

6-6335

CIRCUIT DESCRIPTION  
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-96097-01  
Issue 7-D  
Appendix 3-D  
Dwg. Issue 14-D

COMMON SYSTEMS  
STATION RINGER TEST CIRCUIT  
FOR CROSSBAR OFFICES AND FOR PANEL OFFICES  
HAVING SENDERS EQUIPPED WITH 239 TYPE  
PULSING RELAYS, INDIVIDUAL, 2 PARTY SELECTIVE  
AND 4 PARTY SELECTIVE OR SEMI-SELECTIVE LINES

CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	(L) "G" option 239HE Relay (TA), (TL) "E" option 12B M.R.	(L) "F" option 280W Relay (TA), (TL) "O" option 14LE M.R.

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

C.1 Test notes previously associated with  
the 239HE Relay were removed and were  
as follows:

a negative sign (-) preceding a  
current value indicates that this current  
shall flow in a direction opposite to the  
direction of the circuit operating  
current:

contact separation - min. 3 - max. 4.  
There shall be sufficient clearance between  
each armature stop pin and its associated  
pole face with a .003" gauge inserted in  
this space to permit the corresponding  
contacts to close when the relay is oper-  
ated on 27 ma.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The D, E, F and G options were added  
to the Options Used Table and to  
the table of circuit Note 117.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2352-MPH-EJJ-SA

COMMON SYSTEMS  
STATION RINGER TEST CIRCUIT  
FOR CROSSBAR OFFICES AND FOR PANEL OFFICES  
HAVING SENDERS EQUIPPED WITH 239 TYPE  
PULSING RELAYS, INDIVIDUAL, 2 PARTY SELECTIVE  
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CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded

Superseded By

(A) K Option U365 Relay	(A) J Option U1239 Relay
(L2) V Option U458 Relay	(L2) H Option U1248 Relay
(RS)(ST) U Option U405 Relay	(RS)(ST) T Option U1244 Relay
(TA)(TL) S Option U545 Relay	(TA)(TL) R Option U1250 Relay
(C) Q Option U160 Relay	(C) P Option U1229 Relay

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

C.1 The adjustment for

		Soak	Opr.	Hold	Rel.
(RA) Relay Y79 was	Test	200	80	8.5	6.7
	Readj.	200	74	8.4	6.8
(SR) Relay Y81	Wdg. Test	45	22.5	3.5	1.0
	Alone Readj.	45	21	3.3	2.3
(SR) Relay Y81	Comb. Test	75	38	5.9	1.6
	With a Res. Readj.	75	35.5	5.6	3.7
	Test		7.5		
(A) Relay U365	Readj.		7.1		
	Test		7.3		
(L2) Relay U458	Readj.		6.9		
	Test		5.7		
(RS)(ST) Relay U405	Readj.		5.4		
	Test		5.7		
(TA)(TL) Relay U545	Readj.		5.4		
	Test		8.6		
(C) Relay U160	Readj.		8.1		
	Test	20	12	3.2	1
(G1) Relay Y86	Readj.	20	11.4	3	1.1

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The K, J, H, V, U, T, S, R, Q  
and P options were added to the  
options used table and as circuit  
Note 117.

D.2 The options listed in Par. B  
were added to the relays.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-HCM-FJS

COMMON SYSTEMS  
STATION RINGER TEST CIRCUIT  
FOR CROSSBAR OFFICES AND FOR PANEL OFFICES  
HAVING SENDERS EQUIPPED WITH 239 TYPE  
PULSING RELAYS, INDIVIDUAL, 2 PARTY SELECTIVE  
AND 4 PARTY SELECTIVE OR SEMI-SELECTIVE LINES

CHANGES

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

C.1 The release adjustment for relay  
SR was, readj. 1.1 (relay winding  
alone) and 1.7 (relay comb.).

C.2 Added test note "Adjacent relays  
shall not be energized. See B.S.P."  
for Y type relays on pages 2 and 3.

C.3 Added insulate inf. for relays  
(G1) on ckt req. tables.

