COMMON SYSTEMS
ANSWERING TIME RECORDER
CONCENTRATING TIMING CONTROL
AND TESTING CIRCUIT
PERMANENT TYPE
FOR USE WITH AUXILIARY OR INTERTOLL TRUNKS

CHANGES

B. CHANGES IN APPARATUS

B.1 Added:

DESIG	CODE	OPTION
DIODE D	420 B *	ZQ
DIODE E	420 B	ZR

D. DESCRIPTION OF CHANGES

D.1 Diodes D and E are introduced in Fig. 9 to provide the isolation feature previously provided by relay BC. The diodes will now eliminate the variable load condition which was confronted when connecting different size trunk groups via the switching circuit.

D.2 Application of diode D ("ZQ"option) and diode E ("ZR" option) in Fig. 9 is included in Circuit Note 104.

D.3 Eliminating isolation feature of relay BC causes Circuit Notes 120 and 303 to be Mfr Disc.

D.4 CAD Fig. 61, 62, 63, and 64 have been changed to agree with circuit changes.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2365-NB-WAM

COMMON SYSTEMS
ANSWERING TIME RECORDER
CONCENTRATING TIMING CONTROL
AND TESTING CIRCUIT
PERMANENT TYPE
FOR USE WITH AUXILIARY OR INTERTOLL TRUNKS

CHANGES

D. DESCRIPTION OF CHANGES

D.1 Note 104 is changed to clarify observing or coin zone circuits, when the ATR switching circuit is or is not provided..

D.2 The connecting information of Figs. 2, 8, 9, 10 and 21 has been changed to read "To Observed circuits or to Answer Time Recorder Sw. Circuit."

D.3 CADs 52, 61, 62, 63, 64 and 65 are changed.

4. CONNECTING CIRCUITS

When this circuit is listed on a Keysheet the connecting information thereon is to be followed.

4.18 Special Toll Non Coin Incoming Trunk Circuit - SD-27083-01 (Typical)

4.19 Special Toll Coin Incoming Trunk Circuit - SD-27097-01 (Typical)

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2361-JEK-AAB-SJ

COMMON SYSTEMS
ANSWERING TIME RECORDER
CONCENTRATING TIMING CONTROL
AND TESTING CIRCUIT
PERMANENT TYPE
FOR USE WITH AUXILIARY OR INTERTOLL TRUNKS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 104 is changed to show the required options for observing on senders. This information was inadvertantly removed on the previous issue.

D.2 Note 108 is changed to show the special rating of Options ZK, ZM, and ZN. This information was inadvertantly omitted on the previous issue.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2361-RDK-AAB-JW

COMMON SYSTEMS
ANSWERING TIME RECORDER
CONCENTRATING TIMING CONTROL
AND TESTING CIRCUIT
PERMANENT TYPE
FOR USE WITH AUXILIARY OR INTERTOLL TRUNKS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 104 is changed, and Notes 120 and 303 are added, to clarify the application of Fig. 21 as isolating relays, and to rate this application "Special".

D.2 Note 119 is changed to clarify the method of modifying existing circuits to add the BC relays of Fig. 21, and to provide for such modification when the relays are required for battery conversion purposes.

D.3 The title of Fig. 21 is changed to include reference to its function as isolating relays, and reference to Notes 104, 120, and 303 is added.

D.4 Reference to Notes 119, 120 and 303 is added to the Fig. 21 entry in the record table of Note 108.

1. PURPOSE OF CIRCUIT

1.1 The circuit indicates by means of message registers the number of times it associates it self with a line or trunk having a lighted lamp and the number of such connections in which the answering time exceeds a predetermined value. This time may be set between 3 and 28-1/2 seconds by means of optional connections on one arc of the timing selector.

2. WORKING LIMITS

	45-50V		
	"M" Option (DA and TC Rel)	"K" Option (DA and TC Rel)	
Max.Ext.Ckt. Loop Res.	3400ω		
Max.Ext.Ckt.		3400ω	1400ω
Min.Ins.Res.	30,000ω	30,000ω	30,000ω
Max.Earth Pot.		0V	±20V

3. FUNCTIONS

3.01 Provides means for associating a line or trunk with the timing circuit.

3.02 Provides means for operating a message register each time the timing circuit is associated with a line or trunk.

3.03 Provides means for operating a message register if the line or trunk is not answered within a predetermined time.

3.04 Provides means for restoring the circuit to normal if the call is abandoned, or the operator answers, or the call reaches the timing period and the delayed answer register scores.

3.05 Provides means for connecting to only one line or trunk at a time.

3.06 Provides means for isolating an unanswered call, originated during a previous timing interval, from the common timing circuit.

3.07 Provides means for testing the concentrating and timing features of this circuit.

3.08 Provides means for key or switch control of either of two pre-set timing intervals.

3.09 Provides means for use with flashing lamp signals.

3.10 Provides means for absorbing trunk test flash and other short pulses.

3.11 Provides means for locating the message registers in a distant CAMA office.

3.12 Provides means for recording on the registers located in the distant office or, by transferring, on the registers located in the local terminal room.

3.13 Provides for operation with an associated Traffic Weighting Applique Circuit for the purpose of improving the accuracy of the data recorded.

3.14 Provides means for preventing reseizure of the timing circuit during the same timing interval.

3.15 Provides means for isolating the trunk lamp circuits from the inputs to the associated Traffic Weighting Applique Circuit, to prevent lamp circuit changes from affecting the sensitivity of the counting circuit.

4. CONNECTING CIRCUITS

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

4.1 Observed Circuits.

4.11 Line and Trunk Circuits - Toll, Manual DSA, and Teletypewriter Swbds., Information Desks Nos. 2, 3, 4, and 6 - SD-62614-01 (Typical).

4.12 Incoming Trunk Circuit, Op. Rm. Desk No. 23 - SD-95513-01, SD-95740-01.

4.13 Common Systems - Coin Zone Operator's Trunk Ckt. - SD-95851-01.

4.14 Crossbar No. 5 - Coin Zone Outgoing Trk. or Junctor Ckt. - SD-26078-01.

4.15 Panel or Cbr. No. 1 - Coin Zone Outgoing Trk. - SD-96518-01.

4.16 Step-by-Step - Coin Zone Outgoing Trk. - SD-32317-01.

4.17 Sender Circuits - SD-25961-01, SD-25999-01, SD-27024-01, SD-68489-01, SD-32261-01, SD-26056-01.

4.2 Register Circuits

4.21 Registers Mounted in Traffic Register Cabinet - (SD-95531-01).

4.211 SXS Traffic Register Ckt. - SD-30896-01.

4.212 Crossbar No. 1 and Crossbar Tandem Traffic Register Ckt. - SD-25942-01.

4.213 Crossbar No. 5 Traffic Register Ckt. SD-25892-01.

4.214 No. 4A Toll Traffic Register Ckt. - SD-68412-01 (See 4.22).

4.215 3CL Toll Swbd. and No. 23 Op. Rm. Desk Traffic Register Ckt. - SD-56233-01.

