

CIRCUIT DESCRIPTION

JUN 21 1967
CD-31811-01
ISSUE 5D
APPENDIX 4B
DWG ISSUE 26B

STEP-BY-STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

A. Changed and Added Functions

A.1 A resistance battery is added to the sleeve wiper to prevent the possibility of ringing customer's telephones when testing this circuit with the automatic call through test set.

B. Changes in Apparatus

B.1 Added

F Resistor - 63AB $\pm 5\%$, 10,000 ohms

D. Description of Changes

D.1 To one terminal of resistor F -48V is connected. The other end of the resistor is wire-wrapped to the sleeve wiper terminal of the test jack.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-RRD-RMW

MAY 21 1965

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 BROADWAY, NEW YORK 7

JK

DRAWING NOTICE

SD-31811-01	ISSUE	25B
CD 5D	APP.	3B
RATING A&M Only		
SYSTEM Step-By-Step		
DATE March 12, 1965		

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connector Circuit -
5 Code For - 10 Party, Terminal Per Station - Divided Ringing - Arranged For
Reverting Calls - And For Calling Party Control

DESCRIPTION

- 6.1 A nonoperate requirement of 115 ma. is added for the switch double dog on the circuit requirement table. Also contact separation requirements for RLS magnet springs 1-2 are added.
 - 6.2 The Current Drain Data for this circuit is not affected by changes on this issue.
 - 6.3 B change. Does not require WECO. notification to Tel. Co.
 - 6.4 Equipment information is not affected.
 - 6.5 Equipment Design Requirements are not affected.
- No engineering letter will be issued.

STEP-BY-STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

C. Changes in Circuit Requirements Other Than Those Caused
by Changes in Apparatus

- C.1 A nonoperate current flow requirement of 115 ma for test and readjustment is specified for the double dog of the switch.
- C.2 On Page 4, Test Note 6 is deleted.
- C.3 On Page 4, Test Note 7 formerly read: RLS springs 1-2 shall break.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2363-MKD-RJJ,Jr.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-31811-01	ISSUE 24AC
CD 5D	APP. 2AC
RATING A&M Only	
SYSTEM Step-By-Step	
DATE March 12, 1965	

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connector Circuit -
5 Code For - 10 Party Terminal Per Station - Divided Ringing - Arranged For
Reverting Calls - And For Calling Party Control

DESCRIPTION

- 6.1 False charging on busy connections sometimes occurs in combination connectors modified to replace busy flash signal to the toll operator with busy tone over the same tone lead used for local operation.
 - 6.11 If local and toll calls to a shelf of connectors reach a busy terminal at the same time, a back up from the toll trunk through the busy tone lead to a winding of the supervisory relay in connector being used for the local call causes this relay and the supervisory relay in the toll trunk to operate. This simulates an answered condition on both connections.
 - 6.12 To correct the above condition, option A (added on Issue 22D) which provides busy tone for toll and local calls over the same path is rated Mfr. Disc. replaced by options ZF and ZG which provide separate paths for returning toll and local busy tone.
 - 6.13 The above change requires a wiring change and the addition of a 63L resistor.
 - 6.2 The above change should be coordinated with Issue 25AC of SD-32045-01 and applied on an A basis wherever A option was provided, otherwise provide on a B basis.
 - 6.3 The Current Drain Data for this circuit is not affected by changes on this issue.
 - 6.4 Equipment information is affected and will be covered by drawing ED-31811-01 Issue 20AC and will be available approx. 3-1-65.
 - 6.5 Equipment Design Requirements are not affected.
- No engineering letter will be issued.

CIRCUIT DESCRIPTION

CD-31811-01
ISSUE 5D
APPENDIX 2AC
DWG ISSUE 24AC

STEP-BY-STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

B. Changes in Apparatus

B.1 ADDED

1 - 63L(D) resistor, ZF option.

D. Description of Changes

- D.1 The return of busy flash to the local operator, options B and H, and the return of flash to the toll operator, option ZC, are rated Mfr Disc.
- D.2 The return of busy tone over the same path for local and toll operation, option A, is rated Mfr Disc.
- D.3 Options ZF and ZG are added to provide for return of busy tone over separate paths for toll and local calls.
- D.4 Reference to options ZF and ZG is added to Note 106 and Options Used Table.
- D.5 Note 112 is rated Mfr Disc.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2363-MKD-RJJ, Jr.

SEP 28 1961
ms

PRINTED IN U.S.A.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-31811-011-012

ISSUE 23D

CD 5D

APP. 1D

RATING A&M Only

SYSTEM Step-By-Step

DATE June 27, 1961

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connector
Circuit - 5 Code For - 10 Party Terminal Per Station - Divided Ring-
ing - Arranged For Reverting Calls - And For Calling Party Control

DESCRIPTION

- 6.1 No changes have been made in the manufacturers drawings.
- 6.11 The contact of the RLS magnet is shown as a break contact rather than a make.
- 6.2 The Current Drain Data for this circuit is not affected by changes on this issue.
- 6.3 Equipment information is not affected.
- 6.4 Equipment Design Requirements are not affected.

No engineering letter will be issued.

CIRCUIT DESCRIPTION

CD-31811-01
Issue 5D
Appendix 1D
Dwg. Issue 23D

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The contact on the RLS magnet is shown
as a break rather than a make contact.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 2335-RJA-FBB-AJ

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

*SD-31811-011-012

ISSUE 22D

CD 5D

APP.

RATING A&M Only

SYSTEM Step-By-Step

DATE May 9, 1961

DRAWING NOTICE

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A -
Combination Connector Circuit - 5 Code For -
10 Party Terminal Per Station - Divided Ringing -
Arranged For Reverting Calls - And For Calling Party Control

DESCRIPTION

- 6.1 The rating of this circuit is changed from "AT&TCo Std." to "A&M Only."
- 6.2 A feature is added to permit the connector switch on local non-reverting calls to automatically release the step-by-step switch train and restore the called line to service, after a timed interval of 12 to 30 seconds, when the called party disconnects but the calling party fails to disconnect. The disconnect timing starts on the release of the supervisory relay which occurs when the called party disconnects.
- 6.21 To provide for the above, one KS-5812 type resistor, one 225E relay and wiring changes designated E option are added. The former wiring is designated F option. The 197HC switch designated ZA option is added replacing the 197EC switch designated X option.
- 6.3 The busy flash feature, option H, to the local operator is rated "A&M Only."
- 6.4 The busy flash to the toll operator is rated "A&M Only" (B and ZC options) replaced by return of busy tone to the toll operator (option A). Option A is rated "Standard" for both toll and local.
- 6.5 The Current Drain Data for this circuit is not affected by changes on this issue.
- 6.6 Equipment information is affected and will be covered by drawing ED-31811, Iss. 18D.
- 6.7 Equipment Design Requirements are not affected.

No engineering letter will be issued.

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES**A. CHANGED AND ADDED FUNCTIONS**

A.1 Provision is made to automatically release the connector and switch train on local nonreverting calls within a predetermined time when the called party disconnects but the calling party fails to disconnect.

B. CHANGES IN APPARATUS**B.1 Added**

1-KS-8512 (R) Resistor, E Option
 1-225E (Z) Relay, E Option

B.2 Superseded Superseded by

197EC Switch, 197HC Switch,
 (X Option) (ZA Option)

D. DESCRIPTION OF CIRCUIT CHANGES

D.01 The rating of the circuit is changed from AT&TCo. Standard to A&M Only.

D.02 The busy flash feature Option H to the local operator is rated A&M Only.

D.03 The busy flash to the Toll operator is shown as "B" and "ZC" options which are rated A&M Only. They are replaced by standard Option "A" which provides for return of busy tone.

D.04 In offices without toll train, Options A and ZD provide for return of busy tone.

D.05 Option E is added for use when automatic disconnector of connectors on local nonreverting calling party holds is required. Option F shown the former wiring.

D.06 The Z relay and R resistor, Option E, are added.

D.07 The (B) resistor is shown as ZB option, for use when the circuit is arranged for reverting calls.

D.08 Circuit Note 103 is revised. It formerly read: "This circuit shall

not be used in a local train for calls from inc. repeaters or trunks which place a holding grd. forward on the sleeve."

D.09 Circuit Note 105 is revised to include the use of Options A, B, E, F, ZA, ZB, ZC and ZD and to clarify the use of Option J.

D.10 Reference to Options A, B, E, F, ZA, ZB, ZC and ZD is added to Note 106 and the Options Used table.

D.11 Equipment Note 201 is added.

D.12 A Replacement Note stating the local features are replaced by SD-31810-01 except for additions is added.

D.13 Circuit Note 112 is added.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for extending a call from a toll or local selector to a subscriber's line in a 10 party terminal per station connector group.

1.2 This circuit is arranged for reverting call service on local calls.

1.3 It provides for the use of tube type subsets on 10 Party Lines.

2. WORKING LIMITS

2.1 For Pulsing and Supervisory Limits, see drawing.

2.2 This circuit can be used for reverting call service only where there is a direct local circuit from the sleeve of the line circuit to the connector multiple bank sleeve terminal.

2.3 This circuit shall not be used for local calls through incoming repeaters or trunks which place a holding ground forward on the sleeve at the time when the connector is releasing and the connector removes its ground from the incoming sleeve.

3. FUNCTIONS

3.1 To differentiate between local and toll calls.

- 3.2 To select a line as determined by the pulses received by the connector.
- 3.3 To test busy to toll train when held by the local train.
- 3.4 To test busy to the local trains while held by the toll train.
- 3.5 To return audible ringing tone to the calling end.
- 3.6 To signal the called party with code ringing and to trip machine ringing when the called party answers.
- 3.7 To start the ringing machine or interrupter and alarm circuit.
- 3.8 The following functions apply when used as a local connector:
- 3.801 To return busy tone to the calling subscriber when the line selected is busy.
- 3.802 To start machine ringing as soon as the line selected is seized.
- 3.803 To reverse battery to the calling line when the called subscriber answers.
- 3.804 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.805 To supply the calling and called ends with transmission battery.
- 3.806 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.807 To release after the reverting call test if the sleeve of the called terminal is not connected thru the switch train to the incoming connector sleeve.

