

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

295 NORTH MAPLE AVENUE  
BASKING RIDGE, NEW JERSEY 07920

## DRAWING NOTICE

TITLE  
STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OR TSPS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97  
DESCRIPTION

SD-32245-01  
CD ISSUE 8B  
RATING AT&TCO STD A&M ONLY FOR  
SYSTEM STEP-BY-STEP  
DATE MAY 18 1983  
DRAWING DISTRIBUTION CODE: 1D99  
CLEI BASIC CODE:

ISSUE 26B  
APPX 4B ADD.  
350A  
& 35E97

## 6.1 CHANGES IN CIRCUIT REQUIREMENTS

- (a) FUNCTIONAL DESCRIPTION OF CHANGE: When Option F was added on Issue 9D, relay contact preparation data for relay PTM was not included. The missing information is now added.
- (b) EXTENT OF CHANGE: No changes were made to apparatus or wiring; this change affects only the relay circuit requirements on sheet F1.
- (c) COORDINATING CIRCUIT CHANGES: none
- (d) EQUIPMENT INFORMATION: not affected
- (e) EQUIPMENT DESIGN REQUIREMENTS: not affected
- (f) ENGINEERING COMPLAINT: No. NTW-82030

6.2 This change covers only: design improvement - no added service, testing, or maintenance features.

## 6.3 SUPPLEMENTARY INFORMATION

- (a) DIRECT CURRENT DRAIN DATA: is not affected

## 6.4 AFFECTED SHEETS

- (a) REISSUED: A1, F1 (TOTAL REISSUED: 2)



CIRCUIT DESCRIPTION

CD-32245-01  
ISSUE 8B  
APPENDIX 4B  
DWG ISSUE 26B  
DISTN CODE 1D99

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STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OR TSPTS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

C. Changes in Circuit Requirements Other Than  
Those Caused by Changes in Apparatus

D.01 When option F was added on Issue 9D, relay contact preparation data for relay PTM was not included. The missing block, insulate and test preparation information, is now added on sheet F1.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 55212-NAR

WE DEPT 62810-WCR-JCR-AJN

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Page 1  
1 Page



JUN 14 1966

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

SW

## DRAWING NOTICE

SD-32245-01

ISSUE 13D

CD 6D

APP. 4D

RATING AT&amp;TCo. Std.

SYSTEM Step-By-Step

DATE April 13, 1966

## TITLE

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit -  
To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,  
350A, 355A - And ANI Type C For 35E97

## DESCRIPTION

- 6.1 Reissued sheets A1, A2, B1, C1, C2, D1, D2, F1  
Total reissued sheets 8
- 6.2 A single option provides two features: A guard against talk off with single frequency signaling, and a 48 volt party test feature. The change on this issue makes it possible to provide the guard against talk off independently of the 48 volt party test on trunks prior to Issue 9D. Equipment manufactured in accordance with Issue 9D and later issues automatically provided both features.
- 6.21 Option H (STD) provides both features. Option 2H (A & M) provides a guard against talk off without the 48 volt party test.
- 6.3 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.4 D change. Requires WECO notification to Tel. Co.
- 6.5 Equipment information is not affected.
- 6.6 Equipment Design Requirements are not affected.



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

295 NORTH MAPLE AVENUE  
BASKING RIDGE, NEW JERSEY 07920  
DRAWING NOTICE

02093

AUG 27 1981  
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## TITLE

STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OR TSPS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, OR 355A  
AND ANI TYPE C FOR 35E97

SD-32245-01      ISSUE 25B  
CD ISSUE 8B      APPX 3B ADD.  
RATING AT&TCO STD A&M ONLY FOR  
SYSTEM STEP-BY-STEP 350A, 35E97

DATE MAR 30 1981  
DRAWING DISTRIBUTION CODE: 1D99  
CLE BASIC CODE:

## DESCRIPTION

## 6.1 CIRCUIT IMPROVEMENT

- (a) FUNCTIONAL DESCRIPTION OF CHANGE: "No. 4 ESS" was added to Note 102 to provide for a method of specifying options required when this trunk is routed to No. 4 ESS with time disconnect on partial dialed calls.
- (b) EXTENT OF CHANGE: No. 4 ESS was added to note 102 to provide a method of specifying options required when this trunk is routed to 4 ESS and is provided with timed disconnect on partial dialed calls.
- (d) EQUIPMENT INFORMATION: not affected
- (e) EQUIPMENT DESIGN REQUIREMENTS: available 4Q81, J38943 BSP Section 814-507-150, Issue 8, Addendum 1.
- (f) ENGINEERING COMPLAINT: No. NEA 0510
- (g) TRANSMISSION: not affected
- (h) TRAFFIC: not affected

6.3 This change covers only design improvement - no added service, testing, or maintenance features.

## 6.4 SUPPLEMENTARY INFORMATION

- (a) DIRECT CURRENT DRAIN DATA: is affected but negligible.
- (b) ALTERNATING CURRENT DRAIN DATA: is not affected

## 6.5 AFFECTED SHEETS

- (a) REISSUED: A1, D1, D2,

(TOTAL REISSUED: 3)

1961-1962



AUG 27 1981

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CIRCUIT DESCRIPTION

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CD-32245-01  
ISSUE 8B  
APPENDIX 3B  
DWG ISSUE 25B  
DISTN CODE 1D99

STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OR TSPS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

D. Description of Changes

D.01 The No. 4 ESS is added to Note 102  
to provide a method of specifying op-  
tions required when this trunk is routed  
to No. 4 ESS and is provided with timed  
disconnect on partial dialed calls.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 55213-DAJ

WE DEPT 45240-JME-JTT-CLC



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
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OCT 11 1977

## DRAWING NOTICE

TITLE	Step-by-Step Systems -	SD-32245-01	ISSUE 24B
	No. 1, 350A, 355A or 35E97 -	CD ISSUE 8B	APPX 2B ADD.
	Outgoing Trunk Circuit -	RATING	AT&TCo Standard-A&M Only
	To CAMA or TSPS No. 1 Office -		for 350A and 35E97
	Loop Pulsing - With ANI Type B	SYSTEM	SXS
	or ANI Type C - For No. 1,	DATE	09-10-76
	350A, 355A - and ANI Type C	DRAWING DISTRIBUTION CODE:	1D99
	for 35E97		

## DESCRIPTION

- 6.1 Project: ANI Trunk Timeout
- 6.2 Reissued sheets: A1, 2; B2, 3; C1, 2; D1 and F1  
(Total reissued sheets: 8)
- 6.3 This change for TELCO consideration is to add an improvement to an existing feature.
- 6.31 Option YF is designated and Option YG is added and rated Standard. Option YG reduces an unguarded sleeve interval to prevent outpulser seizures and consequent outpulser failure registrations on permanent signal or partial dial type calls in step-by-step offices served by Crossbar Tandem offices equipped with 10 digit registers.
- 6.4 Option YD is designated and rerated Manufacture Discontinued and Option YE is added and rated Standard to increase the outpulser access timing to approximately 4 seconds.
- 6.5 A pulse repeating requirement is added to the "A" relay.
- 6.6 A section of the circuit description is eliminated regarding TSPS disconnect.
- 6.7 Reference to options YD, YE, YF and YG are added to the Option Index and Notes 102 and 104.
- 6.8 This B change does require WECO notification to TELCO.
- 6.9 Transmission is not affected by changes in this issue.
- 6.10 Direct Current Drain Data is affected by this issue but is negligible.
- 6.11 Equipment information is affected and will be covered by WECO drawing J38943N-( ) which will be available about 1Q77.
- 6.12 Equipment Design Requirements are not affected.
- lb



NOV 12 1976

CD-32245-01  
ISSUE 8B  
APPENDIX 2B  
DWG ISSUE 24B  
DISTN CODE 1D99  
DATED 9-10-76

STEP-BY-STEP-SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OR TSPS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGESB. Changes in ApparatusB.1 SupersededSuperseded By

1 - Resistor (H), Option YD,  
626 Kohm,  $\frac{1}{2}$  Watt

1 - Resistor (H), Option YE,  
1 Megohm,  $\frac{1}{2}$  Watt

D. Description of Changes

D.1 Option YF is designated and option YG is added and rated Standard. Option YG reduces an unguarded sleeve interval to prevent outpulser seizures and consequent outpulser failure registrations on permanent signal or partial dial type calls in Step-by-Step offices served by Crossbar Tandem offices with 10 digit registers.

D.2 Option YD is designated and rerated to Mfr. Disc. and option YE is added and rated Standard to increase the outpulser access timing.

D.3 A pulse repeating requirement is added to the (A) relay.

D.4 Reference to options YD, YE, YF and YG are added to the options used index and to Notes 102 and 104.

F. Changes in CD Sections

F.1 Under SECTION IV - REASONS FOR REISSUE, item D.1 should be modified to eliminate reference to No. 1 TSPS.



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DRAWING NOTICE

TITLE	Step-by-Step Systems - No. 1, 350A, 355A or 35E97 - Outgoing Trunk Circuit - To CAMA, TSPS No. 1 Office - Loop Pulsing - With ANI Type B or ANI Type C - For No. 1, 350A, 355A - And ANI Type C for 35E97	SD-32245-01 CD ISSUE 8B RATING AT&TCo Standard-A&M Only for 350A or 35E97 SYSTEM SXS DATE 03-26-76 DRAWING DISTRIBUTION CODE:	ISSUE 23B APPX 1B ADD. 1D99
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DESCRIPTION

- 6.1 Project: None
- 6.2 Reissued sheets: A1, A2, B1, B2, C1, C2, D1, D2, G1, G3  
(Total reissued sheets: 10)  
Added sheets: G4  
(Total added sheets: 1)
- 6.3 This change for TELCO consideration is to correct a trouble condition. The ring station customers are being billed for calls originated by the tip station customer. The relay sequence of operation between the ANI (PTC Relay) and the Auxiliary Trunk (CC Relay) is too critical and they could operate simultaneously if they are at the limit of their specification ranges, causing a party test before the tip and ring conductors are "cut-through" to the subscribers station equipment.
- 6.31 To correct this problem, the release time of the C1 relay is delayed an additional 30 to 60 msec by removing the "B" contact, option ZW, from the secondary winding of relay C1.
- 6.32 A connection is added to a totalizer circuit, option YA.
- 6.4 This change also covers: Drafting correction
- 6.5 This B change does require WECO notification to TELCO.
- 6.6 Transmission is not affected by changes in this issue.
- 6.7 Direct Current Drain Data is affected by this issue but is negligible.
- 6.8 Equipment information is affected and will be covered by WECO drawing J38943N-( )
- 6.9 Equipment Design Requirements are not affected.



