute to the flashing operation.

3.17 When the switchhook is released, A or AA and A1 reoperate. A or AA removes ground from lead M and replaces it with -48 volt battery through lamp M.

3.18 The foregoing is one operation of the switchhook; subsequent operations are repetitions of this description.

4. CALL IDENTIFIED BY ANI (SC5)

4.01 In addition to those described in 3.06, RV performs three additional operations when ANI is required. These are as follows:

(a) Connects a holding bridge consisting of resistor E and break contacts of T1 and SP across relay A. This serves to hold the customer switch train until the ANI function is completed, thus preventing false trouble indications should the customer disconnect.

(b) Starts a 4.5-second timer by operating ST. ST connects battery to capacitor B.

(c) Connects battery through lamp ST to lead ST to the outpulser connection in order to get an outpulser connected to this circuit. This is referred to as bidding for an outpulser.

OUTPULSER IS ATTACHED

4.02 The trunk and the outpulser are connected together over four leads, T, R, SP, and AB. When the outpulser is connected, it records the class information that is on lead R (ground on a 1-type call; resistance battery on a 0-type call). After testing the SP lead, the outpulser operates SP over its primary winding.

4.03 The operation of SP:

(a) Stops the timer by releasing ST.

(b) Opens the ST lead to the outpulser connector.

(c) Removes the A relay holding bridge.

(d) Removes the class information and connects ID to lead R.

(e) Locks under control of B1 and removes itself from the SP lead.

(f) Connects MF to lead AB.

4.04 The outpulser then applies resistance battery to lead SP. This operates SP1.

A. Testing for Abandoned Call

4.05 Before going ahead to obtain the calling number, the outpulser tests to see that the customer is still connected to the trunk. It accomplishes this by operating SP1 with a resistance battery on lead SP.

4.06 The operation of SP1:

(a) Connects a holding bridge consisting of resistor E across relay A. If the subscriber had disconnected during the outpulser bid time, then the operation of SP causes A and A1 to release. SP1 reoperates A and A1.

(b) Transfers the customer T and R leads to the outpulser T and R leads.

4.07 The outpulser tests the customer T and R leads for continuity. If the customer is off-hook, the outpulser releases SP1 and then proceeds to make a calling number identification. However, if the customer is on-hook, the outpulser releases SP1, and, approximately 400 ms later, tests to see whether ground is present on lead AB. (Refer to SC5A.) When SP1 was released, it caused A and A1 to release. A1 releases B, which grounds lead AB. The circuit then proceeds to release as described in 7.01 through 7.18.

B. Identifying the Line

4.08 After making an abandoned call test, the outpulser will proceed to identify the calling number if the customer is off-hook. It proceeds by operating ID with a ground on lead R.

4.09 The operation of ID:

(a) Closes a circuit from the identifier to either the oscillator or pulse generator. This will permit an identification signal to be applied to the sleeve lead to identify the calling line.

(b) Connects a holding bridge consisting of resistor E across relay A.

(c) Connects resistance lamp ST to lead T as a check to the outpulser that it had operated.

4.10 The preceding circuits are held operated by a low dc resistance path over the S lead to either the oscillator or the pulse generator. ID is released when the identification is completed.

C. Outpulsing Calling Number

4.11 When the outpulser is ready to send out the calling number, it operates relay MF.

4.12 The operation of MF:

(a) With loop signaling releases S but holds S1.

(b) With E and M lead signaling, inserts a holding path via the outpulser to hold A.

(c) Connects a holding circuit for relay B to prevent the release of MF if the customer should abandon the call at this time.

(d) Transfers the outgoing trunk T and R leads to the outpulser T and R leads.

(e) Operates CR when initial coin return feature is provided.

4.13 When the outpulser has checked that it has the outgoing T and R leads, it outpulses the calling number information and other pertinent information dealing with the call.

D. Release of Outpulser

4.14 When the outpulser has completed its operation, it releases the outpulser connector, thereby opening its connection to this trunk. SP remains operated for the remainder of the call.

FAILURE TO OBTAIN OUTPULSER

4.15 When RV operates, it starts a 4.5-second timer, bids for an outpulser, and performs other operations as previously noted. The purpose of the timing operation is to time for an outpulser attached. If the outpulser is not attached within the timed period, then the timer is permitted to expire, thus operating T. The operation of T grounds lead OSF and operates T1.

4.16 The operation of T1:

(a) Opens the holding bridge across A established by RV.

(b) Opens the ST lead, thus canceling the bid for an outpulser.

(c) Releases the timer and T.

(d) Locks to ground under control of RV.

(e) Ungrounds lead OSF, thus causing a traffic register to score.

(f) Operates CR when initial coin return feature is provided.

4.17 The distant office recognizes that an outpulse failure has occurred and proceeds to identify the call by an operator.

5. COIN CONTROL - AUTOMATIC OR OPERATOR CONTROL

5.01 The control of the coins in the coin box is under control of the operator and automatic coin collect operation. If the call extends beyond a specified time period, the automatic coin collect operation takes place. If special charges are required, as an example, the operator can control the coins. In both operations, the coins are controlled by signals over the customer T and R leads.

5.02 In the loop signaling version of this trunk, coin signals are in the form of high-low voltages applied to the T and R leads from the distant office incoming trunk. In the E and M lead version of this trunk, coin signals are in the form of ac inband signals applied to the T and R leads from the distant office incoming trunk.

5.03 When App Fig. 6 is provided, coin and ringback signals are in the form of multiwink signals for loop and E and M trunk signaling.

COIN CONTROL WITH APP FIG. 2 (CUSTOMER OFF-HOOK) (SC6)

A. Coin Collect

5.04 When the automatic coin collect operation takes place or the operator wishes to collect coins, the signal from the distant office incoming trunk is a high-voltage on-hook, or +130 volts on the T lead and -48 volts on the R lead. This signal causes the release of S and operates CN over its primary winding. S releases because the polarity of the coin collect signal is opposite to its operate polarity. S released operates R1. R1 connects a path from CC to the break contact of the operated D. R1 locks to ground under control of T and CN.