- 3.808 To ring both the called and the calling station bells on a reverting call.
- 3.809 To release the line finder and selectors on reverting calls.
- 3.810 To release when the calling party disconnects.
- 3.811 To allow the calling party to release the train of switches.
- 3.812 With "H" and "B" options to return busy flash on calls from operators.
- 3.813 To automatically release the connector and switch train on local nonreverting calls within a predetermined time when the called party disconnects but calling party fails to disconnect.
- 3.9 The following functions apply when used as a toll connector:
- 3.91 To cause the operator to receive busy flash with "B" and "J" options or busy tone with "A" and "J" options if the line dialed is busy.
- 3.92 To extend the trunk free of transmission obstructions to the line seized.
- 3.93 To cause the operator to be signalled when the line has been seized.
- 3.94 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

Where this circuit is shown on a key-sheet the connecting information thereon is to be followed.

Circuit	No. 1 or 350A	No. 355
4.01 Local Selectors	SD-30200-01*	SD-31735-01*
4.02 Toll Intermediate Selector	SD-31179-01	SD-31744-01
4.03 Toll Transmission Selector	SD-31745-01	
4.04 AB Toll Transmission Selector	SD-31723-01*	
4.05 Selector Bank Multiple Circuit	SD-32123-01	
4.06 Switch Trouble Alarm Circuit or Misc. Alarm Circuit - Connector Shelves	SD-32045-01	
4.07 Connector Bank Multiple Circuit	SD-32128-01	
4.08 Ringing Interrupter and Alarm Circuit	SD-31298-01	
4.09 Power Ringing Circuit	-	SD-80780-01*
4.10 Interrupter Relay Circuit	SD-32135-01	SD-31868-01
4.11 Subscriber Line Circuit	SD-32133-01*	SD-31777-01
4.12 Intercepting Trunk Circuit	SD-31337-01	

*Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring leads which causes relay (A) to operate. (A) operated, operates (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. (G) operated, also prepares certain circuits which will be described later.

5.2 Toll ("J" Option)

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of (K) to the toll control lead. (M) operates and locks to ground on the toll sleeve and (a) opens the supervisory No. 1 circuit, (b) operates (L), (c) operates (F) to ground on the "C" lead and (d) closes the locking circuit of (F) to the "C" lead. (L) operated (a) partially closes a circuit to (K), (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. with B and ZC options and (c) partially closes the operate circuit for (B), with A option, busy tone is returned to the operator. The operation of (A) is the same as Paragraph 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, (A) responds to the pulses, closing the circuit through (C) and the vertical magnet in series. (C) and the vertical magnet both operate. (C) and the (C) are slow to release and do not restore on dial pulses. When the pulses cease (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses from (A). (G) remains operated during the rotary stepping on account of its slow release feature. (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. (E) closes a circuit for operating (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

The toll and local sleeves are normally connected together through the rotary off-normal springs 1 and 3. This reduces the unguarded interval to either multiple bank when the switch is seized from the other one, and insures that both sleeves will test busy when the switch is made busy in any of the usual ways. When the R.O.N. springs operate this connection is opened to prevent interference with the release of relay (P) on release from a reverting call. The lead to 1B (P) is normally open until the R.O.N. springs operate to prevent the (P) relay remaining operated in case it is manually operated while the switch is normal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, (E) releases and opens the circuit to the winding of (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates (N) during the releasing time of (B) which releases slowly. (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station with J and A or B options or ZD and A options. When "H" and B options are provided, the path thru (P) and (N) operates (L) which connects busy tone to the ring, and busy flash to lead "F" which on calls from an operator, causes the associated trunk circuit to return busy flashes to the operator.

8.2 Toll Call ("J" Option)

If the called line is busy (N) will operate upon release of (E) as described for the local call. With (N) operated a circuit is closed to operate (K) which (a) closes 60 or 120 I.P.M. to the toll selector ring lead with "B" and "ZC" options or busy tone with "A" option, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for (A) and (G). The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. or busy tone circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, (N) does not operate and upon release of (E) and (B) the sleeve is closed through for operating (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized (P) operates thru its 125 ohm winding from battery in the called line circuit to ground

at the front contact of (G). This ground acts as a guarding potential on the "S" wiper until (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of (P) serves only to operate spring 1 which closes a local circuit to its locking winding to fully operate the relay. The locking circuit is maintained for the duration of the call. The operation of (P) also closes the tip and ring wipers thru for ringing the called station and talking as hereinafter described.

The battery to the secondary winding of (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by an irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and 4B have broken. If (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. (J) locks to its own contacts in series with contacts on (F) to ground at contacts on (G) and closes the ringing interrupter leads and the ringing supply circuit. (G) operated grounds the "MS or INT. ST" lead under control of (D) for the purpose of starting the ringing or interrupter circuit. (N) is operated from the ground pulses on the ringing interrupter leads connected to wiper "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connected to wiper "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon (F) operates to close contacts with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of the (F) relay connects the talking leads thru to (D) which supplies talking battery to the called station and causes (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described.

10.2 Toll Call ("J" Option)

On a toll call the operation of (P) upon seizure of the line causes (K) relay

to operate. (K) extends the called subscriber's line to the transmission selector, free from all transmission obstructions, and also removes ground from the toll "C" lead which is a signal to the toll operator or the A-B Toll Transmission Selector to ring. (K) also opens the operating circuit to the (F) relay secondary winding and holds operated the (A) relay. (F) is held operated thru its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays then operate as for a local call. When the called party answers (F) operates over its primary winding and locks on its secondary winding to the "C" lead. This arrangement provides a means for reringing from the toll board when required. (F) connects the called line thru contacts of (K) relay operated to the transmission selector. Talking battery and supervision on the called line are provided by the transmission selector.

11. REVERTING CALLS - Z AND ZB OPTIONS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under Paragraph 8. When the calling station hangs up (A) releases, operating (E) and allowing (G) to release. On the release of (G), (E) is locked to a ground thru the back contacts of (G) and grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When (G) releases the shunt is removed from the primary winding of (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the ground from the back contact of (M) thru (E) connected to the called line sleeve is also closed thru the line and selector ckt. to the operate winding of (H), operating the latter, which then fully operates over its secondary winding. The operation of (H) operates (C) in series with resistance (A) and the vertical magnet. The operation of (C) opens the holding circuit for (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, (N) releases but the circuit for the release magnet of the connector is opened by contacts on (C). The release of (N) operates (G) which grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. (E) released closes ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of (E) to insure release of the line and preceding selector circuits. The release of (E)

also closes a circuit from ground thru the primary winding of (P) in series with the cut-off relay of the line circuit to battery. This operates the cut-off relay and also (P) sufficiently to close contacts 1 and 2 and P then fully operates over its locking winding and remains energized until the connection is released. The release of (E) also allows (C) to release and opens the circuit to the winding of (G). Relay (G) is slow in releasing and holds during the operating time of (P). (P) closes a circuit for holding (G). The operation of (P) also closes the tip and ring wipers thru to (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of (N), grounds the sleeve and closes a circuit for operating (J) over the pickup lead. The operation of (J) starts the ringing in the same manner as already described under Paragraph 10.1. Ground over the RR or RS lead operates (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling station's ringer is on the opposite side of the line from that of the called station, so that the calling party will know when the called party answers. When the called station answers, (F) is operated the same as already described in Paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of (F), ground is removed from the winding of (G), but (G) is slow in releasing and therefore does not release during the operating time of (D) which re-established the holding circuit for (G) which is held operated from the ground at contacts of (D) until the connection is released. If the called party does not answer, the calling party must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release (G) releases just enough before the forward ground is removed from the sleeve to operate (H) and the ground is removed a sufficient length of time before the release of (E) to allow the reoperation of (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first (D) releases and closes a circuit to the

SUPV 1 lead with F option provided to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects (A) releases in turn releasing (G). With (A) relay normal a circuit is closed to momentarily operate (E). The operation of (E) at this time has no effect. (G) in releasing (a) removes ground from the toll and local selector sleeves and (b) releases (P) on a completed call or releases (N) on a line busy condition. With (G), (N), and (P) normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing (F) to release. (H) does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when (G) releases.

With Option E provided, if the calling party fails to replace his receiver on hook after the called party has disconnected, releasing the (D) relay, the connector is automatically disconnected after a predetermined interval. With (D) released and (F) operated, relay (Z) operates. With (Z) operated, ground over lead AUT. DISC through R resistor, VON spring, RLS magnet to battery operates RLS on first step to release (G). (G) released permits the preceding switches to restore and open the loop to release (A) (G) also releases (P). The release of (A) and (P) fully operates the (RLS) magnet, returning the connector to normal.

12.2 Local Reverting Call

On a reverting call (D) remains operated until both the calling and the called station disconnect - thus holding the (G) thru (H) operated. (G) holds the circuit off normal as on a nonreverting call. When (D) releases upon disconnect of both parties (G) releases. (P) releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release (F) and (H).

12.3 Toll Call ("J" Option)

The connector does not release until the toll selector removes ground from the toll sleeve terminal. The removal of sleeve ground releases the (A), (K), (L), (P), and (M) relays. (M) is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of (P). (A) releases (G) which in turn operates the release magnet and restores the switch to normal.