All other headings, No change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-WCJ-FJS

2-1891-3

COMMON SYSTEMS  
STATION RINGER TEST CIRCUIT  
FOR CROSSBAR OFFICES AND FOR PANEL OFFICES  
HAVING SENDERS EQUIPPED WITH 239 TYPE  
PULSING RELAYS, INDIVIDUAL, 2 PARTY SELECTIVE  
AND 4 PARTY SELECTIVE OR SEMI-SELECTIVE LINES

CHANGES

B. CHANGES IN APPARATUS

B.1 Added

U648 (DS) Relay )  
Y86 (G1) Relay )  
U207 (TG) Relay ) Fig. I  
291 Type Jack (T) )  
18GH Res. (R) )

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

C.1 The U516 (DS) relay is removed from under Fig. 1 and shown  
under Fig. H.

C.2 Prior to Issue 11-D, Note 4, Page 2 was as follows:

"With a 10 gauge between armature and core, and relay  
energized, the studs of the .030 in. buffer springs shall  
not be in contact with the 1T or 1B springs".

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Fig. I is added. The (DS) relay shown in Fig. H formerly  
was part of Fig. 1. The connecting information in Fig. I is  
changed to show connection to Fig. H or I. In Fig. 2 the  
"TL" lead was formerly shown connecting to Fig. 1. In Figs.  
1F and 1G the "S" and "S1" leads formerly connected to Fig.  
1 and were numbered 9 and 8 respectively. "And for circuits  
used in common for panel and crossbar offices" is added to  
Note 112. Note 111 is added. "Only" is added to the end  
of Note 108.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 To test ringers at subscriber stations and to connect with  
51 type dial tester circuit, without the aid of any one at  
the central office.
- 1.2 A test call is routed to this circuit from the office link  
and connector circuit in crossbar offices or from the dis-  
trict or office multiple in panel offices, and this circuit  
in turn routes it to a 51 type dial tester circuit for dial  
tests.

- 1.3 The subscriber set to be tested is associated with this circuit by dialing a two or three digit code which causes a connection to be made to one of a group of these circuits.
- 1.4 Repeat tests of a ringer may be made and dial tests may be made after making ringer tests without breaking down the connection.

**2. WORKING LIMITS**

	10 P.P.S. Dials		20 P.P.S. Dials
	Sub's Line	P.B.X. Ext. Lines	Operator's Trunks
Max. Ext. Ckt. Loop	1500 $\omega$	1500 $\omega$	1500 $\omega$
Max. Trk. Conductor Res.			1400 $\omega$
Allowable Rated Bridged Cap. at Sub. Sets	4 mf	3 mf	
Min. Ins. Res.	10,000 $\omega$	10,000 $\omega$	15,000 $\omega$

Max. ext. ckt. loop for trunk guard test 2740 $\omega$

**3. FUNCTIONS**

- 3.01 Arranged so that an outside maintenance man at a subscriber station can associate one of these circuits with the subscriber station under test and can direct it to apply the desired test without the aid of any one at the central office.
- 3.02 Selector (P) is used as a pulse or register switch taking its setting under control of dial pulses. It controls the type of test to be made. It has two normal positions, one being opposite the feeder terminals.
- 3.03 In the pulsing circuit relay (SS) is provided to simulate the action of a selector in order that when the selector is set for a ringer test, any number of digits may be dialed for the purpose of testing the ringer without advancing the switch and without releasing relay (SR).
- 3.04 Arranged to apply machine ringing, to the tip or ring of the line by dialing a certain number for each condition from the subscriber station.
- 3.05 Forms connecting link with 51 type Dial Test Circuit so that dial tests may be made without the aid of any one at the central office.

- 3.06 Arranged so that after making a ringing test it may be repeated or connection may be made with the Dial Test Circuit without breaking down the connection.
  - 3.07 Arranged to automatically disconnect after it has been held a certain length of time.
  - 3.08 Message register (TL) scores once each time one of these circuits is seized.
  - 3.09 Message register (TA) scores once each time one of these circuits is held until the automatic disconnect functions.
  - 3.10 When a circuit is stuck off-normal the individual lamp (TL) lights.
  - 3.11 For testing the circuit (T) jack is provided.
  - 3.12 Arranged to keep ground and battery across the tip and ring of the district circuit. A timed delay for cutting through is arranged, to allow the sender to disconnect and in order to prevent premature dial tone from the Ringer Test Circuit.
  - 3.13 Arranged to ring individual, two party, four party semi-selective, or four party selective subscriber's stations.
4. CONNECTING CIRCUITS
- 4.1 Office Link and Connector Circuit (Crossbar).
  - 4.2 District or Office Selector (Panel).
  - 4.3 51 Type Dial Test Circuit.
  - 4.4 Subscriber Sender Circuit.
  - 4.5 Miscellaneous and Auxiliary Alarm Circuit for Floor Alarm Frame.
  - 4.6 Interrupter Frame Circuit.