4.22 Register Not Mounted in Cabinet per SD-95531-01.

4.221 Panel GCO Miscellaneous Registers - SD-20141-01.

4.222 Panel BCO Miscellaneous Register Ckt. - SD-21537-01.

4.223 Crossbar No. 1 and Cbr. Tdm. Traffic Register Ckt. - SD-25317-01.

4.224 Crossbar No. 5 Traffic Register Ckt. - SD-25890-01.

4.225 SXS Traffic Register Ckt. - SD-31109-01.

4.226 No. 4A Toll Traffic Register Ckt. - SD-68412-01 (See 4.21).

4.3 Interrupter Circuits

4.31 Manual - 60 or 120 IPM BR1 Terminal.

4.32 SXS - 30, 60 or 120 IPM Interrupter Ckt. - SD-31606-01.

4.33 Cbr. No. 5 - 60 or 120 IPM Interrupter Ckt. - SD-25814-01.

4.34 No. 4 or 4A Toll Interrupter Ckt. - SD-68058-01.

4.35 Power Ringing Ckt. - SD-80978-01.

4.4 Miscellaneous Circuits

4.41 Answering Time Recorder Switching Ckt. - SD-96360-01.

4.42 Traffic Weighting Applique Ckt. - SD-96497-01.

DESCRIPTION OF OPERATION

5. ANSWERING TIME RECORDER WITHOUT TRAFFIC WEIGHTING APPLIQUE

Figs. 1; 2, 8, 9, or 10; A or B; C or D; E or F; G or H; and J or K; Options "J" and "ZA"; and Figs. 3, 4, 5, 6, 7, 11 or 22, 12, 13, 14, and 18, and Option "ZE", as required.

5.01 General

This circuit is used to automatically observe and record the number of times the operator answering time on lines or trunks exceeds a predetermined time in seconds. This "delayed answer" interval is controlled by the wiring of an "A" lead on bank 3 of the TM selector, the position of the TT key, if provided, or the (TT) relay of the associated Switching Circuit, if used, and the provision of Option "G", as required. When the circuit is idle, the TM selector rests in terminal Position 1.

5.02 Connections

The "L" lead is connected to the lamp lead of a line or trunk whose associated line or trunk lamp is connected to battery, while the "L1" lead is connected to the lamp lead of a line or trunk whose associated line or trunk lamp is connected to ground. In the case of the incoming trunk circuit for the No. 23 operating room desk, the "L1" lead is connected to the service observing "L" lead of the trunk, as no answer lamp is

used. In other cases where no answer lamp is used, direct connections can be made, as for dial office sender circuits, and CAMA sender circuits, using the "ATR" lead, and coin zone operator trunk or junctor circuits using the "ATR1" lead.

5.03 Call Originated and Seizure

When a call is originated on an associated line or trunk, (A) operates through its secondary winding to ground on the "L" or "ATR" lead or through its primary winding to battery on the "L1" or "ATR1" lead. (A) operated operates (SU) through its primary winding to ground on the "L" or "ATR" lead or through its secondary winding to battery on the "L1" or "ATR1" lead.

SU operated:

(a) Opens one operating path of the RL relay.

(b) Partially completes the operating circuit of the DA register.

(c) Partially completes the circuit for lighting the BY lamp.

Figs. A and H provided -

(d) Operates SR1, which in turn operates SR2, which opens the same RL operating circuit at another point.

(e) Operates LK.

Figs. B and G provided -

(f) Shunts down the SR relay. SR released operates LK. The slow release SR relay provides a delay in locking the timing circuit to a call signal. This prevents the circuits being seized by short false signals like teletypewriter "hits", or the preliminary pulse caused by a panel office trunk guard test.

(g) Prepares the LK locking circuit.

LK operated:

(a) Locks to ground at contacts of RL (Fig. J) or RL1 (Fig. K) released, direct (with Fig. H) or thru contacts of SU (with Fig. G).

(b) Locks the operated A relay. If two A relays have operated simultaneously, the one nearest the LK contact in the locking chain will remain locked up.

(c) Operates all B relays in multiple.

(d) Operates the (TC) register directly, if Fig. 4 or 18 without Fig. 22 is furnished; or operates the (BP) relay of Fig. 11 or 22, or the (DBP) relay of Fig. 14. The (BP) relay of Fig. 11 operates the (TC) register of Fig. 12 or of the traffic or miscellaneous register circuit. The (BP) relay of Fig. 22 operates the (TC) register of Fig. 4, 12 or 18, or of the traffic or miscellaneous register circuit, and prepares a locking circuit for the (RT) relay. In addition, if Option "ZE" is furnished, the (BP) relay of Fig. 22 also operates a second or duplicate (TC) register in the traffic or miscellaneous register circuit. The (DBP) relay of Fig. 14 functions as described in Paragraph 5.09 to operate the (TC) register or registers in a distant office.

(e) Connects the P relay to the interrupter lead, if Fig. L is provided; or, operates the ST relay, which connects P to the interrupter lead and grounds the "ST" lead to the interrupter circuit in a No. 5 Crossbar Office, if Fig. M is provided.

In addition, the LK relay connects ground from contacts of RL or RL1 released, and through contacts of SU if Fig. G is furnished, to various points in the circuit, including contacts of LK1, TM, and R, the brush of selector bank 3, and, thru normal contacts of TM released, to contacts of RA, if provided, and to terminal 1 of selector bank 1. This action of LK results in the following additional functions:

(f) Prepares locking circuits for LK1, TM, R, and RA.

(g) Prepares a circuit, thru bank 3 of the timing selector, for various circuit functions at specified times during the timing interval.

(h) Steps the selector from terminal 1 to terminal 2, thru bank 1 and the selector running contacts.

The B relays operated:

(a) Disconnect the lamp leads from the A relay windings. This prevents subsequent calls on other lines or trunks in the group from interfering with the state of the SU relay which monitors the condition of the lamp lead of the trunk on which the signal is being timed. In addition, if two or more calls should be originated simultaneously, all operated A relays except the one whose contact in the locking chain is nearest the LK relay will be released.

(b) Connect locking windings to the lamp leads. The B relays will thus lock to calls originated during the timing interval, including any simultaneous calls locked out by the chain locking arrangement.

The P relay will operate and release in response to the 120 IPM interrupter signal, in turn stepping the TM selector thru bank 2.

5.04 Timing

5.041 Calls on Lines

For a description of the operation of the timing circuit when observing on lines, assume that an elapsed answering time of 10 seconds is to be registered. "Z" wiring shall be provided and the "A" lead will be connected to terminal 2 of arc 3 of the (TM) selector (18 less than 20 half-seconds). If this circuit is to be used solely for calls on lines (10 secs. timing), Fig. F is provided. Otherwise, Fig. E is furnished, and the (TT) key of Fig. 5 is normal, or the (TT) relay of the switching circuit is normal. The connection of (P) to 120 IPM will operate and release it under control of interruptions. This will step the (TM) selector brush assembly from terminal 2 to terminal 22. When this terminal is reached, (R) operates.

(R) operated:

(a) Locks under control of (LK).

(b) Prepares a circuit to operate (TM).

(c) Prepares a circuit to operate the (DA) register.

(d) Prepares its own shunt-down circuit.

When terminal 1 on the second revolution of the selector brush assembly is reached the selector will immediately step to terminal 2 through its arc 1.

5.042 Calls On Auxiliary Trunks

For a description of the operation of the timing circuit when observing an auxiliary trunk assume that an elapsed answering time of 20 seconds is to be registered. "Z" wiring will be provided and the "A" lead will be connected to terminal 2 of arc 3 of the (TM) selector (38 less than 40 half-seconds).

Figure 5 provided - the (TT) key will be operated.
Switching circuit provided - (TT) relay in switching circuit will be operated.

The connection of the (P) relay to 120 IPM will cause (P) to operate and release under control of the interruptions. This will step the selector brush assembly from terminal 2 to terminal 7.

Figure C provided - (LK1) operates when selector reaches terminal 7.

(LK1) operated:

(a) Locks under control of (LK), and (RL) when Fig. J is provided or (RL1) when Fig. K is provided.

(b) Closes in part a circuit to operate (RL).

Fig. C prevents the circuit from releasing in case the subscriber disconnects or operator answers prior to the selector brush assembly reaching terminal 7. This is done so as to absorb the flash on Trunk Test which may occur on panel DS "A" trunks.

