COMMON SYSTEMS
LINE CONCENTRATOR-IDENTIFIER CIRCUIT
APPLIED TO TELEPHONE SECRETARIAL SERVICE
TERMINATING END

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 Provision has been added in this circuit so that when all trunks are held busy an all trunk busy relay will operate which will light a switchboard lamp and operate an all trunk busy register.

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	Figure 21 Y187 Relay (ATB)	Figure 25 UA 49 Relay (ATB)

B.2 Added

Figure 26
14E Register
(AB)

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Figure 21 has been rated Manufacture Discontinued. Figure 25 has been added as Standard.

D.2 Circuit Notes 102 and 103 have been changed to reflect drawing Issue 17-D.

D.3 Figure 1 and Figure 14 Option H has been rated Manufacture Discontinued. Option A has been added as Standard.

D.4 In Figure 4 the code of the IA and IB keys is changed from 92B to 552A to agree with the manufacturing information.

D.5 Add wiring ZA to Figure 14.

D.6 Figure 26 added to show a 14E register.

D.7 A U-3 relay cover is added to relay DC1 in the controller circuit to reduce the magnetic interference with relay DC.

D.8 Figure 22 is rated Special and removed from Note 102.

D.9 In cabling Figure 52 lead "BL" is designated Special.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

This circuit is used to identify and give a lamp indication for any one of 100 customer lines that are being called and to provide a means for an attendant to answer the calls.

2. WORKING LIMITS

2.1 Max. external conductor resistance for relay TC - 2000 ohms.

2.2 Earth potential ± 20 volts (between originating and terminating limits).

3. FUNCTIONS

3.01 Recognizes a call waiting to be served.

3.02 Recognizes CC+ and CC- pulses coming from the originating circuit.

3.03 Identifies the called subscribers line.

3.04 Lights a subscriber line lamp and closes a talking circuit between the answering jack and the incoming trunk.

3.05 Permits answering bureau attendant to seize and hold trunk by means of a dry bridge cord circuit.

3.06 Recognizes CC+ on tip of first trunk as time-out signal to recycle and shift pulsing path to an auxiliary trunk.

3.07 Recognizes CC+ on the tip of second trunk as an alarm release signal to restore pulsing path to original trunk.

3.08 Provides a high-low condition on the ring of the second trunk as a signal to the originating circuit to start pulsing the tens digit.

3.09 Provides an indicator control and two indicator allotters which serve calls on an alternate basis.

3.10 Provides the following keys, lamps and jacks having functions as indicated below.

Keys

CA (Option H or A) or EB (Option J Manufacture Discontinued) makes controller A busy.

CB (Option H or A) or EA (Option J Manufacture Discontinued) makes controller B busy.

I1 makes indicator No. 1 busy.

I2 makes indicator No. 2 busy.

I3 makes indicator No. 3 busy.

I4 makes indicator No. 4 busy.

IA makes indicator allotter A busy.

IB makes indicator allotter B busy.

Lamps

T1 to T4 trunk busy.

I1 to I4 indicator selected.

TO time out.

FA fuse alarm.

Jacks

Test line answering jack and lamp circuit.

3.11 Provides for an all trunk busy relay under control of the originating equipment.

3.12 Provides for an all trunk busy lamp and register.

4. CONNECTING CIRCUITS

When this circuit is shown on a key-sheet the connecting information thereon should be furnished.

4.1 Telephone Answering Service Originating Circuit - SD-95739-01.

4.2 No. 557A Secretarial Line Circuit - SD-65716-01.*

4.3 No. 557B Secretarial Line Circuit - SD-65729-01.*

*Typical

DESCRIPTION OF OPERATION

5. GENERAL

5.1 Originating End Equipment

This concentrator-identifier system consists of two units interconnected by 2 to 4 trunks as shown in attached Figure 7.

The originating equipment located in the central office consists of an 11'6" frame mounting about 225 relays and two crossbar switches (used as multicontact relays) which concentrates 100 lines (MAX.) over 4 trunks (MAX.) to the terminating equipment.

Each line to be served by the system is cross-connected to the originating equipment by a pair of wires at the "Main" frame. For identification purposes, each line connected is assigned an arbitrary 2-digit code from 00-99. The originating equipment components are as follows:

1. Auxiliary line circuits (100 Max.) consisting principally of a cold cathode tube and a ring-up relay per line.

2. One units identifier, consisting of ten relays corresponding to the units digit (0-9) operated by the auxiliary line circuit to indicate to the system the units digit of the called line.

3. One tens identifier connector consisting essentially of two crossbar verticals, receives information from the auxiliary line circuit and the units identifier and passes this to the tens identifier.

4. One tens identifier consisting of ten relays corresponding to the tens digit (0-9) which indicate to the system the tens digit of the called line.

5. One controller connector provides a means of transferring from one controller to the other on successive calls.

6. Two controllers that operate on alternate calls to pulse the line code number forward.

7. Two trunk allotters are provided to seize an idle trunk. One allotter has access to all talking trunks. The alternate, used in case of emergency connects to only the first trunk.

8. Four trunk connectors consisting of four crossbar verticals per trunk. Each is provided to complete the transmission path from the subscribers line through to the allotted trunk.

9. One start circuit, not shown in the attached Figure 7, is provided to coordinate the functions of the various concentrating and identifying circuits.

10. Two to four trunks, each consisting of a transmission path and two composite signal paths.

11. One message register and all trunk busy control circuit to (a) indicate to the terminating end an ATB condition and (b) provide message register leads.

5.2 Terminating End Equipment

The terminating equipment located at the answering bureau is a floor supported cabinet 7' high mounting about 100 relays, three crossbar switches (used as multicontact relay) and a 24-volt storage battery supply It is connected to the associated switchboard that contains the required answering jacks and line lamps. The terminating equipment components are as follows:

1. Two to four trunks each consisting of a transmission path and two composite signal paths.
2. One controller connector provides means of transferring from one controller to the other on successive calls.
3. Two controllers "A" and "B" that operate alternately to receive the digits pulsed by the originating end and to energize the indicating equipment at the terminating end.
4. Two indicator allotters "A" and "B" are provided which seize an idle indicator for each call and determine the length of time the switchboard lamp is lighted.
5. Four indicators are provided which light the proper switchboard lamps through the indicator connector.
6. One indicator connector is furnished consisting of 8 verticals of 2 crossbar switches which closes the crosspoints to light the selected switchboard lamps.
7. One trunk connector is furnished consisting of 16 verticals of 3 crossbar switches which closes the crosspoints to complete the transmission path from a trunk to the switchboard jack.
8. Three unit selectors which are part of the 3 crossbar switches determine the level at which the crosspoints are to be closed by both the trunk connector and the indicator connector.

5.3 General Operation

On an incoming call ringing on the called line through the cross connections at the "Main Frame" causes the auxiliary line circuit to operate. This action energizes a "Start" circuit which calls in a units and tens identifier circuit in order to identify the two digit number of the line being called. This circuit then connects to a common "Controller" circuit which first checks the pulsing path for continuity and then pulses the identified line number forward over the ring side of the first trunk to the terminating equipment. Receipt of this information is verified over the ring conductor of the second trunk circuit.

The originating equipment pulses the identified line forward by means of two digits. Each digit consists of three pulses, CC+ (+115 volts dc) CC- (-115 volts dc) or an open as shown below:

Units or Tens Pulse	First Pulse	Second Pulse	Third Pulse
0	CC-		
1	CC-	CC-	CC+
2	CC-	CC-	CC-
3	CC-	CC+	CC-
4	CC-	CC+	CC+
5	CC+		
6	CC+	CC-	CC+
7	CC+	CC-	CC-
8	CC+	CC+	CC-
9	CC+	CC+	CC+

Simultaneously, the controller circuit in the originating end causes a trunk allotter circuit to hunt an idle trunk talking path. If available the path is closed through on crossbar switches at each end of the trunk for a period of about 1/2 second.

In the meantime the terminating equipment has received the units and tens pulses, selected and utilized an indicator circuit to light the proper line lamp on the associated switchboard and has connected the trunk determined by the originating equipment through to the switchboard jack.