**12.4 Toll or Local Call (Nonreverting)
Line Busy**

When the toll train disconnects on a busy condition the release of (A) operates (E) which remains locked through the operated (N) relay to ground on a back contact of (G). (N) however releases upon release of (G) thereby releasing (E) which performs no function at this time. (N) normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1 (F OPTION)

If the called station disconnects before the calling station a circuit is closed thru a back contact of relay (D) and

a front contact of relay (F) for operating a signal designed SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The (C) contact protection unit is provided for protecting the contacts which make and break the circuit to the stepping magnet. The (B) contact protection unit is provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2335-MKD-FEB-AP

SEP 10 1956 *any*

PRINTED IN U.S.A.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-31811-011-012 ISSUE 21-B
CD 4-B APP. 4-B
RATING AT&TCo Std.
SYSTEM Step-By-Step - Ckt.
DATE March 7, 1956

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connector
Circuit - 5 Code For - 10 Party Terminal Per Station - Divided
Ringing - Arranged For Reverting Calls - And For Calling Party
Control

DESCRIPTION

- 6.1 The test clip data for relay (L), with "H" option, is clarified to specify connecting to 8T (N) relay instead of 8 (N) relay.
- 6.2 Current Drains are not affected.
- 6.3 Equipment information is not affected.
- 6.4 Equipment Design Requirements are not affected.
- 6.5 No engineering letter will be issued.

SEP 10 1956 *Am*

CD-31811-01
Issue 4-B
Appendix 4-B
Dwg. Issue 21-B

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

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

C.1 Test Note 9 on Page 3, referred to at
relay (L) is clarified to specify
connecting to 8T (N) relay instead of 8 (N)
relay with "H" Option.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2325-FHP-EWO-LN

PRINTED IN U.S.A.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SR
4/27/55

SD-31811-011-012	ISSUE 20-B
CD 4-B	APP. 3-B
RATING AT&TCo Std	
SYSTEM Step-By-Step - Ckt.	
DATE Feb. 28, 1955	

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connection Circuit -
5 Code For - 10 Party Terminal Per Station - Divided Ringing - Arranged For
Reverting Calls - And For Calling Party Control

DESCRIPTION

The circuit is reissued to clarify the situation in regard to the arrangement
necessary in intercepting trunks for tripping ringing when the connectors are
provided with "K" or "M" option. This is covered in note 301.

Current Drain is not affected.

Equipment Information is covered on ED-31881-01, Iss. 19.

Engineering Requirements are not affected.

No engineering letter will be issued.

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

AR
612000
CD-31811-01
Issue 4-B
Appendix 3-B
Dwg. Issue 20-B

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 111 is changed to remove reference to the intercepting trunks for tripping ringing with momentary ground, cold cathode tube or momentary battery. Note 111 formerly read: "Provide "M" option where intercepting circuits trip ringing only with momentary grd. on one side of the circuit and where 10-party lines are equipped with high impedance ringers. Provide "K" option if any 10-party line is equipped with tube type sublets or where the intercepting circuits trip either with a cold cathode

tube or by a momentary battery on one side of the circuit."

D.2 Note 301 is added to clarify the situation in regard to the arrangement necessary in intercepting trunks for tripping ringing when the connectors are provided with "K" or "M" options.

D.3 Reference to Note 301 is added to Note 106 at the entry for Issue 10-D.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2353-VDM-EWO-SL

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

OCT 21 1954
R.M.

DRAWING NOTICE

SD-31811-011-012 ISSUE 19-B
CD 4-B APP. 2-B
RATING AT&TCo Std.
SYSTEM Step-By-Step - Ckt.
DATE Aug. 10, 1954

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Combination Connector Circuit -
5 Code For - 10 Party Terminal Per Station - Divided Ringing - Arranged For
Reverting Calls - And For Calling Party Control

DESCRIPTION

Since the windings of relay (E) and internally connected, "P/S" is removed
from the "TEST WDG" column of the circuit requirements table for this relay.

Current drain is not affected.

Equipment information is not affected.

Engineering Requirements are not affected.

No engineering letter will be issued.

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31811-01
Issue 4-B
Appendix 2-B
Dwg. Issue 19-B

STEP-BY-STEP SYSTEMS
NO.1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

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

C.1 "P/S" is removed from the "TEST WDG."
column for relay (E) since the windings
are internally connected.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 2353-MBB-EWO-PS

MAR 18 1954

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-31811-011-012 ISSUE 18-D
CD 4-B APP. 1-D
RATING AT&TCo Std
SYSTEM Step-By-Step - Ckt.
DATE December 30, 1953

TITLE

Step-By-Step Systems - No. 1 350A or 355A - Combination Connector Circuit - 5 Code
For - 10 Party Terminal Per Station - Divided Ringing - Arranged For Reverting
Calls - And For Calling Party Control

DESCRIPTION

1.1 Where this circuit is used to complete calls from operators, over the local train, busy flash is carried by the "F" lead, option H, rated special, replaces option J, formerly part of Fig. 1, to provide this feature. Option H is intended for modification of circuits provided in offices without a toll train. Where option H is provided, this circuit can not be used for completing calls over the toll train. This involves a wiring change only.

1.2 Where options Q and V have been used for improved balance against inductive interference, and the D relay has been adjusted for 1500 ohm range, the A and D relays may buzz on disconnect. G option is provided to replace V and Q in order to remedy this trouble. This involves a change in connections to the D relay windings and replacement of Q option by R option.

Current drain is not affected.

Equipment information is on a job basis.

Engineering Requirements are on a job basis.

No engineering letter will be issued.

STEP BY STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

A. CHANGED OR ADDED FUNCTIONS

A.1 "H" option is added to provide busy flash on calls to operators in offices without a toll train where this circuit has been provided.

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

C.1 Test Note 9, page 3 is added to replace test clip data for relay L.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 To provide the feature per A.1 above, "H" option is added to replace "J" option, formerly part of Fig. 1.

D.2 "G" option is added to replace "Q" and "V" options in case buzzing of

the (A) and (D) relays should occur on disconnect, when the (D) relay adjustment is weakened for 1500 ohm loops.

D.3 Notes 105, 106 and 107 are revised to refer to options G, H and J.

D.4 Note 109 formerly read "'Q' option is for use with 'V' option when improvement in balance against inductive disturbance is req."

D.5 The "F" lead designated "H" option is added in Fig. 51 and the "C" lead is designated "J" option.

D.6 Information is added at the multiple strap on the busy tone lead to care for cases where the connecting circuit is arranged to prevent conferences over the busy tone lead, and the multiple is shown thereon.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3030-0CH-RLL-R2

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-31811-01 ISSUE 17-B
CD 4-B APP.
RATING AT&TCo. Std.
SYSTEM Step-By-Step - Ckt.
DATE December 30, 1954

TITLE

Step-By-Step Systems - No. 1, 350A OR 355A - Combination Connector Circuit -
5 Code For - 10 Party Terminal Per Station - Divided Ringing - Arranged For
Reverting Calls - And For Calling Party Control

DESCRIPTION

1.1 Experience with the adjustments previously specified for the ring-trip relay with 1400 or 1500 ohm external circuit station loops indicates insufficient margin for passing the 1600 ohm trip test in the connector test set or test line. See P.E.I. 5034. To relieve this situation the following ring-trip relay requirements changes are made on this issue:

1.11 Adjustments "B" and "C" for springs 1-2 are replaced by Adjustments "E" and "F".

1.2 To facilitate the adjustment of ring-trip relays to the long range requirements, the non-operate requirements for the secondary winding are lowered.

1.3 Ring-trip relays adjusted to the new requirements will often fail to pass the 3000 ohm ringing interval pre-trip test. The test circuits have been revised to provide a 2200 ohm 48.5-50 volt silent interval pre-trip test for checking the new requirements. When connectors with ring-trip relays adjusted to the new requirements are added to an office it is essential that the test set or test line used for making the pre-trip test be arranged to provide the new silent interval pre-trip test.

Current drain is not affected.

Equipment information is not affected.

Engineering Requirements are not affected.

An engineering letter will be issued.

STEP-BY-STEP SYSTEMS
NO. 1, 350-A OR 355-A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

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

C.1 For Relay (F), adjustments "E" and
"F" are added to supersede adjust-
ments C and D for the primary winding. The
secondary current flow requirements were
formerly:

	Test	Readjust
O	30	27
NO	23	25.5

C.2 Three test notes have been added
referring to adjustments E and F, and
reference to the note concerning superseding
of adjustments has been added opposite
adjustments C and D.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In the tripping range table, "ADJS.
"E" & "F" was formerly ADJS. "C"
& "D".

D.2 The Description of Operation applies
to Drawing Issue 18-D, issued con-
currently.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for extending a
call from a toll or local selector
to a subscriber's line in a 10 party
terminal per station connector group.

1.2 This circuit is arranged for revert-
ing call service on local calls.

1.3 It provides for the use of tube type
subsets on 10 Party Lines.

2. WORKING LIMITS

2.1 For Pulsing and Supervisory Limits,
see drawing.

2.2 This circuit can be used for revert-
ing call service only where there is

a direct local circuit from the sleeve of
the line circuit to the connector multiple
bank sleeve terminal.

2.3 This circuit shall not be used for
local calls over incoming repeaters
or trunks which place a holding ground for-
ward on the sleeve at the time when the
connector is releasing.

3. FUNCTIONS

3.1 To differentiate between local and
toll calls.

3.2 To select a line as determined by
the pulses received by the connector.

3.3 To test busy to toll train when held
by the local train.

3.4 To test busy to the local trains
while held by the toll train.

3.5 To return audible ringing tone to
the calling end.

3.6 To signal the called party with code
ringing and to trip machine ringing
when the called party answers.

3.7 To start the ringing machine or inter-
rupter and alarm circuit.

3.8 The following functions apply when
used as a local connector:

3.801 To return busy tone to the calling
subscriber when the line selected
is busy.

3.802 To start machine ringing as soon as
the line selected is seized.

3.803 To reverse battery to the calling
line when the called subscriber
answers.

- 3.804 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.805 To supply the calling and called ends with transmission battery.
- 3.806 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.807 To release after the reverting call test if the sleeve of the called terminal is not connected thru the switch train to the incoming connector sleeve.
- 3.808 To ring both the called and the calling station bells on a reverting call.
- 3.809 To release the line finder and selectors on reverting calls.
- 3.810 To release when the calling party disconnects.
- 3.811 To allow the calling party to release the train of switches.