B. Coin Return

5.05 When the condition arises where the operator wishes to return coins to the customer, the coin return key is depressed. The distant office incoming trunk sends a high-voltage off-hook signal, or +130 volts on the R lead and -48 volts on the T lead. This signal causes the operation of CN over its primary winding. The S stays operated because the coin return signal is in the off-hook polarity, and SA operates.

C. Coin Control Operation

5.06 The major initial differences in the coin collect or return operations were described in 5.04 and 5.05. The remaining coin operation will be described by treating the coin collect and return together, and noting minor differences. The operation continues with the operation of CN.

5.07 The operation of CN:

(a) Removes the secondary winding of CN and diodes L and L1 from the loop. These diodes are used during coin control against on-hook, which is described later.

(b) During coin collect, supplements the holding path that D provides for R1.

(c) Removes the direct short from resistor D that is in the D secondary path.

(d) Releases D.

(e) Connects ground through RV operated to the break contact of D.

5.08 D releases somewhat slowly (32 to 65 ms) to ensure that during coin collect R1 has fully operated. When D has released, CC or CR operates from a ground provided by CN.

5.09 The operation of CC or CR:

(a) CC connects coin collect potential (+110 or +130 volts) or CR connects coin return potential (-110 or -130 volts) to the make contacts of CB in the incoming T and R leads or T lead only.

(b) Locks under control of RV, CN, and S1.

(c) Maintains a holding path for S1.

(d) Operates D.

5.10 The operation of D opens the operate path of CC or CR and operates CB.

5.11 The operation of CB:

(a) Operates ST, which starts a 500-ms timer.

(b) Shorts resistor D in the D secondary path to make it slow to release.

(c) Provides a holding bridge for A through resistor E.

(d) Closes its secondary winding to make it slow to release.

(e) Connects coin collect or return potential to the customer line.

5.12 The application of coin potential to the customer line lasts for a minimum of 1/2 second to ensure the operation of the coin magnet. The maximum application is based on how long the operator operates the coin key after the timer has expired.

5.13 When the coin key is released, CN releases. If coin collect was the operation, S reoperates to the off-hook polarity. If coin return was the operation, SA releases. Before total release can be effected, the timer must expire. When it does, T operates. With CN released and T operated, the holding path for CC or CR is opened, causing its release.

5.14 The release of CC or CR:

(a) Removes the alternate holding path for S1 and CB.

(b) Removes the coin collect (CC released) or coin return (CR released) potential and starts line discharge.

(c) Releases D.

5.15 With the removal of coin potential, the time discharge network, consisting of resistors B and C and capacitor A, is on the customer line to discharge line charges built up during the application of coin voltage. The network is in effect during the release time of D and CB.

5.16 The release of D releases CB.

5.17 The release of CB:

(a) Reoperates D.

(b) Releases ST, which releases T, thus the timer is restored and ready for reuse.

(c) Removes the holding bridge across A.

(d) Restores the customer T and R leads to normal.

5.18 After CB has released, the circuit is in the talking condition.

COIN CONTROL WITH APP FIG. 2 (CUSTOMER ON-HOOK) (SC6)

5.19 Coin control against on-hook is rarely performed outside the normal coin cycle during calling or called party disconnect. However, provision is made for the operator to initiate coin disposal against a customer on-hook, independent of disconnect.

5.20 The total operation is almost identical to that described in 5.04 through 5.18 for coin control against a customer off-hook. The only difference is the method by which the coin signals from the distant office incoming trunk operate CN of this trunk.

5.21 When the customer goes on-hook, relays A, A1, and B release. A opens the low-resistance bridge, while A1 and B close a high-resistance bridge across the outgoing T and R leads. The high bridge is through the secondary winding of S. S will remain operated to battery and ground supplied by the incoming trunk during the bridge change.

5.22 Another bridge consisting of diodes L and L1 is across the A contact in the T lead. Normally, this bridge is shorted by the operated A1. This bridge is designed to conduct when a voltage greater than 61 volts is impressed on the line. When a coin voltage is impressed on the line, a path is completed from lead R to diodes L and L1, the CN secondary winding, winding 1-2 of transformer A, the primary winding of S and CN, and winding 4-3 of repeat coil A, and to lead T. CN operates over this path to a coin collect or return voltage. If coin collect is the function, S will release; however, S stays operated during coin return.

5.23 When CN operates, it removes diodes L and L1 and holds over its own contact directly to the coin signal.

5.24 As the coin cycle proceeds, the operation of CB applies the coin potential to the line. The holding bridge for A, normally closed by CB, is held open by the released A1.

5.25 Other than the minor difference just described, the coin operation against on-hook is the same as described for coin control against off-hook.

COIN CONTROL WITH APP FIG. 3 (CUSTOMER OFF-HOOK) (SC7)

5.26 Operation of either the coin collect or return key by the operator, or operation of the automatic coin collect sequence, causes the incoming trunk to send a 65- to 125-ms on-hook signal as a wink. S of this circuit follows the wink. On the release of S, TR operates.

5.27 The operation of TR:

(a) Connects -48 volts to the Receiver Circuit to energize it.

(b) Locks to ground provided by S1.

(c) Connects the outgoing T and R leads to the Receiver Circuit via the T1 and R1 leads.

(d) Applies a holding bridge consisting of resistor E across A to hold A if it is operated.

5.28 At the end of the wink signal, S reoperates. S completes the T1 and R1 path to the receiver and operates ST to start a 750-ms timing period. This circuit and the Receiver Circuit are now ready to receive the coin ac inband tones. However, the incoming trunk circuit delays sending the inband signals for approximately 100 ms. This is referred to as the quiet period and is used to stabilize the transmission line and equipment. At the end of the quiet period, inband tones are applied. If the coin action is coin collect, the signals are a combination of 700- and 1100-Hz tones. If the coin action is coin return, 1100-Hz tone is applied. These tones are subject to delays of up to 300 ms if certain types of transmission equipment are used in the transmission path. When the tones reach this trunk, they are directed to the Receiver Circuit by the operated TR. The Receiver Circuit is basically an ac-to-dc converter. If the coin action is coin collect, then the receiver grounds leads P1 and P2, thereby operating F1 and F2. If the coin action is coin return, then the receiver grounds only lead P2, thereby operating F2.