If the attendant has an answering cord connected to the jack associated with this lamp during the 1/2 second period when the trunk path is closed through the switches, she will be connected with the calling party. Otherwise at the expiration of the 1/2 second the trunk talking path will be released but it will be reinstated on the next identification of the calling line. Should the attendant plug in this jack when the line lamp is dark, the talking connection will not be completed until the next identification occurs.

Called line "scanning" is independent of trunk talking path availability so that when all talking paths are busy the equipment continues to flash line lamps associated with other incoming calls.

A maximum of four talking paths are provided. However, the number of lamps that can be lighted is independent of this number of talking paths. Four indicator circuits are provided at the terminating end so that a maximum of four lamps can be

lighted simultaneously. However, as many as six different lamps can be lighted successively during six seconds which is the length of each cycle of machine ringing. While more than six unanswered calls exist, each call is indicated once by its lighted lamp before any call is indicated a second time. Thus, each call will be indicated once every six seconds while six or less unanswered calls are waiting; and while more than six calls are waiting, the interval between successive indications of the same call will be more than six seconds, the amount more being determined by the total number of unanswered calls.

5.4 When the terminating end is connected to battery and ground at the time of installation the following relays operate: (1) relay CC in the battery control circuit (Figure 12) will operate from ground on its winding through contacts of relay CT to fuse CC if the battery voltage is of the correct value, (2) relay CA in the controller connector circuit (Figure 14) operates on its primary winding through key BB, contacts of relays CB1 and CB to ground, and (3) relay IO in the indicator allotter circuit (second Figure 5) operates on its primary winding through contact of relays I1, I2, I3, I4, lead G and to ground on contacts relay SA (Figure 4).

5.5 Relays PP and PN are spring biased (released) polar relays connected so that PP operates on current from a positive potential of about +115 volts dc and PN operates on current from a negative potential of about -115 volts dc. Relays PP and PN release when no current flows through their windings or when the direction of the current is opposite to that on which they operate.

5.6 Identification and Supervisory Signaling

Signaling between the originating and terminating end is accomplished over the composite legs derived from the trunk conductors. Four types of signals are used:

(1) Identification

The identity of the called line requesting service is pulsed to the terminating end over the composite leg of the ring conductor of trunk No. 1 during normal operation. Verification of pulses received at the terminating end is made over the composite leg of the ring conductor of trunk No. 2.

During trouble conditions the pulsing and verification signaling is transferred to the composite legs of the ring conductors of trunks 3 and 4 respectively or to the tip and ring conductors of an auxiliary pair which is provided if trunks 3 and 4 are not equipped.

(2) Trunk Supervisory Signaling

The composite legs of the trunk tip conductors are used for the following purposes: (1) trunk seizure of the terminating end corresponding with that selected at the originating end and (2) attendant seizure and disconnection of the trunk circuit controlled by the terminating end.

(3) Trouble Supervisory Signals

The composite leg or the tip conductor of trunk No. 1 is used as an alarm time-out path to transfer the terminating equipment controller connector from A to B or B to A depending upon the circuit in use at the time. The composite leg of the tip conductor of trunk No. 2 is used as an alarm time-out release path which releases the trouble relays at the terminating equipment. Both functions are independent of trunk supervisory signals.

(4) All Trunk Busy Signaling

During normal operation and all trunks busy the composite leg of trunk No. 3 ring conductor supplies a 48-volt battery which operates an ATB relay at the terminating end to indicate an all trunk busy condition. This feature is canceled during an alarm time-out period.

The following table indicates the functions that take place over the various trunk conductors.

Originating End	Trunk Conductor	Terminating End
Sends -48 volts as signal of call to be served	R1	Ground as signal to start pulsing
Sends units pulses	R1	Receives units pulses
Sends -48 volts to select terminating end of allotted trunk	Tip of allotted trunk	Selects trunk

Originating End	Trunk Conductor	Terminating End
Sends -48 volts as signal units pulsing completed	R2	Shunt relay winding as signal or digits pulses registered and to pulse tens digit
Sends tens pulses	R1	Receives tens pulses
Removes -48 volts from ring of trunk 2	R2	Registers tens pulses
Receives signal to trip ringing	Tip of allotted trunk	Attendant answers sends signal to trip ringing
Receives signal to release trunk	Tip of allotted trunk	Attendant disconnects sends signal to release trunk
Sends CC+ signal as an alarm (time out)	T1	Receives alarm (time out) signal
Sends CC+ signal to release alarm (time out)	T2	Receives alarm release signal
Alternate for R1	R3	Alternate for R1
Alternate for R2	R4	Alternate for R2
Sends -48 volts to terminating end as an ATB condition	R3	Operates ATB relay lights ATB lamp

5.7 Functional designation of relays
A, B, & C - call indicator auxiliary
AC - alternate controller
AR - alarm release
ATB - all trunks busy
CA - controller A
CB - controller B
CB1 - auxiliary to CB
CC - charge control
CF - charge failure
CI - call indicator
CIA - call indicator auxiliary
CT - charge trip
DC - digit check
DC1 - auxiliary to DC
E & F - trunk auxiliary
FA - fuse alarm
HM - hold magnet
IO, I1, I2, I3 & I4 - indicator walking
IT & IT1 - interrupter
PC1 - pulse counter
PC & PC2 - auxiliary to PC1
PN - pulse receiving negative
PP - pulse receiving positive
RC - recycle
RCA - auxiliary to RC
SA & SA1 - shifts indicator allotters
SM - select magnet
TC, TC1, TC2 & TCA - trunk connectors
TO - time out
TS - tens selector
US - units selector
X, Y, XN, YN, ZN, XP, YP, & ZP - pulse register

6. INCOMING CALL

When the originating end has a call to be served, assuming the first trunk is available, it connects -48 volts through the winding of a relay over the ring side of the first trunk through the composite equipment and lead R1 of the trunk circuit first (Figure 1), contacts of relays TO and CA of the controller connector circuit (Figure 14) lead R1, windings of relay PP and PN, contact of relays PC, SM and DC1 to local ground (with Option "S") first (Figure 3) or originating ground with Option "T". Relays PP and PN do not operate because of the relatively small current from the -48 volts. However, this current is large enough to operate the relay at the originating end to cause it to start pulsing the units digit.

7. RECEIVING UNITS DIGIT (Refer to Attached Figures)

Note: Assume line No. 63 is pulsed for purpose of describing circuit operation.

Assume that the units digit 3 will be pulsed and that controller "A" will handle the call. On the first pulse CC- will be connected to the ring side of the first trunk to operate relay PN. Relay PN operates relay XN which (1) locks through the winding of relay X, contacts of relays SM

and PC, lead G1 to ground at relay RCA (Figure 14), and (2) operates relay PC1 over its primary winding and contacts of relay PC. Relay X does not operate due to the shunting ground at relay PP. At the end of the first pulse CC- is removed from the ring side of the first trunk to release relay PN. Relay PN released removes the shunt from relay X which operates in series with the holding ground for relay XN. Relay X operated (1) opens the operating path for relays XP, and XN, and (2) prepares a path for operating relays YP and YN. The second pulse CC+ operates relay PP which operates relay YP. Relay YP operated (1) locks through the winding of relay Y, contacts of relays SM and PC, lead G1 to ground at relay RCA and provides an additional ground to hold relay PC1 operated. Relay Y does not operate due to the shunting ground at relay PN. At the end of the second pulse, CC+ is removed from the ring of the first trunk allowing relay PP to release. Relay PP released removed the shunting ground from relay Y which operates in series with the holding ground for relay YP. Relay Y operated (1) opens the operating paths for relays YP and YN and (2) prepares the operating path for relays ZP or ZN. The third pulse CC- operates relay PN which operates relay ZN. Relay ZN operated locks over lead G1 to ground at relay RCA. At the end of the third pulse CC- is removed to release relay PN.

The register relays X-Y-Z will operate for digit 0 - 9 as follows:

Units or Tens Digit	Register	Relays	Operated
0	XN	-	-
1	XN	YN	ZP
2	XN	YN	ZN
3	XN	YP	ZN
4	XN	YP	ZP
5	XP	-	-
6	XP	YN	ZP
7	XP	YN	ZN
8	XP	YP	ZN
9	XP	YP	ZP

When the originating end completes the units digit, it connects battery to the tip of the first trunk to select the corresponding trunk equipment at the terminating end. It also connects battery to the ring of the second trunk to indicate to the terminating end that units pulsing is completed. Relay TC operates from battery over the tip of the first trunk, leads T1 and T2, varistor E, both windings of relay TC to ground (Option S or T). Relay TC operated (1) causes relay TC2 to operate through the normal contacts of relay TC1 and (2) lights lamp T1 if "A" or "H" Option is furnished. Relay TC2 operated (1) lights the trunk indicator lamp T1 if "J" Option is furnished and (2) prepares a holding path for relay CA and an operating path for relay CB1 under control of relay PC1 (Figure 3).