- 3.812 With "H" option to return busy flash on calls from operators.
- 3.9 The following functions apply when used as a toll connector:
- 3.91 To cause the operator to receive the line busy flash if the line dialed is busy.
- 3.92 To extend the trunk free of transmission obstructions to the line seized.
- 3.93 To cause the operator to be signalled when the line has been seized.
- 3.94 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

Where this circuit is shown on a key-sheet the connecting information thereon is to be followed.

Circuit	No. 1 or 350A	No. 355
4.1 Local Selectors	SD-30200-01*	SD-31735-01*
4.2 Toll Intermediate Selector	SD-31179-01	SD-31744-01
4.3 Toll Transmission Selector	SD-31745-01	
4.4 AB Toll Transmission Selector	SD-31723-01*	
4.5 Selector Bank Multiple Circuit	SD-32123-01	
4.6 Switch Trouble Alarm Circuit or Misc. Alarm Circuit - Connector Shelves	SD-32045-01	
4.7 Connector Bank Multiple Circuit	SD-32128-01	
4.8 Ringing Interrupter and Alarm Circuit	SD-31298-01	-
4.9 Power Ringing Circuit	-	SD-80780-01*
4.10 Interrupter Relay Circuit	SD-32135-01	SD-31868-01
4.11 Subscriber Line Circuit	SD-32133-01*	SD-31777-01
4.12 Intercepting Trunk Circuit	SD-31337-01	

* Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring leads which causes relay (A) to operate. (A) operated, operates (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. (G) operated, also prepares certain circuits which will be described later.

5.2 Toll ("J" Option)

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of (K) to the toll control lead. (M) operates and locks to ground on the toll sleeve and (a) opens the supervisory No. 1 circuit, (b) operates (L), (c) operates (F) to ground on the "C" lead and (d) closes the locking circuit of (F) to the "C" lead. (L) operated (a) partially closes a circuit to (K), (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. and (c) partially closes the operate circuit for (B). The operation of (A) is the same as Paragraph 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, (A) responds to the pulses, closing the circuit through (C) and the vertical magnet in series. (C) and the vertical magnet both operate. (G) and the (C) are slow to release and do not restore on dial pulses. When the pulses cease (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses from (A). (G) remains operated during the rotary stepping on account of its slow release feature. (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. (E) closes a circuit for operating (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

The toll and local sleeves are normally connected together through the rotary off-normal springs 1 and 3. This reduces the unguarded interval to either multiple bank when the switch is seized from the other one, and insures that both sleeves will test busy when the switch is made busy in any of the usual ways. When the R.O.N. springs operate this connection is opened to prevent interference with the release of relay (P) on release from a reverting call. The lead to 1B (P) is normally open until the R.O.N. springs operate to prevent the (P) relay remaining operated in case it is manually operated while the switch is normal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, (E) releases and opens the circuit to the winding of (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates (N) during the releasing time of (B) which releases slowly. (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station. ("J" option) When "H" option is provided, the path thru (P) and (N) operates (L) which connects busy tone to the ring, and busy flash to lead "F" which on calls from an operator, causes the associated trunk circuit to return busy flashes to the operator.

8.2 Toll Call ("J" option)

If the called line is busy (N) will operate upon release of (E) as described for the local call. With (N) operated a circuit is closed to operate (K) which (a) closes 60 or 120 I.P.M. to the toll selector ring lead, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for (A) and (G). The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, (N) does not operate and upon release of (E) and (B) the sleeve is closed through for operating (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized (P) operates thru its 125 ohm winding from battery in the called line circuit to ground at the front contact of (G). This ground

acts as a guarding potential on the "S" wiper until (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of (P) serves only to operate spring 1 which closes a local circuit to its locking winding to fully operate the relay. The locking circuit is maintained for the duration of the call. The operation of (P) also closes the tip and ring wipers thru for ringing the called station and talking as hereinafter described.

The battery to the secondary winding of (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by an irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and 4B have broken. If (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. (J) locks to its own contacts in series with contacts on (F) to ground at contacts on (G) and closes the ringing interrupter leads and the ringing supply circuit. (G) operated grounds the "MS or INT. ST" lead under control of (D) for the purpose of starting the ringing or interrupter circuit. (N) is operated from the ground pulses on the ringing interrupter leads connected to wiper "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connected to wiper "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon (F) operates to close contacts with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of this relay connects the talking leads thru to (D) which supplies talking battery to the called station and causes (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described.

10.2 Toll Call ("J" option)

On a toll call the operation of (P) upon seizure of the line causes (K) relay

to operate. (K) extends the called subscriber's line to the transmission selector, free from all transmission obstructions, and also removes ground from the toll "C" lead which is a signal to the toll operator or the A-B Toll Transmission Selector to ring. (K) also opens the operating circuit to the (F) relay secondary winding, and holds operated the (A) relay. (F) is held operated thru its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays then operate as for a local call. When the called party answers (F) operates over its primary winding and locks on its secondary winding to the "C" lead. This arrangement provides a means for reringing from the toll board when required. (F) connects the called line thru contacts of (K) relay operated to the transmission selector. Talking battery and supervision on the called line are provided by the transmission selector.

11. REVERTING CALLS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under paragraph 8. When the calling station hangs up (A) releases, operating (E) and allowing (G) to release. On the release of (G), (E) is locked to a ground thru the back contacts of (G) and grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When (G) releases the shunt is removed from the primary winding of (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the ground from the back contact of (M) thru (E) connected to the called line sleeve is also closed thru the line and selector ckt. to the operate winding of (H), operating the latter, which then fully operates over its secondary winding. The operation of (H) operates (C) in series with resistance (A) and the vertical magnet. The operation of (C) opens the holding circuit for (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, (N) releases but the circuit for the release magnet of the connector is opened by contacts on (C). The release of (N) operates (G) which grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. (E) released closes ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of (E) to insure release of the line and preceding selector circuits. The release of (E)

also closes a circuit from ground thru the primary winding of (P) in series with the cut-off relay of the line circuit to battery. This operates the cut-off relay and also (P) sufficiently to close contacts 1 and 2 and P then fully operates over its locking winding and remains energized until the connection is released. The release of (E) also allows (C) to release and opens the circuit to the winding of (G). Relay (G) is slow in releasing and holds during the operating time of (P). (P) closes a circuit for holding (C). The operation of (P) also closes the tip and ring wipers thru to (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of (N), grounds the sleeve and closes a circuit for operating (J) over the pickup lead. The operation of (J) starts the ringing in the same manner as already described under paragraph 10.1. Ground over the RR lead operates (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling station's ringer is on the opposite side of the line from that of the called station, so that the calling party will know when the called party answers. When the called station answers, (F) is operated the same as already described in paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of (F), ground is removed from the winding of (G), but (G) is slow in releasing and therefore does not release during the operating time of (D) which re-established the holding circuit for (G) which is held operated from the ground at contacts of (D) until the connection is released. If the called party does not answer, the calling party must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release (G) releases just enough before the forward ground is removed from the sleeve to operate (H) and the ground is removed a sufficient length of time before the release of (E) to allow the re-operation of (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first (D) releases and closes a circuit to the

SUPV 1 lead to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects (A) releases in turn releasing (G). With (A) relay normal a circuit is closed to momentarily operate (E). The operation of (E) at this time has no effect. (G) in releasing (a) removes ground from the toll and local selector sleeves and (b) releases (P) on a completed call or releases (N) on a line busy condition. With (G), (N), and (P) normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing (F) to release. (H) does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when (G) releases.

12.2 Local Reverting Call

On a reverting call (D) remains operated until both the calling and the called station disconnect - thus holding the (G) thru (H) operated. (G) holds the circuit off normal as on a nonreverting call. When (D) releases upon disconnect of both parties (G) releases. (P) releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release (F) and (H).

12.3 Toll Call ("J" option)

The connector does not release until the toll selector removes ground from the toll sleeve terminal. The removal of sleeve ground releases the (A), (K), (L), (P), and (M) relays. (M) is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of (P). (A) releases (G) which in turn operates the release magnet and restores the switch to normal.

12.4 Toll or Local Call (Nonreverting) Line Busy

When the toll train disconnects on a busy condition the release of (A) operates (E) which remains locked through the operated (N) relay to ground on a back contact of (G). (N) however releases upon release of (G) thereby releasing (E) which performs no function at this time. (N) normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1

If the called station disconnects before the calling station a circuit is closed thru a back contact of relay (D) and a front contact of relay (F) for operating a signal designed SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The (C) contact protection unit is provided for protecting the contacts

which make and break the circuit to the stepping magnet. The (B) contact protection unit is provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3030-OCH-RLI-TC

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31811-01
Issue 3-D
Appendix 6-B
Dwg. Issue 16-B

AUG 15 1952

STEP BY STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN
THOSE APPLYING TO ADDED OR REMOVED AP-
PARATUS

C.1 Insulate 1(K) is added to "block or in-
sulate" column for the (M) relay to
avoid joint circuit operation of (M) and (F)
relays.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-VJA-RLL-TD

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31811-01
Issue 3-D
Appendix 5-D
Dwg. Issue 15-D

DEC 14 1951

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 To clarify the use of "M" and "K"
options, circuit note lll is re-
vised. It formerly read: "M" option

is required for use with intercepting
ckts. which trip ringing by grd. on
the ring."

All other headings, no change.

BELL TELEPHONE LABORATORIES,, INC.

DEPT. 3310-VJA-RLL-KU

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31811-01
Issue 3-D
Appendix 4-D
Dwg. Issue 14-D

AUG 27 1951

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

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

C.1 In order to increase the operating range of the (D) relay a new adjustment was added and shown as ADJ "B" which supersedes the previous adjustment, now designated ADJ "A".

