10

CROSSBAR SYSTEMS
NO. 3
RECORDING COMPLETING OR SPECIAL SERVICE
PLUG-ENDED TRUNK
CIRCUIT
COIN WITH OR WITHOUT NON-COIN
HIGH-LOW SUPERVISION
TO DISTANT TOLL SWITCHBOARD

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit is used in completing special service or toll calls from coin customer lines, in No. 3 crossbar office, to a distant toll switchboard.

1.02 This circuit is also arranged to complete route advanced special service or toll calls from noncoin customer lines, in a No. 3 crossbar office, to a distant toll switchboard.

1.03 This circuit is arranged, to send a tone indication signal to the operator on coin calls.

1.04 This circuit can be arranged, on an optional basis, for automatic return of the initial coin on operator answer.

1.05 This circuit is arranged for controlling the disposal of coins over the tip and ring only.

1.06 This circuit can be arranged for dial tone first, option V.

2. GENERAL DESCRIPTION OF OPERATION

SEIZURE FOR COMPLETION OF A CALL

2.01 When the marker receives an indication that a trunk of this type is required, it selects an idle trunk switch and connector circuit, an idle trunk on that circuit associated with the desired route. After the marker completes certain tests, the selected trunk is connected to the calling customer.

OPERATOR ANSWERS

2.02 When the operator at the distant switchboard answers, answer supervision is returned toward the cabling end when this trunk may be accessed by an intercept trunk that has been transferred from an announcement machine.

2.03 On coin calls with option S provided the operator is sent an identification tone indicating that this is a coin call, this is only required when this trunk serves both coin and noncoin customers.

OPERATOR COIN CONTROL AND RECALL

2.04 The operator controls the coins in the box only by the direct coin control method over the tip and ring. With direct coin control the operation of the coin collect or coin return keys by the operator will cause 130-volt potential to be connected to the tip or ring to the coin box as required to dispose of the coins. If the operator wishes to recall the customer the ringing key is operated at the switchboard causing the trunk to connect 20-Hz ringing to the customers line. When the ring key is released the line is restored to the talking state.

DISCONNECT

2.05 When the customer disconnects at the end of a call a disconnect signal is forwarded to the operator. When the operator disconnects if this is a noncoin call the trunk restores to normal, if the call is a coin call the trunk will start the automatic coin collect cycle, thus any coins which the operator failed to return or collect will be collected. When the coin cycle is complete the trunk is restored to idle and is available for another call.

SECTION II - DETAILED DESCRIPTION

1. TRUNK SELECTION AND SEIZURE BY THE MARKER

1.01 The marker receives information from the originating register and from this information selects an idle trunk of this type in the following manner. The marker first selects an idle trunk switch and connector circuit with at least one such idle trunk. If there is at least one idle trunk of this type on a trunk switch and connector circuit the FT lead to the marker will be grounded. The marker then connects to the selected idle trunk switch and connector circuit, and selects an idle trunk by supplying battery to lead TF operating relay F of the selected trunk. The operation of F:

(a) Transfers the T, R, and S leads from this trunk to the marker for tests.

(b) Locks F operated over lead TF to the marker.

(c) Connects the windings of COIN to lead CN and if the customer is a coin class the marker operates COIN.

(d) Ground leads JC and SW to the trunk switch and connector circuit.

(e) Operates the AR relay.

The operation of AR:

(f) Provides a locking path for itself through L or SL operated.

(g) Operates S1.

(h) Provides an auxiliary locking path for CL.

(i) Open an operate path for CC.

The operation of S1:

(j) Connects ground to the S lead to the trunk switch and connector circuit to hold the connection to the customer line.

(k) Opens lead MB to prevent seizure of the trunk for test calls and operates BY.

(ℓ) Opens the operate path of F to prevent this trunk from being seized for other service calls while this trunk is busy.

(m) Provides a locking ground for relay COIN.

(n) Provides ground for operating CC.

(o) Provides ground for operating CRL.

The operation of COIN:

(p) Locks COIN operated to S1.