8. SELECTION OF INDICATOR AND TRUNK ("K" Option Figure 4) (Refer to Attached Figures)

Relay PC1 operated (after first pulse) grounds lead AC through Figures 14 and 4 to operate relay AC in the indicator controller B (second Figure 5) and operates relay SA1 (Figure 4). Relay AC operated operates relay I1 and locks relay IO through key I1 to ground at relay SA released. Relay I1 operates relay CI (first Figure 6) through contacts of relay I1 IO, HM and AC. Relay CI operated (1) lights indicator lamp 1, (2) operates relay CB1 (Figure 14) over leads T5 and G (Figures 1 and 6) lead H to ground at relay PC1, (3) provides a holding path for relay CA over same leads that operated relay CB1 and (4) releases relays A, B and C (Figure 6) if operated from a previous call. Relay CB1 operated (1) locks relay PC1 through the shunted windings of relay PC and (2) locks operated to ground at relay CB.

Note: After receiving the units digit the following condition exists:

(1) "A" controller relays "X, Y and Z" set up in preparation for operation of proper select magnet for unit digit 3 (Figure 3).

(2) First trunk circuit lamp T1 lighted (Figure 1).

(3) First indicator circuit lamp I1 lighted (Figure 6).

(4) Indicator prepared to set up proper relays and hold magnets in the indicator connector circuit after the tens digit is received (Figure 6).

9. REGISTRATION OF UNITS DIGIT (Refer to Attached Figures)

Battery over the ring of the second trunk through the composite equipment (Second Figure 1), lead R2 through controller connector circuit (Figure 14) and through both windings of relay DC (controller A) causes relay DC to operate (Option "S" or "T") which operates relay DC1. Relay DC1 operated (1) operates relay US, (2) opens the operating path for relay TS, and (3) opens the pulsing path. Relay US operated causes select magnet S3 (Figure 8) to operate over lead 3, contacts of relay XN, YP and ZN to ground at relay XP. Select magnet S3 grounds lead C1 to operate relay SM which (1) locks in parallel with select magnet S3 over lead G to ground at relay CB1, (2) releases relay US, X, Y, XN, YP, and ZN, (3) grounds lead CT to operate relay CT (Figure 12) to increase the battery charging rate and (4) shunts relay DC (second trunk) from high (24,160 ohms) to low (160 ohms) for operation of relays at the originating end as a

signal to pulse the tens digit. Release of relay XN, YP, and ZN open the ground shunt from the secondary winding of relay PC allowing it to operate which (1) transfers the pulsing path to ground at relay DC1, (2) operates relay PC2 and (3) transfers the operating path for relay TS.

Note: The following conditions exist before pulsing the tens digit:

(1) First trunk circuit (Figure 1) relays TC and TC2 operated. Lamp T1 lighted.

(2) "A" controller (Figure 3) relays PC, PC1, PC2, DC, DC1, and SM operated.

(3) Indicator allotter "B" (Figure 5) relays AC, IO, and I1 operated.

(4) First indicator circuit (Figure 6) relay C1 operated and I1 lamps lighted.

(5) Select magnet S3 (Figure 8) operated.

(6) Battery control (Figure 12) relay CT operated.

(7) Controller connector (Figure 14) relay CA and CB1 operated.

10. RECEIVING TENS DIGIT (Refer to Attached Figures)

Assume that the tens digit 6 will be pulsed. The originating end connects -48 volts over the ring side of the first trunk through relays PP and PN to ground at relay DC1. This ground is a signal for the originating end to start pulsing the tens digit. The first pulse of CC+ will operate relay PP. Relay PP operated will cause relay XP to operate which (1) will lock through the shunted winding of relay X and (2) provides a holding path for relay PC1. Relay X does not operate due to the shunting ground. At the end of the first pulse, CC+ is removed from the pulsing circuit allowing relay PP to release removing the ground shunt from relay X which operates in series with the holding path of relay XP. The second pulse of CC- will operate relay PN causing relay YN to operate which (1) locks through the shunted winding of relay Y and (2) provides a holding path for relay PC1. Relay Y does not operate due to the shunting ground. At the end of the second pulse CC- is removed from the pulsing circuit allowing relay PN to release which removes the shunting ground allowing relay Y to operate in series with the holding path of relay YN. The third pulse of CC+ operates relay PP which in turn operates relay ZP. Relay ZP locks to ground over lead G1. At the end of the third pulse CC+ is removed from the pulsing circuit to allow relay PP to release.

11. REGISTRATION OF TENS DIGIT CLOSURE OF TALKING PATH AND LIGHTING OF SUBSCRIBERS SIGNAL LAMP

The originating end now removes battery from the ring of the second trunk allowing relay DC to release which releases relay DC1. Relay DC1 released operates relay TS which (1) operates hold magnet F (Figure 7) over lead F through contacts of relay CI (first Figure 6) to ground on relay PC2, (2) operates relay B through contacts of relays CI, TS, YN, ZP and YP to ground at relay XN, (3) operates relay C through contacts of relays CI, TS, ZP and YP to ground at relay XN, (4) operates hold magnet C (Figure 2) over lead C, contacts of relay TC2 (Figure 1), lead C through contacts of relays TS, XP, and PC2 to ground at relay YN and (5) operates relay E over lead E (Figure 1) through contacts of relays TS and PC2 to ground at relay ZP.

Notes: 1. Hold magnet E operates for numbers 0-49 and hold magnet F operates for numbers 50-99.

2. Relays A, B, or C (Figure 6) operate as follows:

Tens Digit	Relays Operated
0 or 5	none
1 or 6	B, C
2 or 7	C
3 or 8	A, B, C
4 or 9	A, C

3. A, B, C, or D hold magnets (Figure 2) operate as follows:

Tens Digit	Hold Magnet Operated
0, 1, 2	A
3, 4	B
5, 6, 7	C
8, 9	D

4. E or F relays (Figure 1) will operate as follows:

Tens Digit	Relay Operated
0, 3, 5, 8	none
1, 4, 6, 9	E
2 or 7	F

Operation of the F hold magnet (Figure 7) will close the six crosspoints on the crossbar switch at the level of the operated select magnet S3.

Battery from Figure 14 over lead B1 through the winding of relay CIA, contacts of relay B and C operated and lead 8 (Figure 6) through the crosspoint selected by select magnet S3 of the crossbar switch

(Figure 7), through the tip side of selected digit 63 (Figures 2 and 102) and the switchboard lamp to ground will light the lamp and operate relay CIA.

Operation of the F hold magnet (1) connects "D" ground to lead H (Figure 7) through (Figure 14 and 4) to hold relay SA1 which locks (relay SA does not operate due to a ground shunt), (2) operates relay HM over lead HM, contacts of relay SA (Figure 4) lead HM through Figure 14, lead HM through contacts of relay TS (Figure 3), lead G contacts of relay CI (Figure 6) lead 12 through contacts of hold magnet F (Figure 7), lead F, contacts of relay CI (Figure 6) to Figure 3 over lead F, contacts of relays TS and XP to ground at relay PC2.

Note: When hold magnet C operated, the tip and ring of the first trunk was connected through the crossbar switch to the selected switchboard jack.

Relay HM operated (1) provides a locking path for relays B and C over lead D (Figure 6) through second Figure 5, through contacts of relays AC and HM to ground at relay AC and (2) releases relay CI (Figure 6). Relay CI released (1) extinguishes lamp I1, (2) locks hold magnet F operated over lead 12 (Figure 7) through contacts of relay CI to ground at relay CIA, (3) locks relay B and C and (4) releases relay CA (Figure 14). Relay CA released transfers leads R1, R2 and opens lead G from controller A to controller B which cause relay SM to release. Relay SM released (1) releases select magnet S3 (Figure 8), (2) releases relays US, XP, X, YN, Y and ZP and (3) releases relay CT (Figure 12). Relays XP, YN and ZP released cause relays PC and PC1 to release. Release of relay PC (1) allows the pulsing path to become available as soon as the pulsing path of the first trunk is shifted back to controller A and (2) releases relays PC2 and TS. Relay PC1 released (1) allows relay AC (second Figure 5) to release which in turn releases relays IO and HM and (2) operates relay IT through contacts of relays IT1, AC, and SA1 to ground at relay SA. Relay IT operated causes relay IT1 to operate which releases relay IT. (NOTE) This is the beginning of a "Walking Sequence" which determines the length of time the switchboard lamp will be lighted.

