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STEP-BY-STEP SYSTEMS
NO. 1 350A OR 355A
LOCAL CONNECTOR CIRCUIT
8-PARTY TERMINAL PER STATION
SEMI-SELECTIVE RINGING

CHANGES

D. DESCRIPTION OF CHANGES

D.1 The return of busy flash to the operator, option Q, is rated Mfr Disc.

D.2 Option ZB and ZC are added, for additions to nonuniversal-type shelves, and rated A&M Only. Option ZD is added as the standard option. These options are added to agree with manufacturing information.

D. 3 This circuit is rated A&M Only for use in No. 350A offices.

D.4 Reference to options ZB, ZC, and ZD is added to Note 106.

D.5 Use of options ZB and ZC is added in Note 109.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2363-MKD-RJJ,JR

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CHANGES

B. Changes in Apparatus

B.1 SUPERSEDED	SUPERSEDED BY
197GN Switch, E Option	197HP Switch, ZF Option

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 Readj is specified for the double dog of the switch.

C.2 On page 1, Test Note 8 is deleted. It formerly read: Double Dog shall not operate.

C.3 On page 1, Test Note 9 formerly read: (RLS) springs 1-2 shall break.

C.4 On page 4, test clip data for the Z relay when option F is provided, is added in Note 8.

D. Description of Changes

D.1 Option ZI is added to open the original operating path for the rotary magnet and E relay to prevent rotary overstepping after the units digit has been dialed. The former wiring is shown as ZH option which is rated Mfr Disc.

D.2 Option ZE is added to provide battery directly to secondary winding of K instead of through the rotary magnet.

D.3 The 197GN switch, option E, is replaced by the 197HP switch, option ZF to provide RON springs.

D.4 Former Equipment Note 201 is changed to Note 202 and a new Note 201 is added. Note 203 is added.

D.5 Reference to options ZE, ZF, ZG, ZH, and ZI is added to Note 106 and Options Used table.

F. Changes in Description of Operation

F.1 In the first sentence of second paragraph under 9, add after "of relay K" the following: with ZG option.

F.2 Add a third paragraph under 9 as follows:

With ZI option, the original operating path for the rotary magnet and E relay is opened to prevent rotary overstepping after the units digit has been dialed.

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CHANGES

A. CHANGED AND ADDED FUNCTIONS

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

B. CHANGES IN APPARATUS

B.1

Superseded	Superseded By
197BF switch, (H option)	197GN switch, (E option)
222KN (D) relay (Y option)	222KR (D) relay (ZA option)
221ND (A) relay (Y option)	221ND (A) relay (ZA option)
221W (G) relay (Q option)	221T (G) relay (R option)

B.2 Added

1 - KS-8512, L4C (R) resistor (F option)

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

C.1 The readjust operate for Adj. D of the (F) 222H relay is changed from 20.5 to 22.5 to show the correct value.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Option F is added for use when automatic disconnect of connectors on calling party holds is required. Option G shows the former wiring.

D.2 The title is changed to add reference to No. 1 and 350A offices.

D.3 The leads formerly connecting to Misc. Alarm Circuit are also shown connecting to Switch Trouble Alarm Circuit.

D.4 Note 105 is changed to include ZA option.

D.5 Note 110 is added to show the use of options F and G.

D.6 Reference to Options E, F, G and ZA is added to Note 106 and options used table.

D.7 Equipment Note 201 is added.

D.8 The feature providing the busy flash signal to operators is changed from Standard to A & M.

D.9 Lead designated "INT ST or MS" formerly was shown as "MS" connecting to "Power Ringing Ckt."

All other headings under changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is for use in a No. 1, 350A or 355A dial office for making the final connections to a called line in 8 party semi-selective ringing rural line groups. It responds to the last two digits of the number dialed.

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2. WORKING LIMITS

2.1 Limits are for single office areas. For multioffice areas, and for operator pulsing, see key sheets.

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

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

*When using 1000ω loop - Leak B in pulsing test set.
**When using 1200ω loop - Leak A in pulsing test set.
***When using 1400ω loop - Leak A in pulsing test set.

2.2 Tripping Ranges

Type of Ringing and District	Ringing 20 Cycles A.C. Voltage	D.C. Voltage	Silent Interval Voltage	Code of (F) Relay	Options	Rating	Max. Ext.Ckt. Loop for Tripping Adj. "A"	Adj. "B"	Adj. "D"	Adj. "E"
Sup. Tube ± 5V. E.P.	80-90*	45-52	45-52	222H	B, K	STD	-	-	-	1400ω
			48-52	222H	B, K	STD	-	-	-	1500ω
	65-90	37-40	45-52	222H	B, K	STD	-	-	-	1400ω
					B, M	MD	1030ω	-	1400	-
			48-52	222H	B, K	STD	-	-	-	1500ω
					B, M	MD	1115ω	-	1500	-
	65-90	37-40	60-75	222H	B, M	MD	-	1500ω	-	-
				222GP	A, M	A&M	-	1500ω	-	-
Superimposed 8 Party Inverted High Impedance and tube 4 Party; 42A, Inv. 42A and Tube	65-90	37-40	60-75	222GP	A, M.	A&M	900ω	-	-	-

*75-90 During Power Failure

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3. FUNCTIONS

3.01 To return ground on the release trunk lead for holding the switches back of it in their operated position and to prevent intrusion from selectors hunting for an idle connector.