CIRCUIT DESCRIPTION

JUN 17 1976

CD-32245-01  
ISSUE 8B  
APPENDIX 1B  
DWG ISSUE 23B  
DATE 03-26-76  
DISTN CODE ID99

STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35-E-97  
OUTGOING TRUNK CIRCUIT  
TO CAMA, TSFS NO. 1 OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35-E-97

CHANGES

B. CHANGES IN APPARATUS

B.1 Added

E - 446F Diode, Option "YA", App. Fig. 1

B.2 Superseded

Superseded By

PTKA - 18AC Resistor  
Option YB, ZU, App. Fig. 1

PTKA - Resistor - KS 14603,  
LSBD, 499SL, 10 Watt,  
Option YC, ZU, App. Fig. 1

D. Description of Changes

D.1 FS1 has been revised to show the addition of "ZW" option.  
Wiring formerly not designated has been designated "ZV" option  
and rated "Mfr Disc." Option "ZW" prevents tip party billing to  
ring party .

D.2 FS2 has been revised to show the addition of "YA" option.  
Wiring formerly not designated has been designated "ZZ"  
option and rated "Mfr. Disc." Option "YA" adds a connection  
to a traffic usage or totalizer circuit.

D.3 Circuit Note 104 has been modified.

D.4 CADs 2, 3, r, 11 & 12 are rated Mfr. Disc., CADs 8, 9 &  
10 are changed and CADs 13, 14 & 15 are added to reflect  
the above.

F. CHANGES IN CD SECTION III

F.1 In 4.01, add the following connecting circuits:

(x) ANI-B Identifier Circuit - SD-1C593-01.

(y) Totalizer Circuit - SD-95965-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

Dept 5245-GFC  
WECO Dept 2311 -NCR-WEA



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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## DRAWING NOTICE

SD-32245-01

ISSUE 22B

CD 8B

APP.

RATING AT&amp;TCo Standard

SYSTEM SXS

DATE March 7, 1973

DWG DIST CODE: 1D99

## TITLE

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit - To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1, 350A, 355A - And ANI Type C For 35E97

## DESCRIPTION

JUL 13 1973  
C.

- 6.1 PROJECT: None
- 6.2 Reissued sheets: A1, A2, B2, C1, C2, D1, E1, E2, F1, G3  
(Total reissued sheets: 10)
- 6.3 This change for TELCO consideration, is to insure that lamp "TTO" of the test and line verification circuit (SD-32379-01, ANI Type C) operates when testing a trunk for ground removal test failure.
- 6.31 Option ZS is added and rated Standard to insure the operation of lamp TTO in the above mentioned test.
- 6.32 Reference to Option ZS is made in Note 104 and the Option Index.
- 6.33 Sequence Chart 3 is changed to reflect the recycling of trunk timer TM on a ground removal failure which was not previously documented.
- 6.4 This change also eliminates the printing of false trouble tickets on false starts to the outpulser on Dial-1 type calls, followed by no other digits, where timed disconnect on partial dialed calls is furnished by the crossbar tandem office with 10 digit registers or by the TSPS No. 1 Office.
- 6.41 Option ZT is designated and rated Standard for use in those offices where timed disconnect is furnished by this circuit.
- 6.42 Option ZU is added and rated Standard for use in those offices where timed disconnect is furnished by the crossbar tandem office equipped with 10 digit registers or the TSPS No. 1 Office.



- 6.43 Associated with Option ZU is the addition of resistor PTKA and the designation of relay PTKA which is undesignated when Option ZE is furnished. These modifications will prevent lead ST to the outpulser connector from being closed until after the second digit has been dialed into CAMA and the party test check has been made.
- 6.44 Reference to Options ZT and ZU is made in the Option Index and Notes 102 and 104.
- 6.5 Add Maintenance BSPs to Supporting Information Table.
- 6.6 In the Circuit Requirements Table, the BSP Figure Number for relay A (221FAE) is corrected to show 728. Prior to this issue, 366 was shown.
- 6.7 This B change does require WECO notification to TELCO.
- 6.8 Transmission is not affected by changes in this issue.
- 6.9 Direct Current Drain Data is not affected by this issue.
- 6.10 Equipment information is affected and will be covered by WECO drawing J38943N-( ) which will be available about 2Q73.
- 6.11 Equipment Design Requirements will be available about 3Q73 in J38943N, BSP Section 814-507-150, Issue 6, Addendum 1.



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STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35-E-97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35-E-97

MAR 23 1973  
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#### SECTION IV - REASONS FOR REISSUE . . . . . 12

### SECTION I - GENERAL DESCRIPTION

#### 1. PURPOSE OF CIRCUIT

1.01 This outgoing trunk circuit completes calls to the CAMA office from step-by-step offices arranged for automatic number identification type B or type C.

#### 2. GENERAL DESCRIPTION OF OPERATION

2.01 The trunk is reached by dialing a directing code through selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

2.02 During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party; the tip party being identified by ground through the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

2.03 When the CAMA office is ready to receive the calling number, supervision is received over the trunk; the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication and then checks to see that the call is not abandoned.