DESCRIPTION OF OPERATION

5. OPERATION

5.01 Seizure

When an outside maintenance man at a subscriber station desires to test the dial or ringer, he will dial a certain two or three digit code which will cause a connection to be completed to one of a group of ringer test circuits for testing ringers and connecting to the 51 type dial tester circuit. When this circuit is seized ground from the offices link circuit is connected to the "S1"

lead in crossbar offices or from the district or office selector to the "S" lead in panel offices holding this circuit busy. When the fundamental circuit is closed on trunk guard test, a circuit is closed from battery through (L) relay "P" winding and (L2) relay winding over the ring through the sender, back over the tip to ground thru (DT) Rep. coil. Relays (L) and (L2) will operate in series with (TG) relay of sender. The operation of the (TG) relay of the sender will operate the proper relays of the district circuit for talking selection the same as for an operator's call. The operation of the (L2) relay will operate the (TG) relay which locks through back contacts of (RN) and (ST1) relays. The operation of (TG) relay operates (TGL) relay through "B" contact of (TG) interrupter, the (TGL) relay locks under control of (TG) relay and short circuits the (L2) relay winding, releasing (L2) relay. The (TG) relay also closes the circuit for the biasing winding of (L) relay and grounds "S" lead and "S1" lead if fig. I is used to hold the district and the connection. The operation of (TGL) relay closes the circuit for operating the (CTL) relay, when the "F" contact of the (TG) interrupter makes. Relay (CTL) operated, locks under control of the (TG) relay and operates relays (SR) and (L1) through contacts of (L) relay or from ground through contacts of (TGL) relay and maintains the short circuit around the (L2) relay winding. (SR) relay operated, steps selector (P) from normal to position 1. With the selector off normal, ground from (RN) arc operates relay (G) which in turn operates relay (G1). Relay (G1) operated, operates relay (CT) and replaces ground from (TG) relay to hold the biasing winding of (L) relay and the locking circuit of (CTL) relay closed. Relays (G) and (CT) hold ground on the off-normal ground leads. (CT) relay operated starts the timing circuit by grounding "INT" lead. Relay (G1) holds ground on "S" and "S1" leads, holding the connection and maintaining a busy trunk condition. Relay (CT) operated, operates relay (ST) from ground through (RV) arc and normal contacts of (RA) and (RN) relays. Relay (ST) locks under control of relay (CT), and operates (ST1) relay through operated contacts of relays (G) and (SR). The operation of relay (ST1) closes the circuit from the back contact of (L) relay to (P) stepping magnet and connects the (PH) relay winding to the back contact of (P) selector, it also releases (TG) relay in turn releasing (TGL) relay. In position 1 relay (SS) operates from ground through (CL) arc. The operation of relays (ST1) and (SS) closes a tone through "S" winding of (DT) coil to ground at relay (SS).

## 5.02 Dialing

The tone through the "S" winding of repeating coil (DT) induces a tone in the "P" winding which is audible at the station under test and is the signal to dial a single digit, "W" wiring and apparatus is special for N. Y. Tel. Co. and

increases the volume of tone and prevents the removal of tone in the ringer test position. The particular digit dialed depends upon the test it is desired to make, as later explained. The pulsing circuit contains the (L), (Ll), (SR), (RA) and (PH) relays and the (P) selector switch. (L) relay is a polarized relay operated on its primary winding over the subscriber loop. The (L) relay secondary winding, which is in series with a condenser, reinforces the primary winding and makes its operation and release quicker and more energetic. The (L) relay tertiary winding biases it and tends to keep its armature on the back contact. (Ll) relay operates and releases with (L) relay, serving to provide additional contacts. (SR) relay operated by (L) relay, holds operated during the momentary releases of (L) relay due to dial breaks. (RA) relay operates through a back contact of (Ll) relay on the first dial break of each digit dialed, and remains operated throughout that string of pulses despite the repeated momentary breaking of its operating path. It releases when the dial comes to rest after sending pulses for one digit. (P) stepping magnet operates and releases stepping its brushes one position each time (L) relay releases and reoperates. (PH) relay insures the operation of the stepping magnet on dial pulses of short duration.

