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CROSSBAR SYSTEMS
NO. 3
REVERTING CALL PLUG-ENDED TRUNK
CIRCUIT
FOR ALL NEGATIVE RINGING

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This trunk provides for the connection and supervision of reverting calls in No. 3 crossbar offices using all negative coded ringing.

2. GENERAL DESCRIPTION OF OPERATION

2.01 When customers on a 2-, 4-, or 8-party line make calls to a station on the same line, the marker connects the line to an idle reverting call trunk. The marker operates the proper ringing combination relays in the trunk. The trunk applies busy tone to the line as a signal to the calling customer to hang up. Then the called customers ringing code is applied on the side of the line to which the ringer is attached. Alternately, reverting ringing is applied to the opposite side of the line. When a station answers ringing is tripped. The calling customer hears the cessation of ringing and goes off-hook again, both parties are now connected; conversation can begin. When all stations on the line put their receivers on the switch-hook, the trunk drops the connection and returns to normal.

SECTION II - DETAILED DESCRIPTION

1. ESTABLISHING CONNECTION - SC1

MARKER SEIZURE

1.01 When a call originated by a station on a line entitled to reverting ringing service is identified by the marker as being for the same line as the calling line, the marker seizes an idle reverting call trunk. It looks first for a grounded FT lead from trunks of this type on trunks switch and connector circuits which are ready to handle a call. There is one FT lead per trunk switch and connector circuit for reverting call trunks. If there is at least one idle reverting call trunk there will be ground on the FT lead to the trunk switch and connector circuit which serves the idle reverting trunk(s). The marker selects an idle trunk switch and connector circuit which is ready to handle a call and

applies ground through the selected circuit to the TT leads of all of the associated reverting call trunks. The ground is returned to the marker by each idle reverting call trunk over their individual TG leads. The marker selects an idle trunk and operates its F relay by applying resistance battery to the trunks TF lead. The F relay operated:

- (a) Locks to the TF lead through its 9 make-contact.
- (b) Transfers the T, R, and S leads to the marker over the T1, R1, and S1 leads. The marker performs a trouble ground test on the sleeve and controls the channel over the S1 lead. After the channel has been set up, the marker checks tip and ring continuity using the T1 and R1 leads.
- (c) Cuts through to the marker the operate paths of the R2, R3, and TPR ringing combination relays.
- (d) Opens the operate path of the BT busy tone relay.
- (e) Grounds the JC and SW leads to the trunk switch and connector circuit.
- (f) Operates the S1 relay.

1.02 The S1 relay operated:

- (a) Prepares a locking ground for itself and the RC ringing control relay through its 6 make-contact.
- (b) Through its 10 make-contact supplies a ground for the S sleeve lead by which the S1 will control the channel after the marker releases.
- (c) Opens the FT, TF, and TT leads which will make the trunk appear busy and prevent its seizure by a marker during the remainder of the call.

1.03 The marker operates the RC ringing control relay. It checks that the RC operates and that its locking path is intact by checking for ground on the RA lead. The path to ground starts at the RA lead and goes through 5 make F, 6 break RT, and 6 make S1 to ground. The marker stores the called party ringing information in the trunk by operating the proper combination of R2, R3, and TPR relays. These relays lock operated to ground through 2 make RC.

1.04 The marker sets up the channel from the line to the trunk, performs its tests on the T, R, and S and prepares to release by releasing the trunk F relay. The F relay released:

- (a) Partially closes the operate path of the BT busy tone relay.
- (b) Transfers the tip and ring from the line into the trunk and onto the S relay. The S relay provides the talking battery and ground to the line and operates over the loop to the calling customer. Six make S also provides a lock path for the operated S1.
- (c) Transfers the S sleeve lead and control of it into the trunk.

The marker checks that the ground, used to control the channel, appears on the sleeve and then releases.

