CIRCUIT DESCRIPTION

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ISSUE 3AC
APPENDIX 1B
DWG ISSUE 4B

TRAFFIC MANAGEMENT SYSTEMS
DIAL PULSE MONITORING CIRCUIT
FOR USE WITH
SERVICE OBSERVING CIRCUITS

CHANGES

B. Changes in Apparatus

B.1 Added

To convert option Z to option Y in Fig. 1:

1 - (LL) Diode 446F
1 - (LL) Relay AF70
1 - (LL) Resistor, 100 Ohms per KS-13491, L1

D. Description of Changes

D.1 Changes are made in Fig. 1 to adapt this circuit for monitoring on Unigauge subscriber lines in a No. 5 crossbar office.

(a) The original wiring, for use without Unigauge lines, is now designated option Z.

(b) The added wiring and apparatus for use with Unigauge lines is now designated option Y.

(c) Three added connecting leads (19, 20, and 21) to the Service Observing Circuit are required with option Y.

D.2 Circuit Note 101 is expanded to include an added -72 volt battery supply, lead 19.

D.3 Circuit Note 102 has been expanded to include added options Y and Z, for use in Fig. 1, and to indicate that Fig. 2 should be provided when both panel and crossbar No. 1 lines or trunks are to be observed.

D.4 An Option Index, Circuit Note 104, has been added.

D.5 Test Note 6 has been added for the P(280CE) relay to clarify the NGB test information.

D.6 The title is changed to agree with other traffic management series drawings.

F. Changes in Description of Operation

F.1 In Section II, under 5. OPERATION WITH SERVICE OBSERVING CIRCUITS, designate existing first paragraph as 5.1, and add 5.2 as follows:

5.2 When all lines or trunks to be observed are in a crossbar No. 5 office without any Unigauge lines, the description in 5.1 applies, for Fig. 1 with Z option wiring. However, when all lines or trunks to be observed are in crossbar No. 5 office with any Unigauge lines, Fig. 1 with Y option wiring functions as in 5.1 except:

(a) -72 volt battery is applied via lead 19.

(b) Lead 20 connects to an M lead in a Fig. 7 or 13 in SD-90647-01. This lead controls the LL relay. On other than Unigauge calls, ground appearing on the M lead does not operate the LL relay. On Unigauge calls, +130 volt (via a resistor and lamp in the dial tone marker) on the M lead causes the LL relay to operate on its primary winding via the LL diode.

(c) The LL relay is locked to ground on its secondary winding via a make contact on the DP relay, a lead 21 and a make contact on an operated AS relay of Fig. 7, or a G relay of Fig. 13 in SD-90647-01.

(d) The operated LL relay switches the reference bias of the V electron tube from -48 to -72 volts and inserts an added 100 ohms of cathode 2 bias resistance during Unigauge pulsing and supervision.

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DEPT 5822-RWU-WAM

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COMMON SYSTEMS
DIAL PULSE MONITORING CIRCUIT
FOR USE WITH
SERVICE OBSERVING CIRCUITS

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. This loop pulse detector circuit is a high impedance, balanced input, electron tube device capable of responding to small DC signal changes; and at the same time is highly insensitive to longitudinal AC or DC earth potentials appearing on the loop.

The high impedance input permits the monitoring of dial pulses without appreciable shunting effect on the subscriber's line circuit or the common control circuits used for pulse registration, and provides corresponding ground pulses for the operation of a pen register circuit.

SECTION II - DETAILED DESCRIPTION

1. TESTING AND ADJUSTMENT

1.1 The (DP) Relay Normal

The (DP) relay is kept normal during testing by use of the (A) or (B) jacks which cut off the battery supply (-48V over lead "11") to the (DP) relay winding and ground lead "9" as a busy signal to the S.O. Circuit when required. The (DP) relay normal assures that input signals appearing on the "T" and "R" leads. "17" and "1" from the Service Observing Circuit, are excluded from the (V) electron tube circuit during testing; and ground (over lead "8") is kept from the armatures of the (P) and (P1) relays to prevent unwanted signals from appearing on the "6" lead to the S.O. Circuit.

The (A) and (B) jacks are also used in the adjustment of the (P) and (P1) polar relays as outlined in the C.R. table.