Note: Under normal traffic the switchboard lamp will be lighted for approximately 3 seconds. If the traffic is very light and the RU relay in the originating unit is operated for the second time during one ringing interval or on a two ring circuit, the call may be served for the second time. The terminating indicator connector used the first time may or may not be used the second time (it will depend upon the number of calls served and how far the terminating indicator allotter has advanced during the interval). If the terminating indicator connector is still on the first call, a second indicator connector may be set up for the same call and this overlap will extend the time that the switchboard lamp is lighted.

12. FIRST TRUNK CONNECTED THROUGH TO SWITCHBOARD JACK

When relay E (Figure 1) was operated the tip and ring of the first trunk was connected over leads 3 and 4, through the crosspoints in the vertical determined by hold magnet C operated (Figure 2) and the level determined by select magnet S3 operated (Figure 8) through to the switchboard jack circuit. Hold magnet C operated causes relay TC1 (Figure 1) to operate and lock over lead M. Relay TC1 operated (1) releases relay TC2 and locks hold magnet C and relay E operated. Relay TC2 released extinguishes lamp T1 if "J" Option was furnished.

13. ATTENDANT ANSWERS (Refer to Attached Figures)

When the attendant inserts the plug into the jack, relay TCA (Figure 1) operates over the loop in series with resistance TS to ground which (1) locks operated through the secondary winding, (2) supplies talking battery and ground to the extension circuit and (3) shunts the 24,000-ohm winding of relay TC with resistance G (Figure 14) as a signal to the originating end to trip the ringing.

Relay CIA (Figure 6) releases due to opening the path to ground through the extension jack allowing hold magnet F (Figure 7) to release which (1) opens the crosspoints in the indicator connector circuit and (2) removes ground D from lead H through (Figure 14 and 4) to operate relay SA.

Note: The relays operated during talking are as follows:

(1) First trunk circuit (Figure 1) relay TCA, TC, TC1 and E or F operated or released (E for this case).

(2) First trunk connector circuit (Figure 2) hold magnet A, B, C or D (C for this case).

(3) Indicator control (Figure 4) relay SA and SA1 (no immediate successive call).

(4) Indicator allotter (second Figure 5) see Paragraph 13 or 14.

(5) First indicator circuit (Figure 6) relays A, B, or C which do not release until reoperation of relay CI. (B and C this case).

(6) Controller connector (Figure 14) relays CIB or CA (CIB for this case),

14. ATTENDANT DISCONNECTS (Refer to Attached Figures)

When the attendant removes the plug from the jack, relay TCA releases due to an open loop and removes the shunt ground from the secondary winding of relay TC. The change in resistance of the winding of relay TC signals the originating end to remove battery from the tip of the second trunk allowing relay TC to release which (1) extinguishes lamp T1 if "H" Option is furnished and (2) releases relay TC1 which in turn releases relay E and hold magnet C.

15. RETURNING THE INDICATOR ALLOTTER TO NORMAL (WALKING SEQUENCE) (Refer to Attached Figures)

Assume relays SA and SA1 (Figure 4) normal. When relay PC1 (Figure 3) is released after the controller connector (Figure 14) shifts controllers (release of relay CA) relay AC (second Figure 5) releases causing (1) relay IT to operate through contacts of relay IT1, AC, lead H, contacts of relay SA1 to ground at relay SA (provided either hold magnet E or F in Figure 7 operate), (2) releases relay HM and (3) releases relay IO. Relay I1 holds over lead 12 through key I1, lead 11, contacts of relays I1, I2, I3, I4, lead 10, key I2, lead 1, contacts of relay AC, lead G to ground at relay SA. Relay IT operated causes relay IT1 to operate which releases relay IT. Relay AC operates (relay IT operated and IT1 slow to release) causing relay I2 to operate and hold relay I1 over lead 9, key I2, lead 8, secondary winding and contacts of relay I1, contacts of relay IO and AC, lead G to ground at relay SA. Relay I2 operated causes relay CI (second Figure 6) to operate over lead 2, contact of relays I2, I1, IO and HM to ground at relay AC and light lamp I2. Relay IT1 releases causing relay AC to release which (1) holds relay I2 operated over lead 9, key I2, lead 8 contact of relays I2, I3, and I4, lead 7 key I3, lead 1, contacts of relay AC, lead G to ground at relay SA, (2) releases relays I1 and CI (first Figure 6) and (3) operates relay IT, relay IT operated causes relay IT1 to operate which (1) operates relay AC and (2) releases relay IT. Relay AC operated operates relay I3 and holds I2 over lead 6, key I3, lead 5 secondary winding and contacts of relay I2, contact of relays I1, IO and AC, lead G to ground at relay SA. Relay I3 operated causes relay CI (third Figure 6) to operate over lead 3 and light lamp I3. Relay IT1 releases causing relay AC to release which (1) releases relays I2 and CI (second Figure 6), (2) operates relay IT and (3) holds relay I3 over lead 6, key I3, lead 5, contacts of relays I3 and I4 lead 2, key I4, lead 1, contacts of relay AC, lead G to ground at relay SA. Relay IT operated causes relay IT1 to operate which (1) releases relay IT and (2) operates relay AC which operates relay I4 over lead 4, key I4, lead 3 secondary winding and contact of relay I3, contacts of relays I3, I2, I1, IO and AC, lead G to ground at relay SA and (2) releases relay IT. Relay I4 causes relay CI (fourth Figure 6) to operate over lead 4 and light lamp I4. Relay IT1 releases causing relay AC to release which (1) releases relay IT. Relay I4 released operates relay IO. Relay IT operates (IT1 slow release and AC released) causing relay IT1 to reoperate which operates relay AC. Relay I1 operates as before causing relay CI (first Figure 6) to operate which (1) opens lead 12 to Figure 7 to release hold magnet F, (2) releases relay B and C and (3) light lamp I1. Hold magnet F released (1) releases relay CIA and (2) removes "D" ground from lead H to operate relay SA (removes ground shunt). Relay SA operated (1) removes ground from lead H to prevent relay IT from operating upon the release of relay AC, (2) operates relay IO of the first Figure 5 and (3) transfers leads AO, H and HM to the next indicator allotter circuit providing no call is started in either controller (ground on lead M). Relay IT released causes relays IT1 and AC to release. Relay AC released releases relay I1 which releases relay CI. The indicator allotter is now returned to normal. It is this "Walking Sequence" that determines the length of time the switchboard lamp is lighted.

16. ALTERNATE USE OF INDICATOR ALLOTTER (Refer to Attached Figures)

If the next call occurs after the allotter used in Paragraph 10 has returned to normal, ground on lead M releases relay SA1 which connects ground to lead H and operates relay IT (first Figure 5). The operation for the first allotter will be the same as described in Paragraph 10.

Note: With relay SA operated and relay SA1 released, the call will be served by the first indicator allotter. With relay SA1 operated and relay SA released the call will be serviced by the second indicator allotter.

17. USE OF INDICATOR ALLOTTER ON SUCCESSIVE CALLS

When the crosspoint of the indicator connector switch is closed by the operation of the E or F hold magnets, ground from the indicator connector switch operates relay SA1 of the indicator controller which in turn locks to ground on its own contacts. Relay SA does not operate at this time because it is shunted through its own normal contacts. With the SA relay normal and the SA1 relay operated, the call will be served

by indicator allotter B. Any succeeding calls which originate while the crosspoints at either the E or F hold magnets are still closed from the previous call will also be served by indicator allotter B. When the E and F hold magnets both release due to the absence of calls in the system, the shunting ground on the winding of relay SA is removed and relay SA operates. When the next call is served, the crosspoints at the E and F hold magnets will close causing relay SA1 to release. With the SA relay operated and relay SA1 released, the call will be served by indicator allotter A. Any succeeding calls originated before the crosspoints at the E and F hold magnets have had a chance to release, will continue to be served by indicator allotter A. When the crosspoints of the indicator connector switch open due to the release of the E and F hold magnets between successive calls, relay SA will release. This completes the cycle of events using alternate allotters and the next call will be served by the second indicator allotter.