5.29 The operation of F1 and F2 (coin collect) or F2 alone (coin return):

(a) Releases ST to stop and reset the timer.

(b) F2 blocks the operate path of RB.

(c) For coin collect, prepares the operate path for CC.

(d) For coin return, prepares the operate path for CR.

(e) Starts the release of D. D releases in 32 to 65 ms. This is to allow time for the Receiver Circuit to stabilize its output signal and for resetting the timer.

5.30 When D has released, CC or CR operates, depending on the function required.

5.31 The operation of CC or CR:

(a) CC connects coin collect potential (+110 or +130 volts) or CR connects coin return potential (-110 or -130 volts) to the make contacts of CE in the incoming T and R leads.

(b) Locks under control of RV, F2, and S1.

(c) Maintains a holding path for S1.

(d) Operates D.

5.32 The operation of D opens the operate path of CC or CR and operates CB.

5.33 The operation of CB:

(a) Operates ST, which starts a 500-ms timer.

(b) Shorts resistor D in the D secondary path to make it slow to release.

(c) Provides a holding bridge for A through resistor E.

(d) Closes its secondary winding to make it slow to release.

(e) Connects coin collect or return potential to the customer line.

5.34 The application of coin potential to the customer line lasts for a minimum of 1/2 second to ensure operation of the coin magnet. The maximum application is based on how long the operator operates the coin key after the timer has expired.

5.35 When the coin key is released, the application of inband tones ends and the receiver stops functioning. The receiver releases F1 and F2 (coin collect) or F2 (coin return). However, coin potential will still continue to be applied to the customer line until the timer operates. This is signified when T operates. With T operated and the F relays released, the holding path to CC or CR is opened.

5.36 The release of CC or CR:

(a) Removes the alternate holding path for S1 and CB.

(b) Removes the coin collect (CC released) or coin return (CR released) potential and starts line discharge.

(c) Releases D.

5.37 With the removal of coin potential, the line discharge network consisting of resistors B and C and capacitor A is on the customer line to discharge line charges built up during the application of coin voltage. The network is in effect during the release time of D and CB.

5.38 The release of D releases CB.

5.39 The release of CB:

(a) Reoperates D.

(b) Releases ST, which releases T; thus the timer is restored and ready for reuse.

(c) Removes the holding bridge across A.

(d) Restores the customer T and R leads to normal.

5.40 After CB has released, the circuit is in the talking condition.

COIN COLLECT WITH APP FIG. 3 (CUSTOMER ON-HOOK) (SC7)

5.41 The total operation is almost identical to that described in 5.26 through 5.39 for coin control against a customer off-hook. The only difference is that when CB operates, it has no effect on the A relay holding bridge consisting of resistor E and an A1 contact. Since the customer is on-hook, A1 is released and the bridge is ineffective.

COIN CONTROL WITH APP FIG. 6 - MULTIWINK SIGNALING

A. Coin Collect

5.42 The operation for coin control is shown on SC12A, SC12B, and SC12C. Coin collect is recognized by this trunk as three wink signals (battery reversals from the incoming trunk). This first release of S operates slow release relays GD and P1. Additional operation and release of the S relay advances the counting P- relays. At the end of the third wink, guard relay GD releases, closing the circuit to operate CC. CC locks under control of T.

B. Coin Return

5.43 The operation for coin return is shown on SC12A, SC12B, and SC12C. Coin return is recognized as four wink signals. After the fourth wink, GD releases, closing the operate circuit for CR. CR locks under control of T.

C. Coin Control Operation

5.44 The remaining coin operation will be described by treating coin collect and return

together and noting minor differences. The operation continues with CR or CC operating CB.

5.45 The operation of CB:

(a) Operates ST, initiating coin timing.

(b) Applies coin potential to the tip, positive potential for coin collect or negative potential for coin return.

(c) Opens the ring side of the line.

5.46 The application of coin potential to the customer line lasts for 1/2 second to ensure the operation of the coin magnet. When the timer expires, T operates, releasing CC or CR, which removes coin potential from the ring.

5.47 Either CC or CR releases CB. CB releases ST. ST releases T and recycles the TM timer.

6. OPERATOR RINGBACK SIGNALS

6.01 A ringback arrangement is provided to enable the operator to ring the calling station, whether it is on- or off-hook.

6.02 If the trunk is provided with App Fig. 2, then the ringback signal from the distant office incoming trunk is an alternating reversal of signal battery and ground. The alternating reversals last for approximately 75 ms. Three cycles are necessary to start ringing.

6.03 If the trunk is provided with App Fig. 3, then the ringback signal from the distant office incoming trunk is an ac inband signal of 700 Hz.

6.04 If the trunk is provided with App Fig. 6, then the ringback signal from the distant office incoming trunk is five wink signals.

OPERATOR RINGBACK WITH APP FIG. 2 (SC9)

6.05 Ringback is initiated when the operator operates the ringback key. This causes the distant office incoming trunk to send an on-hook signal lasting for 50 to 100 ms. The first of the ringback alternating reversals causes S to release and R1 to operate. S1 will hold over the on-hook signal.

6.06 The operation of R1:

(a) Locks under control of D to ground.

(b) Prepares the R2 operate path.

(c) Prepares the RB lockup path.

6.07 At the end of the on-hook signal, S will reoperate. This causes R2 to operate.

6.08 The operation of R2:

(a) Locks under control of R1 to ground.

(b) Prepares the operate path for RB.

(c) Transfers the holding path of D to the operated S break contact; thus D starts to release.

6.09 D is slow to release and will hold over the alternating reversals. If S does not release within the release time of D, then, when D fully releases, it causes R1 and R2 to restore to normal. D functions as a guard to restore the ringback relays in the event S released because of hits or other false conditions on the transmission path.