1.2 Tube Circuit Adjustment

Normal contacts on the (DP) relay apply artificial "T" (95 ohm ground) and "R" (226 ohm battery) test potentials and a dummy loop resistance twice the maximum anticipated actual loop (adjustable at resistors M and N), to the input grids of tube (V). With these test conditions applied, the (A) potentiometer may be adjusted to balance out differences in the two triode sections of tube (V). As outlined in the C.R. table, a voltmeter connected across pin jacks (P4) and (P6) will read zero when a balance is reached.

1.3 Balanced Circuit of the (P) Relay

This balance or test condition of the electron tube circuit results in equal currents flowing in the two plate circuits. Since the identical primary (P) and secondary (S) windings of the (P) polar relay in the plate circuits are connected in opposite polarity, with the (P) producing operating ampere-turns and the (S) producing releasing ampere-turns. The ampere-turns developed in these two windings at this time are equal but opposite, thereby cancelling each other.

During testing the tertiary winding (T) circuit of relay (P) is opened by the use of jack (B) and the (DP) relay normal. However, in normal circuit operation the (T) winding circuit with series resistance (T) provides additional operate ampere-turns for the (P) relay.

2. PREPARATION FOR DIAL PULSING

2.1 Operation of (DP) Relay

After the tube circuit is balanced, and plugs are removed from the (A) and (B) jacks, a ground on lead "5" from the S.O. Circuit, will cause the (DP) relay to operate. With Fig. 1, during the operate time of the (DP) relay, ground on lead "5" through a break contact on the (DP) relay is applied to the (-6) terminal of the (P1) relay. Therefore, current flows through the secondary winding of the (P1) relay in a nonoperate direction, and capacitor (C) maintains this flow during the transfer time of the (DP) relay.

With Fig. 2, (-48V) (V) resistance battery through primary winding of (P1) flows to ground (in the nonoperate direction) via a break contact on (DP) normal, to assure that (P1) will remain down while awaiting an observation with (DP) normal. With the (DP) and (P) operated, prior to the first dial pulse, (V) resistance (-) battery appears at (+2) terminal of (P1) and ground appears at (-5) terminal of (P1) via make contacts on the (P) and (DP) relays, to hold (P1) nonoperated.

These features provide that the (P1) relay will be nonoperated when the (DP) relay operates and cuts the "T" and "R" leads (17 and 1) through to the S.O. Circuit. This is done to safeguard against false pen register operation prior to the first open of the dial contacts.

Operation of the (DP) relay also closes the tertiary (T) winding circuit of the (P) relay, to provide some additional operating ampere-turns.

Operation of the (DP) relay also transfers one grid return and the common cathode return of the (V) tube, from battery supplied over the "11" lead (necessary for balancing the tube circuit) to battery supplied over the "18" lead for actual observations.

2.2 Operation With One or Two Power Plants

When all the lines or trunks to be observed are powered by a single (45-50V) power plant, the "11" and "18" leads are supplied from the same fuse in the S.O. Trunk Circuit.

When the lines or trunks to be observed are supplied by two (45-50V) power plants, the S.O. Trunk Circuit will furnish an average potential to the "18" lead during observations.

3. LOOP DIAL PULSING

3.1 Operation of (P) Relay

When the Monitoring Circuit input is cut through to the S.O. Circuit, by the operation of the (DP) relay, the balanced condition of the (P) relay will change due to the changes in grid voltages detected on the "T" and "R" leads. There will be a decrease of current flow in the (S) winding and an increase of current flow in the (P) winding of relay (P), with a combined effect of producing an excess of operating ampere-turns, to retain relay (P) operated. This operation of the Monitoring Circuit will be noted: (P) relay operated, whether the termination is of infinitely high resistance or the (T) and (R) are cut through to a subscriber's line circuit in an "off-hook" condition with a Common Control Circuit (No. 5 Crossbar D.P. Register Circuit, for example) attached.

On a "cut through" to the S.O. Circuit with an "off-hook" condition, and before dialing is started, the negative potential at grid 7 will be greater, while the negative potential at grid 3 will be less, than when the circuit was in its balanced or test condition; therefore the (P) relay remains operated. Relay (P) operated, closes a circuit and relay (P1) remains released. When the dial contacts open on the first pulse, the negative potential (due to negative battery on the "R") at grid 3 is increased resulting in a decrease in plate current in the primary winding of relay (P), which is a decrease in operating ampere-turns. At the same time (due to ground on the "T") the negative potential at grid 7 will be less, the plate current in the secondary winding of relay (P) will increase; since this is a sufficient increase in releasing ampere-turns, in addition to the decrease in operating ampere-turns, the (P) relay releases.