18. TIMEOUT (Refer to Figure 4 Attached)

When the originating circuit times out because of a trouble that prevents the completion of a call within the time-out interval, it applies CC+ to the tip of the first trunk to operate the recycle RC relay in this circuit. Relay RC operated operates relay RCA which in turn operates relay TO. Relay RCA operated removes locking ground for relays X, XN, XP, Y, YP, ZN and ZP if these relays are operated. The release of these relays would in turn release relays PC, PC1 and PC2 if they are operated. Relay TO operated (1) lights lamp TO to indicate a time-out, (2) operates relay CB or CB1 to use the controller which was not in service at the time the time-out occurred, (3) locks to AR relay normal and (4) removes the operating ground from the (ATB) relay, if Option ZA is furnished. When the originating end is restored CC+ is removed from the tip of the first trunk to release relay RC which in turn releases relay RCA, and CC+ is connected to the tip side of trunk 2 to operate relay AR which releases relay TO.

19. TRANSFERRING THE PULSING LEADS AFTER A TIME-OUT (Refer to Figure 4 Attached)

When the originating circuit times out as described in the preceding paragraph, it operates relay TO in this circuit. Relay TO operated (1) transfers the pulsing and signaling leads from trunks one and two to trunks three and four or to an auxiliary pair to conform with the transfer of the pulsing and signaling leads made in the originating circuit and (2) opens a ground to the ATB relay if Option ZA is furnished. The operation of the alarm release key in the originating circuit operates relay AR in this circuit which in turn releases relay TO which (1) extinguishes the TO lamp (2) transferring the pulsing path to normal and (3) supplies operating ground to the (ATB) relay if Option ZA is furnished.

20. BATTERY CONTROL CIRCUIT FIGURE 12

The battery control circuit is furnished when the 24-volt supply is derived from a battery located in the cabinet below the switches and relays. When the circuit is idle a trickle charge of approximately 0.350 amperes is maintained on the battery. This trickle charge is adjusted to the proper value by varying resistor R1. When relay SM operates it connects ground to lead CT to operate relay CT of the battery control circuit which in turn releases relay CC. Relay CC released short circuits resistor R1 which raises the charging rate to 0.600 amperes or higher if traffic conditions warrant. This higher rate is adjusted to the proper value by varying resistor R2.

When relay SM releases, it releases relay CT which in turn closes the operating path for relay CC. Should the voltage drop to such a point that relay CC will not reoperate once it is released, the higher charging rate will be maintained until the voltage is raised sufficiently to operate relay CC. The charge then drops back to a trickle charge.

21. CHARGING FAILURE ALARM FIGURE 20

21.1 When the charging source is connected to lead B1, relay CF will operate. Relay CF operated (1) removes battery to release relay FA (Figure 9) and (2) connects lead B1 to the battery control circuit (Figure 12). If the charging source should fail, relay CF will release and connect battery to operate relay FA which gives the alarm.

22. INDICATOR CONTROL (Figure 4 "M" Option)

22.1 With keys IA and IB normal, the circuit operates as described in Paragraphs 8 and 17. If both keys IA and IB are operated, operation is provided using allotter A.

22.2 Key IA Operated and Key IB Normal

When a call is served a ground is applied to lead M and if both relays SA and SA1 are normal, relay SA1 will operate from battery through resistor W, contacts of key IB winding and contacts of relay SA1 to ground on lead M. Relay SA1 will lock operated. Relay SA does not operate because the battery through resistor V is by-passed through contacts of keys IA and IB to ground on lead M. This prevents allotter A from operating while allotter B is connected over the normal contacts of relay SA. At the end of

the indicating period the indicator connector will release removing the by-pass ground. Relay SA now operates from battery through resistor V, winding of relay SA, contacts of relay SA1 to ground which disconnects allotter B. Allotter A is connected but has no operational effect. On a following call, ground is reapplied to lead M and relay SA is shunted down releasing allotter A. Allotter B is reconnected over the normal contacts of relay SA thus leaving allotter A busied out.

22.3 Key 1B Operated and Key 1A Normal

Relay SA1 releases if previously locked up due to opening of the battery at the contacts of key 1B. The release of relay SA1 releases relay SA by removing the locking ground. When a call is served, ground is applied to lead M to operate relay SA from battery through resistor V, winding of relay SA and contacts of relay SA1. Relay SA1 cannot operate because the battery path is open by key 1B operated. The operation of relay SA while relay SA1 is normal prevents allotter B from operating and connects allotter A over the operated contact of relay SA. When ground is removed from leads M and H at the release of the indicator connector, relay SA releases. This disconnects allotter A and closes the circuit for allotter B but has no operational effect. On the following call relay SA operates and allotter B is busied out.

23. ALL TRUNKS BUSY

23.1 Figures 21 and 22 with "H" Option (Manufacture Discontinued)

Relay ATB is normally operated from battery to ground on relays TO in each trunk circuit. As each trunk becomes busy ground is removed from the associated BY (Option H) lead. When all the trunks are busy relay ATB releases causing the all trunks busy lamp at the switchboard to light. As soon as any trunk becomes idle relay ATB operates to extinguish the ATB switchboard lamp.

23.2 Figures 22, 25 and 26 with "ZA" Option

When all trunks are held busy 48-volt battery is supplied from the originating end over the composite ring conductor of the third trunk or the tip conductor of the spare cable pair which operates the ATB relay over leads AB1 and AB2 to a ground from the TO relay. The operated ATB relay (1) lights the ATB lamp at the switchboard and (2) operates the AB message register when Figure 26 is provided. When a TBR- relay releases at the originating end the ATB relay releases.

During a time out as explained in Section 18 the ATB relay is ineffective. The TO relay opens the operating circuit for the ATB relay.

24. TEST LINE (Figure 23)

The test line furnished is an answering jack and lamp circuit which may be locally terminated in test leads equipped with clips that may connect to any line for test purposes or may be wired locally to a number of permanently assigned as a test number. In some type of switchboards the answering jack may have to be opened before the lamp in the test line will light.

25. REPAIRMANS TALKING TERMINALS (Figure 24)

Two 1A test posts are provided which may be connected locally to an official line. The test posts facilitate using a hand test set when clearing trouble and talking to the originating end.

26. ALARM ROUTINE

As this circuit performs its functions, the following lamp signals indicate the progress of the call:

(1) The TO to T4 lamps indicate which trunk (1, 2, 3, or 4) has been selected for use on the call.

(2) The IO to I4 lamps show which indicator (I1, I2, I3 or I4) has been allotted for use on the call.

(3) The lamp located at the switchboard indicates which customers' line is waiting to be served.

(4) TO lamp indicates a time-out caused by trouble occurring either in the originating circuit or in this circuit.

27. TALKING EQUIPMENT OUT OF SERVICE

When it is necessary to change the relays listed below, the precautions indicated should be observed to prevent blocking the system.

CA relay Figure 14

(1) Operate EB key.

(2) Connect 5T (TO) relay to 2 (PP) relay of controller A.

(3) Connect 2B (TO) relay to 3M (DC) relay of controller A.

(4) Connect 2B (RCA) relay to 2T (PC1) relay of controller A.

CB relay Figure 14

(1) Operate EA key.

(2) Connect direct ground to 7TF (CA) relay.

CB1 relay Figure 14

(1) Operates EA key.

TO relay Figure 14

(1) Connect 1 (T2) ret. coil of trunk 1 to 5T (CA) relay.

(2) Connect 1 (T2) ret. coil of trunk 2 to 2T (CA) relay.

(3) Ground the 3T of the ATB relay.

RC relay Figure 14

(1) None.

RCA relay Figure 14

(1) Connect direct ground to 6B (PC) relay of controller A.

(2) Connect 5B (CA) to 6B (TC2) relay of the first trunk.

Any relay in trunk circuit Figure 1

(1) Make the trunk busy by operating the associated TB1, TB2, TB3 or TB4 key in the originating circuit.