2.04 When ANI type B is used in the office, the outpulser then causes the trunk to connect identification tone, generated by one of the two oscillator circuits associated with the trunk to the sleeve. This is used by the identifier to derive the calling number which is registered in the outpulser.

2.05 When ANI type C is used, the outpulser causes the trunk to connect dc pulsing voltage generated by the pulse generator to the sleeve. This is used by the Number Network and Identifier Circuit to derive the calling number which is then registered in the outpulser.

2.06 After identification the outgoing trunk conductors are transferred to the out-

pulser which then sends the calling number to the CAMA office, using MF signaling.

2.07 No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

2.08 At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket, after which the trunk and switches are released. On calls from 2-party message rate lines the 2-party message rate trunk circuit between the line finder and first selector is caused to cut through after outpulsing the calling number so that a ground removal test can be made at the end of the call.

2.09 Provision is made to allow this trunk to operate on a non-ANI basis. The result is that the trunk will not perform the party test, party test check, and the ground removal test. In addition, the trunk will be unable to seize an outpulser through the outpulser connector.

2.10 The trunk also provides on an optional basis a timed disconnect feature on partial dial calls.

2.11 Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.

### SECTION II - DETAILED DESCRIPTION

#### 1. SEIZURE, SC1

1.01 On seizure of the trunk by a selector, relay A operates over the loop, operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit opens the BR, LTB, or ATB lead to the Traffic Register Circuit, and opens the high resistance winding of relay CS from the trunk tip and ring. B1 operated initiates a start timing in the connecting timing circuit.

1.02 Relay A closes the low resistance winding of CS in series with transformer A to the trunk to seize the incoming trunk in the CAMA office.

2. PULSING CALLED NUMBER, SC1

2.01 The A relay follows dial pulses as the customer dials the called number. When A releases on the first open, it operates the C relay which operates C1. Relay C transfers the tip and ring to resistance battery and ground, respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. Relays C and C1 hold during pulsing but release at the end of each digit, restoring the loop condition. Relay B holds over pulsing.

3. PARTY TEST, OPTION ZQ AND SC1

3.01 A party test is made between the first and second digits as follows.

3.02 With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized capacitor timed relay, electrically biased on its primary winding. When C1 releases, battery through the secondary winding charges capacitor C. As the capacitor charges, the current through the S winding decreases until it is less than the P or bias winding current, at which point the relay releases. The time to release depends upon the type of test and is shown on the sequence chart.

3.03 Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110-volts (option H) or negative 48-volts (option J) through the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or non-operated position after being applied to the line.

TIP PARTY-FLAT RATE

3.04 Tip party stations are equipped with 3640-ohm ringers connected to ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48 volts through resistance lamp PT to the line. The -48 volt battery, in conjunction with the PT varistor and shunting resistor B, discharges the line when a 110-volt party test is used in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

3.05 The circuit for PTC is opened by PTM also. PTC is slow to release due to

the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

RING PARTY-FLAT RATE

3.06 Ring party stations will have no ground on them. The test is made as in 3.04 and 3.05 except that when PTM releases, PT should be nonoperated. RP operates through the PT back contact, opens the circuit for TP, and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48 volts through resistance lamp PT until PTC releases as described in 3.04 and 3.05. RP releases.

MESSAGE RATE LINES

3.07 On calls from 2-party message rate lines, the party test relay cannot test the line itself because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification. Individual message rate lines will be treated as ring party lines.

3.08 As will be described later, a direct test of 2-party message rate lines is made on disconnect.

MULTIPARTY LINES OTHER THAN 2-PARTY

3.09 The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

3.10 Where tube sets with 3-element tubes are used on such lines and these lines have access to any trunks arranged for -110 volt party test, it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

CHECK OF PARTY TEST FEATURE, OPTION ZQ, SC1 AND SC5

3.11 To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated.

ated. This is done at the end of the second digit as follows.

#### A. Check of 110-Volt Type Party Test

3.12 C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates through either TPA or RPA operated. Relay PTK operated in turn operates relay PTKA (Option ZU). Relay PTKA operated partially prepares a path for seizing the output pulser through the output pulser connector and locks relay PTK under control of ground on the sleeve lead. If TPA is operated, PTK connects resistors V and W, a total of 6720 ohms, to the PT relay secondary windings. This is a nonoperate for PT. When PTM releases with PT nonoperated, RP and RPA operate and lock. In addition, relay PTM released releases relay PTK (Option ZT).

3.13 With TPA, RPA, and RP operated, a ground is connected to the T lead to the output pulser connector as a tip party indication to the output pulser as described later.

3.14 If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y, Z, and inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated, TP and TPA will operate and lock.

3.15 With TP, TPA, and RPA operated and RP nonoperated, a ground is connected to the R lead to the output pulser connector as a ring party indication to the output pulser.

3.16 If the PT relay fails to operate on the 3640- or 2650- ohm ringer ground to a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154- ohm operate test on the relay on which it should also fail. On release of relay PTM, relay RP will operate and relay PTK (Option ZT) releases. Relay PTK released in turn releases relay RP. Hence, either relays RP and RPA (Option ZU) or relay RPA (Option ZT) is finally operated and neither T nor R lead to the output pulser is grounded.

