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CROSSBAR SYSTEMS
NO. 3
RECORDING COMPLETING OR SPECIAL SERVICE
PLUG-ENDED TRUNK
CIRCUIT
NONCOIN
E AND M LEAD SUPERVISION

CHANGES

B. Changes in Apparatus

B.1 Superseded	Superseded By
M - 18BH Resistor - Fig. 1, Option Y	M - 533A Diode - Fig. 1, Option X

D. Description of Changes

D.1 The FS1 and CAD 2 reference to "Transmission and Signaling Facilities with Type I Interface" is added.

D.2 The FS1 is revised to show the addition of X option. Option Y was not formerly designated and is rated Mfr Disc.

D.3 Circuit Note 104 is revised.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-GFC

WE DEPT 25820-JRF-GWC-PN

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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 noncoin 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 late.

SEIZURE FOR COMPLETION OF A CALL

2.02 When the marker determines 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. 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.

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2.04 Relay L operates over the customer loop and provides a holding path for S1. The L1 is then operated by relay L. Relay L1 in turn connects battery to the M lead as a seizure signal to the distant office. The call is now established to the switchboard. Ringing induction tone is being sent to the customer while waiting for an operator answer.

OPERATOR ANSWERS

2.05 When the operator answers at the distant toll or DSA switchboard, ground is received on the E lead operating E. Relay E operates relay SR. The call is now completed to the operator and conversation can begin.

RECALLING THE CUSTOMER

2.06 If the operator wishes to recall the customer the ringing key at the distant switchboard is momentarily operated. This results in a 50- to 100-millisecond loss of ground on the E lead. Relay E releases during this loss of ground interval. When E releases relay P1 operates. When E reoperates at the end of the 50- to 100-millisecond period, the combination of relays P1 and E operated results in the operation of relay P2. Relay P2 operated operates relay R which applies ringing voltage to the tip and ring. This ringing voltage is applied for a minimum of 1.5 seconds at which time RB timer operates relay RB. The operation of RB releases the rering relay R and talking battery is once again applied to the customer line.

DISCONNECT

2.07 When the customer disconnects at the end of the call L and L1 release. Relay L1 released connects ground to the M lead as a disconnect signal to the operator. When the operator disconnects E releases which in turn releases SR. Then SR releases S1. Relay S1 releases BY and removes ground on the S lead to the trunk switch and connector circuit to release the connection to the customer line. Relay 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 determined 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. 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 selects and seizes one of the idle trunks of the desired route. The marker connects resistance battery to the TF lead which operates F relay which locks operated through its own 6M contact. The operation of F:

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

(b) Locks directly to lead TF.

(c) Connects the T, R, and S leads to the T1, R1, and SL leads, respectively, which are then connected to the marker through the trunk switch and connector circuit for certain tests.

(d) Operates the S1 relay.

1.02 The operation of S1:

(a) Connects 18.7-ohm ground to the S lead to the trunk switch and connector circuit for holding the channel connections.

(b) Opens the operate path for F to prevent seizure of the trunk for other service calls.

(c) Opens the MB lead to the test circuit.

(d) Operates BY.

(e) Connects ringing induction tone to the calling customers line.

The operation of BY:

(f) Removes the trunk idle indicating ground from the FT lead.

(g) Opens the path from lead TT to TG to prevent a subsequent seizure while this call is in process.

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 from the time the marker disconnects until L operates. The S1 will also hold if the customer dials extra pulses in error after cut through.

(b) Operates L1.

The operation of L1:

(c) Provides a ground path for rering relay R to permit ringing the customer line when the receiver is off the switchhook.

(d) Closes the talking path.

(e) Connects battery to the M lead as a seizure signal to the switchboard circuit.

(f) Removes the idle circuit termination from across the tip and ring.

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

3. OPERATOR ANSWERS

3.01 When the operator at the distant office answers the E lead is grounded. Relay E is then operated. The operation of E operates relay SR. The operation of SR:

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

(b) Removes ringing induction tone from the calling customers line.

(c) Provides an off-normal ground to relays P1 and P2.

(d) Bridges the SL resistor on the sleeve lead and replaces the 18.7-ohm resistance ground with full ground to provide answer supervision when an intercept trunk, working with an announcement machine, has been transferred to this trunk.

3.02 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 party lines are not 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 ground is lost on the E lead for a period of from 50 to 100 milliseconds. The loss of ground releases E and relay P1 operates. When ground is restored to the E lead, E reoperates. The combination of E and P1 operated, operates P2.

4.04 The operation of P2 will operate R with L1 operated. (If Z option is provided R operates from P2). The operation of P2 also opens the discharge path for capacitor T, which starts the capacitor charging toward the threshold voltage of the RB timer. The operation of R:

(a) Provides a second path for holding L.

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

4.05 In about 1.5 to 2 seconds capacitor T has charged to the threshold voltage of the RB timer. Timer RB operates and in turn operates RB relay.

4.06 The operation of RB opens the ground path for relays P1 and P2 releasing both relays.

4.07 The release of P2 releases R. The R released removes 20-Hz ringing voltage and reconnects talking battery to the customers line.

4.08 The sequence of operations described in 4.03 through 4.07 occurs each time the ringing key is operated at the switchboard.

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 transfers the M lead from battery to ground alternately 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 E and SR release. Battery continues to be sent over the M lead 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 releases L1. The release of L1 transfers the M lead from battery to ground, which causes the cord supevisory lamp to light steadily as a disconnect signal.

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

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

(b) Disconnects ground from the S lead to the trunk switch and connector circuit thus releasing the channel through the switches.

(c) Releases BY.

The release of BY:

(d) Grounds lead FT of the trunk switch and connector circuit indicating this trunk is nonidle.

(e) Reconnects the path from the TT lead to the TG lead making it possible for the marker to reselect this trunk for another call.

7. TESTING

7.01 Routine tests are made on this trunk by setting up a test connection to 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 marker can be directed to temporarily remove ground from lead MB 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.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
BY	Busy
E	Receive
F	Frame
L	Calling-End Supervisory
L1	Auxiliary to L
P1	Trip Ringing
P2	Auxiliary to P1
R	Ring
RB	Ringback
S1	Sleeve
SR	Called-End Supervisory

3. FUNCTIONS

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

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 TF during the operation of this circuit to present a busy indication to the markers.

3.04 When a marker seizes this trunk and operates relay F, relay S1 is operated 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 customer 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 have disconnected after the operator has once answered.

3.10 Provides a means of returning answer supervision to an intercept trunk that has been transferred to this circuit from an announcement machine.

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

3.12 Provides switchhook supervision to the operator.

3.13 Provides connection to an associated make-busy jack MB in the test circuit to make the trunk busy without interferring 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 information thereon is to be followed.

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

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

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

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

(e) Signaling and Transmission Facilities Compatability Circuit - SD-99421-01.

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

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 the BY disconnects ground from lead FT which indicates, this trunk is busy.

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.

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