

(XTRA)
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CIRCUIT DESCRIPTION

CD-25292-01
ISSUE 6D
APPENDIX 3D
DWG ISSUE 18D

10

CROSSBAR SYSTEMS

NO. 13

INCOMING TRUNK CIRCUIT
REVERSE BATTERY SUPERVISION
RP, DP OR MF PULSING OR SF
AUTOMATIC START OF RINGING
4 PARTY SEMI-SELECTIVE RINGING
TYPE B TB SUPPLY

(CHANGES)

A. Changed and Added Functions

- A.1 Provision is made for a slow disconnect, on trunks utilizing SF signaling units, to reduce the number of false disconnects due to speech simulated disconnect signals, ("talk-offs").
- A.2 Connection to the Traffic Usage Recorder Circuit is added.

B. Changes in Apparatus

B.1 Added

A1 - Y334 Relay - "ZG" Option - Fig. D

D. Description of Changes

- D.01 The A1 relay is added, "ZG" option Fig. D and is required for a slow disconnect trunk.
- D.02 Option "ZF" is added to indicate wiring previously shown nonoptional. "ZF" option is required where "ZG" option is not furnished.
- D.03 Option "ZH" is added and is required where "ZG" option is furnished but the need for a slow disconnect trunk is not required.
- D.04 Provision is made for connecting to the traffic usage recorder circuit. Lead "PB" to the traffic register circuit is designated "ZB" option and lead "PB" to the traffic usage recorder circuit is designated "ZC" option.
- D.05 Options "ZD" and "ZE" are added to remove flash on line busy and overflow.

Option "ZE" is rated "Standard" and option "ZD" is rated "Mfr Disc."

- D.06 Note 106 is revised to include "ZC", "ZB", "ZF" and "ZG" options.
- D.07 Note 105 and the options used table are revised to include "ZB", "ZC", "ZD", "ZE", "ZF", "ZG" and "ZH" options.
- D.08 Fig. 1K, 1L, 1M, 1N and 1P are changed to include information concerning "ZC" and "ZD" options.
- D.09 CAD 1 for "ZC" option and CAD 2 for "ZG" option are added.
- D.10 Notes 112 and 301 are added.
- D.11 Equipment information is changed to "Job Basis"

F. Changes in Description of Operation

- F.1 Note that the locking path of the D relay and the grounding of the "ST" lead to the terminating sender link and controller circuit for options "ZF" and "ZH" remain as described. With "ZG" option, these functions are performed by the A1 relay which operates and releases in sequence with the A relay. In addition the operated A1 relay functions to close its primary winding to prepare it for slow release. Thus with "ZG" option a momentary release of the A relay caused by a speech simulated disconnect signal in the SF signaling unit will not cause a false disconnect if the A relay releases for 160 ms. or less.
- F.2 Note in paragraph 15 and 16 that flash is only provided with "ZD" option.
- F.3 Under 4. CONNECTING CIRCUITS add:
- 4.830 Traffic Usage Recorder Circuit SD-95738-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2319-JJB-LF-SW

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-25292-01
Issue 6-D
Appendix 2-B
Dwg. Issue 17-B

CROSSBAR SYSTEMS
NO. 1
INCOMING TRUNK CIRCUIT
REVERSE BATTERY SUPERVISION
RP, DP OR MF PULSING OR SF
AUTOMATIC START OF RINGING
4 PARTY SEMI-SELECTIVE RINGING
TYPE B TB SUPPLY

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER
THAN THOSE APPLYING TO ADDED OR RE-
MOVED APPARATUS

C.1 Test note 2, in page 2, for the Y57
relay, formerly read: "For Springs
10T-11T and 9B-10B, contact make 15, no
make 20."

C.2 Test note 3, in page 3, for the Y301
relay, formerly read: "For Springs
10T-11T and 10B-11B, contact make 15, no
make 20."

