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CROSSBAR SYSTEMS
NO. 3
RECORDING COMPLETING OR SPECIAL SERVICE
PLUG-ENDED TRUNK
CIRCUIT
NON-COIN
HIGH-LOW SUPERVISION
TO DISTANT TOLL SWITCHBOARD

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit is used to complete special service, or toll calls from non-coin customer lines in a No. 3 crossbar office to distant DSA or toll switchboards.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The circuit operation will now be described for a regular call, from seizure through the talking period to release without discussing any variations. The other possible conditions are introduced later.

SEIZURE FOR COMPLETION OF A CALL

2.02 When the marker finds out that a trunk of this type is required to complete a call in progress, it makes tests to find an idle trunk on an idle trunk switch and connector circuit. Then the marker operates the F relay of the selected trunk.

2.03 When F operates the trunk is associated with the marker through the trunk switch and connector circuit. The F operated, operates S1. Then BY operates from S1 to set the busy indication. After the marker determines that the connections to the trunk are in order, the marker releases, As a result F releases, and the customer line is connected to the tip and ring of this circuit.

2.04 The L operates over the customer loop and provides a holding path for S1. Then L1 and C operate from L. The C connects battery and ground through the

windings of TK to the tip and ring as a seizure signal to the distant office. The TK does not operate at this time. Now the call is established to the switchboard waiting for an operator to answer. Ringing induction tone is sent to the customer during this period.

OPERATOR ANSWERS

2.05 When the operator answers at the distant toll or DSA switchboard aiding ground and battery over the tip and ring, respectively, operates TK. Then SL operates from TK. The SL starts the release of C. When C releases TK releases and H operates to hold SL. Now the call is completed to the operator and conversation can proceed.

RECALLING THE CUSTOMER

2.06 If the operator wishes to recall the customer the ringing key at the distant switchboard is operated. This causes a reversal of battery and ground on the tip and ring of the trunk circuit at the switchboard which operates RC. Then RC operates R which connects ringing voltage to the customer line and holds L operated. When the ringing key is released RC and R release thus disconnecting the ringing voltage from the line and restoring the talking battery.

DISCONNECT

2.07 When the customer disconnects at the end of the call L and L1 release. The L1 released connects the high-resistance windings of RC and H in series with the low-resistance windings as a disconnect signal to the operator. When the operator disconnects H releases which in turn releases SL. Then SL releases S1. The S1 releases BY, and removes ground on the S lead to the trunk switch and connector circuit to release the channel hold magnets. The BY released restores the circuit to normal, making it available for another call.

SECTION II - DETAILED DESCRIPTION

1. TRUNK SELECTION AND SEIZURE BY THE MARKER

1.01 After the marker has decided that a trunk of this type is required to complete the call it finds and selects an idle trunk in the following manner. The marker first locates an idle trunk switch and connector circuit that has at least one idle trunk of the desired route before establishing a connection through its connector. Ground on the FT lead from the trunk indicates to the marker that at least one trunk in the group on a trunk switch and connector circuit is idle. Then the marker connects to the idle unit and selects and seizes one of the idle trunks of the desired route. The marker connects battery to the TF lead. This operates F which locks to the battery on the TF lead. The operation of F:

(a) Grounds leads JC and SW to the trunk switch and connector circuit.

(b) Locks directly to lead TF.

(c) Transfers the trunk T, R, and S leads via leads T1, R1, and SL to the marker for tests.

(d) Operates the S1 relay.

The operation of S1:

(e) Connects 18.7-ohm ground to the S lead to the trunk switch and connector circuit for holding the switch connections after F releases.

(f) Opens lead MB to the test circuit to prevent the trunk from being seized on a test call.

(g) Opens the operate path for F.

(h) Provides a locking path for itself with L or SL operated.

(i) Operates BY.

The operation of BY:

(j) Opens lead FT to indicate that the circuit is busy.

(k) Breaks continuity between leads TT and TG.

2. SEIZURE SIGNAL TO THE DISTANT SWITCHBOARD

2.01 A short time after the operation of S1 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 extended to the customer line. The customer supervisory relay L then operates over the customer loop. The operation of L:

(a) Provides a holding path for S1. The S1 is a slow-release relay so that it holds over from the time the marker disconnects until L operates. The S1 will also hold over if the customer dials extra pulses in error after cut through.

(b) Operates L1 and C.

The operation of L1:

(c) Grounds the armature contact of RC to permit applying ringing to the customer line when the receiver is off the switchhook.

(d) Connects ringing induction tone to the customer line.

(e) Closes the talking path to the T and R capacitor.

(f) Short circuits the high-resistance windings of RC and H to give off-hook supervision of customers line to operator after the operator answers.

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 at the distant office to light the trunk lamps at the switchboard.

2.02 The TK does not operate at this time due to the high-resistance of the relay at the distant office.

2.03 If the customer disconnects at this time all operated relays and the channel connections will release, restoring this circuit to normal.

3. OPERATOR ANSWERS

3.01 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 and ground aids the battery and ground through the windings of TK and TK operates. The operation of TK operates SL. The operation of SL:

(a) Provides a holding path for SL so that S1 is under joint control of the operator and customer.