C.2 To increase the operating range of the 222H (F) relay new adjustments are added and shown as ADJS "C" & "D" which supersedes former adjustments now designated ADJS "A" & "B".

C.3 Test note 6, page 3 applying to the (N) 223AE relay formerly read: "Test as permitted by seq. any two break conts. may break."

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The operating voltage of this circuit was formerly 45-50 volts.

D.2 The Working Limits and Tripping Range were formerly shown:

Max. Ext. Ckt. Loop 1000 ω
Min. Ins. Res. 15,000 ω

For pulsing test set requirements use 1400 ω loop and leak "A" in pulsing test set.

Applicable When Tube Sets Are Employed

Volts A-C	Volts D-C	Earth Potential	Leak	Ohms Ringing Range Per Side for 3, 4 or 5 Ringers		
				3	4	5
84-88	45-50	0	100,000 ω	2500	1830	1430
84-88	45-50	5V	100,000 ω	2060	1500	1165
84-88	45-50	0	15,000 ω	1950	1500	1200
84-88	45-50	5V	15,000 ω	1590	1220	970

Applicable When Tube Sets Are Not Employed

Rating	Type of Ringing	Ringing Voltage		Silent Interval Voltage	Max. Ext. Ckt. Loop Ringing	
		AC	DC		Interval	Silent Interval
A & M Only	AC - DC	80-88	46-52	45-50	1420 ω	1030 ω
A & M Only	Sup.	72-80	42-46	45-50	1300 ω	1030 ω
A & M Only	AC - DC	72-88	46-52	45-50	1420 ω	1030 ω
Standard	Sup.	84-88	37-40	45-50	1300 ω	1030 ω
Standard	AC - DC	84-88	46-52	45-50	1420 ω	1030 ω

D.3 Ckt. Note 110 is removed. It was formerly shown: "For subscriber lines equipped with or without tube type subscriber sets, use "K" option."

2. WORKING LIMITS

2.1

Type of Dial or Adj.	45V. Min.			Called Sta.		48V. Min.			Called Sta.	
	Pulsing From Sub.			Supv.		Pulsing From Sub.			Supv.	
	2,4 or 5	6	7	Adj. A	Adj. B	2,4 or 5	6	7	Adj. A	Adj. B
Max. Ext. Ckt. Loop*	750w	1200w	1100w	1000w	1400w	850w	1500w	1400w	1115w	1500w
Max. Ext. Ckt. Loop**	850w	1400w	1300w	1000w	1400w	1000w	1500w	1500w	1115w	1500w
Max. Ext. Ckt. Loop***	1000w	1400w	1400w	1000w	1400w	1115w	1500w	1500w	1115w	1500w
Min. Ins. Res.		15000w			15000w		15000w			15000w

*When using 1000w loop - Leak B in pulsing test set

**When using 1200w loop - Leak A in pulsing test set

***When using 1400w loop - Leak A in pulsing test set

Tripping Ranges

Type of Ringing and District	Ringing 20 Cycles					Silent Interval Voltage	Rating	Max. Ext. Ckt. Loop For Tripping	
	A.C. Voltage			D.C. Voltage				Adj. A & B	Adj. C & D
	#1	#350A	#355A	#1,350A	#355A				
AC-DC	84-88	72-88				45-52	Std*	1030w	1400w
	or	or	75-110		45-52				
	80-88	84-88				48-52	Std*	1115w	1500w
Sup. Tube ±5V. E.P.	72-80	72-88		42-46		45-52	Std*	1030w	1400w
	or	or	65-90	or	37-40				
	84-88	84-88		37-40		48-52	Std*	1115w	1500w

*72-80V AC & 80-88V AC are A&H.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-VJA-RLL-BZ

STEP-BY-STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The rating of "M" option is changed from "Mfr. Disc." to "A. & M. Only" to provide for the use of this circuit with intercepting circuits which trip ringing by ground on the ring.

D.2 Note 111 was added and Note 106 revised to record the above change.

D.3 The equipment designation was (Comb 5 Code TPS Conn).

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-OCH-RLL-PH

STEP BY STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The ringing voltages and ranges formerly shown were:

RINGING VOLTAGES AND TRIPPING RANGE							
TYPE OF RINGING	OPTION USED	RINGING VOLTAGES			SILENT INTERVAL VOLTAGE	MAX. EXT. CKT. LOOP	
		RATING	A-C	D-C		RINGING INTERVAL	SILENT INTERVAL
AC-DC AUD.	K OR M	A&M ONLY	80-88				
	M	MFR. DISC.	72-88				
	K	A&M ONLY	75-110	46-52		1420	
	K OR M	STANDARD	84-88		45-50		1030
-SUP.	K OR M	STANDARD	84-88				
	M	MFR. DISC.	72-80	42-46		1300	
	M	MFR. DISC.	84-88	37-40		1420	

D.2 Ringing voltages and ranges are
added for use when the tube sets
are employed.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330-MHK-FJS-RN

STEP BY STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

- C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO ADDED OR REMOVED APPARATUS.
- C.1 Remark for (K) relay formerly showed contacts 1-2 and 3-4 may break. All other headings, no change.
- C.2 Relay 222AE was specified for the (N) position in error.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330-MHK-FJS-RN

STEP-BY-STEP SYSTEMS
NO. 1, 350-A OR 355-A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

B. CHANGES IN APPARATUS

B.1 Added 13D Resistance Lamp K (A).

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

C.1 An adjustment for relay (F) is added on Page 2 to show values for use with new std. option "K".

C.2 Note 10 Page 2 previously read, "soak values added on Issue 6-D". Notes 10 and 11 are added.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Option "K" is added, replacing option "M" to provide for use of vacuum tubes in subsets where inductive interference is encountered. Option "K" connects the 200 ohm trip relay winding in series with grd. lead and connects a 13D resistance lamp in the ringing lead. This arrangement also increases the ringing range approx. 200 ohms.

D.2 A "ringing and ring trip" table is added to show values for these options and to indicate that 46-52 volts is required with "K" option instead of 37-40 volts for the d-c component in sup. offices.

D.3 Circuit Note 102 is rated "Mfr. Disc." since Fig. 2 is rated "Mfr. Disc.".

D.4 Circuit Note 106 is changed to show options M and K and Note 110 is added.

D.5 "OR to Interrupter Relay Circuit" is added to leads "MS", "RR" etc.

D.6 "OR-sup." is added to ringing supply lead designated AC-DC AUD.

D.7 Options used table is changed to show K and M.

All other headings under Changes, No change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for extending a call from a toll or local selector to a subscriber's line in a 10 party terminal per station connector group.

1.2 This circuit is arranged for reverting call service on local calls.

1.3 It provides for the use of tube type subsets on 10 Party Lines.

2. WORKING LIMITS

2.1 Max. Ext. Ckt. Loop - 1000 ohms
Min. Ins. Res. - 15,000 ohms

2.2 This circuit can be used for reverting call service only where there is a direct local circuit from the sleeve of the line circuit to the connector multiple bank sleeve terminal.

2.3 This circuit shall not be used for local calls over incoming repeaters or trunks which place a holding ground forward on the sleeve at the time when the connector is releasing.

3. FUNCTIONS

3.1 To differentiate between local and toll calls.

3.2 To select a line as determined by the pulses received by the connector.

3.3 To remain operated until both the calling and called subscribers have disconnected except when used as a local connector.

3.4 To test busy while held by the toll train.

3.5 To return audible ringing tone to the calling end.

3.6 To signal the called party with code ringing and to trip machine ringing when the called party answers.

3.7 To start the ringing machine or interrupter and alarm circuit.

3.8 The following functions apply when used as a local connector:

- 3.801 To return busy tone to the calling subscriber when the line selected is busy.
- 3.802 To start machine ringing as soon as the line selected is seized.
- 3.803 To reverse battery to the calling line when the called subscriber answers.
- 3.804 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.805 To supply the calling and called ends with transmission battery.
- 3.806 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.807 To release after the reverting call test if the sleeve of the called terminal is not connected thru the switch train to the incoming connector sleeve.
- 3.808 To ring both the called and the calling station bells on a reverting call.
- 3.809 To release the line finder and selectors on reverting calls.
- 3.810 To release when the calling party disconnects.
- 3.811 To allow the calling party to release the train of switches.
- 3.9 The following functions apply when used as a toll connector:
- 3.91 To cause the operator to receive the line busy flash if the line dialed is busy.
- 3.92 To extend the trunk free of transmission obstructions to the line seized.
- 3.93 To cause the operator to be signalled when the line has been seized.
- 3.94 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

Where this circuit is shown on a keysheet the connecting information thereon is to be followed.

Circuit	<u>No. 1 or 350A</u>	<u>No. 355</u>
4.1 Local Selectors	SD-30200-01*	SD-31735-01*
4.2 Toll Intermediate Selector	SD-31179-01	SD-31744-01
4.3 Toll Transmission Selector	SD-31522-01	SD-31745-01
4.4 AB Toll Transmission Selector	SD-31723-01*	SD-31746-01
4.5 Selector Bank Multiple Circuit	SD-32123-01	
4.6 Switch Trouble Alarm Circuit or Misc. Alarm Circuit - Connector Shelves	SD-32045-01	
4.7 Connector Bank Multiple Circuit	SD-32128-01	
4.8 Ringing Interrupter and Alarm Circuit	SD-31298-01	-
4.9 Power Ringing Circuit	-	SD-80780-01*
4.10 Interrupter Relay Circuit	SD-32135-01	SD-31868-01
4.11 Subscriber Line Circuit	SD-32133-01*	SD-31777-01
4.12 Intercepting Trunk Circuit	SD-31337-01	

* Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring leads which causes relay (A) to operate. (A) operated, operates (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. (G) operated, also prepares certain circuits which will be described later.