6.10 On the next reversal or on-hook signal, S releases. Its release holds D operated and operates RB.

6.11 The operation of RB:

(a) Locks under control of R1 to ground.

(b) Operates ST to start a 2-second timer.

(c) Maintains a holding path for A if it is operated.

(d) Applies ringing potential to the customer line.

6.12 Ringing potential is now being applied and continues as long as the operator wishes or until the timer operates, whichever is longer.

6.13 When the operator releases the ringback key, S will remain operated. The holding path for D is opened by S operated. D released releases R1. The combination of R1 released and T of the timer operated releases RB. RB removes the ringing potential from the customer line and releases ST. ST releases T, thereby resetting the timer. When R1 released, it released R2. R2 released permits D to reoperate.

6.14 This circuit is now back to a talking condition.

OPERATOR RINGBACK WITH APP FIG. 3 (SC8)

6.15 Ringback is initiated when the operator operates the ringback key. This causes the distant office incoming trunk to send an on-hook signal lasting for 65 to 125 ms. This signal, referred to as a wink, causes S to release. S released closes an operate path for TR.

6.16 The operation of TR:

(a) Connects -48 volts to the Receiver Circuit to energize it.

(b) Locks to ground provided by S1.

(c) Maintains a holding path for A if it is operated.

(d) Connects the outgoing T and R leads to the Receiver Circuit via the T1 and R1 leads.

6.17 At the end of the wink signal, S reoperates. S completes the T1 and R1 path to the receiver and operates ST to start a 750-ms timing period. This circuit is now ready to receive the ringback ac inband tones. The ringback signal is a 700-Hz tone. When the tone arrives at this trunk, it is directed to the Receiver Circuit by the operated TR. The receiver functions and grounds lead P1, thereby operating F1.

6.18 The operation of F1:

(a) Releases ST to reset the timer.

(b) Prepares the operate circuit for RB.

(c) Starts the release of D. D releases in 32 to 65 ms.

6.19 This is to allow time for the Receiver Circuit to stabilize its output signal and for resetting the timer.

6.20 When D has released, RB operates.

6.21 The operation of RB:

(a) Locks to two paths under control of F1 and T.

(b) Operates ST to start a 2-second timer.

(c) Maintains a holding path for A if it is operated.

(d) Applies ringing potential to the customer line.

6.22 Ringing potential is now being applied and continues as long as the operator wishes or until the timer operates, whichever is longer.

6.23 When the operator releases the ringback key, the ringback tone is removed, thereby releasing the receiver. F1 in turn releases. With the release of F1, D operates. Before ringback potential is removed from the customer line, the timer must operate. When T of the timer has operated and F1 is released, the locking path for RB and TR is opened and they release. TR disconnects the receiver from the outgoing T and R leads, and RB removes ringing potential from the customer T and R leads.

6.24 This circuit is now back to a talking condition.

OPERATOR RINGBACK WITH APP FIG. 6 (SC12A AND SC12B)

6.25 Ringback is initiated when the operator operates the ringback key. This causes the distant office to send five wink signals.

6.26 Relay S responds to these signals, and, on its first release, operates GD and P1. GD releases SA1 which remains released throughout wink signaling. S, reoperating, operates P2 which operates SR1. SR1 performs no useful function during ringback. The second release of S operates P1. P1 operates P3 which releases SR1 and operates SR. SR performs no useful function during ringback. S reoperates, releasing P2. The third release of S reoperates P1. S operates, operating P2. P2 operates P4. The fourth release of S releases P1. S operates, releasing P2. The fifth release of S operates P1 which releases P3. The fifth operation of S operates P2. P2 operates RB prior to the release of the guard relay, GD. Since no signals are more than five winks, the guard delay is not necessary.

6.27 The operation of RB:

(a) Operates ST to start the 2-second timer.

(b) Maintains a holding path for A if it is operated.

(c) Applies ringing potential to the customer line.

6.28 Ringing will continue until the 2-second timer operates. T operates and releases RB. RB releases ST, which releases T. This completes one ringback cycle.

6.29 After the last wink signal, slow release GD releases. GD operates SA1 and releases the P1, P2, and P4 relays.

6.30 If more than one ringing cycle is required, the distant office will send additional series of five wink signals.

7. DISCONNECT - LOOP SIGNALING (SC10)

CALLING PARTY DISCONNECTS FIRST

7.01 When the calling customer goes on-hook, A or AA releases. A or AA releases A1. A1 changes the bridge from low to high, thus notifying the incoming trunk of an on-hook condition. The high bridge is the 30,000-ohm secondary winding of S. A1 releases the slow-to-release B. B released reinforces the high bridge established by A1.

7.02 This is as far as the outgoing trunk releases until the distant office incoming trunk recognizes that the on-hook signal is a legitimate disconnect. When it does, it starts a disconnect function by sending a

low-voltage on-hook signal to the outgoing trunk to continue the disconnect operations.

7.03 Refer to 7.06 through 7.18 for continuation of disconnect sequence.

CALLED PARTY DISCONNECTS FIRST

7.04 When the called station goes on-hook, the distant office incoming trunk goes through a timed disconnect sequence. After a period of 13 to 32 seconds, it sends a low-voltage on-hook signal to the outgoing trunk to start its disconnect operation.

7.05 Refer to 7.06 through 7.18 for continuation of disconnect sequence.

DISCONNECT - COMBINED CALLING AND CALLED PARTY DISCONNECT

7.06 The low-voltage on-hook signal sent to the outgoing trunk releases S, thereby causing R1 to operate. The incoming trunk replaces the low-voltage on-hook with either a coin collect high-voltage on-hook or coin return high-voltage off-hook potential. A coin collect voltage would normally follow on disconnect from a special toll or station-to-station sent paid call. A coin return voltage would normally follow on disconnect from an operator assistance call.

7.07 The coin collect or return cleanup cycle is very similar to the coin disposal operation described in 5.04 through 5.18; hence, in the disconnect sequence the coin portion is treated briefly.

A. Coin Collect Cleanup Cycle

7.08 The coin collect potential applied by the incoming trunk operates CN. CN causes D to release. With D released and R1 operated, CC will operate. CC reoperates D. D operates CB.