C.3 These test notes are modified to in-
clude a test value for the "contact
make" and "no make" to provide a margin
between the test and readjust.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3440-JFM-EWO-RN

CROSSBAR SYSTEMS
NO. 1
INCOMING TRUNK CIRCUIT
REVERSE BATTERY SUPERVISION
RP, DP OR MF PULSING OR SF
AUTOMATIC START OF RINGING
4. PARTY SEMI-SELECTIVE RINGING
TYPE B TB SUPPLY

CHANGES

B. CHANGES IN APPARATUS

B.1 Added

KS-13491, L1 resistance B,
620 ω \pm 5%, Fig. D.

C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO
ADDED OR REMOVED APPARATUS

C.1 Test note 2 is added for the (D)
Y57 relay, Fig. C, to increase
the contact follow of the 10T-11T and
9B-10B springs. Test note 3 is added
for the Y301 (D) relay, Fig. D, to
increase the contact follow of the
10T-11T and 10B-11B springs. A similar
change is being made on all Y57 and
Y301 relays in the field.

C.2 A release adjustment is added
for the (T) U126 relay for use
with "ZA" option.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 A 620 ohm resistance is added as
"ZA" option in series with the
secondary winding of the T relay,
Fig. D, between contacts of the TC
and D relays. This is to insure that
the T relay releases when shunted by
battery on the "CO" lead from a DP
or MF sender in the event that the
circuit is re seized before the called
subscriber on a previous call has

disconnected. The former wiring is
shown as "E" option.

D.2 Equipment note 208 is added to
show that the resistance of the
"CO" lead (Fig. D) from trunk to
sender shall not exceed 6 ohms with
"E" option furnished or 20 ohms with
"ZA" option furnished.

D.3 Circuit note 104 is revised since
part of the information which was
shown in this note was incorrect for
MFP and DP and it is covered correctly
in circuit note 106. The following
was formerly shown as part of circuit
note 104.

"Specify "Y" apparatus when the
external circuit loop for selection
and supervision does not exceed
2800 ohms and 6760 ohms, respectively.
Specify "Z" apparatus when the external
circuit loop for selection and super-
vision exceeds 2800 ohms and 6760
ohms, respectively".

D.4 In Fig. C, contact 1 was shown
as a break and contact 2 or 3
was shown as a make in error. It is
corrected on this issue.

D.5 The circuit rating is changed
from "A&M Only" to "Mfr. Disc."
The replacement note formerly read as
follows: "Replaced by SD-25875-01 for
160 Trunk Inc. Link and Conn. Frame".

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3320-JLB-RGD-RC

CROSSBAR SYSTEMS
NO. 1
INCOMING TRUNK CIRCUIT
REVERSE BATTERY SUPERVISION
RP, DP OR MF PULSING OR SF
AUTOMATIC START OF RINGING
4 PARTY SEMI-SELECTIVE RINGING
TYPE B TB SUPPLY

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit is being reissued to provide the necessary reversals require in giving the proper start signal to senders.

B. CHANGES IN APPARATUS

B.1 Added Optional

Fig. (D) Fig. (C)

Relay (D) Y301	Resistances (D1) and
Relay (T) U126	(D2) KS-13490-L3
Relay (A) "Z"	1.0 meg.
optional S523	
Relay (A) "Y"	
option B608	

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The rating of the circuit is changed from A. T. & T. Co. Standard to "A & M Only".

D.2 Replacement note is added in title box: Replaced by SD-25875-01 for 160 trunk incl. link and conn. frame.

D.3 Figure (D) has been added.
Connecting leads have been designated to provide interchangeability of optional Figures (C) and (D).

D.4 The circuit requirements tables have been revised to add requirements of optional apparatus for figure (D).

D.5 The armature travel of the (F) relay, figure B was formerly 59. Arm. travel 59 max. has been added to the remarks column for this relay.

D.6 Note 106 is changed to show use of the added options, Q, N, M, J, H, G, F and optional figures C and D.