3.02 To return busy flash on operator originated calls if the line tested is busy.

3.03 To step the shaft in a vertical and in a rotary direction in response to impulses sent out by the dial at the calling station.

3.04 To connect the talking wires through to the called line and remove the line relay from the called line.

3.05 To place a busy condition on the sleeve of the called line.

3.06 To determine the character of the ringing current for a station on a party line by the terminal selected by means of a fourth conductor in the multiple bank.

3.07 To ring the called party semi-selective and trip the ringing when the called party answers.

3.08 To test a busy line and return a busy tone to the calling party.

3.09 To release when the calling party hangs up.

3.10 To cut through to the called line.

3.11 To furnish talking battery to the called and to the calling parties.

3.12 To give the calling party ringing induction when the called line is not busy.

3.13 To start the ringing machine.

3.14 To automatically disconnect the calling line after a predetermined interval on calling party holds, permitting release of connector and freeing called line.

4. CONNECTING CIRCUITS

When this circuit is listed on a keysheet the connecting information thereon shall be followed.

4.01 Selector Circuit - SD-31735-01*.

4.02 Incoming Selector Circuit - SD-30972-01.

4.03 Selector Bank Multiple Circuit - SD-32123-01.

4.04 Connector Bank Multiple Circuit - SD-32128-01.

4.05 Miscellaneous Alarm Circuit or Switch Trouble Alarm Circuit - SD-32045-01.

4.06 Subscribers' Line Circuit - SD-32133-01*.

4.07 Intercepting Trunk Circuits - SD-31337-01*.

4.08 Power Ringing Circuit - SD-80885-01*.

4.09 Interrupter Relay Circuit - SD-31868-01.

4.10 Ringing Interrupter and Alarm Circuit - SD-31336-01*.

4.11 Interrupter Relay Circuit - SD-32135-01.

*Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

When this switch is seized by a selector switch, relay (A) operates over the subscriber's loop which in turn operates relay (B). Relay (B) returns ground to the release trunk lead "S" for holding the switches in the train in their operated position and to guard the connector from seizure by another selector, opens the release circuit for this switch and prepares the circuit for the operation of the vertical magnet, grounds the MS lead, as well as preparing certain holding circuits which will be described later.

6. VERTICAL STEPPING

The first set of impulses sent out by the calling station after the seizure of this switch, releases and operates relay (A) to step the shaft in a vertical direction and relay (C) operates in series with the vertical magnet. Relays (B) and (C) remain operated during this series of pulses since they are slow to release. As soon as the shaft moves one vertical step, the original circuit, through the off-normal springs for operating the vertical magnets, is transferred from off-normal spring 3 to off-normal spring 4 and the front contact of relay (C) which circuit is maintained due to the slow release action of relay (C) for all the additional pulses sent out by the dial. As soon as this set of pulses ceases, relay (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

A set of impulses sent out by the calling station will now operate the rotary magnet and step the shaft in a rotary direction due to the pulses sent out from relay (A) as before. Relay (B) will also remain operated as during vertical stepping on account of its slow release feature. During the rotary stepping, relay (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the set of pulses to close a circuit for testing the called line.

8. TESTING THE CALLED LINE

If the line called is busy, ground is found on the bank contacts for the "S" wiper. Relay (G) will operate from this ground and upon the release of relay (E) it will lock to ground on the (B) relay and returns a busy signal to the calling end of the line as determined by option "R" or "Q".

With option "R" busy tone is connected through contacts of the (G) relay to the ring of the line connected to the calling party.

With option "Q" busy tone is connected through contacts of the (G) relay to the ring of the line connected to the calling party or operator and the busy flash is connected through other contacts of the (G) relay to the "F" lead to preceding selectors toward the calling operator.

If the called line is idle the switch will cut through to the line upon the release of relay (E).

9. CUTTING THROUGH TO CALLED LINE

As soon as the called line is seized, relay (K) will operate through its 125 ohm winding from battery in the called line circuit to ground on the front contact of relay (B). This ground acts as a guarding potential on the S terminal until relay (K) operates and puts ground on the S wiper. The circuit through the 125 ohm winding of relay (K) operates spring 1B of the relay which closes a local circuit through its 1100 ohm winding to fully operate the relay. This circuit is maintained until the switch releases. The operation of relay (K) also closes the tip and ring wipers through to the ringing leads on relay (F) for automatically ringing the called station.