The selector brush assembly continues to step to terminal 22. When this terminal is reached (RA) operates and locks under control of the (TM) and (RL) or (RL1) relays. (RA) operated also prepares the (R) relay operating circuit, and a circuit to skip the selector over terminal 19.

When terminal 1 on the second revolution of the selector brush assembly is reached the selector will immediately step to terminal 2 through its arc 1. The selector will then step to terminal 19 where it will immediately step to 20, the purpose of this step being to make it unnecessary to shift the "A" lead when transferring from 10 to 20 seconds. The selector will then step under control of (P) to terminal 21 where a path is closed to operate (R) thru (RA) operated.

(R) operated:

(a) Locks under control of (RL) or (RL1).

(b) Prepares circuits to operate (TM) and the (DA) register.

(c) Prepares its own shunt-down circuit.

When terminal 1 of the third revolution of the brush assembly is reached the selector will immediately step to terminal 2 through its arc 1.

5.05 Call Abandoned or Answered by Operator Before Delayed Answer Registration

Should the call be abandoned, or answered by the operator, SU will release.

SU released:

Figs. A, D and H -

(a) Opens the operating circuit of the DA register.

(b) Opens the operating circuit of LK, which remains locked to RL (Fig. J) or RL1 (Fig. K) normal.

(c) Opens one circuit to the BY lamp.

(d) Partially completes the HI operating circuit.

(e) Releases SR1. SR1 released releases SR2, which then completes the operating circuit of, and operates, RL. SR2 also

extinguishes the BY lamp, if lighted. SR1 and SR2 hold open the operating circuit of RL for a time of sufficient duration to absorb flashes on miscellaneous trunks arranged for flashing lamps.

Figs. B and G, with Fig. C or D -

(a) Opens the operating circuit of the DA register.

(b) Opens the locking circuit of the LK relay.

(c) Removes the short circuit from around the winding of the SR relay. SR operates, opening the operating circuit of the LK relay. With both locking and operating paths open, LK releases.

(d) Extinguishes the BY lamp, if lighted.

(e) Operates RL, if Fig. D is provided, or, if Fig. C is furnished, operates RL if or when the TM selector has passed or reached terminal 7, operating LK1. The purpose of the LK1 relay is described in Par. 5.042.

Figs. B, D and H -

(a) Opens the operating circuit of the DA register.

(b) Opens the operating circuit of LK, which remains locked to RL (Fig. J) or RL1 (Fig. K) normal.

(c) Extinguishes the BY lamp, if lighted.

(d) Operates RL.

(RL) operated (when Fig. J is provided):

(a) Locks in series with the selector magnet.

(b) Releases (LK) except where Fig. G is provided in which case the release of (LK) is effected as described above.

(LK) released:

(a) Releases (A).

(b) Releases the (R) and (RA) relays, if operated.

(c) Fig. L - Opens the operating circuit of (P) thereby stopping the selector.

(d) Fig. M - Releases (ST), which opens the operating circuit of (P), and removes start ground from the interrupter circuit.

(A) released performs no useful function for this class of call.

5.06 Call Not Answered Before Delayed Answer Registration

If the operator has not answered and the call has not been abandoned by the time the brush assembly of the (TM) selector has reached terminal 2, with (R) operated on subscriber calls or with (RA) and (R) operated on trunk calls, (TM) will operate through arc 3.

(TM) operated:

(a) Locks under control of (LK).

(b) Opens the operating circuit of (R), if subscriber call.

(c) Releases (RA), which opens the operating circuit of (R), if trunk call.

(d) Opens the stepping circuit of the selector.

(e) Operates the (DA) register directly, when Fig. 4 or 18 without Fig. 22 is provided; or operates the (RT) relay of Fig. 11 or 22, or the (DRT) relay of Fig. 14. The (RT) relay of Fig. 11 operates the (DA) register of Fig. 12 or of the traffic or miscellaneous register circuit. The (RT) relay of Fig. 22 operates the (DA) register of Fig. 4, 12 or 18, or of the traffic or miscellaneous register circuit, and locks to the operated (BP) relay. In addition, if Option "ZE" is furnished, and (RT) relay of Fig. 22 also operates a duplicate (DA) register in the traffic or miscellaneous register circuit. The (DRT) relay of Fig. 14 functions as described in Par. 5.09 to operate the (DA) register(s) in the distant office.

In addition to the above, the operation of the (DA) register of Fig. 4 or 18 when Fig. 22 is not furnished, or of the (RT) relay of Fig. 11 or 22, or (DRT) relay of Fig. 14, releases the (R) relay by shunting it. (R) released operates (RL).

(RL) operated:

(a) Locks in series with the selector magnet when Fig. J is provided.

(b) Releases (LK).

(LK) released:

(a) Fig. L - Opens the operating circuit of (P).

(b) Fig. M - Releases (ST), which opens the operating circuit of (P), and removes start ground from the interrupter circuit.

(c) Releases (A).

(d) Releases (TM). (TM) is slow to release to insure complete operation of (RL) before it releases.

(e) Releases (LK1) if provided.

(A) released releases (SU).

(SU) released:

Fig. A provided - Releases (SR1) and (SR2) in tandem.

5.07 Restore to Normal

5.071 When Fig. J is Provided

With (RL) operated, a circuit is established thru the normally made contacts of the (TM) selector to return the selector to normal through self-interruptions. While the selector is returning to normal, the (B) relays are held operated by (RL) which is slow to release in order to hold operated over the steps. When the selector brush assembly reaches terminal 1, (RL) releases. The release of (RL) releases all the (B) relays except those associated with lines on which calls have appeared while this or a previous call was being timed, and which have not yet been answered or abandoned. The circuit is restored to normal and is free to serve other calls.

5.072 When Fig. K is Provided

Under this condition the (RL) relay operates as previously described except that it operates on its high resistance secondary winding which does not step the (TM) selector.

The operation of the (RL) relay (a) opens the ground to the (P) relay contact and (b) operates the (RL1) relay.

(RL) operated:

(a) Connects ground to primary winding of (RL) relay to step (TM) selector to normal.

(b) Opens the ground to the (P) relay contact at another point.

(c) Releases (LK) relay.

(d) Holds all (B) relays operated.

When the (TM) selector has returned to terminal 1 through self-interruptions the (RL) relay releases and after a time interval the (RL1) relay releases restoring the circuit to normal.

5.08 Timing Lockout

Should a call appear on a line or trunk of the group of lines or trunks to which this circuit is connected while this circuit is timing another call, it will not be timed, regardless of the condition of the timing circuit. This is accomplished by locking (B) to the "L" or "L1" lead of the line or trunk so that when the timing circuit is released from the call it has been timing the locked (B) prevents the operation of its associated (A). The (B) will release when the call has been answered or abandoned.

5.09 Answer Time Recording on CAMA Senders With Registers Located in Distant CAMA Office

5.091 The operation is essentially the same as described in the previous paragraphs with the following exceptions:

1. Lead "ATR" is substituted for lead "L" in Fig. 9.

2. (LK) operated operates (DBP) in Fig. 14 which in turn operates (TC) in Fig. 13 in the distant CAMA office over the connecting loop. (TC) operated operates the (TC) total calls register in that office. If "ZE" option is furnished, (TC) also operates a duplicate (TC) register in the traffic register circuit.

3. (TM) operated operates (DRT) in Fig. 14 which in turn operates (DA) Fig. 13 in the distant CAMA office over the connecting loop. (DA) operated operates the (DA) delayed answer register in that office. If "ZE" option is furnished, (DA) also operates a duplicate (DA) register in the traffic register circuit.