D.7 Options used table is revised to include figures C and D and apparatus or wiring Q, N, M, J, H, G & F.

D.8 Note 105 is revised to provide a record of the added options Q, N, M, J, H, G, F and figures (C) and (D).

D.9 Circuit note 101 formerly read:
(B) Provide one 1-1/3 amp. fuse per 20 figs. 1 for each ringing lead.

D.10 The table working limits, title trunk range formerly had column heads which read:

Revertive
Pulsing
Res. Cable

D.11 The title formerly read:

CROSSBAR SYSTEMS
NO. 1
INCOMING TRUNK CIRCUIT
FROM MANUAL PANEL OR CROSSBAR
LOCAL OR TANDUM OFFICE
4 PARTY SEMI-SELECTIVE RINGING

D.12 Notes 110 and 111 are added to the circuit.

D.13 Fig. B is rated Mfr. Disc.

All other headings under "Changes", no change

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to establish connection between subscriber stations in crossbar offices and also in establishing connection between subscribers in crossbar offices and subscribers in panel offices.

1.2 The circuit is used in establishing connection between subscriber stations in manual offices and subscribers in crossbar offices.

2. WORKING LIMITS

2.1 The maximum external circuit loop resistance for selection is 2800 ohms for the (A) relay, B608.

2.2 The maximum external circuit loop resistance for selection is 3400 ohms for the (A) relay, S523.

2.3 The maximum external circuit loop resistance for trunk supervision is 6760 ohms for the (A) relay, B608.

2.4 The maximum external circuit loop resistance for trunk supervision is 8500 ohms for the (A) relay, S523.

2.5 The minimum insulation resistance for trunk selection and trunk supervision is 30,000 ohms.

2.6 (R) relay - Maximum external circuit loop resistance for ringing and silent intervals.

Max. Ext. Ckt.	Earth Potential	Station Capacity
1000 ohms	± 20 volts	4 M.F.
1500 ohms	± 20 volts	2 M.F.

2.7 The maximum external circuit loop resistance for relay (S) is 1500 ohms.

2.8 The minimum insulation resistance for subscriber supervision is 10,000 ohms.

3. FUNCTIONS

3.01 Recognize selection from the originating sender.

3.02 Causes a terminating sender link and controller circuit to hunt for and connect to this circuit.

3.03 Recognizes selection from a manual office.

3.04 Remove battery and ground from the trunk upon receiving a signal that the sender and link are attached.

3.05 Recloses battery and ground to the trunk for supervision when the sender has completed registration and has sent reverse battery back to the originating sender.

3.06 Signals the sender when trunk closure is received.

3.07 Signals the sender if the call is abandoned before the connection has been established.

3.08 Functions so that the traffic register will operate if all trunks in the group are busy.

3.09 Closes the tip and ring to the incoming link and connector circuit for a continuity test when a signal is received from the terminating marker.

3.10 Furnishes ground for operating the primary select magnet or magnets of the incoming link and connector circuit.

3.11 Receives and locks in a signal from the marker on calls where ringing is required.

3.12 Receives and locks in a signal from the marker on calls requiring 2 rings ringing.

3.13 Receives and locks in a signal from the marker on tip party calls.

3.14 Receives and locks in a signal from the marker on overflow or line busy calls.

3.15 Receives and locks in a signal from the marker on free line calls.

3.16 Transmits ringing induction to the calling subscriber or operator.

3.17 Transmits overflow and line busy tone to the calling subscriber or operator.

3.18 Furnishes impedance bridge transmission during the time the calling and the called stations are connected.

3.19 Provides trunk supervision when the terminating subscriber answers and disconnects.

3.20 Supplies time out ground for releasing this circuit if the terminating subscriber does not disconnect after a predetermined time.