BUSY TONE

1.05 Earlier when the marker operated the RC relay it had:

- (a) Closed ground through its 1 make contact to ST start lead to the interrupter circuit.
- (b) Completed the operate path to ground of the S0 S operated relay which operated at that time but performed no useful function.

When F relay releases, the operated S0 prevents the BT from operating immediately thus maintaining the S1 under control of the S relay. This allows the trunk to release should the calling customer abandon the call before busy tone is applied. The operated S relay releases the slow-release S0 relay which closes the operate path of the BT relay to ground. The BT operated:

- (a) Locks operated under control of the RC ringing control relay.
- (b) Partially closes the operate paths of the PU pick up and RR revertive ringing relays. These are the relays which when operated apply ringing potential to the line.
- (c) Transfers the lock path of the S1 relay from control of the S relay. This allows the trunk to hold the channel when the calling customer hangs up after busy tone is sent.

(d) Applies busy tone from the interrupter circuit LBT lead through the A capacitor, 7 break of the SO and 11 make BT to the tip circuit.

1.06 Busy tone applied to the tip circuit is the signal to the calling customer which tells that party to hang up so that ringing can begin. When the calling customer puts the receiver on-hook, the S relay releases.

2. RINGING - SC1 AND SC2

START OF RINGING

2.01 When the calling customer releases upon hearing busy tone and releases the S relay, the operate path of the SO relay is completed to ground. The SO operated:

- (a) Removes busy tone, through its 7 break-contact, from the tip circuit.
- (b) Enables the operate paths of the PU and RR relays. These relays control the application of ringing potentials to the line.

Because the PU relay operating will apply the called party ringing code to the tip or ring, it is important that the time when it operates is controlled. If the called station ringing is a code 1 (see chart below) the PU is allowed to operate as soon as the SO relay operates. The operate path is from ground on 8 break R2, 2 break R3, 8 break PU, 12 make SO, and 12 make BT. If the called station ringing code is other than code 1, R2, or R3 operated, PU operates under control of the PU ground pulse (Sequence Chart 2). The PU pulse guarantees that the PU relay operates just before the start of the 6-second ringing cycle thus insuring that ringing codes 2, 3, and 4 are not mutilated. In either event when the PU relay operates, ringing starts. The following chart specifies the called station ringing codes for the various combinations of operated R2, R3, and TPR relays.

RINGING COMBINATIONS

Called Party	Relays Oper	Ringing	
		Code	Applied To
1	-	1	Ring
2	TPR	1	Tip
3	R2	2	Ring
4	R2, TPR	2	Tip
5	R3	3	Ring
6	R3, TPR	3	Tip
7	R2, R3	4	Ring
8	R2, R3, TPR	4	Tip

RINGING

2.02 The operated PU transfers the tip and ring to the line from the S relay to the ringing potential leads. Coded ringing potential leads C1, C2, C3, and C4 provide the ringing potentials to the trunk. The ringing code selected for the call appears at the RT ringing trip relay through the five transfer contact of R3. It appears through the RT and is directed to the tip or ring circuit by the TPR tip party ringing relay 3 and 4 transfer contacts. The ringing potential and ringing ground are applied to the line under control of the 2 and 3 transfer contacts of the RR relay.

2.03 At the same time SO relay enabled the PU relay, it also enabled the RR revertive ringing relay. The RR relay immediately begins following the RR revertive ringing ground pulses. The RR relay pulsing applies ringing through the R resistance lamp to the opposite side of line to which the called party ringing is applied. This is done under control of the 1 and 2 transfer contacts on the TPR relay and the RR 2 and 3 transfer contacts. Ringing the called party and applying revertive ringing to the opposite side of the line insures that the calling party will also hear ringing.

3. ANSWER AND DISCONNECT - SC1

ANSWER

3.01 Ringing of both sides of the line continues until someone on the line answers. A station off-hook on the line lowers the loop impedance sufficiently so that the resulting increase in current operates the RT ringing trip relay. Six break opens the RC relay lock path. The RC relay released:

- (a) Releases the operated ringing combination relays R2, R3, and TPR.
- (b) Releases slow-release relay SO.
- (c) Releases BT relay.