As the dial restores to normal, the dialing loop is successively opened and closed, the number of opens corresponding to the digit dialed. (L) relay releases during the opens, opening the circuit to (SR) and (Ll) relays and closing the circuit to the (P) stepping magnet and (PH) relay. (SR) relay is slow releasing and should remain operated during the pulsing. (Ll) relay will follow the pulses and on releasing will operate (RA) relay. (PH) relay operated, insures the operation of the (P) stepping magnet on pulses of short duration. (PE) relay only remains operated until the (P) stepping magnet operates and breaks its circuit. When (L) relay reoperates and (PH) relay releases, (P) stepping magnet releases, stepping the selector switch one position. (Ll) relay reoperates and the circuit to (SR) relay is reclosed. (RA) relay is slow releasing and will remain operated while (L) and (Ll) relays are reoperated between pulses, this keeps ground from being connected to the feeder brushes of (RV), (A) and (CL) arcs while the selector switch is stepping. After (L) and (Ll) relays have reoperated at the conclusion of a train of pulses, (RA) relay releases. As (P) selector switch advances out of position 1, (SS) relay releases removing dial tone.

### 5.03 Connection to Dial Tester

Should 2, 3, 4 or 5 be dialed the switch will step to position 3, 4, 5 or 6, respectively. When the dial returns to normal after dialing 2, 3, 4 or 5, relay (RA) releases connecting ground to (RV), (A) and (CL) brushes.

Relay (D) operates from ground through (CL) arc, closing lead "HL" to relay (H), connecting battery through resistance (H) to lead "HG", connecting resistance (E) across leads "T" and "R" to 51 type dial tester circuit, opening the circuit of (RA) relay so it will not reoperate, and connecting ground to lead "ST", which is common to other ringer test circuits in the same group and also to connecting circuits at the local test desk. This starts the idle dial tester circuits, hunting for this circuit. If the station under test disconnects before this circuit is seized by a dial test circuit, relay (L) will release in turn releasing (LL) and (SR) relays and operating relay (DS) and in turn operating (RN) relay. (RN) relay operated disconnects ground from (RV), (A) and (CL) brushes releasing relay (D), opening leads "ST", "HL", "T", "R" and "HG" and restoring to normal as described in paragraph 5.08. When this circuit is found by a dial tester circuit, the closed circuit across the leads "T" and "R" causes the dial tester circuit to move off-normal and connect ground to lead "HL" operating relay (H). Relay (H) operated, removes ground from lead "ST" stopping other hunting dial tester circuits, removes battery from lead "HG" and operates relays (DL) and (RS) which lock under control of relay (G). The operation of (DL) relay opens the circuit of (L) relay, releasing it, in turn releasing (LL) and (SR) relays, however the release of (SR) relay at this time will not release the circuit because of the operation of (RS) relay which will operate before the (SR) relay can release. Relay (DL) operated, disconnects battery from lead "HG" and ground from lead "ST" to prevent the reclosure of these leads when relay (H) releases, removes resistance (E) from across leads "T" and "R" to the dial tester circuit, transfers the "tip" and "ring" to the dial tester circuit, and closes in part the operating circuit of relay (DS). The release of relay (SR) causes relay (ST1) to release. The circuit is now under control of the dial tester circuit which is held over the subscriber loop. The kind of test that the dial tester will make depends upon the condition placed upon lead "SP" which is dependent on the position in which selector (P) stops which in turn is dependent on the number dialed. Should 2 be dialed the selector will stop in position 3, relays (RV) and (A) do not operate and lead "SP" is open. This is the condition for low-speed dial test. Should 3 be dialed the selector will stop in position 4, relay (A) operates, connecting ground through resistance (A) to lead "SP". Relay (RV) does not operate. This is the condition for low-speed dial readjust. Should 4 be dialed the selector will stop in position 5, relay (RV) operates and connects 48 volt battery to lead "SP". Relay (A) does not operate. This is the condition for high-speed dial test. Should 5 be dialed the selector will stop in position 6. Both relays

(A) and (RV) operate connecting direct ground to lead "SP". This is the condition for the high-speed dial re-adjust.