3.21 Restores to normal when the originating subscriber or operator disconnects.

3.22 The circuit may be resealed before the terminating subscriber disconnects without mutilating the call.

3.23 Arranged for initial individual and 2 party selective ringing.

4. CONNECTING CIRCUITS

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

4.1 Incoming from panel (revertive pulsing).

4.11 District or office multiple SD-21784-01, and ES-240252.

4.12 Line Finder and District Selector. SD-21821-01, thru the district and office multiple. (Battery on ring "off hook")

- 4.13 Subscriber Sender SD-21193-01, thru the district and link circuit.
- 4.2 Incoming from Panel Sender Tandem (revertive pulsing)
- 4.21 District Selector Circuit, SD-21143-01, (Battery on ring "off hook")
- 4.22 Sender Circuit SD-21146-01, thru district and link circuit.
- 4.3 Incoming from No. 1 Crossbar.
- 4.31 Office Link and Connector Circuit, SD-25033-01.
- 4.32 District Junctor Circuit, SD-25020-01, (Battery on ring "off hook")
- 4.33 Subscriber Sender, SD-25012-01 (revertive pulsing)
- 4.4 Incoming from No. 5 X-Bar,
- 4.41 Outgoing Trunk, SD-25694-01, (Battery on ring "off hook")
- 4.42 Dial Pulse Outgoing Sender, SD-25579-01 (Wink)
- 4.43 Multifrequency Outgoing Sender, SD-25580-01. (Wink)
- 4.44 Revertive Pulse Outgoing Sender, SD-25732-01 (revertive pulsing)
- 4.5 Incoming from Tandem Crossbar
- 4.51 Office Link and Connector Circuit, SD-25033-01.
- 4.52 Trunk Link and Connector Circuit, SD-25362-01.
- 4.53 Tandem Trunk Circuit, SD-25517-01. (Typical) (Battery on ring "off hook")
- 4.54 Sender Circuit, SD-25769-01, (Wink) (Stop-go) or (Revertive Pulsing)
- 4.6 Incoming from SXS
- 4.61 (Auto. ticket.) Outgoing Trunk, SD-31949-01. (Battery on tip "off hook")
- 4.62 (Auto. ticket.) Sender Circuit, SD-31955-01 (Wink)
- 4.63 SXS Selector Circuit, SD-30200 - Typical.
- 4.7 Incoming from Switchboards
- 4.71 "A" Switchboard Outgoing Trunk Circuit, SD-25127-01 (Typical)
- 4.72 "B" Switchboard Auxiliary Trunk Circuit, SD-25025-01, (Battery on ring "off hook")
- 4.73 Outgoing Trunk Circuit in Local Manual or Manual Tandem Office, SD-12570-01, and SD-12599-01.
- 4.74 Central DSA Switchboards SD-25446-01 O.G.T. arranged for controlled ringing and coin control.
- 4.75 Central DSA Switchboards SD-96164-01 O.G.T. jack circuit. For use with immediate ringing incoming trunks.
- 4.8 Terminating Circuits
- 4.81 Terminating Sender Link and Controller Circuit, SD-25459-01.
- 4.821 Revertive Pulse Terminating Sender, SD-25013-01.
- 4.822 Terminating "B" Sender, SD-25014-01.
- 4.823 Dial Pulse Terminating Sender, SD-25434-01 (Dial tone or start dial signal as required by associated originating office).
- 4.824 Multi-frequency Terminating Sender SD-25455-01 (Start dial signal as required by associated originating office).
- 4.825 Incoming Link and Connector Circuit for 100 and 160 Trunk Frames, SD-25032-01 and SD-25457-01 respectively.
- 4.826 Timing Circuit for Incoming Trunk Circuits, SD-25038-01.
- 4.827 Traffic Register Circuit, SD-25317-01.
- 4.828 Interrupter Frame Circuit, SD-25062-01.
- 4.829 Miscellaneous Circuit for Incoming Trunk Frame, SD-25206-01.