5.092 The (DA) and (TC) registers located in the distant CAMA office will be part of the system used to measure the quality of service given by a CAMA operating unit. The P.C.I. or D.P. Sender will apply ground to lead "ATR", Fig. 9, from the time it requests a position at the distant CAMA office until the position is attached. If the position is not attached before the answer time recorder times out the (DA) register in the distant CAMA office will be operated. From the data received on the registers in their office, the operating people can make force adjustments of their CAMA operating units accordingly.

5.10 Tests

All tests are made with the (BG) key normal when the circuit to be tested is associated with line or trunk lamps connected to ground and with the (BG) key operated when the circuit to be tested is associated with line or trunk lamps connected to battery.

5.101 Test of Concentrating Features

When the plug of the patching cord is inserted in the (T1) jack, ground on the

contact of the jack will light the (BY) lamp if (SU) is operated, which will be the case if a call is being timed. When (SU) releases the lamp will be extinguished. The operation of the (T1) key operates the (A) relay associated with the first (TST) jack. The operation of that (A) operates (SU) which in turn lights the (BY) lamp. The operation of the (T2) key provides a locking circuit for (B) associated with the second (TST) jack. When the (T1) key is restored this relay will hold thus preventing the operation of its associated (A) and (SU) will release. The release of (SU) will extinguish the (BY) lamp.

5.102 Test of Timing and Registering Feature

The (BY) lamp functions as described in Par. 5.101. In a period of 10 seconds the circuit will function as described in Par. 5.041. In a period of 20 seconds, the circuit will function as described in Par. 5.042, the operating and restoring of the (T1) key simulating a call that has been originated and abandoned or answered.

The timing intervals specified can be changed to conform with intervals that may be used.

5.11 Register Transfer

5.111 Registers Located in Same Office

When it is desired to provide (DA) or (TC) registers in both operating and terminal rooms, a key circuit per Fig. 3 will be furnished. When the key is normal, the total number of calls and the number of delayed answer calls will be recorded on the operating room registers, while when the key is operated they will be recorded on the terminal room registers shown in Figs. 4, 12, or 18. When the key is operated a key pilot (KP) will be lit.

5.112 Registers Located in Local Terminal Room and Distant CAMA Office

When it is desired to provide (DA) and (TC) registers in both the distant CAMA office and the local terminal room a key circuit per Fig. 3 will be furnished. When the key is normal the total number of calls and the number of delayed answer calls will be recorded on the registers located in the distant office while when the key is operated they will be recorded on the terminal room register shown in Fig. 12 or 18. When the key is operated a key pilot (KP) lamp will be lit.

6. ANSWERING TIME RECORDER EQUIPPED WITH TRAFFIC WEIGHTING APPLIQUE

Figs. 1, 9, E or F, G or H, K, and L or M; Options H: A, E, or F; and ZA, ZB, or ZC; and Figs. 3, 5, 6, 7, 15, 16, 17, 19 and 21, "ZE" option, "ZJ" or "ZK" option, and "ZL", "ZM" or "ZN" option, as required - Mfr. Disc.

6.01 General

This circuit is used to automatically observe and record the number of times the operator answering time on lines or trunks exceeds a predetermined time in seconds. This "delayed answer" interval is controlled by the wiring of an "A" lead on bank 3 of the TM selector, the position of the TT key, if provided, or the (TT) relay of the associated Switching Circuit, if used, and the provision of Option "G", as required. When the circuit is idle, the TM Selector rests in terminal position 1. The function of the Traffic Weighting Applique Ckt., hereinafter referred to as "the TWA Ckt.", is to count and store all calls originated on the 25 lines or trunks associated with the circuit, and to register the count on one or both of a pair of message registers upon receipt of the "delayed" or "not delayed" indication from this circuit.

6.02 Connections

6.021 The "L" lead is connected to the lamp lead of a line or trunk whose associated line or trunk lamp is connected to battery, while the "L1" lead is connected to the lamp lead of a line or trunk whose associated line or trunk lamp is connected to ground. In the case of the incoming trunk circuits for the No. 23 operating room desk, the "L1" lead is connected to the service observing "L" lead of the trunk, as no answer lamp is available. In other cases where no suitable answer lamp or none at all is available, direct connections can be made, as for dial office sender circuits, CAMA sender circuits, or coin zone outgoing trunks, using the "ATR" lead, and coin zone operator trunks, or outgoing trunk or junctor circuits, using the "ATR1" lead.

6.022 Where the observed group of circuits is to include some Cbr. No. 5 coin zone outgoing trunk or junctor ckts., or some SXS, panel or Cbr. No. 1 coin zone outgoing trunks, or some of each (but not one of these exclusively), a converter relay per Fig. 21, with "ZJ" and "ZL" options, must be furnished for each of these circuits included in the group.

6.023 The BC relay of Fig. 21 may also be furnished, for isolation purposes, where regular or frequent lamp circuit changes would require excessive readjustment of the sensitivity potentiometer in the

T.W.A. Ckt. In this case, each input will be equipped with a BC relay and Options "ZK" and "ZL" "ZM" or "ZN" furnished.

6.024 The BC relay repeats the originated call signal by connecting 24V battery to the "BC" lead of the corresponding connecting circuit per Fig. 9. Thus, when the BC relays are furnished the input signals to the timing portion of this circuit and to the associated TWA Ckt., via the "E" leads, are as for the grounded 24V lamp condition.

6.025 In cases where the BC relays are not furnished, connection of the input signals to the TWA Ckt. is by means of the multipled "E" leads where trunk connections are made on "L1" or "ATR1" leads and via "D" leads where "L" or "ATR" leads are used for the trunk connections.

6.03 Call Originated and Seizure

When Fig. 21 is furnished, an originated call on an observed trunk operates the BC relay on its primary winding by connecting 24V or 48V battery to the "L1" or "ATR1" lead or on its secondary winding by connecting ground to the "L" or "ATR" lead. BC operated connects 24V battery via the "BC" lead to Fig. 9, operating the corresponding A relay on its primary winding through normal contacts of the associated B relay. When Fig. 21 is not used, the A relays operates, through normal (B) relay contacts, directly to battery on the "L1" or "ATR1" lead through its primary winding or to ground on the "L" or "ATR" lead through its secondary winding.

A operated operates SU on its primary winding to ground on the "L" or "ATR" lead, or on its secondary winding to battery on the "L1", "ATR1" or "BC" lead.

SU operated:

(a) Fig. G and Option "ZA" or "ZB" provided - Shunts down the SR relay. SR released operates LK. The slow release SR relay provides a delay in locking in the circuit on a call signal. This prevents the circuit being seized by short false signals like teletypewriter "hits" or the preliminary pulse of a panel "trunk guard" test.

(b) Fig. H and Option "ZA" or "ZC" provided - Operates LK.

(c) Partially completes a locking circuit for the operated A relay, if Option "ZB" or "ZC" is provided.

(d) Partially completes the circuit for lighting the BY lamp.

(e) Partially completes the circuit for grounding the "SA" lead to the Traf. Wtg. Aplq. Ckt. as a delayed answer indication.

LK operated:

(a) Locks to ground at contacts of RL1 released.

(b) Locks the operated A relay. If two A relays are operated simultaneously, the one nearest the LK contact in the locking chain will remain locked up.

(c) Operates all B relays in multiple.

(d) Connects 24 or 48V battery to the "GA" lead to the Traf. Wtg. Aplq. Ckt. to energize the counting circuit there and to cause the "first count" circuit to function.

(c) Connects the P relay to the interrupter lead, if Fig. L is provided; or, operates the ST relay, which connects P to the interrupter lead and grounds the "ST" lead to the interrupter circuit in a No. 5 Crossbar Office, if Fig. M is provided.