5.2 Toll

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of (K) to the toll control lead. (M) operates and locks to ground on the toll sleeve and (a) opens the supervisory No. 1 circuit, (b) operates (L), (c) operates (F) to ground on the "C" lead and (d) closes the locking circuit of (F) to the "C" lead. (L) operated (a) partially closes a circuit to (K), (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. and (c) partially closes the operate circuit for (B). The operation of (A) is the same as Paragraph 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, (A) responds to the pulses, closing the circuit through (G) and the vertical magnet in series. (C) and the vertical magnet both operate. (G) and (C) are slow to release and do not restore on dial pulses. When the pulses cease (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses from (A). (G) remains operated during the rotary stepping on account of its slow release feature. (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. (E) closes a circuit for operating (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

The toll and local sleeves are normally connected together through the rotary off-normal springs 1 and 3. This reduces the unguarded interval to either multiple bank when the switch is seized from the other one, and insures that both sleeves will test busy when the switch is made busy in any of the usual ways. When the R.O.N. springs operate this connection is opened to prevent interference with the release of relay (P) on release from a reverting call. The lead to 1B (P) is normally open until the R.O.N. springs operate to prevent the (P) relay remaining operated in case it is manually operated while the switch is normal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, (E) releases and opens the circuit to the winding of (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates (N) during the releasing time of (B) which releases slowly. (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station.

8.2 Toll Call

If the called line is busy (N) will operate upon release of (E) as described for the local call. With (N) operated a circuit is closed to operate (K) which (a) closes 60 or 120 I.P.M. to the toll selector ring lead, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for (A) and (G). The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, (N) does not operate and upon release of (E) and (B) the sleeve is closed through for operating (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized (P) operates thru its 125 ohm winding from battery in the called line circuit to ground at the front contact of (G). This ground acts as a guarding potential on the "S" wiper until (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of (P) serves only to operate spring 1 which closes a local circuit to its

locking winding to fully operate the relay. The locking circuit is maintained for the duration of the call. The operation of (P) also closes the tip and ring wipers thru for ringing the called station and talking as hereinafter described.

The battery to the secondary winding of (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by an irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and 4B have broken. If (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. (J) locks to its own contacts in series with contacts on (F) to ground at contacts on (G) and closes the ringing interrupter leads and the ringing supply circuit. (G) operated grounds the "MS or INT. ST" lead under control of (D) for the purpose of starting the ringing or interrupter circuit. (N) is operated from the ground pulses on the ringing interrupter leads connected to wiper "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connector to wiper "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon (F) operates to close contacts with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of this relay connects the talking leads thru to (D) which supplies talking battery to the called station and causes (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described.

10.2 Toll Call

On a toll call the operation of (P) upon seizure of the line causes (K) relay to operate. (K) extends the called subscriber's line to the trans-

mission selector, free from all transmission obstructions, and also removes ground from the toll "C" lead which is a signal to the toll operator or the A-B Toll Transmission Selector to ring. (K) also opens the operating circuit to the (F) relay secondary winding, and holds operated the (A) relay. (F) is held operated thru its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays then operate as for a local call. When the called party answers (F) operates over its primary winding and locks on its secondary winding to the "C" lead. This arrangement provides a means for reringing from the toll board when required. (F) connects the called line thru contacts of (K) relay, operated, to the transmission selector. Talking battery and supervision on the called line is provided by the transmission selector.

11. REVERTING CALLS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under paragraph 8. When the calling station hangs up (A) releases, operating (E) and allowing (G) to release. On the release of (G), (E) is locked to a ground thru the back contacts of (G) and grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When (G) releases the shunt is removed from the primary winding of (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the ground from the back contact of (M) thru (E) connected to the called line sleeve is also closed thru the line and selector cks. to the operate winding of (H), operating the latter, which then fully operates over its secondary winding. The operation of (H) operates (C) in series with resistance (A) and the vertical magnet. The operation of (C) opens the holding circuit for (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, (N) releases but the circuit for the release magnet of the connector is opened by contacts on (C). The release of (N) operates (G) which grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. (E) released closes ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of (E) to

insure release of the line and preceding selector circuits. The release of (E) also closes a circuit from ground thru the primary winding of (P) in series with the cut-off relay of the line circuit to battery. This operates the cut-off relay and also (P) sufficiently to close contacts 1 and 2 and P then fully operates over its locking winding and remains energized until the connection is released. The release of (E) also allows (G) to release and opens the circuit to the winding of (G). Relay (G) is slow in releasing and holds during the operating time of (P). (P) closes a circuit for holding (G). The operation of (P) also closes the tip and ring wipers thru to (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of (N), grounds the sleeve and closes a circuit for operating (J) over the pickup lead. The operation of (J) starts the ringing in the same manner as already described under paragraph 10.1. Ground over the RR lead operates (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling stations ringer is on the opposite side of the line from that of the called station, so that the calling party will know when the called party answers. When the called station answers, (F) is operated the same as already described in paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of (F), ground is removed from the winding of (G), but (G) is slow in releasing and therefore does not release during the operating time of (D) which re-established the holding circuit for (G) which is held operated from the ground at contacts of (D) until the connection is released. If the called party does not answer, the calling party must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release (G) releases just enough before the forward ground is removed from the sleeve to operate (H) and the ground is removed a sufficient length of time before the release of (E) to allow the reoperation of (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first (D) releases and closes a circuit

to the SUPV 1 lead to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects (A) releases in turn releasing (G). With (A) relay normal a circuit is closed to momentarily operate (E). The operation of (E) at this time has no effect. (G) in releasing (a) removes ground from the toll and local selector sleeve and (b) releases (P) on a completed call or releases (N) on a line busy condition. With (G), (N), and (P) normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing (F) to release. (H) does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when (G) releases.

12.2 Local Reverting Call

On a reverting call (D) remains operated until both the calling and the called station disconnect - thus holding the (G) thru (H) operated. (G) holds the circuit off normal as on a nonreverting call. When (D) releases upon disconnect of both parties (G) releases. (P) releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release (F) and (H).

12.3 Toll Call

The connector does not release until the toll selector removes ground from the toll sleeve terminal. The removal of sleeve ground releases the (A), (K), (L), (P), and (M) relays. (M) is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of (P). (A) releases (G) which in turn operates the release magnet and restores the switch to normal.

12.4 Toll or Local Call (Nonreverting) Line Busy

When the toll train disconnects on a busy condition the release of (A) operates (E) which remains locked through the operated (N) relay to ground on a back contact of (G). (N) however releases upon release of (G) thereby releasing (E) which performs no function at this time. (N) normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1

If the called station disconnects before the calling station a circuit is

closed thru a back contact of relay (D) and a front contact of relay (F) for operating a signal designated SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The (C) contact protection unit is provided for protecting the contacts which make and break the circuit to the stepping magnet. The (B) contact protection unit is provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330-RLQ-FJS-BB

STEP BY STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

*no app. 1000 ohms
for 15,000 ohms*

CHANGES

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

C.1 Soak values in mil. amperes were
formerly given for relays as
follows:

Relay	Wdg.	Soak	Relay	Wdg.	Soak
A	Both	100	J		17
B		110	K		30
D	Both	100	L		30
E		110	M	P	100
F	S	30	M	S	35
G		50	N		30
H	P	50	P	S	65
H	S	30			

C.2 The residual for relay C was for-
merly S-2. It was changed to S-4
to facilitate meeting the timing
requirements.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Fig. 2 was formerly part of Fig. 1,
and connection to Selector and
Connector bank multiple circuit was
not shown.

D.2 In the title, No. 1 and No. 350A
Office and the last line were
added.

D.3 The switch trouble alarm circuit
and the ringing interrupter and
alarm circuit were added as connecting
circuits in Fig. 1.

D.4 Cross connection Fig. 52 is rated
Mfr. Disc. and Figs. 51 and 53
are revised to show connection to the
Sel. Bank Multiple Ckt. and the Ring-
ing Interrupter and Alarm Ckt., respec-
tively.

All other headings under changes, No
change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for extending
a call from a toll or local se-
lector to a subscriber's line in a 10
party terminal per station connector
group.

1.2 This circuit is arranged for re-
verting call service on local calls.

2. WORKING LIMITS

2.1 Max. Ext. Ckt. Loop - 1000 ohms
Min. Ins. Res. - 15,000 ohms

2.2 This circuit can be used for re-
verting call service only where
there is a direct local circuit from
the sleeve of the line circuit to the
connector multiple bank sleeve ter-
minal.

2.3 This circuit shall not be used
for local calls over incoming re-
peaters or trunks which place a hold-
ing ground forward on the sleeve at
the time when the connector is releas-
ing.

3. FUNCTIONS

3.1 To differentiate between local and
toll calls.

3.2 To select a line as determined by
the pulses received by the con-
nector.

3.3 To remain operated until both the
calling and called subscribers
have disconnected except when used as
a local connector.

3.4 To test busy while held by the toll
train.

3.5 To return audible ringing tone to
the calling end.

3.6 To signal the called party with
code ringing and to trip machine
ringing when the called party answers.

3.7 To start the ringing machine or
interrupter and alarm circuit.

3.8 The following functions apply when
used as a local connector:

3.801 To return busy tone to the call-
ing subscriber when the line
selected is busy.

3.802 To start machine ringing as
soon as the line selected is
seized.

- 3.803 To reverse battery to the calling line when the called subscriber answers.
- 3.804 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.805 To supply the calling and called ends with transmission battery.
- 3.806 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.807 To release after the reverting call test if the sleeve of the called terminal is not connected thru the switch train to the incoming connector sleeve.
- 3.808 To ring both the called and the calling station bells on a reverting call.
- 3.809 To release the line finder and selectors on reverting calls.

- 3.810 To release when the calling party disconnects
- 3.811 To allow the calling party to release the train of switches.
- 3.9 The following functions apply when used as a toll connector:
- 3.91 To cause the operator to receive the line busy flash if the line dialed is busy.
- 3.92 To extend the trunk free of transmission obstructions to the line seized.
- 3.93 To cause the operator to be signalled when the line has been seized.
- 3.94 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

Where this circuit is shown on a keysheet the connecting information thereon is to be followed.