3.17 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated (Option ZU). When Option ZT is furnished, relay TP will release when relay PTK releases. On this condition neither T nor R lead to the output pulser is grounded.

#### B. Check of -48 Volt Type Party Test

3.18 Relay C1, operating on the second digit, operates PTM as previously described. On release of C1, relay PTK operates through either TPA or RPA oper-

ated. Relay PTK operated in turn operates relay PTKA when Option ZU is furnished. Relay PTKA operated partially prepares a path for seizing the output pulser through the output pulser connector and locks relay PTK under control of ground on the sleeve lead. At this time resistors AF and AG, a total of 5760 ohms, are connected to the PT primary and through capacitor PT to the secondary. The current flow is enough to operate PT. However, when the call is identified as tip party, a nonoperate test is made on a time basis instead of a current basis. RPA nonoperated will shorten PTM release time to 24 to 30 msec. Timing starts at the release of C1 and ends at the release of PTM. If the tertiary biasing winding and the AC bucking secondary are operative, relay PT will not operate in the allotted time of 24 to 30 msec. When PTM releases with PT nonoperated, RP and RPA operate and lock. In addition, relay PTM released releases relay PTK (Option ZT). With TPA, RPA and RP operated, a ground is connected to the T lead to the output pulser connector as a tip party indication to the output pulser.

3.19 When the call is identified as a ring party, an operate test is made on relay PT. When PTK operates, resistors AF and AG, a total of 5760 ohms, are connected to PT as described above. With the RPA operated, relay timer PTM will release in 50 to 60 msec. This is the operate condition for relay PT. When PTM releases with PT operated, TP and TPA will operate and lock. Relay PTM released in turn causes relay PTK to release (option ZT).

3.20 With TP, TPA, and RPA operated and RP nonoperated, a ground is connected to the R lead to the output pulser connector as a ring party indication to the output pulser.

3.21 If the PT relay fails to operate on the 3640- or 2650- ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5760- ohm operate test on the relay on which it should also fail. In this case, when relay PTM releases, relay RP will operate and relay PTK (Option ZT) releases. Relay PTK released causes relay RP to return to normal. Hence, either relays RP and RPA (Option ZU) or relay RPA (Option ZT) is finally operated and neither T nor R lead to the output pulser is grounded.

3.22 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated (Option ZU). When Option ZT is furnished relay TP will release when relay PTK releases. On this condition neither T nor R lead to the output pulser is grounded.

#### 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER, OPTION ZQ AND SC2

SUPERVISION

4.01 After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating Pl which locks. Pl will not operate if B has released due to an abandonment.

#### CALLING IN OUTPULSER

4.02 Pl connects battery through resistance lamp A to the ST lead to the outpulser connector in order to get an outpulser connected to this circuit, and starts the TM timer.

4.03 The trunk and outpulser are connected together over five leads, T, R, TPT, AB, and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead for battery, it operates the SP relay.

4.04 SP locks and removes itself from the SP lead: (1) opens the ST lead to the link. (2) stops the timer. (3) releases relay RPA if the calling party is a tip station. Relay RPA released opens ground from the T lead and if option ZT is provided, releases relay RP. If the calling party is a ring station, releases relay TP thereby opening ground from the R lead. (4) connects the SP1 relay to the SP lead, (5) connects the MF relay to the AB lead, and (6) connects the ID relay to the R lead.

#### TESTING FOR ABANDONED CALL

4.05 Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T and R to the outpulser T and R, while relay SP1 is holding the A operated. SP1 is released when the outpulser is satisfied.

4.06 An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

#### IDENTIFYING THE LINE

4.07 When the outpulser is ready for line identification by the identifier, ID is operated. ID connects either tone from one of the oscillators (when the office is arranged for ANI type B or dc pulsing from the pulse generator) to the selector multiple sleeve. The oscillator and generator have a low dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification.

ID is released when identification is completed.

#### OUTPULSING CALLING NUMBER

4.08 When the outpulser is ready to send out the calling number it operates relay MF, transferring the trunk T and R to the outpulser T and R. MF prevents the operation of C since opening the trunk T and R releases CS, and MF holds B until the outpulser releases. Release of the A relay during this time is ineffective.

#### RELEASE OF OUTPULSER

4.09 When the outpulser has completed its work it releases the connector, opening its connection to the trunk circuit. SP remains operated in this circuit.

#### 5. DISCONNECT, SC3

##### CALLING PARTY DISCONNECTS FIRST

5.01 When the calling party disconnects, A releases. With CS and Pl operated, C does not operate because of a shunt path through Pl to the C resistor but C1 operates, its circuit having been transferred by Pl to the A contacts. The circuit to slow release B is opened. Relay A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

##### A. Ring Party, Option ZQ

5.02 When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to Pl. B1 released with C1 operated opens the loop to the A relay preventing re-seizure until C1 releases. In addition, B is prevented from reoperating until C1 has released. This prevents the trunk from being re-seized on the same call once release has progressed beyond the point where B is normal. When Pl releases, the sleeve ground is opened to release the preceding circuits and releases relays PTK and PTKA (Option ZU). Pl is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

##### B. Tip Party - Ground Removal Test, Option ZQ

5.03 When the calling station is a tip party, relay TPA will be operated (and relay RP if option ZU is provided) and, on disconnect by the customer, the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

5.04 Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B, and with P1 operated, operates relay C1. Relay C as noted in 5.01 does not operate. Relay B released in turn releases relay B1. Relay B1 normal causes relay RP (Option ZU) and relay SP to release. B1 and SP released close a circuit to operate GRT through contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

5.05 GRT operating (1) closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and (2) holds TPA operated.

5.06 With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases, relay PTK operates (Option ZT) and after a timed interval, relay PTM releases. Relay PTM released in turn causes relay PTK (Option ZT) to release.