Any relay in controller A or B Figure 3

(1) Make the controller busy by operating exercise key EA or XB for the other controller.

Any relay in indicator circuit Figure 6

(1) Operate the I1, I2, I3, or I4 key to make the associated indicator busy.

Any relay in indicator allotter A or B Figure 5

(1) Make the indicator allotter busy by operating the IA or IB key.

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Attached: Figures 1-7

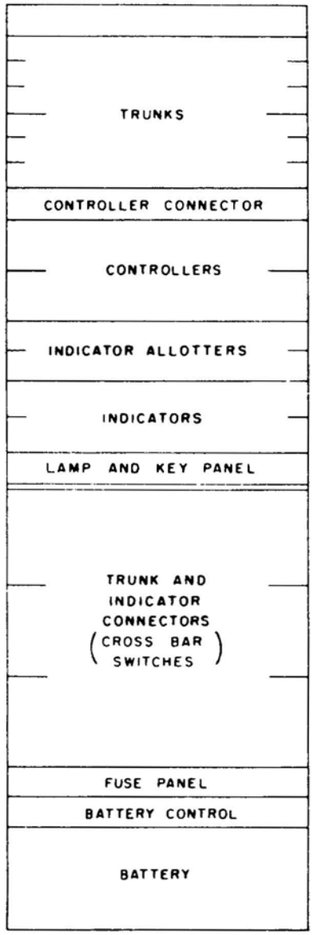