3.2 Operation of (P1) Relay

With Fig. 1 each time the (P) relay releases due to a dial pulse, the (P1) relay operates due to its differential (S) winding being opened, and closes a circuit for operating the pen register.

With Fig. 2, each time the (P) relay releases due to a dial pulse, the (V) resistance (nonoperate) battery is shunted out, and (W) resistance (operate) battery causes the (P1) to operate.

3.3 Purpose of Input Capacitors (A) & (B)

The capacitors (A) and (B) across the inputs of electron tube (V) delay the action of the tube circuit on the opening of the dial contacts, thereby preventing false registrations or split pulses due to momentary surges during or immediately after dialing.

3.4 Release of (P1) Relay

With Fig. 1 a network consisting of capacitor (C) and resistance (K) controls the release of relay (P1), in order to provide sufficient delay to prevent it from reoperating on surge conditions appearing on the observed line during the return of the dial to normal, and prevents objectionable interference with regular dial pulses.

With Fig. 2, when the (P1) relay operates, it opens the shunt down path on the (positive) (U) resistance battery, allowing the (C) capacitor to charge via the tertiary winding of the (P) capacitor charging current holds the (P) operated, even during momentary input transients.

4. DISCONNECT

When the subscriber disconnects, at the end of the call, the loop is opened (on-hook), the (P) relay is again released, causing the (P1) relay to operate and in turn operate the pen register until the S.O. Circuit releases.

5. OPERATION WITH SERVICE OBSERVING CIRCUITS

When this circuit is used with a Service Observing Circuit for observing local originating service or for complaint observing at a service observing desk it functions as follows:

(1) Ground is connected to leads "8".

(2) 45-50 volt battery is apllied to leads "11" and "18".

(3) 100-135 volt battery is supplied to lead "16".

(4) Monitoring circuit "stands-by" with (DP) relay normal and tube (V) "stands-by" in a test or balanced condition.

(5) When the S.O. Circuit recognizes an originating call for observation, the "5" lead is grounded, and leads "17" and "1" are cut through to the "T" and "R" of the line to be observed.

(6) When ground appears on the "5" lead it starts the operation of the (DP) relay and through normal contacts of the (DP) relay assures that the (P1) relay will be down when the (DP) operates, this prevents false signals prior to dialing.

(7) Dial pulses are recognized as previously described in Section II, Part 3.

(8) The output of the monitoring circuit appears as ground closures on lead "6".

(9) During testing or adjustment within the monitoring circuit, lead "9" is grounded, as a "make busy" condition for the S.O. Circuit when required.

6. OPERATION WITH DIAL PULSE RECORDING CIRCUIT, SERVICE OBSERVING SET NO. 6

When this circuit, relay rack mounted along with the Dial Pulse Recording Circuit, is used as part of the semiportable No. 6 S.O. Set for observing on originating traffic on A-B toll and PBX trunks it functions as follows:

(1) On "stand-by" (all "MON" keys normal in S.O. Set No. 6) the monitoring circuit has:

45-50 volt battery supplied to leads "11" and "18".

100-135 volt battery supplied to lead "16".

Ground on "T" of jack (DSO) connected to "17".

2000 ohm battery on "R" of jack (DSO) connected to "1".

(2) When the portable box portion of the S.O. Set No. 6 is plugged up to its power supply and patched to the (DSO) jack of the D.P. Recording Circuit, the T and R conductors are connected through to leads "17" and "1" of the monitoring circuit for input purposes. The sleeve conductor furnishes ground to operate the (SL) relay.

(3) Operation of the (SL) relay on "patch-up" connects ground to leads "5" and "8". Consequently the (DP) relay operates and the tube circuit (V) is energized.

(4) In this case, with the (DP) relay operated, the tube circuit does not "stand-by" in a balanced or test condition; but rather cut-through on leads "17" and "1" to the equivalent "off-hook" condition (ground and 2000 ohm battery) with all (MON) keys normal. When a (MON) key is operated to observe on an originating call these "stand-by" conditions are removed and the conditions prevailing on the T and R of the trunk under observation appear on leads "17" and "1".

(5) These input changes on leads "17" and "1" prior to the first open of the dial all retain the "off-hook" condition, relay (P) operated and relay (P1) released. However, with the first break of the dial contacts, these pulses are recognized as previously described in Section II, Part 3.