5.07 If there is no ground at the station, PT will be nonoperated when PTM releases and RP will operate. Relay RP operated causes relay PTK (Option ZU) to release, and opens the circuit to relay TPA and the selector multiple sleeve. Relay PTK released causes relay PTKA to release. Relay TPA released returns relay GRT to normal, which in turn releases relays RP and PTC. Until relay PTC releases, relay A cannot be reoperated.

#### C. 2-Party Message Rate - Ground Removal Test, Option ZQ

5.08 During the outpulsing of the calling number, as described in 4.08 and 4.09, the operation of MF grounds the C lead to the selector multiple. On calls from 2-party MR lines, this lead is carried back to the 2 PTY MR trunk circuit and the ground causes that trunk to cut through as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

5.09 On disconnect by the 2 PTY MR station, therefore, a ground removal test is made as described in 5.03 through 5.09.

#### D. Ground Removal Failure, Option ZQ

5.10 When the ground removal test is started by GRT operating as described in 5.03 through 5.07, the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 9.5 to 10.5 or 10 to 23.4 seconds, depending upon which type of timer is supplied. During this time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

5.11 At the end of timing TM operates, operating TM1 which is slow acting. TM1 releases TM, at which time a circuit is completed for operating TP, which locks.

5.12 TM1 releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser. In addition, relay TM1 released initiates another complete timing cycle.

5.13 The indication to the outpulser of ground removal failure is ground on the TPT lead for a 2-party flat rate line and ground on the AB lead for a 2-party message rate line. Relay MR operated transfers the ground to the AB lead.

5.14 When the outpulser is connected and after it has received the ground removal failure indication, it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

5.15 Identification of the calling line is made as before, the ID operating over the R lead to connect tone or dc pulsing to the sleeve. Relay ID operated in turn causes the release of relays PTK and PTKA (Option ZU).

5.16 With relays ID and GRT operated, relay RPA if operated is released and relay TPA is released. Upon completion of identification, relay ID is released which in turn causes relay TPA to reoperate. Relay TPA operated at this time holds relay GRT operated until the timing cycle initiated in paragraph 5.12 is complete and relay TM1 has operated. When relay TM1 operates, relay GRT is released over its

primary winding. Prior to this, the out-pulser opened the secondary winding of relay GRT.

5.17 Relay GRT released releases relays SP, TP, TPA and PTC, and relay MR if operated. Relay TP released releases relay TM which in turn releases relay TML. Relay TML released opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release, holds the T and R of the selector multiple open so that if a new call were to seize the trunk, the previously operated relays would be normal before the A and B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

**CALLED PARTY DISCONNECTS FIRST - TIMED DISCONNECT, SC4**

5.18 When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

5.19 CS1 operates C through P1 operated. CS releases CS1, which is slow to release, to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

5.20 A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1, and P1 release. Relay B1 released releases relay SP and relay RP if operated (Option ZU). From this point on, the circuit functions the same as described in paragraph 5.02 if the calling station is a ring party and paragraphs 5.04 through 5.07 if the calling station is a tip party, or a 2-party MR line.

**TIMED DISCONNECT ON PARTIAL DIAL CALLS, SC7**

5.21 Upon seizure of this trunk, after the B1 relay operates, a start timing condition is initiated in the connecting timing circuit by grounding the PU9 or ST lead. The receipt of this ground results in the return of a -48 volt battery signal over the same lead to operate the PU relay. If the calling customer fails to dial the proper number of digits (partial dial condition) before a timed interval of 3 to 7 or 4 to 8 minutes, depending on the type of office, the timing circuit will ground the A9 or ET lead to operate the TML relay. The TML relay operated, operates the P1 relay. The P1 relay operated, operates the C relay and releases the PU relay. The C relay operated opens the incoming S lead to release the preceding circuits.

When the circuits release, the holding path for the A relay is opened, so A releases. Relay A released shunts down the slow release C relay and opens the holding path for the slow release B relay. When C releases, it reconnects ground to the S lead to make this circuit appear busy. The B relay releases the B1 and P1 relays. The B1 released releases the slow release TML relay which removes ground from the S lead and restores the trunk to normal.

## 6. AUTOMATIC NUMBER IDENTIFICATION TEMPORARILY NOT REQUIRED

6.01 When option ZQ is not provided, then either options G, ZN and ZO (+130 volt timer), or options F and ZN (-48 volt timer) will be furnished. In both cases, the circuit will function the same as described in the previous paragraphs with the exception to the following:

- (a) During the interdigital time between the first and second dialed digits, the relays associated with the party test will be rendered inoperative.
- (b) During the interdigital time between the second and third dialed digits, the check of the party test relays will not be performed.
- (c) Lead "ST" to the outpulser connector cannot be closed, thereby preventing seizure of an outpulser for identification purposes.
- (d) On disconnect, the trunk will not be held in order to perform the ground removal test as this test is also non-functional.
- (e) Timing associated with outpulser seizure and the ground removal test is rendered inoperative.