(q) Connects battery to the windings of CR and CC.

(r) Partially prepares the operating path of R.

(s) Prepares the operating path of CN1.

(t) Opens an operating path for CRL.

(u) Operates PB if dial tone first required option V.

(v) Connects lead BT3 from the tone supply to a make-contact of SL.

(w) Partially opens the shunting ground of the CT timer circuit.

(x) Partially prepares the operating path of CT.

The operation of BY:

(y) Removes the idle indicative ground from lead FT.

(z) Breaks continuity between leads TT and TG.

1.02 If this is a coin call and the circuits are arranged for coin service improvements (dial-tone-first), +48 volt talking battery is used to provide the feature by operating the nickel trap relay in the coin telephone which allows the operator to collect a single nickel. In this case the PB relay controls the application of -48 volt or +48 volt talking battery.

2. SEIZURE SIGNAL TO SWITCHBOARD

2.01 A short time after the operation of AR the marker disconnects from the trunk releasing F. The release of F connects the T, R, and S leads of the trunk through the trunk switch and connector circuit with the T and R leads extending to the customer line. The L will then operate over the customer loop. The operation of L:

(a) Provides a holding path for AR. The AR is a slow-release relay so that it holds from the time the marker releases F until L is operated. The AR will also hold if the customer dials extra pulses in error after cut-through.

(b) Operates L1 and C relays.

The operation of L1:

(c) Connects ringing induction tone to the customers line.

(d) Closes the talking path to the T and R capacitors.

(e) Short-circuits the high-resistance windings of CN, RC, and H to give off-hook supervision of customer line to the operator after the operator answers.

2.02 The operation of C connects battery and ground through the windings of TK to the T and R leads which operates a high-resistance relay in the distant office to light the trunk lamps at the switchboard.

3. CALL ABANDONED BY CUSTOMER BEFORE OPERATOR ANSWERS

3.01 When the customer abandons the call at this time the L, L1, and C release. With L released AR releases which releases S1. The release of S1:

(a) Disconnects ground from the sleeve to the trunk switch and connector circuit releasing the connection to the customer line.

(b) Releases COIN and BY.

The release of BY:

(c) Grounds the FT lead to the trunk switch and connector circuit as an indication that this trunk is idle.

(d) Connects lead TT to lead TG of the trunk switch and connector circuit.

3.02 The trunk is now restored to normal and ready for another call.

3.03 If this call originated from a coin station the auxiliary coin line circuit functions at this time to return any initial coin deposits that have been made by the calling customer.

4. OPERATOR ANSWERS

4.01 When the operator at the distant office answers, the high-resistance relay at the distant office is replaced by battery and ground through the windings of another relay. This battery is connected to the ring conductor at the distant office while the battery in this office is connected to the tip conductor. This battery aids the battery through the windings of TK and TK operates. The operation of TK operates SL. The operation of SL:

(a) Provides an auxiliary holding path for AR so that AR will not release until both the customer and operator have disconnected.

(b) Removes ringing inductive tone from customers line.

(c) Releases relay C.

(d) Operates CR (W option provided) and COIN is operated.

(e) Provides an operating path for CT.

(f) Opens the operating path for CC.

(g) Prepares the coin indication tone path to the operator.

(h) Partially opens the shunting ground for the CT timer.

(i) Operates CL.

(j) Connect diode CN1 in parallel with relay CN1 to prevent E6 repeaters from buzzing relay CN.

4.02 When CL operates it locks to S1, partially prepares the operating path of CC, operates CRL if this is a noncoin call or option X is provided, and prepares the operating path of CN, RC, and H.

4.03 The operation of CR activates the automatic coin return cycle (option W provided) which is discussed in detail in 5.03. If CR operates it also causes the coin tone indication to be sent to the operator if the COIN relay is operated.

4.04 The operation of CRL causes tone indication to be sent to the operator if COIN is operated, opens the operate path of CR, prepares the operating path partially for CC, and activates the CT timing circuit. When the CT relay operates the tone indication is removed.