#### 5.04 Disconnection from Dial Tester

When the station under test disconnects, the dial tester circuit removed ground from lead "HL" releasing relay (H) operating relay (DS) which locks to ground under control of relay (CT). Relay (DS) operated, opens the tip, ring and sleeve releasing the district circuit, and operates relay (RN), which opens the circuit to relay (PH), opens the pulsing circuit, removes ground from (RV), (A) and (CL) brushes releasing relay (D) and relays (RV) and (A) if operated, and connects ground from (RN) arc to stepping magnet (P) through its break contact causing selector (P) to step to the normal position. If Fig. 1 is used (DS) relay operated also holds ground on the "Sl" lead in crossbar office to hold the test line busy after the office link hold magnet is released. (RN) relay operated, also closes the circuit of the biasing winding of (L) relay to guarantee that the (L) relay contacts 4 and 9 are left open when the circuit is normal. In the normal position relay (G) releases in turn releasing relays (RS), (D1) and (G1). Relay (G1) released, releases relays (CT) and (CT1) in turn releasing relays (ST) and (DS). Relay (DS) released, releases relay (RN). The release of the (RN) relay opens the circuit to the biasing winding of (L) relay and the circuit is normal. Relay (DS) is held operated until after the district circuit is released to prevent interfering with the breaking down of the connection in case this circuit should be seized before it has returned to normal.

#### 5.05 Preparing for Ringer Test

Should 6, 7, 8 or 9 be dialed, the switch will step to position 7, 8, 9 or 0, respectively. When the dial returns to normal and (L) relay reoperates after dialing 6, 7, 8 or 9, relay (RA) releases connecting ground to (RV), (A), and (CL) brushes. Relay (R) operates from ground through (CL) arc. Relay (RC) will operate from ground through (RV) arc if the selector stops in position 8 or 0. Relay (P) Fig. 1D or 1E and "Y" wiring operates from ground thru arc (A) if selector stops in positions 9 or 0. Relay (R) operated transfers the pulsing lead from the back contact of relay (L) from stepping magnet (P) to relay (SS), closes an auxiliary holding circuit for relays (SR) and (L1) under control of relay (SS), opens the circuit of (RA) relay so it will not reoperate, closes in part, an operating circuit for relay (DS) and closes in part, the operating circuit of relay (R1). Battery through the winding of relay (L) remains connected to the ring of the line and ground remains connected to the tip; this is so that the ringer may be tested to determine if it taps on dial pulses and for this purpose any number of digits may be dialed. This circuit will not respond to these dial pulses, for although relay (L) will follow them, selector (P) will not

move and relay (SS) will simulate the action of a selector and pulse help relay in prolonging the holding circuit of relay (SR) when relay (L) releases during the pulsing. When "W" wiring is used tone is connected to the line in order to prevent fraudulent use; this function is special for N. Y. Tel. Co.

In case it is not desired to make the ringer tap test, sufficient time should be allowed for relay (RA) to release after the last pulse, before placing the receiver on the switchhook for receiving ringing current as described below:

#### 5.06 Ringing Test

When the station under test disconnects, relay (L) will release, relay (SS) will operate and relay (SR) will release, releasing relay (ST1) and connecting ground to (RT) brush operating relay (R1). Relay (ST1) released, releases relay (SS). Relay (R1) operated, locks through its make contact, break contact of relay (R2) and make contact of relay (R), reoperates relay (SR), closes the ringing lead to relay (R2). Relay (SR) operated, reoperates relay (ST1) in turn reoperating relay (SS), and operates relay (RS) which locks to the off-normal ground.

If 6 or 8 ("Y" wiring) was dialed the selector will be in position 7 or 9 ("Y" wiring) and relay (RV) will not be operated and ringing current will be connected to the ring and ringing ground to the tip for testing bridged ringers or ringers on the ring side of the line.

If 7 or 9 ("Y" wiring) was dialed the selector will be in position 8 or 0 ("Y" wiring) and relay (RV) will be operated and ringing current will be connected to the tip and ringing ground to the ring, for testing ringers on the tip side of the line.