DESCRIPTION OF OPERATION

5. GENERAL

5.1 This trunk circuit is arranged with options to provide (a) battery on either the tip or ring conductor when the trunk is normal (b) battery on either the tip or ring when the terminating sender is seized and (c) battery on the tip or ring when the called subscriber receiver is off the hook. These options are used to provide the particular type of signal required by the originating sender, trunk, district, or cord, circuit when an operator is ticketing a call originated on a MF or dial pulse

basis. "T" wiring is provided on loops less than 2800 ohms to avoid unnecessary operation of the (A) relay (false start) as the trunk restores to normal.

5.2 Two general types of start signals are provided for MF or DP operation. The type provided for operator ticketed calls requires that when the trunk is normal battery and ground on the trunk conductors be poled as though the called subscriber receiver were off the hook (off hook). When the sender has been connected and is ready for pulses the trunk conductors are poled as though the called subscriber receiver were on the hook (on hook). This "stop-go" signal provides the operator with a dark cord lamp when the trunk is seized, a lit cord lamp when the sender is ready for keying or dialing, and as usual a dark lamp when the called subscriber answers. Since this start signal requires the trunk to be normally "off hook" it should not be used on calls from senders primed by subscriber dials. The "stop-go" type of start dial signal is used for circuits with calls incoming from No. 4 Toll Crossbar (MF pulsing), step by step selector from crossbar tandem and operator direct (either manual, DSA or toll) DP or MF pulsing.

5.3 The other type of start signal (wink) is provided for senders that are primed directly or indirectly by subscriber dials. When an incoming trunk arranged for this type of start signal is normal the trunk conductors are "on hook". When the terminating sender is connected but before it is ready for pulsing the trunk conductors are poled "off-hook" for a measured time of approximately .3 seconds. When the terminating sender is ready for pulsing it reverses the battery and ground on its tip and ring thus poling the trunk "on hook" once again.

The "wink" type of start dial signal is used, dial pulsing or MF pulsing, for circuits with calls incoming from No. 5 crossbar, step by step automatic ticketing, and crossbar tandem.

5.4 In order to specify which options to use in this trunk when providing Fig. (D) it is necessary to know which type of "off-hook" signal is required by the supervisory equipment in the circuit from which the call originated. Dial pulse terminating sender has battery on its tip when seized for options providing "stop-go" and "wink" start dial signal in note 106.

6. SELECTION BY THE ORIGINATING OFFICE

When this trunk is seized, the (A) relay operates, closing ground to the "ST" lead of the terminating sender link and controller circuit. This causes the

terminating sender link and controller circuit to seize this trunk and also associate itself with an idle terminating sender. In Fig. C the secondary or "P2" winding of the (A) relay is short-circuited and the primary winding is in series with the tertiary winding or the "P1" winding is in parallel with the tertiary winding at this time to improve operating conditions for the pulsing relay of the originating sender circuit. Fig. D provides shorting of P2 or secondary winding only.

7. REGISTRATION OF CALL FROM PANEL OR CROSSBAR OFFICE (FIG. C)

When the link has closed the cross-points of the primary and secondary switches cutting the connecting leads of this circuit through to an idle sender, battery through the winding of the (L) relay of the sender is closed to the "T" lead and ground to the "R" lead in parallel with the battery and ground supplied by this circuit to "T" and "R" leads of the trunk. The sender also closes ground to lead "CO" operating the (T) relay. The operation of relay (T) removes the battery and ground supplied to leads "T" and "R" by the trunk, but the operation of the pulsing relay in the originating sender is maintained by battery and ground supplied to leads "T" and "R" by the terminating sender. The sender proceeds to register the number that is required to satisfy the originating sender and when all digits have been recorded, it closes battery to the "R" lead and ground to the "T" lead of the trunk as a release signal to the originating sender (reverse battery). After removing reverse battery from the "T" and "R" leads of the trunk the sender recloses low resistance battery to both tip and ring to discharge the trunk cable and at the same time replaces the operating ground on the "CO" lead, which held relay (T) operated, with low resistance battery. The removal of the ground from the "CO" lead releases the (T) relay and the low resistance battery causes relay (T) to remain so until this battery is removed. The release of relay (T) again closes battery and ground to leads "T" and "R" of the trunk, thus operating the (A) relay. At the time battery is closed to the "CO" lead by the sender ground is closed to the "D" lead operating relay (D). The (D) relay operated, (a) locks under control of relay (A), (b) opens lead "PB" to the traffic register circuit, (c) opens the "ST" lead, (d) closes ground to lead "S" of the incoming link and connector circuit and (e) prepares an operating path for relay (T). The low resistance battery closed to lead "CO" prevents reoperation of relay (T) in case the