(6) The output of the monitoring circuit appears as ground pulses on lead "6" to the D.P. Recording Circuit for the operation of a pen register patched to a (PR) jack.

7. OPERATION WITH SERVICE OBSERVING SET NO. 4

When this circuit is used with the portable S.O. Set No. 4, it is shown as a part of the portable Dial Pulse Recorder Set No. 2 for the operation of a pen register. The required voltages (45-50) (100-135) and ground are supplied to leads "11", "18", "16" and "8" respectively, to activate the monitoring circuit in a balanced or "stand-by" state with the (DP) relay normal (see Section II, Part 1).

The control lead "5" and input leads "1" and "17" are shown terminating in a (RCDR) jack. This jack is patched (T, R, and S) to the (DP-RCDR) jack of the S.O. Set No. 4. When this patch is completed, ground over the Sleeve appears on lead "5", operating the (DP) relay (see Section II, Part 2).

The T and R in the S.O. Set No. 4 are patched through to leads "17" and "1" and the operated (DP) relay contacts to the input of the (V) tube circuit. Until an originating call is noted and a key on the No. 4 Set is operated, the T and R are not terminated and the monitoring circuit remains in an "off-hook" condition, (P) operated, and (P1) normal.

When a key is operated and the T and R are cut through to the subscriber's line or trunk the monitoring circuit will remain in the "off-hook" condition until the first open of the dial contacts. Dial pulses are recognized as outlined in Section II, Part 3.

The output of the monitoring circuit appears as ground closures on lead "6" which is wired via a lead "A" to the sleeve of the (REG) jack. The pen register when patched to this (REG) jack receives 170 ohm (45-50 volt) battery over the tip and operates in response to the ground pulses on the sleeve coming from the monitoring circuit.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

Max. Ext. Ckt. Loop Res.	3,000 ohms
Min. Insulation Res.	10,000 ohms
Max. Earth Potential	±20 volts
Dial Pulse Rate	8 to 20 PPS (Fig 1) 8 to 15 PPS (Fig. 2)
Battery Supply (between leads "8" and "11" or "18"	(-) 45-50 volts
Plate Bat. Supply (between leads "8" and "16")	(+) 100-135 volts

2. FUNCTIONAL DESIGNATIONS

Jacks

A B	Test and Make Busy) Test and Make Busy)	For Testing Relays and making the S.O. Ckt. busy when required
P4 P6	Tube Ckt. Balance) Tube Ckt. Balance)	For use when adjusting pot. (A)

Relays

DP	Switching	Testing to dial pulsing
P	Pulsing (Input)	Responds to unbalance of vacuum tube bridge due to dial pulses
P1	Pulse Timing (Output)	Follows the output of relay (P), but has a delayed release

Vacuum Tube

V	Pulse Detector	Dual triode used in a bridge circuit, to differentially operate relay (P) in response to dial pulses

3. FUNCTIONS

3.1 To provide a high impedance input for monitoring dial pulses without appreciable shunting effect on the subscriber's line circuit or the common control circuits used for pulse registration.

3.2 To repeat the dial pulses or switchhook signals originating on a subscriber's line or trunk circuit to a pen register circuit.

3.3 To provide a "make-busy" ground on lead "9" to the S.O. Circuit (when required) for the balancing of the vacuum tube circuit, the testing of relays, or other maintenance.

4. CONNECTING CIRCUITS

When the circuit is listed on a keysheet the connecting information thereon is to be followed:

4.1 Service Observing Circuits:

SD-90647-01 (S.O. Desk No. 7 or 12)
SD-90580-01 (S.O. Desk No. 10)
SD-96553-01 (Crossbar Tan. Inc. Trks.)

4.2 Dial Pulse Recording Circuit, Service Observing Set No. 6 - SD-95477-01.

4.3 Service Observing Set No. 4 - SD-95070-01.

Dial Pulse Recorder Set No. 2, for use with Service Observing Set No. 4 - SD-95882-01.

SECTION IV - REASONS FOR REISSUE

CHANGES

B. CHANGES IN APPARATUS

B.1 Added Fig. 2.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Fig. 2 wiring and apparatus has been added, to be used in place of Fig. 1 wiring and apparatus, to prevent momentary releasing of the (P1) relay due to input transients, when observing on lines or trunks in Panel or Step-by-Step offices.

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