If 8 or 9 was dialed the selector will be in position 9 or 0 and if Fig. 1D is used relay (P) will be operated. When relay (R1) operated the "PU" lead is closed thru the (P) relay operated to operate relay (PU) on the next closure of the "PKU" interrupter. Relay (PU) operated locks thru relay (P) operated to the "ON" ground and connects the two ring code ringing to the (R1) relay to start ringing.

If 8 or 9 was dialed the selector will be on position 9 or 0 as stated above but if Fig. 1E is used instead of 1D the (P) relay will operate and change the circuit to (R2) relay winding from  $\pm -$  to  $\pm +$ .

#### 5.07 Tripping

When the receiver at the station under test is removed from the switchhook the increased flow of current through the

winding of relay (R2) should operate it, releasing relay (R1). When relay (R1) releases, it breaks the ringing current to the line and operates relay (RN). Relay (RN) operated, opens the circuit to relay (PH), opens the pulsing circuit, removes ground from (RV), (A) and (CL) brushes releasing relay (R) and connects ground from (RN) arc to stepping magnet (P) through its own break contacts. Relay (R) released, releases relay (SS). Selector (P) steps to the normal position. With relay (R1) released, relay (L) is again connected to the line and operated over the subscriber loop, holding relay (SR) operated in turn holding relay (ST1) operated. With the selector in the normal position relay (G) releases, releasing relays (RS) and (ST1). Relay (RS) released, releases relay (RN). The circuit for relay (G1) is transferred from the make contact of relay (G) to the break contact of relay (G) and the make contacts of relays (ST) and (SR). It remains operated, holding relay (CT) and relay (CT1) operated. The release of relay (RN) closes a circuit from ground on (RN) brush and normal terminal through make contacts of relay (SR) and break contacts of relay (RN), stepping selector (P) from normal to position 1. With the switch off normal, relay (G) is operated from ground on (RN) arc, reclosing the circuit through its make contact to relay (G1) and operating relay (ST1). In position 1 the dial tone circuit is again closed and the circuit is in the same condition as it was before dialing started. The ringer tests may be repeated or connection may be made with the dial tester by dialing the proper code.

#### 5.08 Station Disconnection After Ringer Test or Abandoned Call

Should 0 be dialed, the selector will advance to the next normal position, and as relay (SR) has not released, it will immediately advance to position 1. If the station under test disconnects with this circuit in position 1 before dialing is started or after making a ringer test, or with the selector switch in position 2, (9 or 0 Fig. 1C and "Z" wiring) relay (L) will release. Relay (RA) will operate removing ground from (RV), (A) and (CL) brushes and relay (SR) will release, releasing relay (ST1) and connecting ground to (RT) brush operating relay (DS). Relay (DS) locks under control of relay (CT) and with "N" wiring or Fig. I (G1) relay also, it opens the tip, ring and sleeve, releasing the district circuit, connects ground to "TL" lead, and operates relay (RN). Relay (RN) operated, opens the circuit to relay (PH) and connects ground from (RN) arc to stepping magnet (P) through its own break contact. Selector (P) steps to the normal position. When in the normal position, relay (G) releases, and as relay (SR) is released, relay (G1) releases, in turn releasing relay (CT), and (CT1) relays. The release of relay (CT) removes ground from the off-normal ground leads, releasing relays (ST) and (DS), in turn releasing relay (RN) and the circuit is normal. Relay (DS)

is held operated until after the district circuit is released to prevent interfering with the breaking down of the connection, in case this circuit should be seized before it has returned to normal.

#### 5.09 Battery Failure

Should the battery supply be cut off from the circuit, all the relays will be released. An associated district circuit in its cut-through condition will release as ground will be removed from the "S" lead, and an associated 51 type dial tester circuit will be released. When the battery supply is again connected, relays (G), (G1) and (CT) operate. Relay (DS) will operate through (RT) arc if the switch is in any off-normal position except 7 or 8 and 9 or 0 "Y" wiring and if in position 7 or 8, and 9 or 0 "Y" wiring relay (R) will operate through (CL) arc, and as relay (ST) is released, ground through its break contact and the make contact of relay (R) will operate relay (DS). Relay (DS) operated, restores the circuit to normal as before described. "N" wiring insures a locking circuit for (DS) relay before its operating circuit is opened by the release of (R) relay and operation of (RA) relay.