7.09 The operation of CB:

(a) Operates ST to start a 500-ms timer.

(b) If the disconnect is the calling-party type, it sends a low bridge to the incoming trunk.

(c) Connects coin collect potential to the customer line.

B. Coin Return Cleanup Cycle

7.10 The coin return potential applied by the incoming trunk operates CN and reoperates S. With R1 operated, S causes R2 to operate, thereby preparing an operate path for CR. CN causes D to release. When D releases, CR operates and reoperates D. D operates CB.

7.11 The operation of CB:

(a) Operates ST to start a 500-ms timer.

(b) If the calling party initiated the disconnect, then CB sends a low bridge to the incoming trunk.

(c) If the called party initiated the disconnect, then CB inserts a holding bridge across A.

(d) Connects coin return potential to the customer line.

C. Continuation of Coin Cycle (Coin Collect or Return)

7.12 The incoming trunk, after a prescribed period, removes coin potential and replaces it with a low-voltage on-hook. CN releases. If the coin operation was coin return, then S releases. However, the application of coin potential to the customer line continues until the timer functions, thereby operating T. With T operated and CN released, the holding path for CC or CR is opened, causing their release. With the release of CC or CR, S1 and D release and coin potential is removed. If the release action is a calling party first, then the release of S1 causes a high-bridge signal to be sent to the incoming trunk. This signal notifies the distant office that coin disposal is completed and to proceed to disconnect. W operates when S1 releases.

7.13 The operation of W:

(a) Opens the secondary winding of CB. Therefore, with D released, CB releases quickly.

(b) If the call was an operator-assistance type, releases OC1.

(c) Removes ground from the S lead, thus releasing the switch train.

(d) Splits the incoming T and R leads and connects ground to leads T and W1 to the R lead.

(e) Opens the holding circuit of W1.

7.14 If the calling party initiated the disconnect operation, then W1 connected to the incoming R lead will release because of the customer on-hook condition. However, if the disconnect operation was initiated by the called party, then W1 connected to the incoming R lead will hold over the customer off-hook condition to ground on lead T. W1 will not release until the switch train releases to open the circuit. W1 is slightly slow to release to ensure that it will not release before the switch train. W1 protects this circuit from new seizures during disconnects. If a seizure should occur when ground is removed from the S lead, then W1 will hold or, under certain conditions, reoperate to the seizure. W1 operated will keep ground off level S, thereby forcing the release of a new seizure. When W1 releases, ground from

RV and B1 appears on the S lead to busy this trunk during the remaining portion of the disconnect operation.

7.15 On called party disconnect the release of CB causes A or AA and, in turn, A1 and B to release. "A" sends an open-circuit signal to the incoming trunk; this signal is replaced by a high bridge when B releases. The high-bridge signal notifies the distant office incoming trunk that the coin disposal operation is completed and to proceed to disconnect.

7.16 Release sequence continues when W1, S1, and B on called party disconnect are released. The holding path to B1 is opened and it releases.

7.17 The release of B1:

(a) Releases SP, if ANI was required.

(b) Removes one of the S lead grounds.

(c) Releases RV.

7.18 The release of RV releases W, OA (option B), and T1 if it had operated and removes ground from lead S. The circuit is now fully released and ready for reseizure.

8. DISCONNECT - E AND M LEAD SIGNALING (SC11)

CALLING PARTY DISCONNECTS FIRST

8.01 When the calling customer goes on-hook, A or AA releases. A or AA releases A1 and sends an on-hook signal to the distant office incoming trunk. A1 releases the slow-to-release B.

8.02 This is as far as the outgoing trunk releases until the distant office incoming trunk recognizes that the on-hook signal is a legitimate disconnect. When it does, it starts a disconnect function by sending an on-hook signal to the outgoing trunk to continue the disconnect operation.

8.03 Refer to 8.06 through 8.10 for continuation of disconnect sequence.

CALLED PARTY DISCONNECTS FIRST

8.04 When the called station goes on-hook, the distant office incoming trunk goes through a timed disconnect sequence. After a period of 13 to 32 seconds, it sends an on-hook signal to the outgoing trunk to start its disconnect operation.

8.05 Refer to 8.06 through 8.10 for continuation of disconnect sequence.

DISCONNECT - COMBINED CALLING AND CALLED PARTY DISCONNECT

8.06 The on-hook signal or wink sent to the outgoing trunk releases S, thereby causing TR to operate. This on-hook signal is replaced by an off-hook signal at the end of 65 to 125 ms. S will then reoperate. When TR operated, it closed a path to energize the Receiver Circuit and connected the outgoing T and R leads to the T1 and R1 leads to the receiver. After a designated quiet period, coin disposal ac inband tones are applied by the incoming trunk. A coin collect operation would normally follow on disconnect from a special toll or station-to-station sent paid call. A coin return operation would normally follow on disconnect from an operator assistance call.

8.07 The coin collect of the return cleanup cycle is very similar to the coin disposal operation described in 5.26 through 5.40; hence, in the disconnect sequence the coin portion is brief.

A. Coin Collect Cleanup Cycle

8.08 At the end of the quiet period, the incoming trunk applies an ac coin-collect tone. The Receiver Circuit, upon receipt of the tone, converts the ac signal to a dc signal and grounds leads F1 and F2. Relays F1 and F2 will then operate. They cause D to release, resulting in the operation of CC. CC reoperates D, which operates CB. The operation of CB applies coin-collect potential to the customer line and operates ST to start a 500-ms timing operation.

B. Coin Return Cleanup Cycle

8.09 At the end of the quiet period, the incoming trunk applies an ac coin-return tone. The Receiver Circuit, upon receipt of the tone, converts the ac signal to a dc signal and grounds lead F2. Relay F2 will then operate. This causes D to release, resulting in the operation of CR. CR reoperates D, which operates CB. The operation of CB applies coin-return potential to the customer line and operates ST to start a 500-ms timing operation.