The battery to the secondary winding of relay (K) 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 3T and 4T have broken. If relay (K) were permitted to operate under the conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

Ringing is not impressed upon the called line until relay (Z) operates from ground on the PKU lead to insure the right number of rings being sent out on the line on 2-ring calls. The operation of relay (Z) closes the circuit to the "A" wiper. The "A" terminal in the multiple band may be connected to any of the following four interrupter leads from interrupter relay circuit.

(a) (1-) Interrupted ground through a resistance from a relay furnishing 1-1/2 second make and a 4-1/2 second break interruptions.

(b) (2-) Interrupted ground through a resistance from a relay furnishing 1 second make, 1/2 second break, 1 second make and 3-1/2 second break interruptions.

(c) (1+) Interrupted ground directly from a relay furnishing 1-1/2 second make and 4-1/2 second break interruptions.

(d) (2+) Interrupted ground directly from a relay furnishing 1 second make, 1/2 second break, 1 second make and 3-1/2 second break interruptions.

When a terminal connected to lead (1-) is selected, relay (H) operates on each closure of the interrupter but relay (J) does not operate due to the resistance "A". Relay (H) follows the interrupter and transmits a "1-ring" negative superimposed ringing current to the called line.

When a terminal connected to lead (2-) is selected, relay (J) does not operate, but relay (H) follows the interrupter and transmits a "2-ring" negative superimposed ringing current to the called line.

When a terminal connected to lead (1+) is selected, both relays (H) and (J) operate on the first closure of the interrupter. Relay (J) locks to its own contact, transfers from negative superimposed ringing to positive superimposed ringing, transfers from negative trip battery to positive trip battery and reverses the connections to the 200 ohm winding of relay (F). Relay (H) follows the interrupter and transmits a "1-ring" positive superimposed ringing current to the called line.

When a terminal connected to lead (2+) is selected, both relays (H) and (J) operate as described above. Relay (H) follows the interrupter and transmits a "2-ring" positive superimposed ringing current to the called line.

The positive trip battery is wired through a contact on relay (Z) and the negative superimposed ringing lead through a contact on relay (H) to permit the adjustment of the top transfer springs on relay (J) without danger of crossing the negative trip battery with the positive trip battery or the negative ringing current with the positive. The ringing current passes through resistance lamp (A), "K" option, or the 200 ohm winding of relay (F) "M" option, and interrupted ringing continues until the called station answers which causes the operation of relay (F) sufficiently to close contacts 1 and 2 due to a flow of either superimposed ringing current or trip battery through its 200 ohm winding. With "K" option, the primary winding of (F) is in the ground return lead. A ringing tone is transmitted to the calling station through the .04 MF condenser (A) during ringing.

On the closure of contacts 1 and 2 of relay (F) the 1300 ohm winding is energized which fully operates the relay and it remains operated until the switch releases. The operation of relay (F) connects the talking leads through to the (D) relay and removes the ground from the MS lead. The (D) relay, which supplies talking battery to the called station, operated, reverses the battery to the calling station for the purpose of supervision or for metered service and for other functions hereinafter described. The called and the calling stations are now connected for talking purposes through the 2 MF condensers connected to the tip and ring leads. Relay (D) operated, releases relay (Z).

11. RELEASE OF CONNECTOR WHEN THE CALLING PARTY IS LAST TO DISCONNECT

If the called station disconnects before the calling station, relay (D) releases and when the calling station disconnects relays (A) and (B) will release which will in turn allow relays (K), (J) and (F) to release; with these relays released the release magnet is energized and the switch will return to normal.

With G option provided, if the calling party fails to disconnect after the called party has disconnected, the connector remains off normal until the calling party replaces his receiver on hook.

With F option (automatic disconnect) 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, ground over lead AUT DISC through (F) resistor, make on VON, through RLS magnet to battery, operates RLS on first step to release (B). (B) released permits the preceding switches to restore and open the loop to release (A). (B) released also releases (K). The release of (A) fully operates the RLS magnet, returning the connector to normal.

12. RELEASE OF CONNECTOR WHEN CALLING PARTY DISCONNECTS

If the calling station disconnects before the called station, the (A) and (B) relays release which allow the (K), (F) and (D) release. With these relays released, the release magnet is energized and the switch will return to normal.

13. SUPERVISORY #1

If the called station disconnects before the calling station, a path is closed through a back contact of relay (D) and a front contact of relay (F) for operating a supervisory signal.

14. TEST JACKS

Test jack springs 3 and 4, may be used to make this switch busy to incoming calls when it is out of order. Springs 1 and 2, may be used for making local tests on this switch to cause it to function in the same manner as described for an originating call. The make busy feature of the test jack is also duplicated by the removal of the switch from its jacks since the jacks are arranged to place ground on the release trunk lead upon the removal of the switch from its position.

15. CONTACT PROTECTION

The "C" contact protection reduces the sparking at the contacts which open the stepping magent circuits. The "B" contact protection reduces the sparking at the contacts of relay (F) when breaking the ringing current on its operation.

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