#### 5.10 Automatic Release and Stuck Alarm

When relay (CT) operates, it connects ground to the common lead "INT", closes through lead "A" to relay (ZA) and lead "B" to relay (ZB) and supplies battery for locking relays (ZA) and (ZB). Ground on lead "INT" causes the timing circuit, shown as Fig. 3 or on the 51 type dial tester circuit, to function. A selector in the timing circuit advances under control of a slow interrupter. In certain positions of this selector, battery is connected to lead "A" and in certain other positions, battery is connected to lead "B". As long as lead "INT" is grounded, battery is thus connected first to one lead then after a definite interval of time to the other lead then after the same interval of time to the first lead and so forth. The lead to which battery is first connected, lead "A" or lead "B", depends upon the position in which this selector was standing when relay (CT) operated. Assume that battery is connected to lead "B" first. This operates relay (ZB), which locks under control of relay (CT). A definite length of time after battery is connected to lead "B" battery will be connected to lead "A", operating relay (ZA). Relay (ZA) locks, and as relay (ZB) is operated, ground is connected to "TA" lead and relay (DS) operates, restoring the circuit to normal and releasing all the operated relays. The district circuit will restore, and in order to make further tests, a call must be again built up. The maximum time before the automatic disconnect will function is approximately twice the minimum time. If due to some trouble, this circuit fails to restore to normal within a definite length of time after both relays (ZA) and (ZB) are

operated, battery will be connected to lead "C" operating relay (AL). Relay (AL) locks under control of relay (ZB), lights lamp (TL) and closes a common alarm circuit, indicating that a ringer test circuit is stuck.

### 5.11 Timing Circuit Fig. 3

When "INT" lead is grounded by a ringer test or dial tester circuit, the common timing circuit shown as Fig. 3 will function in the following manner. When "F" contact of "AL" interrupter closes, (C) relay operates. When "B" contact of "AL" interrupter closes, (SA) relay operates, holding ground on "INT" lead and operating (AL) stepping magnet. When "B" contact opens (SA) relay releases, releasing (AL) stepping magnet advancing (AL) selector switch one step. (AL) selector switch will advance in this manner as long as "INT" lead is grounded. When (AL) switch steps on to a position where brush "1" is connected to ground, (SA) relay will operate through the break contact of (AL) selector. (SA) relay operated, operates (AL) stepping magnet, releasing (SA) relay in turn releasing (AL) stepping magnet, advancing (AL) selector switch independently of the interrupter. When (AL) selector switch is on terminal 1 or 11, battery is connected to "A" lead while (C) relay is operated. Similarly, when (AL) selector switch is on terminal 6 or 16, battery is connected to "B" lead while (C) relay is operated, and when (AL) selector switch is on terminal 2, 7, 12 or 17, battery is connected to "C" lead while (C) relay is operated. Battery is thus connected to "A" lead for a short interval and then after a definite length of time, battery is connected to "B" lead for a short interval, then after the same definite length of time battery is connected to "A" lead and so forth. Battery is connected to "C" lead for a short interval, a definite length of time after it is connected to "A" lead and a definite length of time after it is connected to "B" lead. The interval between the time when battery is connected to "A" lead, and the time when battery is connected to "B" lead, depends upon the connections of "A" and "B" straps, as shown in the table under Circuit Notes.

The timing circuit is common to the group of ringer test and dial tester circuits and is so arranged that when the circuits are held for more than the allowed time, the ringer test circuit is automatically disconnected. This time varies between a definite minimum and maximum depending upon the position of (AL) selector when the call is started.

### 5.12 Register Circuit Fig. 2

The operation of (DS) relay of any of the ringer test circuits connects ground to the common "TL" lead, operating (TL) relay. (TL) relay locks to the back contact of (TL) message register. The locking circuit for (TL) relay is

broken when (TL) message register operates. The grounding of the common "TA" lead by any of the ringer test circuits, causes (TA) relay and (TA) message register to operate in the same manner as described for the (TL) relay and (TL) message register.

#### 5.13 Test Jack

The plug of a dial hand test telephone set may be inserted into (T) jack, if it is desired to test the operation of the circuit. Ground through the local contact of the jack, will hold the circuit busy. The bridged transmitter and receiver of the hand set will start the circuit functioning, as if seized in the regular manner, and the dial may be used to set up ringing or dial test conditions.

#### 5.14 (L) Jack

The (L) jack is provided so as to test and readjust the (L) relay.

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