C. Continuation of Coin Cycle (Coin Collect or Return)

8.10 The incoming trunk, after a prescribed period, removes the ac coin-disposal tones and replaces them with a low-voltage on-hook. S will release and the receiver stops functioning, thereby releasing F1 and F2 or F2. However, the application of coin potential to the customer line continues until the timer functions, thereby operating T. With T operated and the F relays released, the holding path for CC or CR is opened, causing their release. With the release of CC or CR, coin potential is removed and the holding path for D is opened. When S1 releases, W operates. For the remainder of the disconnect operation, refer

to the operation of W in 7.12 through 7.18. The following exceptions should be noted.

(a) If the disconnect action was initiated by the calling party, then, on the release of TR, an on-hook signal is sent to the incoming trunk to notify it to proceed to disconnect.

(b) If the disconnect action was initiated by the called party, then, on the release of A or AA, an on-hook signal is sent to the incoming trunk to notify it to proceed to disconnect. The release of B has no effect on the signal to the incoming trunk.

DISCONNECT WITH APP FIG. 6

8.11 Disconnect is similar to that explained for loop or E and M, except for the coin collect or return being sent by multi-wink signals.

9. MISCELLANEOUS CIRCUIT OPERATIONS

CALL ABANDONED BEFORE COMPLETION OF DIALING (SC4)

9.01 If the calling customer should disconnect before dialing the complete called number, the outgoing trunk proceeds to release once B has released. With the customer on-hook, A will release and send an on-hook signal to the distant office incoming trunk. The incoming trunk goes through a timed period to determine whether the on-hook is a disconnect or beginning of dialed digit. After the incoming trunk determines that the on-hook is a legitimate disconnect, it will then proceed to release. The incoming trunk release action is quick, since dialing is incomplete. Under this type of disconnect the incoming trunk does not initiate a coin cleanup cycle; however, it relies on the coin box trunk to return the customer's money.

9.02 A1 releases the slow release B.

9.03 The release of B:

(a) With App Fig. 2, sends a high bridge to the incoming trunk.

(b) Releases the slow release B1.

9.04 The release of B1 and B causes W to operate.

9.05 The operation of W:

(a) Opens the customer S lead, thereby releasing the switch train. The coin box trunk will then function to return the customer's money, since it was not cut through by a reversal from the outgoing trunk.

(b) Releases OC1 if the call was a 0 type.

(c) Operates ST to start a 750-ms timer.

(d) Releases the slow release W1.

9.06 The operation of the timer during this type of release serves only to cover the release time of the incoming trunk. This release action is to ensure the complete release of the incoming trunk before the final release of the outgoing trunk.

9.07 W1 releases slowly to ensure complete release of the switch train before it regrounds the outgoing S lead. If a new seizure takes place while the S lead is ungrounded, then W1 will not release. Hence, the S lead stays ungrounded and the new seizure falls off. No further operation takes place until the timer expires. After 750 ms, the timer functions, resulting in the operation of T. T releases W.

9.08 The release of W:

(a) Reoperates W1.

(b) Releases C.

9.09 When C releases, it releases W1 and removes ground from the outgoing S lead. It also releases ST which releases T.

9.10 The outgoing trunk is now fully released and ready for reseizure.

CALL ABANDONED AFTER COMPLETION OF DIALING (SC4)

9.11 If the calling customer should disconnect after dialing the complete called number, the outgoing trunk proceeds to release once B has released. With the customer on-hook, A will release and send an on-hook signal to the distant office incoming trunk. After the incoming trunk determines that the on-hook signal is a disconnect and not a flash, it proceeds to release. In a disconnect of this type, the operation that follows depends on to what stage of operation the incoming trunk and associated equipment have advanced. In most situations, the incoming trunk will initiate a coin cleanup cycle. However, there are some situations where it will not. In such instances, the disconnect follows the sequence of release as call abandoned before completion of dialing described in 9.01 through 9.10.

9.12 Since the coin cleanup cycle initiated by the incoming trunk is not reliable, the outgoing trunk does not respond to any coin signals. Instead, it always winks off the switch train, thereby permitting the coin box trunk to return the customer's money.

9.13 The release action from the point when the customer disconnects to the point when the incoming trunk recognizes the disconnect is the same as described in 9.01 through 9.10. The major difference is that

the incoming trunk may or may not go through a coin-return cleanup cycle. If it does, it first sends an off-hook signal to alert the outgoing trunk. This will cause S and S1 to operate. S1 holds W, thereby preventing it from releasing when the 750-ms timer expires.

9.14 If App Fig. 2 is supplied, then CN will operate after S1 operates. CN sends a low bridge to the incoming trunk and performs no further function. When the coin return signal is removed, CN and S release. CN changes the bridge condition to high; this notifies the incoming trunk to release.

9.15 If App Fig. 3 is supplied after the off-hook signal, the incoming trunk sends a 65- to 125-ms wink signal, thereby releasing S. S1 stays operated over the wink. At the end of the wink, S reoperates. It performs no functions. Coin-return signal tones are applied by the incoming trunk but have no effect on the outgoing trunk. At the end of coin return, the tones are removed and S releases. S sends an on-hook signal to the incoming trunk, notifying it to release.

9.16 With the release of S (both App Fig. 2 and 3), S1 will release. When S1 releases and T of the timer is operated, W will release. The operation that follows is described in 9.01 through 9.10 with the release of W.

TRUNK MAKE BUSY

A. Outgoing Trunk Equipped With App Fig. 2

9.17 When this circuit is to be made busy while it is in the idle condition, the incoming trunk reverses battery and ground on the T and R leads, thereby operating S over its secondary winding. S operates S1, which grounds the incoming S leads of the 0 and 1 access points, thus making this circuit appear busy to incoming calls.

B. Outgoing Trunk Equipped With App Fig. 3

9.18 When this circuit is to be made busy while it is in the idle condition, the incoming trunk causes lead E to be grounded, thereby operating S. S operates S1, which grounds the incoming S leads of the 0 and 1 access points, making this circuit appear busy to incoming calls.