## 7. TIMING CIRCUIT

**AWAITING OUTPULSER FOR IDENTIFICATION**

7.01 Referring to 4.02 through 4.04, P1 operating to call in the outpulser also starts the timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds when 130-volt tube timer is used or 3.8 to 4.2 seconds when 48-volt timer is used, the start circuit will be opened to prevent holding out other trunks.

### A. 130-Volt Timer Operation

7.02 Assuming an outpulser is not connected, P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now

charges through resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown, the tube is ionized and transfers to the main gap, operating the TM relay.

7.03 TM locks to ground through TML, and this ground extinguishes the tube. TM operates TML which is slow to operate to give the tube time to deionize. TM and TML reconnect battery to capacitor D to discharge it through the F resistor and restore -48 volts to the control anode of the tube. TML locks through B1 operated and, unless TP is operated, releases TM.

7.04 After disconnect by the customer TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

#### B. 48-Volt Timer Operation

7.05 Assuming an outpulser is not connected, P1 operating applies battery to terminal 2 of timer TM. Resistors AA, AB, capacitor F, and internal components of timer TM are such that the timer will function and operate relay TM within 3.8 to 4.2 seconds.

7.06 TM locks to the applied 48 volts through TML. TML operates, locks to B1, and disables the timer, discharges capacitor F and releases relay TM.

7.07 The circuit remains in this condition until disconnect. After disconnect by the customer, TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

#### GROUND REMOVAL FAILURE

##### A. 130-Volt Timer

7.08 Referring to 5.11 through 5.18, GRT operating starts the timer circuit by opening -48 volt battery from the control anode of the tube and from capacitor D. With GRT operated, resistor G, instead of resistor H, is included in the charging circuit for capacitor D described in 7.02. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

7.09 Relays TM and TML operate and the tube is extinguished.

##### B. 48-Volt Timer

7.10 Referring to 5.11 through 5.18, GRT operation applies -48 volts to timer TM. On ground removal test resistor AB, capacitor P and timer components will cause the timer to function and operate TM within 9.5 to 10.5 seconds.

#### AWAITING OUTPULSER ON GROUND REMOVAL FAILURE

7.11 The timer is again recycled to time for 10 to 23.4 seconds with 130-volt operation or 9.5 to 10.5 seconds with 48-volt operation. As described in 5.11 through 5.18, TP operates when TM is released and TML is operated at the end of the 10-second timing. TML releases and its slow release gives time for capacitor D or F to discharge before again starting to charge it. TML released with TP operated closes the start lead to the outpulser connector.

7.12 Relay TML released initiates another timing cycle. This trunk cannot return to normal until this timing interval is complete. At the end of the timed interval, relay TM operates and locks, which in turn causes relay TML to operate. Relay TML operated initiates final release of this trunk as described in paragraphs 5.16 and 5.17.

7.13 If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser, the TM operates and locks to TP. TML operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

7.14 TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TML. The sleeve is held grounded until TML releases, after which the preceding circuits are released and the trunk is restored to normal.

#### 8. TESTING

##### FROM TEST JACKS

8.01 Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

## FROM TEST CIRCUIT

8.02 Relays TT and TT1 and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the FR lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test, which it does by operating the TT1 relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

8.03 When the outpulser is called in on a test call, the TST lead to the outpulser connector is grounded to indicate that it is a test call.

9. MISCELLANEOUS

## LAST TRUNK BUSY REGISTRATION, S OPTION

9.01 Means are provided for operating a traffic register. Ground is extended to the LTB lead when the circuit is normal. This lead, which is connected on the last trunk of an identifier group, is open whenever the circuit is busy for any reason.

## TRAFFIC USAGE RECORDER, R OPTION

9.02 Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the BR lead to the traffic usage recorder circuit; otherwise, the BR lead is grounded.

## ALL TRUNKS BUSY REGISTRATION, F OPTION

9.03 Means are provided for operating a traffic register. Ground is extended to the ATB lead when the circuit is normal. This lead is multiplied to leads of other trunks in the same group. When all trunks of the group are busy, ground is removed from the lead to the register.

## PEG COUNT

9.04 Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead OSF to the miscellaneous circuit (for trunk frames) is grounded from the time TM is operated until TM1 operates. No registration is made on ground removal operation of the timer as GRT opens the OSF lead.

## HOLDING CIRCUIT FOR TRACING TROUBLE

9.05 The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on the LU lead from the Miscellaneous Circuit for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure, and a ground removal test will not be made on disconnect when TR is operated.

## FUSE OPERATION

9.06 Relay MB is normally operated through the MB resistor. If the circuit fuse is operated or is removed, MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.