In addition, LK connects ground from contacts of RL1 normal to various points in the circuit, including contacts of TM and R, the brush of selector bank 3, and, through normal contacts of TM, to contacts of RA, if provided, and to terminal 1 of selector bank 1. This results in the following additional functions:

(f) Prepares locking circuits for TM, R and RA.

(g) Prepares a circuit, through bank 3 of the timing selector, for various circuit functions at specified times during the timing interval.

(h) Steps the selector from terminal 1 to terminal 2, thru bank 1 and the selector running contacts.

The B relays operated:

(a) Disconnect the lamp or other input leads from the A relay windings. This prevents subsequent calls on other lines or trunks in the group from interfering with the state of the SU relay which monitors the condition of the lamp lead of the trunk on which the signal is being timed. In addition, if two or more calls should be originated simultaneously, all operated A relays except the one whose contact in the locking chain is nearest the LK relay will be released.

(b) Connect locking windings to the lamp or other input leads or to the "BC" lead. The B relays will thus lock to calls originated during the timing interval, including any simultaneous calls locked out by the chain locking arrangement. When the circuit is released at the end of the timing interval, any locked up B relays will prevent operation of their associated A relays. This prevents the timing circuit from being seized by calls already awaiting answer, as these could not, of course, be fully timed. The B relays release when the calls on the associated lines or trunks are answered or abandoned.

The P relay will operate and release in response to the 120 IPM interrupter signal, in turn stepping the TM selector through bank 2.

6.04 Timing

The timing circuit can be arranged for a delayed answer interval of from 3 to 28-1/2 seconds without the time transfer feature. When the time transfer feature is provided, the interval can be switched by means of the (TT) key, or automatically, under control of the group switch of the associated Switching Circuit. When the (TT) key, or the (TT) relay of the Switching Circuit is normal, the timing interval is 10 - 18-1/2 seconds, as determined by the "A" lead connection on bank 3 of the (TM) selector. The (TT) key or relay operated adds 10 seconds to the normal, or untransferred, interval.

The timing circuit is subject to an inherent variation which occurs at the start of each timing interval due to the use of standard office interrupter pulses to step the timing selector. Since a call may originate at any instant with respect to a 120 IPM interrupter cycle, a variation in the actual duration of the first step, ranging from 0 to 0.5 seconds, takes place. This first step refers to the advance of the timing selector from terminal 2 to terminal 3 - the step from terminal 1 to 2 is always by means of self-interruption. The method of setting the timing interval so that the advance of the selector brush into terminal position 4 is considered as the first half-second of elapsed time ("3 higher than the number of half-seconds specified") insures that the actual elapsed time will never be shorter than indicated. For example, with respect to this factor alone, the start of a call signal will have preceded the end of a timing interval set for 10 seconds, by at least 10 full seconds and as much as 10.5.

In addition, when Fig. C is used, a further variation consisting of the release time of the SR relay - approximately 0.3 to 0.6 seconds - is introduced. Since the SR relay delays seizure of this circuit, and thus start of the timing interval, this variation also increases the actual elapsed time with respect to the timing interval.

The effect of both variations is that the end of a 10 second timing interval will be anywhere from 10.3 to 11.1 seconds after the start of the call signal, and thus a 10 second "delayed answer", under these conditions, will not be shorter than 10.3 seconds, and, on the average, will be at least 10.7 seconds long.

The operation of the timing circuit will be described for nominal delayed answer intervals of 5, 10 and 20 seconds used separately, and also for time transfer between the latter two intervals.

6.041 Delay Interval 5 Seconds - Fig. F and "Y" Wiring

The "A" lead is connected to terminal 13 of bank 3 (3 higher than the number of half-seconds specified) for this elapsed time interval. When the selector is stepped from terminal 1 to terminal 2 by the operation of LK, R is operated through bank 3 of the selector.

R operated:

(a) Locks to RL1 normal.

(b) Opens a parallel connection between the windings of the RL relay.

(c) Advances the TM relay operating circuit to terminal 13 of bank 3 of the TM selector.

When the selector reaches terminal 13, the TM relay operates through bank 3.

Should the call be answered (or abandoned) at any time before the selector reaches terminal 13, the SU relay releases.

SU released:

(a) Opens the circuit for lighting the BY lamp.

(b) Opens the operating circuit of the LK relay, if Fig. H is provided; or,

removes the short circuit from around the winding of the SR relay, which operates and opens the operating circuit of LK, if Fig. G is provided.

(c) Opens the "SA" lead to the TWA Ckt., to prevent registering this call as a delayed answer call.

(d) Releases the operated A relay, if Option "ZB" or "ZC" is provided. This prevents its own reoperation should the line or trunk be released and reseized during the same timing interval. SU reoperated would result in the "SA" leads being grounded at the end of the timing interval, causing a false "slow answer" indication to the Traf. Wtg. Aplq. Ckt.

6.042 Delay Interval 10 Seconds (No Time Transfer) - Fig. F and "Z" Wiring

The "A" lead should be connected to terminal 2 of bank 3 (18 lower than no. of half-seconds specified). No action takes place when the selector passes over terminal 2 for the first time, as the R relay will not be operated. When the selector reaches terminal 22.

R operates:

(a) Locks to RL1 normal.

(b) Opens a parallel connection between windings of the RL relay.

(c) Advances the TM relay operating circuit up to terminal 2 of bank 3 of the TM selector.

When the selector is advanced to terminal 1, in the next interval, it is immediately stepped again through its running contact and bank 1. On terminal 2, the TM relay is operated through bank 3.

Should the call be answered (or abandoned) at any time before the selector reaches terminal 2 on the second revolution, the SU relay releases. SU released functions as described in Par. 6.041.

6.043 Delay Interval 10 or 20 Seconds (Time Transfer Provided) - Fig. E and "Z" Wiring, With Fig. 5 or Connection to ATR Switching Ckt.

The "A" lead should be connected to terminal 2 of bank 3 (18 or 38 lower than no. of half-seconds specified). With the TT key of Fig. 5 or the TT relay of the associated Switching Circuit normal, the circuit functions exactly as described in Par. 6.042 for a 10 second delay interval without time transfer. With the TT key or relay operated, a 20 second interval is obtained as described in the following paragraphs.

No action takes place on the first pass of the selector brushes over terminal 2, as the R relay has not been operated. When the selector reaches terminal 22.

RA relay operates:

(a) Locks, through TM released, to RL1 normal.

(b) Closes a circuit between the selector running contacts and terminal 19 of bank 3, to cause the selector to skip over terminal 19 on subsequent revolutions.

(c) Prepares a circuit to operate R on the next revolution of the selector.

When the selector advances to terminal 1 in the next interval, it is immediately stepped onto terminal 2 thru its running contacts and bank 1. Again, no action takes place in the terminal 2 position, as the R relay is still not operated. When the selector reaches terminal 19 in this second revolution, it is immediately advanced to terminal 20. This is necessary so that terminal 2 may represent the 20 second point on the next revolution; otherwise the 21 terminals (excluding terminal 1, already arranged for skip-over) per revolution would add 10-1/2 seconds via the time transfer feature instead of the desired 10 seconds. Upon reaching terminal 21 in the following interval, bank 3 of the selector completes the R relay operating circuit.

R operated:

(a) Locks to RL1 normal.

(b) Opens a parallel connection between windings of the RL relay.

(c) Closes the TM relay operating circuit to terminal 2 of bank 3 of the TM selector.

When the selector reaches terminal 1 on the third revolution, it is immediately advanced to terminal 2 through bank 1 and its own running contact. In terminal position 2, the TM relay is operated.