4.05 The release of C disconnects battery and ground through the windings of TK thus releasing TK and closes the operate path for CN, RC, and H.

4.06 The H operates over the trunk loop from battery and ground at the distant office and provides a holding ground for SL.

4.07 The trunk is now in the talking condition.

5. AUTOMATIC COIN CONTROL CYCLES

5.01 The automatic coin return cycle is used to return the initial coin when the operator answers. The automatic coin collect cycle is used to collect any coin which may be in the box when both customer and operator have disconnected. The coin cycles are timed by an electronic timer circuit to insure a minimum application of coin potential to the customer line for 500 milliseconds.

5.02 The coin collect and coin return cycles are very similar in operation, so it should be sufficient to discuss only one and merely indicate the differences in the other.

AUTOMATIC COIN RETURN

5.03 The automatic coin return cycle is started by CR operating. The CR is operated by SL operating if option W is provided. The SL operates when the operator answers. The operation of CR:

(a) Connects the winding of CT relay to terminal 10 of the CT timer.

(b) Partially closes coin return potential path to the customer line.

(c) Operates CR1.

(d) Applies tone indication to the trunk for the operator if COIN is operated.

The operation of CR1:

(e) Provides a holding path for S1 and L.

(f) Extends coin return potential to a make-contact of CB.

(g) Operates CB.

The operation of CB:

(h) Disconnects taking battery from the customer line.

(i) Connects coin return potential to the tip of the customer line through the 70-ohm resistance CB.

(j) Provides an auxiliary holding path of L.

(k) Opens the operating path of CC.

(ℓ) Starts the charging of capacitor TM by opening the shunting path.

5.04 The coin return potential is applied to the customer line from the time CB operates and until CR releases.

5.05 The charging time necessary to build up the voltage across capacitor TM to a magnitude that will cause the operation of CT timer is about 500 to 650 milliseconds. The timer operated operates relay CT. The operation of CT:

(a) Locks through CR operated.

(b) Resets the timer.

(c) Operates CRL.

(d) Removes the tone indication transmitted to the operator.

5.06 When CRL operates it locks to S1 operated and releases CR. Then when CR releases it disconnects the coin potential from the customer line and releases CT and CR1. However, the CT is held operated through SL and COIN if tone indication to the operator is required for the call. When CR1 releases, it opens one holding path for S1 and L and releases CB. The release of CB:

(a) Open a holding path for L.

(b) Reconnects talking battery to the customer line.

(c) Removes the discharge network consisting of capacitor and resistor CS and resistor J from the customer line. This discharge network is connected to the customer line for at least 400 milliseconds after the coin potential is removed, the time being determined by the release time of CR1 and CB. Thus, the customer line is discharged before talking battery is reconnected.

5.07 After CB has released the circuit is in the talking condition.

AUTOMATIC COIN COLLECT

5.08 The automatic coin collect feature is used only at the end of a call. This feature is similar to the automatic coin return feature, which is described in greater detail. When the customer and operator have both disconnected, causing both L and SL to release, AR releases. The AR released, closes ground through S1, CL, and CRL operated, and SL and CB released to operate CC. The CC operates CC1 and connects the winding of CT to terminal 10 of the CT timer. The CC1 operates CB which connects coin collect potential to the customer line, and allows capacitor TM to charge. When timer CT operates it operates relay CT which locks through CC. The CT relay resets the timer and releases CL. The CL relay releases CC to remove the coin potential from the customer and release CC1. The CC1 releases S1 and CB. The CB removes the discharge network from the customer line. The S1 releasing, releases CRL, COIN, and BY. The BY released restores the circuit to normal.

6. COIN CONTROL FROM DISTANT SWITCHBOARD OVER TIP AND RING

COIN COLLECT

6.01 The operation of the coin collect key in the connected cord circuit at the distant office causes the removal of the regular signaling battery and ground, and the connection of a positive coin control voltage to the ring conductor and -48 volts to the tip conductor at the distant office end of this trunk. This operates CN and RC and holds H.