Circuit	No. 1 or 350A	No. 355
4.1 Local Selectors	SD-30200-01*	SD-31735-01*
4.2 Toll Intermediate Selector	SD-31179-01	SD-31744-01
4.3 Toll Transmission Selector	SD-31522-01	SD-31745-01
4.4 AB Toll Transmission Selector	SD-31723-01*	SD-31746-01
4.5 Selector Bank Multiple Circuit	SD-32123-01	
4.6 Switch Trouble Alarm Circuit or Misc. Alarm Circuit - Connector Shelves	SD-32045-01	
4.7 Connector Bank Multiple Circuit	SD-32128-01	
4.8 Ringing Interrupter and Alarm Circuit	SD-31330-01	-
4.9 Power Ringing Circuit	-	SD-80780-01*
4.10 Relay Interrupter Circuit	-	SD-31868-01
4.11 Subscriber Line Circuit	SD-32133-01*	SD-31777-01
4.12 Intercepting Trunk Circuit	SD-31337-01	

* Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring

leads which causes relay (A) to operate. (A) operated, operates (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. (G) operated, also prepares certain circuits which will be described later.

5.2 Toll

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of (K) to the toll control lead. (M) operates and locks to ground on the toll sleeve and (a) opens the supervisory No. 1 circuit, (b) operates (L), (c) operates (F) to ground on the "C" lead and (d) closes the locking circuit of (M) to the "C" lead. (L) operated (a) partially closes a circuit to (K), (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. and (c) partially closes the operate circuit for (B). The operation of (A) is the same as Paragraph 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, (A) responds to the pulses, closing the circuit through (C) and the vertical magnet in series. (C) and the vertical magnet both operate. (G) and (C) are slow to release and do not restore on dial pulses. When the pulses cease (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses from (A). (G) remains operated during the rotary stepping on account of its slow release feature. (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. (E) closes a circuit for operating (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

The toll and local sleeves are normally connected together through the rotary off-normal springs 1 and 3. This reduces the unguarded interval to either multiple bank when the switch is seized from the other one, and insures that both sleeves will test busy when the switch is made busy in any of the usual ways. When the R.O.N. springs operate this connection is opened to prevent interference with the release of relay (P) on release from a reverting call. The lead to 1B (P) is normally open until the R.O.N. springs operate to prevent the (P) relay remaining operated in case it is manually operated while the switch is normal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, (E) releases and opens the circuit to the winding of (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates (N) during the releasing time of (B) which releases slowly. (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station.

8.2 Toll Call

If the called line is busy (N) will operate upon release of (E) as described for the local call. With (N) operated a circuit is closed to operate (K) which (a) closes 60 or 120 I.P.M. to the toll selector ring lead, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for (A) and (G). The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, (N) does not operate and upon release of (E) and (B) the sleeve is closed through for operating (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized (P) operates thru its 125 ohm winding from battery in the called line circuit to ground at the front contact of (G). This ground acts as a guarding potential on the "S" wiper until (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of (P) serves only to operate spring 1 which closes a local circuit to its locking winding to fully operate the relay. The locking circuit is maintained for the duration of the call. The operation of (P) also closes the tip and ring wipers thru for ringing the called station and talking as hereinafter described.

The battery to the secondary winding of (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by any irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and

4B have broken. If (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. (J) locks to its own contacts in series with contacts on (F) to ground at contacts on (G) and closes the ringing interrupter leads and the ringing supply circuit. (G) operated grounds the "MS or INT. ST" lead under control of (D) for the purpose of starting the ringing or interrupter circuit. (N) is operated from the ground pulses on the ringing interrupter leads connected to wiper "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connector to wiper "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon (F) operates to close contacts with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of this relay connects the talking leads thru to (D) which supplies talking battery to the called station and causes (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described.

10.2 Toll Call

On a toll call the operation of (P) upon seizure of the line causes (K) relay to operate. (K) extends the called subscriber's line to the transmission selector, free from all transmission obstructions, and also removes ground from the toll "C" lead which is a signal to the toll operator or the A-B Toll Transmission Selector to ring. (K) also opens the operating circuit to the (F) relay secondary winding, and holds operated the (A) relay. (F) is held operated thru its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays

then operate as for a local call. When the called party answers (F) operates over its primary winding and locks on its secondary winding to the "C" lead. This arrangement provides a means for reringing from the toll board when required. (F) connects the called line thru contacts of (K) relay, operated, to the transmission selector. Talking battery and supervision on the called line is provided by the transmission selector.

11. REVERTING CALLS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under paragraph 8. When the calling station hangs up (A) releases, operating (E) and allowing (G) to release. On the release of (G), (E) is locked to a ground thru the back contacts of (G) and grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When (G) releases the shunt is removed from the primary winding of (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the ground from the back contact of (M) thru (E) connected to the called line sleeve is also closed thru the line and selector cks. to the operate winding of (H), operating the latter, which then fully operates over its secondary winding. The operation of (H) operates (C) in series with resistance (A) and the vertical magnet. The operation of (C) opens the holding circuit for (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, (N) releases but the circuit for the release magnet of the connector is opened by contacts on (C). The release of (N) operates (G) which grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. (E) released closes ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of (E) to insure release of the line and preceding selector circuits. The release of (E) also closes a circuit from ground thru the primary winding of (P) in series with the cut-off relay of the line circuit to battery. This operates the cut-off relay and also (P) sufficiently to close contacts 1 and 2 and P then fully operates over its locking winding and remains energized until

the connection is released. The release of (E) also allows (C) to release and opens the circuit to the winding of (G). Relay (G) is slow in releasing and holds during the operating time of (P). (P) closes a circuit for holding (G). The operation of (P) also closes the tip and ring wipers thru to (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of (N), grounds the sleeve and closes a circuit for operating (J) over the pickup lead. The operation of (J) starts the ringing in the same manner as already described under paragraph 10.1. Ground over the RR lead operates (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling stations ringer is on the opposite side of the line from that of the called station, so that the calling party will know when the called party answers. When the called station answers, (F) is operated the same as already described in paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of (F), ground is removed from the winding of (G), but (G) is slow in releasing and therefore does not release during the operating time of (D) which re-established the holding circuit for (G) which is held operated from the ground at contacts of (D) until the connection is released. If the called party does not answer, the calling party must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release (G) releases just enough before the forward ground is removed from the sleeve to operate (H) and the ground is removed a sufficient length of time before the release of (E) to allow the reoperation of (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first (D) releases and closes a circuit to the SUPV 1 lead to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects (A) releases in turn releasing (G). With (A) relay normal a circuit is closed to momentarily operate (E). The operation of (E) at this time has no effect. (G) in releasing (a) removes ground from the toll and local selector sleeve and (b) releases (P) on a completed call or releases (N) on a line busy condition. With (G), (N), and (P) normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing (F) to release. (H) does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when (G) releases.

12.2 Local Reverting Call

On a reverting call (D) remains operated until both the calling and the called station disconnect - thus holding the (G) thru (H) operated. (G) holds the circuit off normal as on a nonreverting call. When (D) releases upon disconnect of both parties (G) releases. (P) releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release (F) and (H).

12.3 Toll Call

The connector does not release until the toll selector removes ground from the toll sleeve terminal. The removal of sleeve ground releases the (A), (K), (L), (P), and (M) relays. (M) is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of (P). (A) releases (G) which in turn operates the release magnet and restores the switch to normal.

12.4 Toll or Local Call (Nonreverting) Line Busy

When the toll train disconnects on a busy condition the release of (A) operates (E) which remains locked through the operated (N) relay to ground on a back contact of (G). (N) however releases upon release of (G) thereby releasing (E) which performs no function at this time. (N) normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1

If the called station disconnects before the calling station a circuit is

closed thru a back contact of relay (D) and a front contact of relay (F) for operating a signal designated SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The (C) contact protection unit is provided for protecting the contacts which make and break the circuit to the stepping magnet. The (B) contact protection unit is provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330-OCH-FJS-KM

STEP-BY-STEP SYSTEMS
NO. 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS

no App. 6.

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The rating of "P" option was changed
from "Mfr. Disc." to "A & M Only" by
adding the last line to note 106.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3350-EAK-RSW

STEP-BY-STEP SYSTEMS
NO. 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS

CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded by
	1 M.F. Cond. & 81B Res. (C) "T" Option	177A Network (C) "S" Option
	0.1 M.F. Cond. & 81A Res. (B) "T" Option	177B Network (B) "S" Option

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

- C.1 Soak values were added for the (F) and (P) relay secondary windings.
- C.2 REMARKS were added for the (F) relay on Page 1, and note 10 was added for the (P) relay on Page 2.
- C.3 Note 1, Page 2, 1st sentence formerly read "Cont. 1-2 shall make before cont. 3-5 make."

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Separate condensers and resistors formerly used were superseded by the condenser-resistor networks indicated in B above to provide a cheaper and more convenient apparatus unit and the (T) and (R) condensers were balanced for better balance against inductive disturbances.
- D.2 The last line was added to note 106 and notes 108 and 109 were added.

- D.3 "Q" option was added as an alternate to "R" option, not formerly designated, for use with tandem wound (A) and (D) relays ("V" option) where improvement in balance against inductive disturbances is required, but where the expense of modifying the circuits by the provision of sandwich wound relays ("U" option) is not justified.

E. CHANGES IN TRANSMISSION REQUIREMENTS

- E.1 The table was revised.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3350

OCH)
RSW)MT

STEP BY STEP SYSTEM
355A DIAL OFFICE
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
TEN PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used in community dial offices for extending a call from a toll or local selector to a subscriber's line in a 10 party terminal per station connector group.
- 1.2 This circuit is arranged for reverting call service on local calls.