Should the call be answered (or abandoned) before the selector reaches terminal 2 on the third revolution, the SU relay releases. SU released functions as described in Par. 6.041.

6.044 20 Seconds Delay Interval (No Time Transfer) - Fig. E and "Z" and "G" Wiring

Under these conditions, the circuit functions exactly as described in Par. 6.043 for the 20 second interval (TT key or relay operated).

6.05 Time-out, Registration, and Restoring to Normal

6.051 Call Answered Within Delayed Answer Interval

(TM) operated:

(a) Locks under control of (RL1).

(b) Opens (TM) selector stepping circuit.

(c) On 5 or 10 second interval - opens operating circuit of (R); on 20 second interval - opens operating and locking circuits of (RA), which releases and opens operating circuit of (R).

(d) Operates (RL) through its high resistance secondary winding to battery through the winding and normal contact and bank 1 of the (TM) selector, which does not receive enough current to operate under this condition.

(e) Removes ground from terminal 1 of selector bank 1.

(RL) operated:

(a) Opens the (TM) selector stepping circuit at another point.

(b) Grounds lead "DM" to the TWA circuit.

Ground on "DM" acts as a signal to the TWA circuit to start the read-out operation. The TWA circuit also grounds the "RL1" and "S" leads, operating (RL1) and the (S) register. The (N) message register of Fig. 17 will operate and release on each cycle of the read-out, once for each call that appeared on an associated line or trunk during this circuits timing period.

(RL1) operated:

(a) Opens (TM) selector stepping circuit at another point.

(b) Connects ground to the low resistance primary winding of (RL), also in series with (TM) SEL magnet through the latters normal, or "running", contact. (TM) SEL runs forward, under control of bank 1, to terminal 1, where it rests until the start of the next timing interval.

(c) Holds all (B) relays operated.

(d) Releases (LK), (TM), and (R).

(e) Removes ground from the brush of (TM) selector bank 3.

(R) released:

(a) Completes another circuit for the secondary winding of (RL) from make contacts of (RL1). This will enable (RL) to hold operated over opens caused by selector running contact.

(b) Opens the operating circuit of the (TM) relay.

(LK) released:

(a) Fig. L - Opens the (P) relay operating path.

(b) Fig. M - Releases ST, which opens the (P) relay operating path and removes the start signal from the interrupter circuit.

(c) Releases the (A) relay of the line or trunk on which this observation was made, of Option "ZA" is provided.

(d) Removes battery from the "GA" lead.

The operate path of (RL) is opened when the selector reaches terminal 1, and (RL) releases, removing ground from the "DM" lead.

6.052 Call Not Answered Within Delayed Answer Interval

Under this condition, the circuit functions as described in Par. 6.051 with the following exceptions:

(SU) has not released at the time (TM) operates. Thus, (TM) operated grounds the "SA" lead to the TWA circuit, causing that circuit to prepare to record the count of calls on the delayed answer (D) register as well as on the total calls (N) register.

During read-out of the TWA circuit, the (N) and (D) registers of Fig. 17 operate and release once for each call stored. The release of (LK) and (A) in tandem releases (SU).

The circuit remains in this condition, with (RL1) and the (B) relays operated, until the TWA circuit completes the read-out function and the proper count has been added to the (N) and (D) registers. At that time, ground will be removed from leads "RL1" and "S" releasing (RL1) and the (S) register, and, in turn, all the (B) relays associated with idle lines or trunks.

6.06 Answer Time Recording on CAMA Senders With Registers Located in Distant CAMA Office

With this type of operation, the "ATR" lead in Fig. 9 is wired instead of the "L" lead, and Figs. 15 and 16 are furnished. The read-out cycling of the TWA circuit is carried out with the (DBP) and (DRT) relays of Fig. 15 replacing the (N) and (D) registers respectively. Each time (DBP) operates

it operates relay (TC) in the distant CAMA office, shown in Fig. 16; and (DRT) and the (DA) relay perform in the same way. (DA) and (TC) in turn operate the (D) and (N) registers of Fig. 17 or of the traffic register or miscellaneous register circuit, which will also be located in the distant office. If "ZE" option is furnished, the (DA) and (TC) relays also operate a duplicate set of registers located in the traffic or miscellaneous register circuit. The release portion of the cycle will be similarly duplicated in the CAMA office. Thus the proper count of delayed answer and total calls is available at the operating location for force adjustments. A size of sample indication is also provided by the (S) register. When used in this type of operation, the operation of (TC) relay also operates a slow release (SRS) relay, which in turn operates the (S) register. The (SRS) relays operate path is maintained until the (DA) relay releases, and then the (S) register is held over the releasing portion of the read-out cycle by the slow release characteristic of (SRS). Thus (S) register operates once for each usage of the ATR circuit, giving a measure of how many of the total calls were actually timed by the ATR. With "ZE" option, a duplicate (S) register is also operated. The purpose of this general operation is covered in Par. 5.092.

6.07 Tests

The test circuit functions as described in Par. 5.10 except that the test calls are also connected via the "D" or "E" leads to the Traffic Weighting Applique Circuit where they are counted and stored while this circuit is timing, and then read-out to score the D, N, and S registers.

6.08 Register Transfer

This feature is provided as covered in Par. 5.11 except that additional transfer contacts are provided on the (TR) key, the registers are designated (D) and (N), respectively, instead of (DA) and (TC), the (S) register is also transferred, and all registers are shown in Fig. 17 instead of Fig. 4, 12, or 18.

7. ANSWERING TIME RECORDER WITH TRAFFIC WEIGHTING APPLIQUE

Figs. 3, 9, 20, E or F, and N or P; Option "ZD"; and Figs. 5, 6, 7, 15, 16, 17, 19, and 21, Option "ZE", Option "ZJ" or "ZK", and Option "ZL", "ZM" or "ZN", as required.

7.01 General

This circuit is used to automatically observe and record the number of times the operator answering time on lines or trunks exceeds a predetermined time in seconds. This "delayed answer" interval is controlled by the wiring of an "A" lead on bank 3 of the TM selector, the position of the TT key, if provided, or the (TT) relay of the associated Switching Circuit, if used, and the provision of Option "G", as required. When the circuit is idle, the TM selector rests in terminal position 1. The function of the Traffic Weighting Applique Ckt., hereinafter referred to as the TWA" Ckt., is to count and store all calls originated on the 25 lines or trunks associated with the circuit, and to register the count on one or both of a pair of message registers upon receipt of the delayed or not delayed indication from this circuit.

7.02 Connections

The connections between the observed trunks or senders and this circuit and its associated TWA Ckt. are as described in Par. 6.02.

7.03 Call Originated and Seizure

The action of this circuit upon call origination and seizure is as described in Par. 6.03 to the operation of the SU relay.

SU operated:

(a) With Fig. N - Releases the normally operated SR relay. The slow release SR relay introduces a short delay before this circuit locks itself to a call signal, as a protection against false line or trunk seizures such as caused by teletypewriter "hits" or panel "trunk guard" tests. SR released operates LK.

(b) With Fig. P - Operates LK directly.

(c) Prepares a circuit for lighting the BY lamp.

(d) Prepares a circuit for locking the operated A relay.

(e) Partially completes the circuit for grounding the "SA" lead to the TWA circuit.

LK operated:

(a) Locks to ground at contacts of RL1 normal.

(b) Locks the operated A relay through parallel paths under control of the SU and PP relays.

(c) Operates all B relay in multiple.

(d) Operates LKA.

In addition, the LK relay operated connects ground from contacts of RL1 released - the same point to which it locks itself - to various circuit points, including contacts of the PP, TM, and R relays, the brush of

selector bank 3, and through normal contacts of TM released, to contacts of RA, if provided, and to terminal 1 of selector bank 1. This common ground, through contacts of RL1 released and LK operated, will hereinafter be called "off-normal ground". This action of LK results in the following additional functions:

(e) Prepares locking circuits for the PP, TM, R, and RA relays.