6.02 The operation of CN disconnects ground from the armature of R and operates CN1.

6.03 The operation of RC opens the operate path of CR1 and partially closes the operate path of CC1.

6.04 The operation of CN1:

(a) Places the short-circuiting of the high-resistance windings of CN, RC, and H under control of CS.

(b) Partially closes the path for coin control potential.

(c) Operates CC1.

6.05 The operation of CC1:

(a) Locks itself through a CN1 make-contact to ground.

(b) Extends coin collect potential through the winding of CS to the contacts of CB.

(c) Operates CB.

6.06 The operation of CB:

(a) Connects coin potential to the tip of the customer line through the CB resistor after it has disconnected talking battery.

(b) Provides a holding path for L.

6.07 The application of the coin collect voltage to the customer line for approximately one-half second insures the operation of the coin magnet. If there is a coin in the box, CS will operate and short-circuit the high-resistance windings of CN, RC, and H, thereby causing the coin supervisory lamp at the distant office to indicate this condition.

6.08 When the coin collect key is restored to normal, the 48-volt trunk signaling circuit is restored at the distant office end of the trunk, thereby causing CN and RC to release, while H will be held operated.

6.09 The release of CN, releases CN1. The release of CN1:

(a) Restores the path for short-circuiting the high-resistance windings of CN, RC, and H to the control of L1.

(b) Disconnects the coin potential from the customers line.

(c) Releases CC1.

6.10 When CC1 releases it opens one holding path for L and releases CB. The release of CB:

(a) Opens the holding path for L.

(b) Reconnects talking battery to the customers line.

(c) Removes the line discharge network consisting of the CS capacitor and the CS and J resistors from the customers line. This network is connected to the line for at least 0.4 second (the release time of CC1 plus CB) after the coin potential is removed to insure that the line is fully discharged before reconnecting the talking battery.

6.11 After CB has released the circuit is in the talking condition.

COIN RETURN

6.12 When the coin return key in the connected cord circuit at the distant office is operated, the regular signaling battery and ground at the distant office is disconnected, and positive coin control voltage connected to the tip conductor and negative 48-volt battery connected to the ring conductor. This operates CN, and H is held operated.

6.13 The CN operates CN1 which in turn operates CR1 through RC and CC1 released. The subsequent operation of CN performs the exact same functions as described in 6.01 through 6.11 with the exception that coin return battery is connected to the customers line.

6.14 When the key used in the coin control operation by the operator is restored to normal; the coin return battery is disconnected from the customers line and CN, CN1, CR1, and CB release in the same manner as described in 6.01 through 6.11 with CR1 taking the place of CC1.

7. RECALLING THE CUSTOMER

7.01 The ringing feature of this trunk is used to recall the coin customer after a call is completed to request overtime payment, and to recall noncoin and PBX customers to inform these customers of the charges.

7.02 Because this circuit may serve noncoin customer lines restricted ringback and nonrestricted ringback features are provided. These features are superfluous when a coin customer is calling, since COIN allows the operator to ring the customer under all conditions.

UNRESTRICTED RINGBACK - OPTION T

7.03 With unrestricted ringback any customer on PBX line connected to this trunk can be recalled at any time. In this case an operating path is provided for R regardless of the customer switchhook condition. Unrestricted ringback is usually used only if no party lines are served by this trunk.

RESTRICTED RINGBACK

7.04 With restricted ringback R can only operate if L1 is operated, which is the condition existing when the customer receiver is off-hook. This feature is usually used for a PBX line after the extension has disconnected.

CIRCUIT OPERATION ON RECALL

7.05 When the ringing key of the connected cord circuit is operated to recall the customer, the battery and ground connected to the distant office end of the trunk is reversed. This operates RC in addition to holding H.

7.06 The operation of RC operates R from the back contact of CN. The operation of R:

(a) Provides a holding path for L if operated.

(b) Connects ground to armature of R to maintain operate ground for itself in case CN momentarily opens its back contact.

(c) Disconnects talking battery from and connects 20-Hz ringing to the customers line.