(b) Removes ringing induction tone from the customer line.

(c) Releases C.

(d) Shunts down the SL resistor replacing 18.7-ohm ground with full ground as an "answer supervision" indication when an intercept trunk working with an announcement machine has access to this circuit.

(e) Partially closes the operating path for RC and H.

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

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

3.04 The call has now reached the conversation period.

4. RECALLING THE CUSTOMER

UNRESTRICTED RINGBACK

4.01 With unrestricted ringback any customer or PBX line connected to this trunk can be recalled at any time. Option Z is provided in this case to provide a ground for operating R regardless of the customer switchhook condition. Unrestricted ringback is usually used only if no party lines are served by this trunk.

RESTRICTED RINGBACK

4.02 With restricted ringback relay R can operate only with L1 operated, that is, in an off-hook condition. This feature is usually used in connection with a PBX line after the extension has hung up, but while the cord is still connected which presents an off-hook indication. Restricted ringback is used when party lines are served by this trunk; Z option is omitted.

CIRCUIT OPERATION ON RECALL

4.03 When the ringing key is operated at the distant toll or DSA switchboard the result is a reversal of battery and ground over the T and R leads toward this circuit. This operates RC in addition to holding H.

4.04 The operation of RC will operate R if, Z option is provided, or if L1 is operated. The operation of R:

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

(b) Disconnects talking battery and ground from and connects 20-Hz ringing voltage and ringing ground to the customer line.

4.05 When the ringing key is released the RC and R relays release, thus reconnecting talking battery to the customer line.

5. SIGNALING THE OPERATOR

5.01 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.

5.02 The operation and release of L1 closes and opens the short circuit on the high-resistance windings of RC and H thereby causing the supervisory 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.

5.03 If the operator disconnects while the customer has the receiver off-hook, H and SL release. Then C operates to send a seizure signal to the distant office which results in relighting the trunk lamps at the switchboard. Ringing induction tone is applied to the customer line. When an operator again answers the circuit will return to the talking condition.

6. HOLD AND DISCONNECT

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

6.02 When the operator disconnects, H releases in turn releasing SL. Then S1 released, releases S1. The release of S1:

(a) Reconnects the MB lead from the trunk circuit to the make-busy jack at the test circuit.

(b) Disconnects ground from the S lead to the trunk switch and connector circuit thus releasing the connections through to the customer line.

(c) Releases BY.

The release of BY grounds lead FT and connects lead TT to lead TG to indicate there is an idle trunk on the trunk switch andnconnector unit. The circuit is now restored to normal.

7. TESTING

7.01 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 has already been made busy the test circuit can temporarily remove ground from lead MB by operating its TST relay to permit this circuit 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 Trunk supervision RC, H, and TK relays.

Max trunk conductor loop - 3000 ohms for 45-50 Volts at both No. 3 Crossbar and Switchboard and 3300 ohms for 48-50 Volts at both.

Min Ins Res - 30,000 ohms

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
BY	Busy
C	Call Established
F	Frame
H	Hold
L	Customer Supervisory

Designation	Meaning
L1	Customer Supervisory Auxiliary
R	Ring
RC	Ring Control
S1	Sleeve
SL	Called End Supervisory
TK	Talk

3. FUNCTIONS

3.01 When circuit is available for seizure, provides a ground on lead FT of trunk switch and connector circuit to indicate to the marker that there is an idle trunk on that circuit.

3.02 Provides an F relay associated with lead TF which is operated by the marker when seizing this trunk and which provides for making line tip and ring continuity and S lead false ground tests during the build-up of the connection.

3.03 Provides for the removal of ground from lead FT and the opening of lead TT and TG during the operation of this circuit to present a busy indication to the marker.

3.04 When a marker seizes this trunk and operates relay F, which in turn operates relay S1 to hold the connection following the disconnection of the marker, until the customer line supervisory circuit takes control.

3.05 Provides for holding the connection over extra dial pulses.

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

3.07 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.

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

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

3.10 Provides a means of returning "answer supervision" by replacing an 18.7-ohm ground with full ground upon operator answer, when this circuit can be accessed by calls transferred to it from an intercept trunk working with an Announcement System.

3.11 Provides for recalling a customer or PBX where the customer receiver appears to be off the switchhook or provides for recalling the customer on all conditions when the unrestricted ringback feature, option Z is provided.

3.12 Provides switchhook supervision to the operator.

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

3.14 Provides means for overriding a make-busy condition on test calls. The marker may set up test connection by causing the removal of ground from lead MB long enough to permit selection of the trunk.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet, the connecting information thereon shall 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) Incoming Trunk Circuit (Typical) - SD-95789-01.

(f) Incoming Two-Wire Subscribers Recording Completing or Special Service Trunk Circuit Toll Switchboard No. 3C (Typical) - SD-55872-01.

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 test circuit to the MB lead in this circuit causing the BY relay to operate. The operation of BY disconnects ground from lead FT and opens the path between the TT and TG leads which indicates this unit 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

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