(f) Prepares a circuit, through bank 3 of the (TM) selector, for various circuit functions at specified times during the timing interval.

(g) Steps the selector from terminal 1 to terminal 2, through bank 1 and the selector running contacts.

The B relays operated:

(a) Disconnect the lamp or other input leads from the A relay windings. This prevents subsequent calls on other lines or trunks in the group from interfering with the state of the SU relay which monitors the condition of the lamp lead of the trunk on which the signal is being timed. In addition, if two or more calls should be originated simultaneously, all operated A relays except the one whose contact in the locking chain is nearest the LK relay will be released.

(b) Connect locking windings to the lamp or other input leads or to the "BC" lead. The B relays will thus lock to calls originated during the timing interval, including any simultaneous calls locked out by the chain locking arrangement. When the circuit is released at the end of the timing interval, any locked up B relays will prevent operation of their associated A relays. This prevents the timing circuit from being seized by calls already awaiting answer, as these could not, of course, by fully timed. The B relays release when the calls on the associated lines or trunks are answered or abandoned.

LKA operated:

(a) Prepares a second circuit for lighting the BY lamp, with "ZH" option. (Mfr. Disc.)

(b) Grounds the "ST" lead to the interrupter circuit.

(c) Connects 48V battery to the "GA" lead to the TWA Ckt.

(d) Connects the P relay to the interrupter lead.

The P relay will operate and release in response to the 120 IPM interrupter signal, in turn stepping the TM selector through bank 2.

7.04 Timing

The timing circuit can be arranged for a delayed answer interval of from 3 to 28-1/2 seconds without the time transfer feature. When the time transfer feature is provided, the interval can be switched by means of the (TT) key, or automatically, under control of the group switch of the associated Switching Circuit. When the (TT) key, or the (TT) relay of the Switching Circuit is normal, the timing interval if 10 - 19-1/2 seconds, as determined by the "A" lead connection on bank 3 of the (TM) selector. The (TT) key or relay operated adds 10 seconds to the normal, or untransferred, interval.

The timing circuit is subject to an inherent variation which occurs at the start of each timing interval due to the use of standard office interrupter pulses to step the timing selector. Since a call may originate at any instant with respect to a 120 IPM interrupter cycle, a variation in the actual duration of the first step, ranging from 0 to 0.5 seconds, takes place. This first step refers to the advance of the timing selector from terminal 2 to terminal 3 - the step from terminal 1 to 2 is always by means of self-interruption. The method of setting the timing interval so that the advance of the selector brush into terminal position 4 is considered as the first half-second of elapsed time ("3 high than the number of half-seconds specified") insures that the actual elapsed time will never be shorter than indicated. For example, with respect to this factor alone, the start of a call signal will have preceded the end of a timing interval set for 10 seconds, by at least 10 full seconds and as much as 10.5.

In addition, when Fig. N is used, a further variation consisting of the release time of the SR relay - approximately 0.3 to 0.6 seconds - is introduced. Since the SR relay delays seizure of this circuit, and thus start of the timing interval, this variation also increases the actual elapsed time with respect to the timing interval.

The effect of both variations is that the end of a 10 second timing interval will be anywhere from 10.3 to 11.1 seconds after the start of the call signal, and thus a 10 second "delayed answer", under these conditions, will not be shorter than 10.3 seconds, and, on the average, will be at least 10.7 seconds long.

The operation of the timing circuit will be described for nominal delayed answer intervals of 5, 10 and 20 seconds used separately and also for time transfer between the latter two intervals.

7.041 Delay Interval 5 Seconds - Fig. F and "Y" Wiring

The "A" lead is connected to terminal 13 of bank 3 (3 higher than the number of half-seconds specified) for this elapsed time interval. When the selector is stepped from terminal 1 to terminal 2 by the operation of LK, R is operated through bank 3 of the selector.

R operated:

(a) Locks to off-normal ground.

(b) Opens a parallel connection between the windings of the RL relay.

(c) Advances the TM relay operating circuit to terminal 13 of bank 3 of the TM selector.

When the selector brush reaches terminal 7, the PP relay operates through bank 3.

PP operated:

(a) Locks to off-normal ground.

(b) Opens one of the locking circuits of the operated A relay.

When the selector reaches terminal 13, the TM relay operates through bank 3.

Should the call be answered (or abandoned) at any time before the selector reaches terminal 13, the SU relay releases.

SU released:

(a) Opens one of the locking circuits of the operated A relay.

(b) With Fig. N - Reoperates the SR relay, which opens the operating circuit of the LK relay.

(c) With Fig. P - Opens the operating circuit of the LK relay.

(d) Opens one operating circuit of the BY lamp.

(e) Opens the circuit to the TWA circuit "SA" lead, to prevent registering this call as a delayed answer call.

If the release of SU occurs before the 2 second point of the timing interval - terminal 7 on the first revolution of the selector - the operated A relay is maintained operated under control of PP normal. When PP operates upon the selector reaching terminal 7 in this case, and if SU has not reoperated, the A relay releases.

If the call is answered and SU released at some time after the initial 2 seconds, the operated A relay is released immediately.

The release of A prevents reoperation of SU, which would interfere with the OK answer decision on the first call, should the same line or trunk be reseized later in the same timing interval.

The purpose of the A relay locking circuit under control of the PP relay, which prevents release of A until at least 2 seconds of the timing interval have elapsed, is to prevent error due to improper release of the SU relay shortly after seizure. For example, a preliminary pulse, such as may occur in panel on "trunk guard" testing, might seize the circuit. Another such preliminary pulse could be caused by the absorption of an extra digit in a trunk after seizure. The release of the SU relay at the end of such a preliminary pulse or flash would release the operated A relay. With A release, SU could not reoperate at the start of the true seizure signal, thus resulting in an automatic OK answer determination on the call, regardless of the actual answer time.

7.042 Delay Interval 10 Seconds (No Time Transfer) - Fig. F and "Z" Wiring

The "A" lead should be connected to terminal 2 of bank 3 (18 lower than no. of half-seconds specified). No action takes place when the selector passes over terminal 2 for the first time as the R relay is not operated. When the selector reaches terminal 7, PP operates through bank 3.

The action and purpose of the PP relay function is as described in Par. 7.041.

When the selector reaches terminal 22.

R operated:

(a) Locks to off-normal ground.

(b) Opens a parallel connection between windings of the RL relay.

(c) Advances the TM relay operating circuit up to terminal 2 of bank 3 of the TM selector.

When the selector is advanced to terminal 1 in the next interval, it is immediately stepped again through its running contact and bank 1. On terminal 2, the TM relay is operated through bank 3.

Should the call be answered (or abandoned) at any time before the selector reaches terminal 2 on the second revolution, the SU relay releases. SU released functions as described in Par. 7.041.

7.043 Delay Interval 10 or 20 Seconds (Time Transfer Provided) - Fig. E and "Z" Wiring, With Fig. 5 or Connection to ATR Switching Ckt.

The "A" lead should be connected to terminal 2 of bank 3 (18 or 38 lower than no. of half-seconds specified). With the TT key of Fig. 5 or the TT relay of the associated Switching Circuit normal, the circuit functions exactly as described in Par. 7.042 for a 10 second delay interval without time transfer. With the TT key or relay operated, a 20 second interval is obtained as described in the following paragraphs.

No action takes place on the first pass of the selector brushes over terminal 2, as the R relay has not been operated. When the selector reaches terminal 7, the PP relay operates through bank 3.