7.07 When the ringing key is restored to normal RC releases in turn releasing R. The release of R disconnects the ringing and reconnects talking battery to the customer line.

8. SIGNALING THE OPERATOR

8.01 If the calling customer wishes to signal the operator after the operator has answered, the switchhook is depressed and released, and L follows the operation of the switchhook. The L1 follows the operation of L.

8.02 The operation and release of L1 closes and opens the short circuit on the high-resistance windings of CN, RC, and H, thereby causing the relay at the distant office to operate and release in unison. This causes the cord supervisory lamp in the distant office to flash as a recall signal.

8.03 If the operator disconnects while the customer has the receiver off-hook H and SL will release. The SL released operates C which sends a seizure signal to the switchboard as described in 2.01 and 2.02. The SL releases also reapplies ringing induction tone to the customer line. When an operator again answers the circuit will return to the talking condition.

9. HOLD AND DISCONNECT

9.01 The connection is held as long as the operators cord is connected to the trunk or the calling customer has the receiver off-hook. When the customer disconnects L and L1 release. The release of L1 removes the short circuit from the high-resistance winding of CN, RC, and H which causes the cord supervisory lamp to light steadily as a disconnect signal.

9.02 When the operator disconnects by removing the cord from the distant end of this trunk, H releases in turn releasing SL. Then SL released, releases AR.

9.03 The release of AR releases S1 if the calling customer is noncoin or if the calling customer is coin operates CC which starts the automatic coin collect cycle as described in 5.08, of this section. At the end of this cycle S1 releases. The release of S1:

(a) Disconnects ground from the S lead to the trunk switch and connector circuit thus releasing the connection to the customer line.

(b) Releases BY, COIN, and CRL.

The release of BY:

(c) Grounds lead FT of the trunk switch and connector circuit indicating the trunk is idle.

(d) Connect the TT lead to the TG lead of the trunk switch and connector circuit.

9.04 The circuit is now restored to normal.

10. TESTING

10.01 Routine tests are made on this trunk by setting up a test connection to this trunk from a test line. The test circuit is used to control a marker which selects this trunk in the same general manner as for a regular call with the exception that if the trunk had already been made busy, the test circuit may temporarily remove ground from the MB lead by operating its TST relay to permit this trunk to be selected by the marker. Routine operations are performed from the test line to the distant operator in the same manner that a call is completed from a customer to the distant operator.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 See the No. 3 crossbar keysheet for customer line supervision limits.

1.02 Customer Coin Control Supervision Coin Control Battery - Relay CS - 125 to 135 volts.

Max Ext Circuit Loop Res - 4000 ohms
Min Ins Res - 10,000 ohms
Max Earth Pot - ± 10 volts

1.03 Trunk Supervision - Relays RC, H, and CN.

Max Conductor Loop Res - 3000 ohms
Min Ins Res - 30,000 ohms

1.04 Trunk Supervision - Relay TK

Max Conductor Res - 4000 ohms
Min Ins Res - 30,000 ohms

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
AR	All Release
BY	Busy
C	Call Established
CB	Coin Battery
CC	Coin Collect
CC1	Coin Collect Auxiliary
CL	Coin Lock
CN	Coin
CN1	Coin Auxiliary
COIN	Coin (Call)
CR	Coin Return
CR1	Coin Return Auxiliary
CRL	Coin Released
CS	Coin Supervisory
CT	Coin Timer
F	Frame
H	Hold
L	Customer Supervisory Relay
L1	Customer Supervisory Auxiliary
PB	Positive Battery
R	Ring
RC	Ring Control
S1	Sleeve
SL	Called End Supervisory
TK	Talk

3. FUNCTIONS

3.01 When this circuit is available for seizure, a ground is provided on lead FT to the trunk switch and connector circuit indicating to the markers that there is an idle trunk, in the desired trunk group, on the frame.

3.02 Provides an F relay associated with lead TF which is operated by the marker when it seizes this trunk. The F transfers the T, R, and S leads from this trunk to the marker for making a tip and ring continuity test and S lead false ground test.