The released BT relay transfers the S1 relay lock path to control of 6 make S relay and releases the RR and PU relays. Relay PU releasing removes ringing from the tip and ring which releases RT. The PU also cuts through the tip and ring to the S supervisory relay which supplies talking battery and ground to the line. The S operates over the loop and maintains supervision over the connection by holding S1 operated consequently maintaining ground on the sleeve. When PU removed ringing from the line, it signaled the calling party that someone had answered. The calling party now lifts the receiver and in doing so is connected to the answering station. Conversation may now take place.

DISCONNECT

3.02 When the last party hangs up, the S relay releases releasing the S1 relay.
Relay S1 released:

- (a) Removes ground from the S sleeve lead releasing the channel hold magnets and dropping the connection.
- (b) Indicates that the trunk is idle by re-connecting ground to the FT lead and the TG and TT leads together.
- (c) Makes the trunk available for marker seizure by reconnecting the F relay to the TF lead.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 The customer working limits for this trunk will be found in the No. 3 cross-bay keysheet.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designation</u>	<u>Meaning</u>
BT	Busy Tone
F	Traditional
MB	Make Busy
PU	Pick Up
R2	Ringng Code 2 or 4
R3	Ringng Code 3 or 4
RC	Ringng Control
RR	Revertive Ringng
RT	Ringng Trip
S	Supervisory
S1	Supervisory Auxiliary
SO	S (Has) Operated
TPR	Tip Party Ringng

3. FUNCTIONS

- 3.01 Indicate to the marker that there are idle trunks of this type on a selected trunk switch and connector circuit.
- 3.02 Indicate to the marker which of these trunks associated with a particular trunk switch and connector circuit are idle.
- 3.03 Connect the selected idle trunk to the marker.
- 3.04 Operate the S1 to make the trunk appear busy.
- 3.05 Transfer the T, R, and S to the trunk switch and connector circuit for connection to the marker for tests and channel control.
- 3.06 Ground the JC and SW leads to the trunk switch and connector circuit which cuts through various leads from the trunk to the marker.
- 3.07 Register the called party ringng combination.
- 3.08 After marker release, to return busy tone to the calling customer as a signal to hang up.
- 3.09 To await calling party disconnect and then immediately begin revertive ring on the opposite side of the line from the called party ringer.
- 3.10 To start ringng CODE 1 called party codes immediately but to wait until the start of the 6-second ringng cycle to start ringng all other called party codes.
- 3.11 To ring called party codes on the side of the line to which the ringer is attached.
- 3.12 To trip ringng and restore the called party ringng combination register to normal when the called station or any other station on the line removes their receiver from switchhook.
- 3.13 To furnish talking battery and ground and supervision for the called and calling stations.

- 3.14 To restore the trunk to normal when all stations have receiver on switchhook.
- 3.15 To be made busy for test without interfering with an established call.

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 Distribution Circuit - SD-26414-01.
- (c) Test Circuit - SD-26411-01.
- (d) 60- or 120-IPM Interrupter Circuit - SD-26407-01.
- (e) Traffic Usage Recorder (Typical - SD-96494-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing all of the functions listed in

this Circuit Description and of meeting the requirements listed in the Circuit Requirements Tables.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 A jack per trunk is provided at the test circuit for making these trunks busy. When a sleeve-ring shorting plug is inserted, ground through a normal contact of relay TST in the test circuit is passed over lead MB to the trunk MB relay. The MB relay will operate whether the trunk is idle or busy. When the trunk is idle or when it becomes idle the operated MB relay:

- (a) Removes ground from the FT lead.
- (b) Breaks continuity between leads TG and TT.
- (c) Removes the F relay from the TF lead.

In this state the trunk appears busy to a marker

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DEPT 5245-LCB

WE DEPT 355-JRF-KLF-VM