FIG. 1 – FRAME LAYOUT

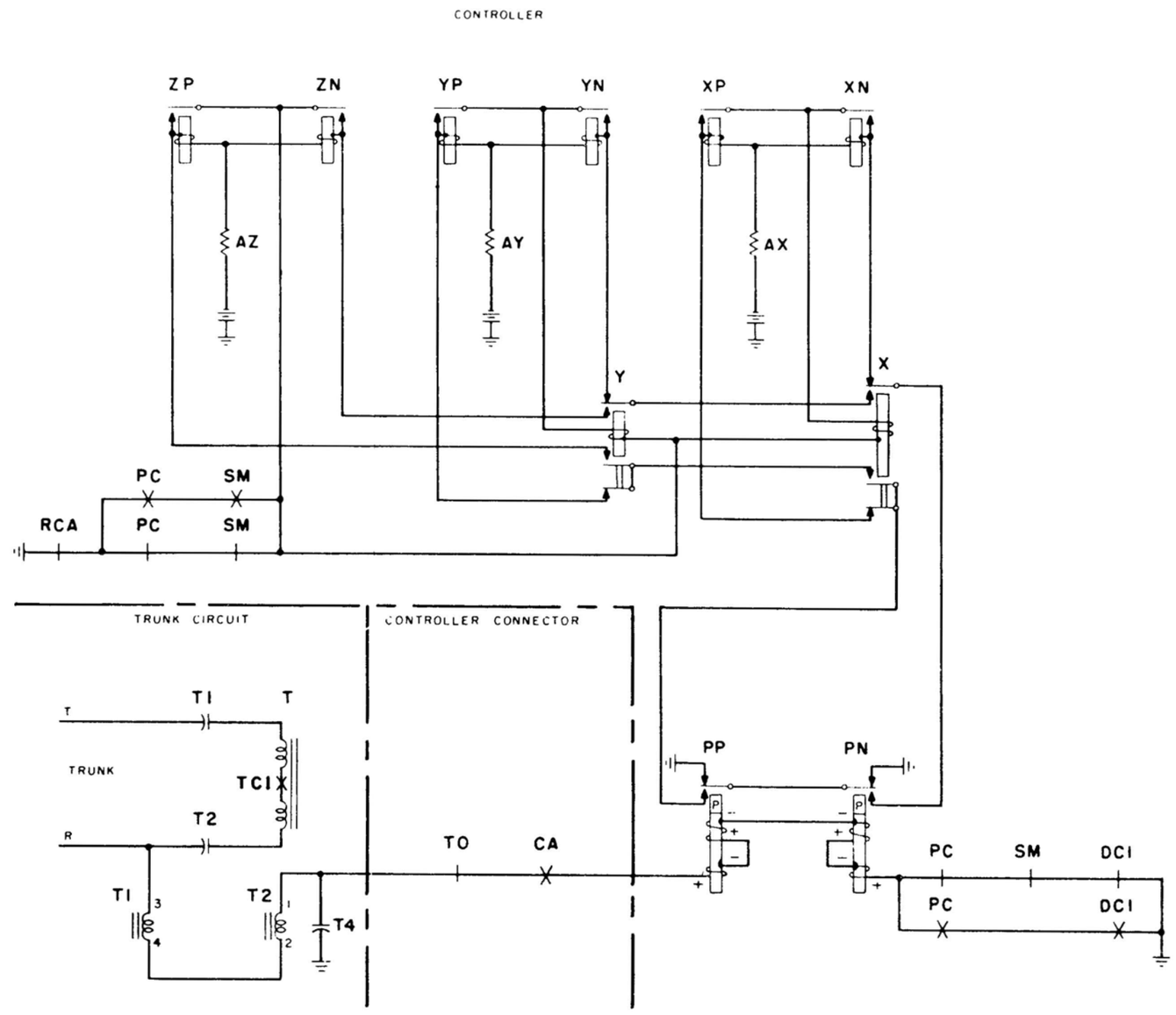

FIG. 2 — SEIZURE AND DIGIT REGISTRATION

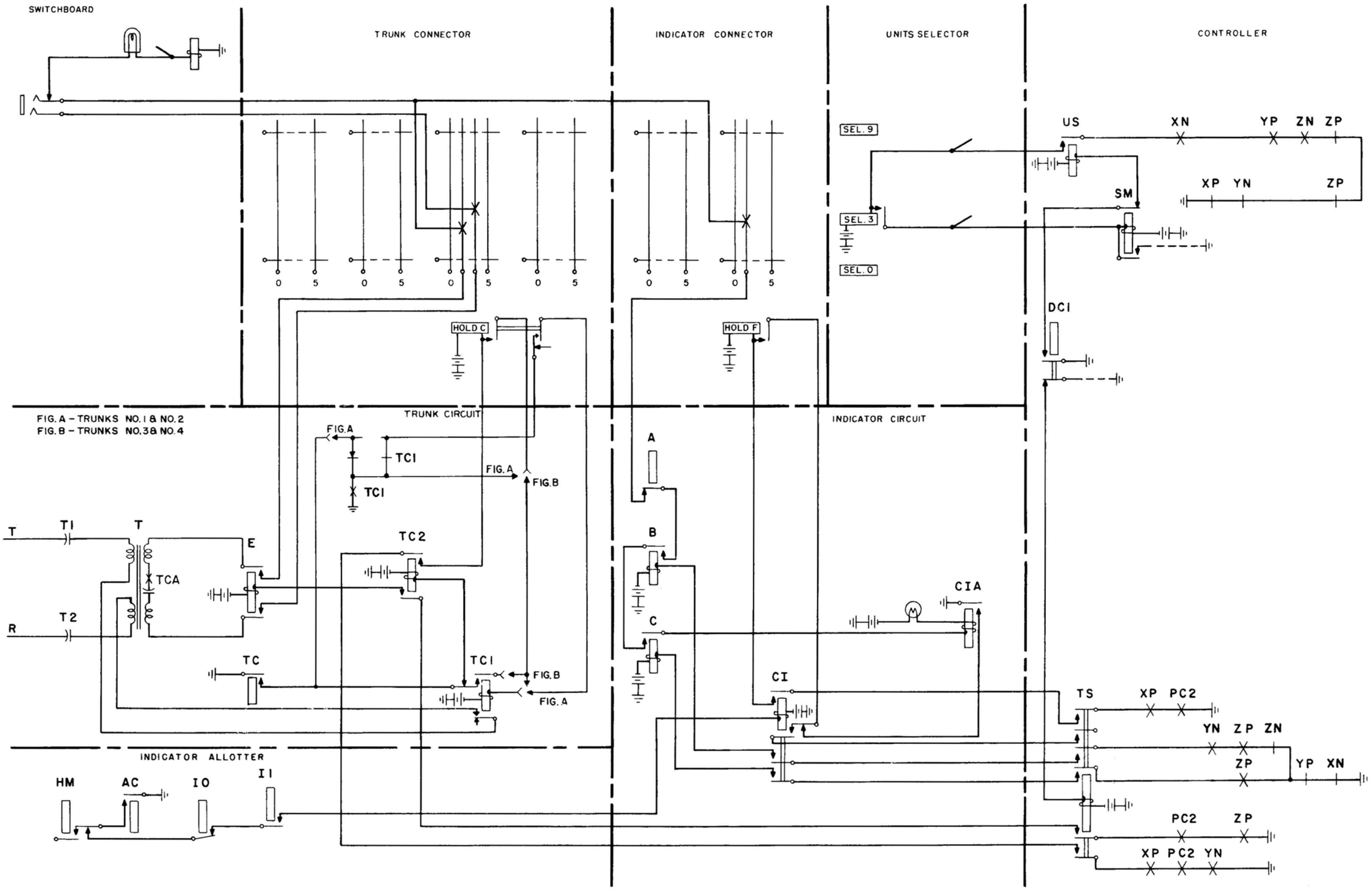

FIG. 3 - CLOSING LAMP AND TALKING PATH

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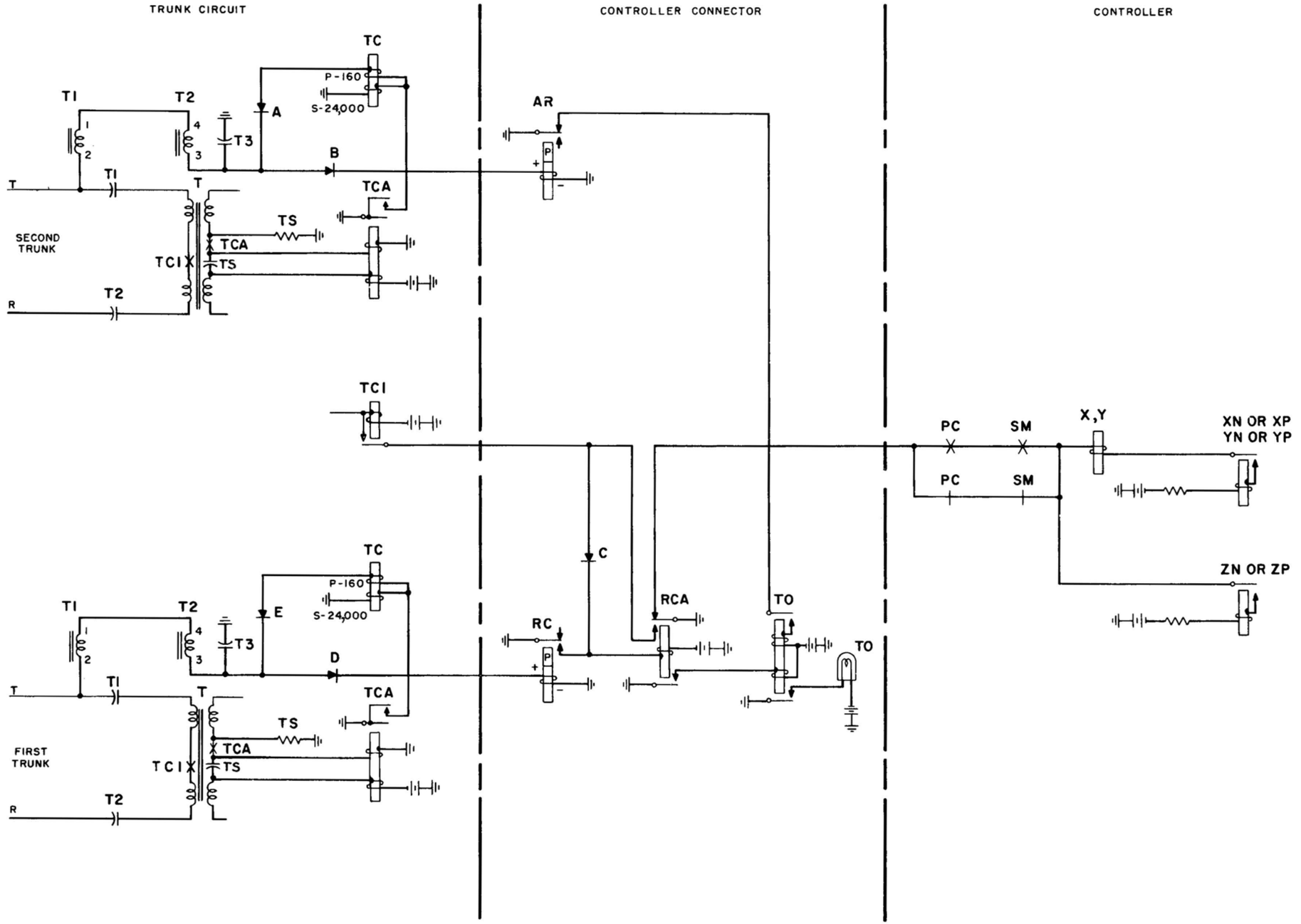

FIG. 4 - TIMEOUT AND ALARM RELEASE

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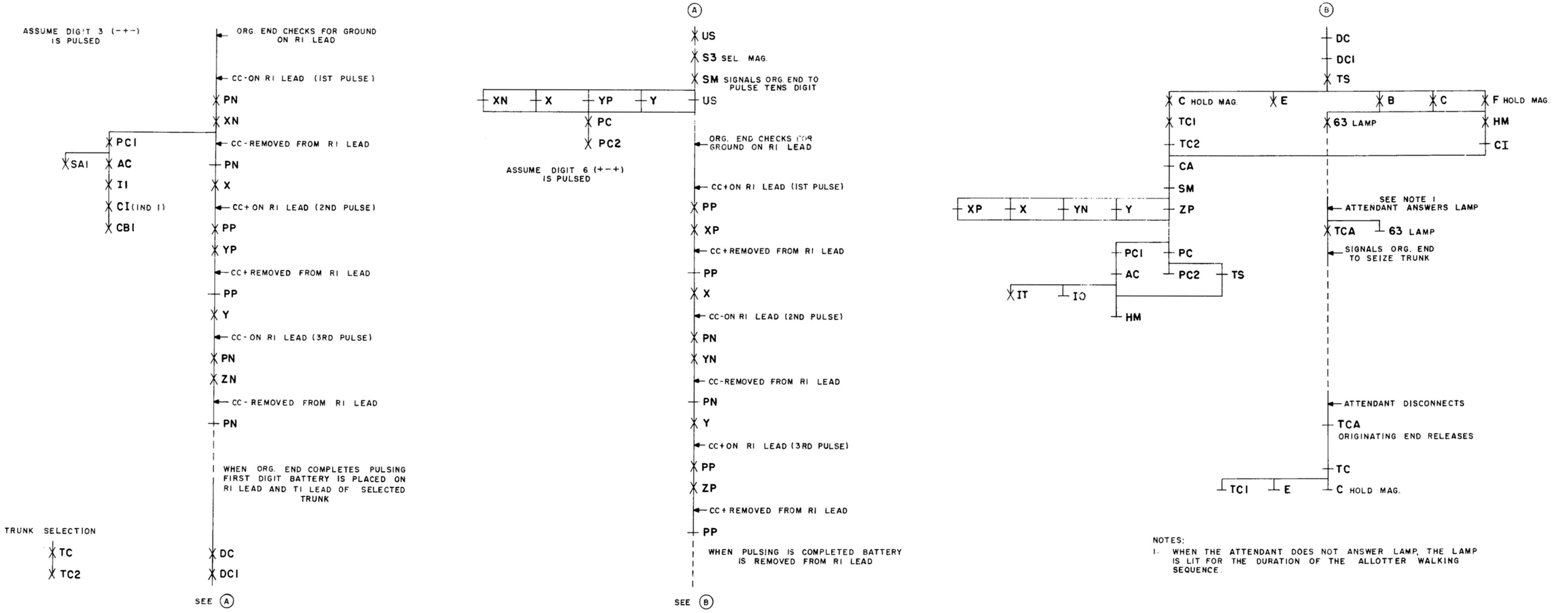
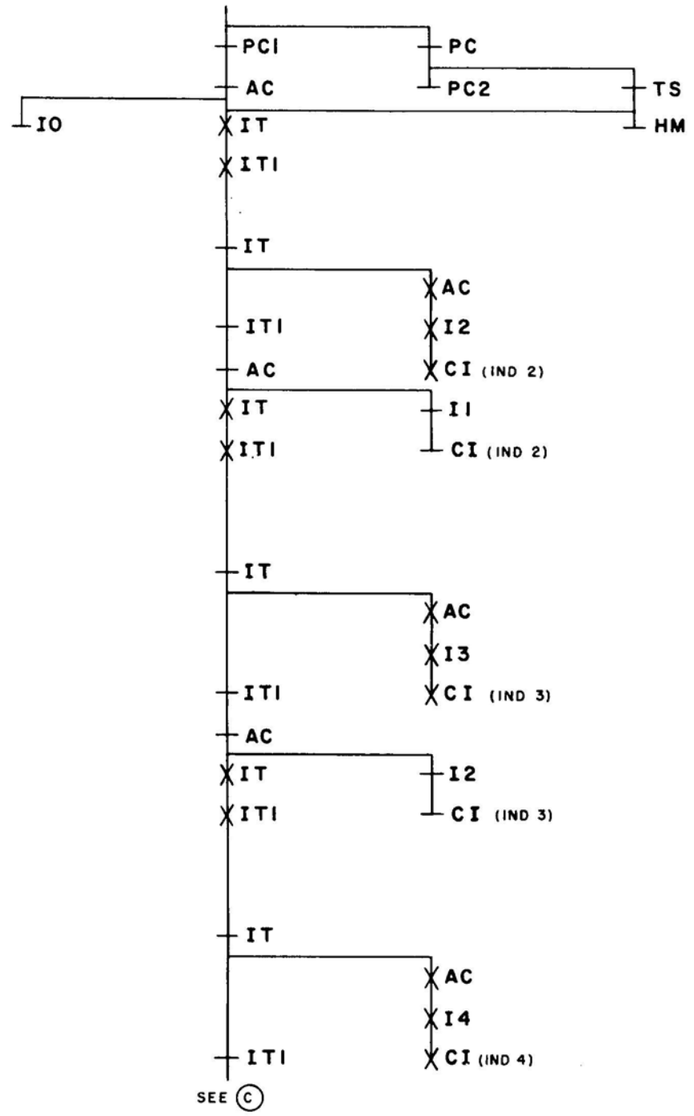