terminating subscriber has not disconnected when relay (D) operates. The operation of the (A) relay provides a locking ground for relay (D) which ground is extended to the terminating sender over the "D" lead as a signal that the trunk is closed. When this signal is received the sender connects itself to a marker through the marker connector circuit whereupon the marker closes ground to lead "FC" operating the (F) relay.

8. REGISTRATION OF A STRAIGHTFORWARD CALL (FIG. D)

When the link has seized the sender and the sender has connected to the position circuit, ground is connected to lead "D" from the call distributing "B" sender operating the (D) relay. The (D) relay operated, (a) locks under control of the (A) relay, (b) opens the "PB" lead to the traffic register circuit, (c) opens the "ST" lead, (d) closes ground to lead "S" of the incoming link and connector circuit, (e) prepares an operating path for the (T) relay when the called subscriber answers, (f) opens a short circuit from the secondary or "P2" winding of the (A) relay and removes the quaternary or tertiary winding from in parallel with the primary or "P1" winding of relay (A). After order tone has been sent back to the originating operator, the number is passed to the "B" operator over the "T" and "R" leads and when the number is written up, the sender connects to the marker. The marker then closes ground to the "FC" lead which operates the (F) relay.

9. REGISTRATION OF A MF OR DIAL PULSE CALL (FIG. D)

When the terminating sender link has closed the crosspoints of the primary and secondary switches connecting this trunk through to an idle sender, battery through the line relay of the sender and ground will be connected to the trunk conductors so as to parallel or oppose the battery and ground through the A relay depending on whether a reversal or a wink start signal is required for the originating sender. When providing the reversal options consideration must be given to the sender start signal and receiver off-hook signal required by the originating office. The sender connects ground to the "CO" lead, operating the T relay which removes the A relay battery and ground from the trunk conductors. When the sender is ready to receive pulses it reverses the battery and ground to its Tip and Ring and consequently to the trunk conductors as a start signal.

Having completed registration, the sender grounds the "D" lead and removes the ground from the "CO" lead. Ground

on the "D" lead operates the D relay which (a) locks under control of relay A (b) opens the "PB" lead to the traffic register circuit (c) opens the "ST" lead (d) closes ground to the "S" lead to the incoming link and connector circuits, and (e) prepares an operating path for relay T.

The D relay operated and the T relay released, the A relay is again connected to the trunk conductors with the polarity required by the originating office, trunk or equivalent circuit. The A relay operates if the call has not been abandoned, and grounds the "D" lead locking the D relay and signaling the sender that the trunk is still closed. When this signal is received the sender connects itself to a marker through the marker connector circuit whereupon the marker closes ground to lead FC which operates the F relay.