3.03 Provides for the removal of ground from lead FT as a busy indication to the markers.

3.04 Provides a slow-release relay, which causes the connection to be held after the marker releases and before the customer line supervisory circuit takes control.

3.05 The CN lead is grounded by the marker as a coin class-of-service indication, operating COIN. The S1 operating supplies a locking ground for COIN.

3.06 Provides the marker with a ground mark over CN as a check that COIN has locked operated. This allows the marker to advance when a coin class signal has been transmitted by the marker.

3.07 Provides for holding the connection over extra dial pulses.

3.08 Provides for signaling the operator when the customers supervisory circuit is completed with the receiver off the hook.

3.09 Provides the customer with ringing induction tone until the operator answers and permits the return of the ringing induction tone to the customer line if the operator disconnects while the customer receiver is off the hook.

3.10 Permits the customer to abandon the call and release the connection before the operator has answered.

3.11 Provides means for holding the connection until both the customer and the operator have disconnected after the operator has once answered.

3.12 Provides switchhook supervision to the operator.

3.13 Provides automatic return of the initial coin when the operator answers if option W is provided.

3.14 Provides for direct control of the coin control features by the distant operator.

3.15 Provides for removal of talking battery when coin potential is applied to the customer line.

3.16 Provides approximately a half-second interval after the coin potential is removed from the customer line, to discharge the line of coin potential. This interval also permits the coin magnet to restore to normal before talking battery is reconnected to the line.

3.17 Provides an automatic coin collect cycle after the customer and operator have disconnected.

3.18 Provides a short spurt of identification tone to the answering operator when the calling customer is COIN class.

3.19 Provides for reapplying the identification tone if the operator disconnects and replugs before the customer disconnects.

3.20 Provides an 18.7-ohm holding ground to the S lead of the trunk switch and connector circuit to hold the channel, also provides a means of bridging the 18.7-ohm ground upon operator answer. This change in potential is used as a means of providing "answer supervision" when this trunk may be accessed by calls transferred to it from an intercept trunk working with an announcement machine.

3.21 Provides for recalling a noncoin customer or PBX when the customer receiver is off-hook; or provides for recalling the customer under all conditions if the unrestricted ringback option is provided. If the calling customer is coin the operator may ring the customer if the receiver is off-hook or on-hook.

3.22 Provides connection to an associated make-busy jack MB on the test circuit to make the trunk busy without interfering with an established connection.

3.23 Provides means for overriding a make-busy condition on test calls, by causing the removal of ground from lead MB long enough to permit selection of the trunk.

3.24 Option V provided, dial-tone-first, provides a means of disabling the nickel trap on 200-type coin phones and the TOUCH-TONE® oscillator on the 1A sets, by placing a positive 48-volt potential on the ring lead through the L relay.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet the connecting information thereon is to be followed.

(a) Trunk Switch and Connector Circuit - SD-26383-01.

(b) Power, Ringing, and Tone Distributing Circuit - SD-26414-01.

(c) Test Circuit - SD-26411-01.

(d) Traffic Usage Recorder Circuit - SD-96494-01.

(e) Time Delay Control Circuit - SD-94820-01.

(f) Incoming Two-Wire Coin Special Service or Subscriber Recording Completing Trunk Circuit at No. 3C Toll Switchboard - SD-55875-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing all the functions listed in this Circuit Description and meeting the requirements listed in the Circuit Requirements Tables.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 If it is desired to remove this trunk from service for trouble or other reasons, a short-circuit plug is inserted into the make-busy jack MB, on the test circuit, associated with this circuit. This connects ground through a normal contact of relay TST in the test circuit to the MB lead in this circuit causing the BY relay to operate. The operation of BY disconnects ground from lead FT which indicates this frame is busy insofar as this circuit is concerned.

6.02 When remote make-busy facilities are provided, the MB lead to the trunk can be grounded by the operation of an associated latching relay located in the remote make-busy and restore translator circuit via the jack at the test circuit.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-LCB

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