2. WORKING LIMITS

- 2.1 Max. Ext. Ckt. loop - 1000w
Min. Ins. Res. - 15,000w
- 2.2 This circuit can be used for reverting call service only where there is a direct local circuit from the sleeve of the line circuit to the connector multiple bank sleeve terminal.
- 2.3 This circuit shall not be used for local calls over incoming repeaters or trunks which place a holding ground forward on the sleeve at the time when the connector is releasing.

3. FUNCTIONS

- 3.1 To differentiate between local and toll calls.
- 3.2 To select a line as determined by the pulses received by the connector.
- 3.3 To remain operated until both the calling and called subscribers have disconnected except when used as a local connector.
- 3.4 To test busy while so held.
- 3.5 To return audible ringing tone to the calling end.
- 3.6 To signal the called party with code ringing and to trip machine ringing when the called party answers.

3.7 The following functions apply when used as a local connector:

- 3.701 To return busy tone to the calling subscriber when the line selected is busy.
- 3.702 To start machine ringing as soon as the line selected is seized.
- 3.703 To reverse battery to the calling line when the called subscriber answers.
- 3.704 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.705 To supply the calling and called ends with transmission battery.
- 3.706 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.707 To release on a reverting call test if no battery is found on the sleeve of the called terminal.
- 3.708 To ring both the called and the calling stations bells on a reverting call.
- 3.709 To release the line finder and selectors on reverting calls.
- 3.710 To release when the calling party disconnects.
- 3.711 To allow the calling party to release the train of switches.
- 3.712 To provide motor start when switch is seized and stop it when called subscriber answers.

3.8 The following functions apply when used as a toll connector:

- 3.81 To cause the operator to receive the line busy flash if the line dialed is busy.
- 3.82 To extend the trunk free of transmission obstructions to the line seized.
- 3.83 To cause the operator to be signalled when the line has been seized.
- 3.84 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

- 4.1 Selector circuit.

- 4.2 Misc. Alarm Circuit.
- 4.3 Power ringing circuit.
- 4.4 Subscriber's line circuit.
- 4.5 Intercepting trunk circuit.
- 4.6 Toll transmission selector.
- 4.7 Toll intermediate selector.
- 4.8 Interrupter relay circuit.

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring leads which causes relay (A) to operate. Relay (A) when operated, operates relay (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. The (G) relay, operated, also prepares certain circuits which will be described later.

5.2 Toll

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of relay (K) to the toll control lead. Relay (M) operates and locks to ground on the toll sleeve. The (M) relay operated (a) opens the supervisory No. 1 circuit, (b) operates the (L) relay, (c) operates the (F) relay to ground on the control lead and (d) closes the locking circuit of the (F) relay to the "C" lead. The (L) relay operated (a) partially closes a circuit to the (K) relay, (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. and (c) partially closes the operate circuit for the (B) relay. The operation of relay (A) is the same as P. 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, relay (A) responds to the pulses, closing the circuit through relay (C) and the vertical magnet in series. Relay (C) and the vertical magnet both operate. Relays (G) and (C) are slow to release and do not restore on dial pulses. When the pulses cease relay (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses sent out from relay (A). Relay (G) remains operated during the rotary stepping on account of its slow release feature. Relay (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. Relay (E) closes a circuit for operating relay (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, relay (E) releases and opens the circuit to the winding of relay (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates relay (N) during the releasing time of the (B) relay which releases slowly. Relay (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station.

8.2 Toll Call

If the called line is busy the (N) relay will operate upon release of the (E) relay as described for the local call. With the (N) relay operated a circuit is closed to operate the (K) relay. The (K) relay operated (a) closes 60 or 120 I.P.M. to the toll selector ring lead, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for the (A) and (G) relays. The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, relay (N) does not operate and upon release of relays (E) and (B) the sleeve is closed through for operating relay (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized relay (P) operates thru its 125 ohm winding from battery in the called line circuit to ground at the front contact of relay (G). This ground acts as a guarding potential on the "S" wiper until relay (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of relay (P) serves only to operate spring 1 which closes a local circuit to its locking winding to fully operate the relay. The locking

circuit is maintained for the duration of the call. The operation of relay (P) also closes the tip and ring wipers thru for ringing the called station and talking as herein-after described.

The battery to the secondary winding of relay (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by any irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and 4B have broken. If relay (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until relay (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. Relay (J) locks to its own contacts in series with contacts on relay (F) to ground at contacts on relay (G) and closes the ringing interrupter leads and the ringing supply circuit. Relay (G) operated grounds the "MS" lead under control of relay (D) for the purpose of starting the ringing circuit. Relay (N) is operated from the ground pulses on the ringing interrupter leads connected to bank terminal "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connected to terminal "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon relay (F) operates to close contact with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of this relay connects the talking leads thru to relay (D) which supplies talking battery to the called station and causes relay (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. Relay (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described. If the called subscriber removes the receiver during the silent interval relay (F) operates from the battery on the back contact of relay (N).

10.2 Toll Call

On a toll call the operation of the (P) relay upon seizure of the line causes the (K) relay to operate. The (K) relay extends the called subscriber's line to the transmission selector, free from all transmission obstructions. The (K) relay, operated, also removes ground from the toll "C" lead

which is a signal to the toll operator to ring and removes the operating circuit to the (F) relay secondary winding. The (K) relay also holds operated the (A) relay. The (F) relay secondary winding is held energized through its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays then operate as for a local call. When the called party answers the (F) relay operates over its primary winding and locks on its secondary winding under control of the toll board. This arrangement provides a means for reringing from the toll board when required. The (F) relay connects the called line thru contacts of the (K) relay, operated, to the toll transmission selector. Talking battery and supervision on the called line is provided by the transmission selector.

11. REVERTING CALLS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under paragraph 8. When the calling station hangs up relay (A) releases. This operates relay (E) and allows relay (G) to release. On the release of relay (G) relay (E) is locked to a ground thru the back contacts of relay (G). Relay (E) grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When relay (G) releases the shunt is removed from the primary winding of relay (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the grd. from the back contact of the (M) relay thru the (E) relay, connected to the called line sleeve is also closed thru the line and selector ckts. to the operate winding of the (H) relay, operating the latter. The (H) relay then fully operates over its secondary winding. The operation of relay (H) operates relay (C) in series with resistance (A) and the vertical magnet. The operation of relay (C) opens the holding circuit for relay (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, relay (N) releases but the circuit for the release magnet of the connector is open by contacts on relay (C). The release of relay (N) operates relay (G). Relay (G) grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. The (E) relay released closed ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of the (E) relay to insure release of the line and preceding selector circuits. The release of relay (E) also closes a circuit from ground thru the primary winding of

relay (P) in series with a relay in the line circuit to battery. This operates relay (P) sufficiently to close contacts 1 and 2 and the relay then fully operates over its locking winding and remains energized until the connection is released. The release of relay (E) also allows relay (C) to release and opens the circuit to the winding of relay (G). Relay (G) is slow in releasing and holds during the operating time of relay (P). Relay (P) closes a circuit for holding relay (G). If no battery is found on the sleeve terminal for the operation of relay (P) the switch will release when relay (G) releases. The operation of relay (P) also closes the tip and ring wipers thru to relay (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of the (N) relay, grounds the sleeve and closes a circuit for operating relay (J) over the pick-up lead. The operation of relay (J) starts the ringing in the same manner as already described under paragraph 10.1. Ground over the RR lead operates relay (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling stations ringer is on the opposite side of the line from that of the called station, so that the calling station will know when the called station answers. When the called station answers, relay (F) is operated the same as already described in paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of relay (F), ground is removed from the winding of relay (G), but (G) is slow in releasing and therefore does not release during the operating time of relay (D) which re-established the holding circuit for relay (G). Relay (G) is held operated from the ground at contacts of relay (D) until the connection is released. If the called station does not answer, the calling station must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release the (G) relay releases just enough before the forward ground is removed from the sleeve to operate relay (H) and the ground is removed a sufficient length of time before the release of relay (E) to allow the reoperation of relay (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first the (D) relay releases and closes a circuit to the SUPV 1 lead to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects the (A) relay releases in turn releasing the (G) relay. With the (A) relay normal a circuit is closed to momentarily operate the (E) relay. The operation of the (E) relay at this time has no effect. The (G) relay in releasing (a) removes ground from the toll and local selector sleeve and (b) releases the (P) relay. With the (G) and (P) relays normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing the (F) relay to release. The (H) relay does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when the (G) relay releases.

12.2 Local Reverting Call

On a reverting call relay (D) remains operated until both the calling and the called station disconnect - thus holding the (G) relay thru the (H) relay operated. The (G) relay holds the circuit off normal as on a nonreverting call. When the (D) relay releases upon disconnect of both parties the (G) relay releases. The (P) relay releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release the (F) and (H) relays.

12.3 Toll Call

The connector does not release until both the calling and called parties disconnect. Ground is then removed from the toll selector sleeve terminal by the toll train. The removal of sleeve ground releases the (A), (K), (L), (P) and (M) relays. The (M) relay is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of the (P) relay. The (A) relay releases the (G) relay which in turn operates the release magnet and restores the switch to normal.

12.4 Toll or Local Call (Nonreverting) Line Busy

When the toll train disconnects on a busy condition the release of the (A) relay operates the (E) relay. The (E) relay remains locked through the operated (N) relay to ground on a back contact of the (G) relay. The (N) relay however releases upon release of the (G) relay thereby releasing the (E) relay which performs no function at this time. The (N) relay normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1

If the called station disconnects before the calling station a circuit is closed thru a back contact of relay (D) and a

front contact of relay (F) for operating a signal designated SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The 1 M.F. condenser (C) and 81B resistance are provided for protecting the contacts which make and break the circuit to the stepping magnet. The .1 M.F. condenser (B) and 81A resistance are provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 332

FK)
WLF) GZ