FUSE FAILURE MAKE BUSY FEATURE

9.19 A make-busy relay is provided to make this circuit busy if the battery supply fails. Failure of the battery supply releases the normally operated MB. MB released grounds the incoming S leads of the 0 and 1 access points, thus making this circuit appear busy to incoming calls.

TIMING ARRANGEMENT

9.20 The timing arrangement utilizes a transistor amplifier and an RC network to achieve four timing periods. The RC network consists of external resistors T, T1, T2, and T3, and capacitor B. Capacitor B is connected in parallel with a capacitor in the timer pack, to achieve timing intervals longer than 3 seconds. The external resistors T, T1, T2, and T3 are used in the following timing periods.

(a) T - 2.0 seconds.

(b) T1 - 0.5 second.

(c) T2 - 0.75 second.

(d) T3 - 4.5 seconds.

9.21 All timing periods are ±5 percent.

9.22 Diodes E, F, G, and H are used to isolate the various RC networks.

9.23 A detailed description of operation can be obtained in CD-32371-01.

OPERATOR RELEASED OR ATTACHED CONTROL (APP FIG. 6)

9.24 Operator release is a single wink signal from the distant office incoming trunk, SC12. With -48 volt battery on the ring and ground on the tip, S releases. S operates GD, which releases SA1 and operates P1. When the incoming trunk turns the battery over, S reoperates, operating P2. P2 operates SR1 which prepares the locking path for OR and makes OA fast release. When GD releases, SA1 and OR operate. OR releases OA and connects the A relay to the customer line. SA1 releases SR1, P1, and P2, preparing the circuit to receive a new control signal from the distant office.

9.25 The operator attached signal is two wink signals from the distant office. The first wink is counted the same as described in 9.24. The second release of S releases P1, and P1 operates P3. P3 releases SR1 and operates SR. When S reoperates, P2 releases. GD releases in 145 to 360 ms, operating OA and SA1. Relay OA operated:

(a) Releases OR.

(b) Connects the AA relay to the customer line.

(c) Disconnects the A relay from the customer line.

(d) Supplies +48 volt battery to the ring and ground to the tip. This potential disables the TOUCH-TONE® pad at the coin station.

The trunk is now in the operator attached mode.

9.26 When the distant office takes control of the trunk on the origination of the call, the operator attached mode is initiated. This supervisory condition will remain until it is changed by the distant office sending a particular series of wink signals.

10. AUTOMATIC RETURN OF INITIAL COIN (SC5)

RETURN DURING OUTPULSING

10.01 The operation of MF operates CR.

10.02 The operation of CR:

(a) Connects coin return potential (-110 or -130 volts) to the make contacts of CB in the incoming T and R leads.

(b) Operates CB.

10.03 The operation of CB:

(a) Operates ST which starts a 500-ms timer.

(b) Connects coin return potential to the customer line.

(c) Operates IR.

10.04 The operation of IR prevents false reoperation of CR after the initial deposit has been returned.

10.05 Expiration of the 500-ms timer causes T to operate. The circuit then proceeds as described in 5.14 through 5.18.

RETURN DURING FAILURE TO OBTAIN OUTPULSER

10.06 When RV operates, it starts a 4.5-second timer to time for an outpulser attachment. If the outpulser is not attached within the time period, the timer expires operating T. The operation of T operates T1.

10.07 The operation of T1 operates CR.

10.08 The circuit operations proceed as described in 10.02 through 10.05.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Battery Voltages

+44 to +52 volts
-45 to -52 volts
+100 to +120 volts
-100 to -120 volts or
-116 to -120 volts
+125 to +135 volts
-125 to -135 volts

1.02 Relay Limits

(a) "A" relay pulsing (loop or E and M signaling): maximum external circuit loop resistance - 1500 ohms.

(b) "A" relay supervisory (loop signaling): maximum external circuit loop resistance - 1885 ohms.

(c) "A" relay supervisory (E and M lead signaling): maximum external circuit loop resistance - 1670 ohms.

(d) "A" relay pulsing and supervisory (loop or E and M signaling): minimum insulation resistance - 15,000 ohms.

(e) S relay supervisory (loop signaling): maximum external circuit loop resistance - 4150 ohms.

(f) S relay supervisory (loop signaling): minimum insulation resistance - 30,000 ohms.

(g) CN relay supervisory (loop signaling): maximum external circuit loop resistance - 3200 ohms.

(h) CN relay supervisory (loop signaling): minimum insulation resistance - 30,000 ohms.

(i) AA relay supervisory; maximum external circuit loop resistance - 2700 ohms.

(j) AA relay supervisory; minimum insulation resistance - 15,000 ohms.

2. FUNCTIONAL DESIGNATIONS

2.01 Operating Elements

Designation	Meaning
CB	Coin Battery
CC	Coin Collect
CN	Coin
CR	Coin Return
D	Delay
F1	Frequency
F2	Frequency
ID	Identify
IR	Initial Return
MB	Make Busy
MF	Multifrequency
OA	Operator Answer
OC	0-Type Call
OC1	0-Type Call
OF	Overflow
OF1	Overflow
R1	Ringback Counting Relay
R2	Ringback Counting Relay
RB	Ringback
RV	Reversal
S	Supervision
S1	Supervision
SP	Seizure Progression
SP1	Seizure Progression
ST	Start Time
T	Timer
T1	Timer
TT	Test Trunk
TT1	Test Trunk
TR	Transfer
W	Wink
W1	Wink

3. FUNCTIONS

3.01 Functions as a loop or E and M lead signaling outgoing trunk.

3.02 Functions with ANI-B, ANI-C, or temporary non-ANI operation.

3.03 Holds the preceding apparatus in the switch train when seized.

3.04 Signals the distant office when seized.

3.05 Repeats dial pulses, as a loop signaling trunk on a loop basis, and as an E and M lead signaling trunk on the M lead.

3.06 Identifies 0- and 1-type calls.

3.07 Passes a distinctive indication of the type of call to the ANI outpulser.

3.08 Sends reorder tone to a 1-type call in the event of a simultaneous seizure.

3.09 Winks off a 1-type call when the 1 customer disconnects because he received reorder tone.

3.10 Winks off the customer if disconnect occurs before distant office answers.

3.11 Reverses the T and R leads to cut through the coin trunk circuit; bids for an outpulser to perform the ANI function; and holds the connection under control of the distant office when distant office answers.