10. SELECTION BY THE MARKER

The operation of the (F) relay of either Fig. A or Fig. B, (a) opens the operating path of the (PU) relay to permit its release when the marker makes a second trial, (b) transfers the "T" and "R" leads of the incoming link from the trunk to the "TT" and "RT" leads, respectively to permit the marker to make a tip and ring continuity test, (c) closes the "RC" lead to operate the (RC) relay, (d) closes the "RV" lead to the (RV) relay which operates for reverse side of the line ringing, (e) closes the operate path of the (TC) relay which indicates a free line overflow or line busy condition, (f) transfers the "S" lead of the incoming link from the trunk to the "SL" lead to permit the marker to make a continuity check of this lead, (g) grounds the "LC" lead to the incoming link and (h) closes the "RP" lead to the (RP) relay when "A" wiring is provided, or operates relay (Fl) when "B" wiring and apparatus are provided. The (Fl) relay, when provided, operates a traffic register by connecting ground to lead "PC" and closes the "RP" lead to the (RP) relay. When Fig. A is used the operation of relay (F) also grounds lead "M" which operates the primary select magnet of the 100 trunk incoming link. When Fig. B is used the operation of relay (F) also grounds both the "M" and "ML" leads which operates two primary select magnets of the 160 trunk incoming link.

11. RINGING CALLED STATION

11.1 One Ring - Tip Party

Under this condition the (RC) and (RV) relays are operated by the marker after the (F) relay is operated. The (RV) relay operated (a) locks under control of the (R) and (D) relays and (d) reverses the MR-R1 ringing

current and ringing ground so that ringing current will be applied to the tip side of the line. The (RC) relay operated (a) disconnects talking battery and ground from the "R" and "T" leads respectively of the subscribers line, (b) closes "MR-R1" ringing current thru the (R) relay and the contacts of the (RV) relay to the "T" lead ringing the desired subscriber's bells, (c) locks to ground under control of the (R) and (D) relays and (d) closes ringing current thru the (T) condenser as a ringing signal to the calling subscriber.

11.2 One ring - Ring Party

Except that the (RV) relay does not operate which causes "MR-R1" ringing current to be connected to the ring side of the line the circuit functions the same as described in paragraph 11.1.

11.3 Two Rings - Tip Party

Under this condition the marker operates the (RP), (RV) and (RC) relays after the (F) relay or the (F) and (FL) relays are operated. The marker upon completing its functions removes ground from the "FC" lead releasing the (F) relay which releases the (FL) relay if provided. The (RP) relay operated (a) locks under control of the (R) and (D) relays, (b) disconnects the "MR-R1" lead from the circuit and (c) prepares the circuit for operating the (PU) relay. With the (F) relay released and the (RP) relay operated, the (PU) relay is operated after ground is connected by the Pick Up Interrupter to the "PKU" lead. This insures starting the ringing cycle at the very beginning of the 2 rings. The (PU) relay operated (a) opens in part the "MR-R1" lead, (b) locks thru its secondary winding under control of the (RP) relay and (c) closes "MR-R2" ringing current to the (RC) relay. The (RC) and (RV) relays operated, connects "MR-R2" ringing current to the tip or (T) side of the subscribers line ringing the bells of the 2 ring party. Subsequent functions of the (RC) and (RV) relays are the same as described in paragraph 11.1.

11.4 Two Rings - Ring Party

Except that the (RV) relay does not operate and "MR-R2" ringing current is connected to the ring side of subscribers line the circuit functions the same as described for paragraphs 11.1 and 11.3.

11.5 Initial Individual and 2 Party Selective Ringing

Under this condition the ringing is accomplished as described in paragraphs 11.1 and 11.2.

12. CALLED PARTY ANSWERS

When the called party answers, the (R) relay operates, releasing the (RC) relay and also the (RV) and (RP) relays if operated. The (RP) relay releases the (PU) relay. This removes ringing current and ground from the subscribers line and closes battery and ground through the windings of relay (S) to the subscriber line operating the (S) relay and furnishing transmitter battery to the called subscriber. The operation of the (S) relay closes a supplementary ground through the timing circuit for incoming trunk circuits to lead "S" and closes ground for operating the (T) relay through its secondary and primary windings in series. The release of the sender when the connection was established removed battery from the "CO" lead on calls originating from a panel or cross-bar office, permitting reoperation of the (T) relay which reverses the battery and ground closed to the "T" and "R" leads of the trunk through windings of relay (A) as a supervisory signal to the district circuit or to the call distributing "B" switchboard auxiliary trunk circuit.