The action and purpose of the PP relay function is as described in Par. 7.041.

When the selector reaches terminal 22, the RA relay operates, and:

(a) Locks through TM released to off-normal ground.

(b) Closes a circuit between the selector running contacts and terminal 19 of bank 3, to cause the selector to skip over terminal 19 on subsequent revolutions.

(c) Prepares a circuit to operate R on the next revolution of the selector.

When the selector advances to terminal 1 in the next interval, it is immediately stepped onto terminal 2 through its running contacts and bank 1. Again, no action takes place in the terminal 2 position, as the R relay is still not operated. When the selector reaches terminal 19 in this second revolution it is immediately advanced to terminal 20. This is necessary so that terminal 2 may represent the 20 second point on the next revolution; otherwise the 21 terminals (excluding terminal 1, already arranged for skip-over) per revolution would add 10-1/2 seconds via the time transfer feature instead of the desired 10 seconds. Upon reaching terminal 21 in the following interval, bank 3 of the selector closes the R relay operating circuit.

R operated:

(a) Locks to off-normal ground.

(b) Opens a parallel connection between windings of the RL relay.

(c) Closes the TM relay operating circuit to terminal 2 of bank 3 of the TM selector.

When the selector reaches terminal 1 on the third revolution, it is immediately advanced to terminal 2 through bank 1 and its own running contact. In terminal position 2, the TM relay is operated.

Should the call be answered (or abandoned) before the selector reaches terminal 2 on the third revolution, the SU relay releases. SU released functions as described in Par. 7.041.

7.044 20 Second Delay Interval (No Time Transfer) - Fig. E, and "Z" and "G" Wiring

Under these conditions, the circuit functions exactly as described in Par. 7.043 for the 20 second interval (TT key or relay operated).

7.05 Time-out, Registration, and Restoring to Normal

7.051 Call Answered Within Delayed Answer Interval

TM operated:

(a) Locks to off-normal ground.

(b) 5 or 10 Second Interval - Opens the R relay operating circuit. 20 second interval - Releases RA.

(c) Disconnects off-normal ground from the selector "jump-off" terminal 1 of bank 1.

(d) Opens the selector stepping circuit.

(e) Partially completes the circuit for grounding the "SA" lead to the TWA circuit. However, this will be held open at the released SU relay.

(f) Operates the RL relay through its 1000Ω winding in series with running contact and winding and bank 1 of the TM selector, which does not receive enough current to operate under this condition.

RL operated:

(a) Opens the selector stepping circuit at another point.

(b) Ground the "DM" lead to the TWA Ckt.

Ground on the "DM" lead notifies the TWA circuit that the timing decision has been made, and the read-out of the stored count onto the traffic registers should commence. When the TWA has responded to and locked in this signal, it grounds the "RL1" lead to this circuit, operating RL1.

RL1 operated:

(a) Opens the selector stepping circuit at another point.

(b) Closes a holding circuit for the multipled B relays.

(c) Disconnects ground from all off-normal ground points, releasing LK, PP, TM, and R, and removing ground from the brush of selector bank 3.

(d) Connects the 2ω winding of the RL relay in parallel with its 1000ω winding and in series with the selector winding and running contact through bank 1.

The TM selector operates through the RL relay 2ω winding, and continues to step rapidly, or "run", due to the action of its running contact. R released closes a path to maintain the 1000ω RL winding in parallel with the low resistance winding after the slow release TM relay releases.

The purpose of the RL relay 1000ω winding shunted across the 2ω winding, under control of R released, is to prevent "chatter" of the RL relay due to interruption of its operating circuit by the selector running contact. Such chatter might result in the "DM" lead being opened for long enough to release the associated relay in the TWA circuit, which would release the RL1 relay in this circuit and thus open the selector running circuit before the selector reaches its terminal 1 "home" position. The relay on the "DM" lead in the TWA circuit is locally locked up for the duration of the read-out interval of that circuit, but under the worst condition of a single, fast-answered stored call, the read-out time may not be long enough to prevent this trouble.

LK released:

(a) Disconnects the A relay locking chain battery from contacts of SU and PP.

(b) Opens the operating circuit of the B relays.

(c) Releases LKA.

LKA released:

(a) Opens the P relay operating circuit.

(b) Opens the "ST" lead to the interrupter circuit.

(c) Opens one of the paths for lighting the BY lamp, with "ZH" option. (Mfr. Disc.)

(d) Disconnects 48V battery from the "GA" lead. However, the counting portion of the TWA circuit is maintained energized during the read-out interval by the same-fused battery over the "RO" lead, under control of a relay in that circuit.

When the running selector reaches terminal 1, it stops due to the open circuit through bank 1, and the RL relay releases, removing ground from the "DM" lead to the TWA circuit. The timing portion of this circuit remains in this condition, with RL1 and the B relays operated, for the remainder of the read out interval.

Upon completion of the read out function, in which this circuit and the TWA circuit collaborate to record the collected answering time data on traffic registers, ground is removed from the "RL1" lead, releasing RL1.

RL1 released:

(a) Releases all B relays not locked to calls awaiting answer at this time.

(b) Connects ground to contacts of SR, if furnished, and LK in preparation for seizure by the next originated call.

(c) Removes ground from the selector running circuit.

During the course of the read-out function, the N register of Fig. 17 operates once for each call, including the timed call, which occurred on the associated group of lines or trunks during the timing interval just concluded; or the DBP relay of Fig. 19 operates once for each call, in turn operating the N register in the traffic register circuit or cabinet over the "N" lead: or the DBP relay of Fig. 15 operates once for each call, in turn operating the TC relay over a ground return or metallic loop depending upon earth potential, the TC relay in turn operating the N register of Fig. 17 or of the traffic register circuit or cabinet. When "ZE" option is furnished the TC relay of Fig. 16 also operates a duplicate N register in the traffic or miscellaneous register ckt. In addition, the N register of Fig. 17, when located in the same building as the equipment, or the DBP relay of Fig. 15 or 19, grounds the "FA" lead to the TWA circuit upon each operation, to advance the read-out circuit.

The S register of Fig. 17 or of the traffic register circuit or cabinet is operated once per timing circuit seizure, over the "S" lead from the TWA circuit, to provide a count of the actual number of calls

timed. When the registers are located in the distant building, the SRS relay of Fig. 16 is used to translate the read-out signals from the ATR location into a single S register count per timing circuit seizure, by operating at the first operation of the TC relay and holding over all additional read-out cycling signals. With "ZE" option, a second (S) register is also operated.

7.052 Call Not Answered Within Delayed Answer Interval

In the case of a delayed answer, the circuit functions as described in Par. 7.051 during time-out, registration, and restoring to normal, with the following differences:

TM operated grounds the "SA" lead, through SU operated, as a slow answer indication to the TWA circuit.

The removal of battery from the A relay locking chain, upon release of LK, releases the operated A relay, which in turn releases SU. SU released reoperates SR, if Fig. N is furnished.

The receipt of the slow answer signal on the "SA" lead causes the TWA circuit to read-out the stored count onto the D register as well as the N. During the course of the read-out function the D register of Fig. 17 operates once for each call; or the DRT relay of Fig. 19 operates, in turn operating the D register in the traffic register circuit or cabinet over the "D" lead; or, the DRT relay of Fig. 15 operates, in turn operating the DA relay in the distant office, the DA relay in turn operating the D register of Fig. 17 or of the traffic register circuit or cabinet. With "ZE" option, a duplicate D register in the traffic or miscellaneous register circuit is provided. In addition, the D register of Fig. 17 or the DRT relay of Fig. 15 or 19 grounds the "RL" lead to the TWA circuit to advance the read-out cycling.

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