3.12 Provides means for reringing the subscriber station.

3.13 Collects or refunds coins under control of the operator.

3.14 Functions with the inband method of coin control and rering when used as an E and M lead signaling circuit.

3.15 Functions with high-low signaling method to control the disposal of coins and alternating low-voltage reversal for rering when used as loop signaling circuit.

3.16 Performs an automatic coin control operation on disconnect after distant office answers.

3.17 Winks off the customer on disconnect after distant office answers.

3.18 Tests busy on a talking battery fuse failure.

3.19 Tests busy on a distant-end make-busy condition.

3.20 Functions with the Automatic Trunk Test Circuit.

3.21 Returns initial coin to customer when required.

3.22 Applies +48 volt battery to the incoming ring and ground to the tip on operator answer (coin service improvement).

3.23 Functions, with the multiwink signaling method, to control the disposal of coins, ringback, operator attached, or operator released from the call.

4. CONNECTING CIRCUITS

(a) Rotary Out Trunk Switch Circuit - SD-30868-01.

(b) Automatic Trunk Test Circuit - SD-32315-01.

(c) Miscellaneous Circuit - Trunk Frame - SD-32248-01.

(d) Outpulser Connector Circuit - SD-95890-01.

(e) Miscellaneous Alarm Circuit (Key, Ring, Fuse, and Fuse Alarm) - SD-31974-01.

(f) Oscillator Circuit - SD-95827-01.

(g) Receiver Circuit - SD-95956-01.

(h) Line Balancing and Repeat Coil and Compromise Network Circuit - SD-95015-01 (typical).

(i) CX Signaling Circuit - SD-95029-01 (typical).

(j) Miscellaneous Tone and Tone Alarm Circuit - SD-31521-01.

(k) Identifier Circuit - SD-95810-01.

(l) Circuit Pack - SD-32371-01.

(m) Selector Bank Multiple Circuit - SD-32123-01.

(n) Auxiliary Trunk Circuit - SD-32281-01.

(o) Test and Line Verification Circuit - SD-32379-01.

(p) Pulse Generator Circuit - SD-32378-01.

(q) Incoming Trunk Circuits - SD-1B002-01 (loop), SD-1B004-01 (E and M), or SD-27104-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This trunk circuit shall be capable of performing all the functions listed in this circuit description.

5.02 Test circuits may be arranged to simulate the necessary functions of the connecting circuits.

5.03 All operation and timing tests shall be made with test voltages within the following limits:

(a) Negative battery: 45 to 52 volts.

(b) Positive battery: 44 to 52 volts.

6. TAKING EQUIPMENT OUT OF SERVICE

TEST JACK T

6.01 This circuit may be made busy by inserting a plug into jack T. When a plug is inserted into this jack, it puts ground on the S leads of the 0 and 1 access points to make this circuit appear busy to incoming calls.

6.02 Test jack T also provides means for making operational tests of this circuit with a hand test set or the trunk test set.

TEST JACK TT

A. Loop Signaling Circuit (App Fig. 2)

6.03 Test jack TT provides for testing relay S and for opening the circuit to the distant office to prevent false seizure of circuits when the A relay is being tested or readjusted.

6.04 Before plugging into test jack TT, test jack T should be plugged to make this circuit appear busy.

B. E and M Lead Signaling Circuit (App Fig. 3)

6.05 Test jack TT provides for opening the E and M leads to the CX signaling set and for preventing false seizure of circuits in the distant office when the A relay is being

tested or readjusted. It is also used for testing relay S.

6.06 Before plugging into test jack TT, test jack T should be plugged to make this circuit appear busy.

BUSY CIRCUIT FROM DISTANT OFFICE

A. Loop Signaling Circuit (App Fig. 2)

6.07 When this circuit is to be made busy while it is in the idle condition, the incoming trunk in the distant office reverses battery and ground on the tip and ring leads, thereby operating relay S over its secondary winding. S operates S1, which connects ground to the sleeve leads of the 0 and 1 access points to make this circuit appear busy to incoming calls.

B. E and M Lead Signaling (App Fig. 3)

6.08 When this circuit is to be made busy while it is in the idle condition, the incoming trunk in the distant office causes the E lead to be grounded, thereby operating relay S. S operates S1, which connects ground to the sleeve leads of the 0 and 1 access points to make this circuit appear busy to incoming calls.

SECTION IV - REASONS FOR REISSUE

A. Changed and Added Functions

A.1 Functions with multiwink signaling method to control the disposal of coins, ringback, operator attached, or operator released from the call.

B. Changes in Apparatus (Components)

B.1 Added

Diode P 446F - App Fig. 6

Diode SR 446F - App Fig. 6

Diode SR1 446F - App Fig. 6

Diode CR 446F - App Fig. 6

Relay GD, AG43 - App Fig. 6

Relay IR, 1/2 AK4 - App Fig. 6

Relay SA1, 1/2 AK4 - App Fig. 6

Relay P1, AF55 - App Fig. 6

Relay P2, AF100 - App Fig. 6

Relay P3, AF55 - App Fig. 6

Relay P4, AF54 - App Fig. 6

Relay SR, 1/2 AK38 - App Fig. 6

Relay SR1, 1/2 AK38 - App Fig. 6

Relay OR, AG37 - App Fig. 2 or 3 - Option ZG

Relay SS, AG30 - App Fig. 2 - Option ZG

D. Description of Changes

D.1 Option ZG is designated. It arranges the circuit to receive multiwink signaling from the distant office. Option ZF is designated for previous wiring with high-low battery or inband signaling methods of coin control from the distant office.

D.2 Circuit Notes 102 and 103 are revised.

D.3 SC3 is revised.

D.4 SC12, SC12A, SC12B, and SC12C are added to show circuit operation with multiwink signaling.

D.5 App Fig. 6 is designated for apparatus and for multiwink signaling.

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