13. DISCONNECTION

When the district is released by the calling subscriber or when the originating operator has removed the plug from the outgoing trunk jack, the trunk is opened, releasing relay (A), which in turn releases the (D) relay. The release of relay (D), (a) causes the release of relay (T) and if the called subscriber has not at this time disconnected, (b) closes a ground over lead "A" to the timing circuit for incoming trunk circuits, (c) closes the shunting ground around the secondary or "P2" winding of the (A) relay and recloses the quaternary around the tertiary in series with the primary or "P1" and tertiary windings of relay (A) in parallel, (d) opens the transmission circuit, (e) removes ground from the "S" lead, (f) opens the locking ground for the (RC), (RV), (RP) and (TC) relays, releasing them if operated, and (g) closes ground to the "PB" lead to the traffic register circuit. If the called subscriber has disconnected, the (S) relay has released and the release of the (D) relay will cause the release of the hold magnets involved in the connection and restore the trunk circuit to normal.

14. PREMATURE DISCONNECT

If the disconnection of the calling party occurs before the connection is established, the (A) relay will release removing ground from the "D" lead as a disconnect signal to the sender and release the (D) relay. The sender will

release, removing ground or battery from the "CO" lead on a call from panel or crossbar office and ground from the "FC" lead, restoring the trunk to normal.

15. ALL TRUNKS BUSY

If all of the trunks in a group test busy, the marker will, during the time the (F) relay is operated, connect ground to the "RV", "RC" and "TC" leads, and operate the (RV), (RC) and (TC) relays, respectively. These relays hold to ground on the make contacts of the (D) relay and provide a path for flashing the (T) relay at the rate of 120 interruptions per minute. At this time, on calls originating from panel or crossbar offices, interrupted low tone over lead "A" from interrupter (OFT) is connected through the make contacts of the (TC), (RC) and (RV) relays through the (A) condenser to the line as an overflow signal to the originating subscriber.

16. CALLED LINE BUSY

If the called line is busy, the marker will, at the time the (F) relay is operated, connect ground to the "RV" and "TC" leads and operate the (RV) and (TC) relays, respectively. These relays operated hold to ground through the make contacts of the (D) relay and provide a path for flashing the (T) relay at the rate of 60 interruptions per minute as a line busy signal. At this time interrupted low tone over lead "A" from interrupter "LBT" is connected through the make contacts of the (RV) and (TC) relays through the (A) condenser to the line as a line busy signal to the calling subscriber.

17. CONNECTION TO A FREE LINE

If the call is to a line on which no charge is to be made the marker will,

after the (F) relay has operated, connect ground to the "RC" and "TC" leads and operate the (RC) and (TC) relays, respectively. The call will then proceed as outlined for a regular call except that when the called subscriber answers, the ground from the make contacts of the (S) relay will be held open at the break contacts of the (TC) relay thus preventing the (T) relay from operating and reversing battery to the district circuit or the call distributing "B" auxiliary trunk circuit. This prevents charging on this type of call.

18. TIMING RELEASE

Should the called subscriber fail to disconnect when the calling subscriber or operator has disconnected, ground is closed by the release of the (D) relay to the "A" lead of the timing circuit for incoming trunk circuits, and after a predetermined time has elapsed, the timing circuit functions to open the ground supplied to the "S1" lead from the front contacts of the (S) relay through the timing circuit for incoming trunk circuits back on the "S" lead releasing the associated hold magnets and returning the trunk to normal. Should the trunk be seized by an incoming call before the timing circuit functions, the number will be registered, reverse battery will be sent to the originating sender as a cut-through signal, and when the sender receives ground from the trunk over the "D" lead, indicating that trunk closure has been made, ground will be closed to the "FC" lead, operating the (F) relay, which opens the "S" lead, releasing the switches associated with the trunk on the previous call, and the marker will proceed to set up a new call.

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