FIG. 5 – OPERATIONAL CHART



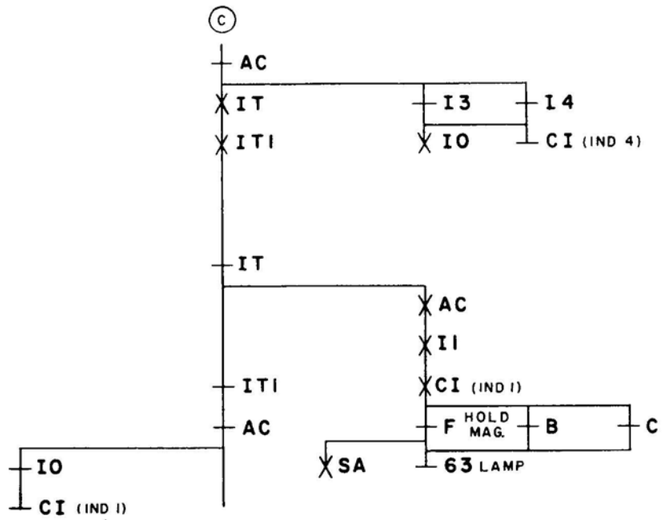


FIG. 6 ALLOTTER WALKING SEQUENCE

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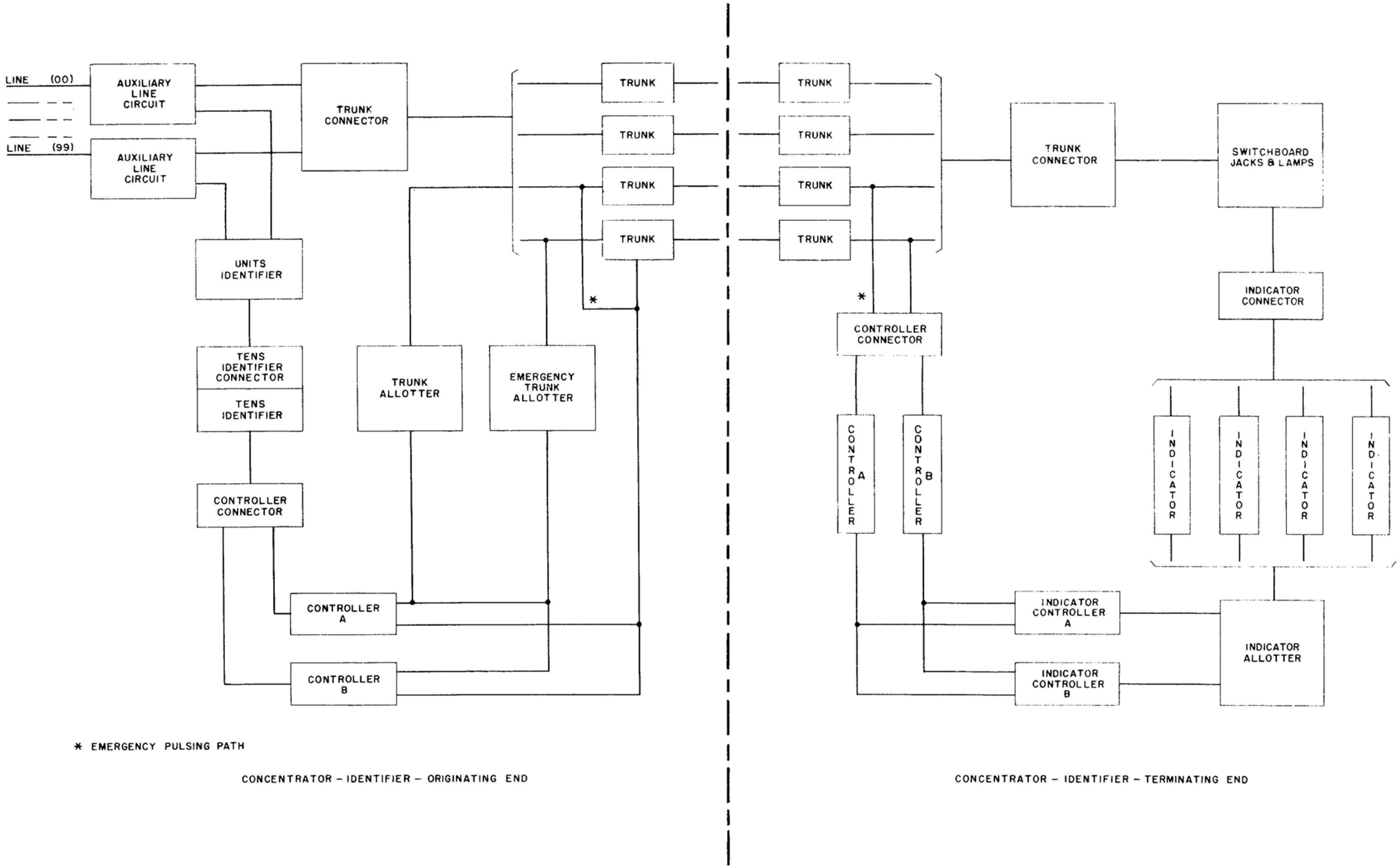

* EMERGENCY PULSING PATH

CONCENTRATOR – IDENTIFIER – ORIGINATING END

CONCENTRATOR – IDENTIFIER – TERMINATING END

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FIG. 7

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COMMON SYSTEMS
LINE CONCENTRATOR-IDENTIFIER CIRCUIT
APPLIED TO TELEPHONE SECRETARIAL SERVICE
TERMINATING END

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Cabling Figure 53 and 54 are changed to make the grounds in Figures 1, 3 and 14 agree with the schematic when Option "T&F" is applied.

D.2 In Figure 1, the ground at resistor "TS" is designated "A-"

D.3 All the battery and grounds in this drawing are changed to agree with the W.E.Co. "T" drawings.

D.4 Circuit Note 101 is revised to agree with the actual fusing per the W.E.Co. "T" drawings.

D.5 Eqpt. Note 202 is rated Mfr. Disc.

All other headings, no change.

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