SECTION III - REFERENCE DATA1. WORKING LIMITS

## 1.01 Battery Voltages

-45 to -52 volts  
+125 to +135 volts  
-116 to -120 volts or -100 to -120 volts

## 1.02 Relay Limits

A Relay Pulsing - Maximum External Circuit Loop Resistance 1500 ohms

A Relay Supervisory - Maximum External Circuit Loop Resistance 2375 ohms

A Pulsing and Supervisory - Minimum Insulation Resistance 15,000 ohms

CS Relay - Supervisory - Maximum External Circuit Loop Resistance 7500 ohms

CS Relay - Supervisory - Minimum Insulation Resistance 30,000 ohms

PT Relay - Maximum External Circuit Loop Resistance 1500 ohms

PT Relay - Minimum Insulation Resistance 15,000 ohms.

PT Relay - Maximum Resistance to Ground at Tip Party of 2-Party FR Line 4004 ohms

Party Test Operated From	DC	Earth Potential	
		25~ AC	60~ AC
-100 -120 -CC Supply	-11V, +20V	7V	10V
-116 -120V -CC Supply	-16V +20V	10V	14.5V
45 -52V Supply	-5V +5V		20V

## 2. FUNCTIONAL DESIGNATIONS

None

## 3. FUNCTIONS

- 3.01 When a loop is closed on the selector multiple tip and ring: to ground the sleeve lead, to hold the preceding circuits, and to close the loop to the distant office.
- 3.02 To repeat dial pulses on a battery and ground basis.
- 3.03 During the first interdigital period, to make a party test.
- 3.04 During the second interdigital period, to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 3.05 When battery and ground is reversed at the distant office, to close the ST lead to the outputpulsor connector circuit.
- 3.06 When the outputpulsor connector has connected an outputpulsor circuit to this circuit:
- (a) To indicate tip or ring party by ground on the T or R lead.
  - (b) To remove the party indications when the outputpulsor operates the SP relay.
  - (c) To connect the outputpulsor tip and ring to the subscriber tip and ring for an abandoned call test when the outputpulsor operates the SPI relay.
  - (d) When the trunk is arranged for ANI type B, to connect identification tone to the selector multiple sleeve from one of the oscillators when the outputpulsor operates the ID relay.
  - (e) When the trunk is arranged for ANI type C, to connect dc pulsing to the selector multiple sleeve from the pulse generator when the outputpulsor operates relay ID.
  - (f) To connect the outgoing tip and ring leads to the outputpulsor tip and ring when the outputpulsor operates the MF relay.
  - (g) To connect ground to the selector multiple C lead when MF is operated to cut through the 2 PTY MR trunk if it is connected.
- 3.07 When a 2 PTY MR trunk is connected, to operate and lock the MR relay after that trunk cuts through.
- 3.08 On hang up by the calling party:
- (a) To open the tip and ring to the distant office.
  - (b) To make a ground removal test if the calling party was a tip party or either party of a 2 PTY MR line.
  - (c) To restore to normal immediately if the calling party was a ring party.
  - (d) To restore to normal after the ground removal test shows the line is clear of ground.
  - (e) When 130-volt tube-type timer is used, to call in the outputpulsor on ground removal test if the line is not clear of ground after 10 to 24 seconds.
  - (f) When 48-volt type timer is used, to call in the outputpulsor on ground removal test if the line is not clear of ground after 9.5 to 10.5 seconds.
  - (g) On ground removal failure, to ground the TPT lead to the outputpulsor on a flat rate line or the AB lead on a message rate line.
  - (h) To remove the failure indications when the outputpulsor operates the SP relay.
  - (i) When the trunk is arranged for ANI type B, to connect identification tone to the sleeve when the ID is operated.
  - (j) When the trunk is arranged for ANI type C, to connect dc pulsing to the sleeve when ID is operated.
  - (k) To hold the GRT relay from the outputpulsor over the SP lead and restore the trunk and preceding circuits to normal when the outputpulsor opens this lead.
- 3.09 When the calling party fails to disconnect before the incoming trunk times out:
- (a) To open the sleeve to the selector multiple long enough to release the preceding switches.
  - (b) When the selector multiple tip and ring leads open, to restore to normal.

- (c) To reclose ground to the selector sleeve during release of the trunk.
- 3.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.
- 3.11 To test busy when a fuse operates.
- 3.12 To operate a last trunk busy register or operate the traffic usage recorder.
- 3.13 To operate a peg count register when the timing cycle circuit functions, except on ground removal operation.
- 3.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.
- 3.15 When the trunk is arranged for ANI type B, to hold the connection from releasing when the outputer operates the TR relay.
- 3.16 Provides for timed disconnect on partial dial calls.
- 3.17 Provide on an optional basis the temporary operation of this trunk circuit, as a non-ANI trunk.
- 3.18 To prevent seizure of the outputer until after the second digit has been dialed into CAMA and the party test check has been made when timed disconnect on partial dial calls is furnished by the crossbar tandem office equipped with 10 digit registers.

#### 4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

- (a) Automatic Trunk Test Circuit - SD-32315-01.
- (b) Identifier Circuit - SD-95810-01.
- (c) Incoming Trunk in No. 4 Crossbar Office - SD-68480-01.
- (d) Incoming Trunk in No. 5 Crossbar Office - SD-26101-01.
- (e) Incoming Trunk in Tandem Office - SD-27036-01.

- (f) Incoming Trunk in SXS CAMA Office - SD-32255-01.
- (g) Miscellaneous Circuit for Trouble Ticketer - SD-95823-01.
- (h) Miscellaneous Circuit Trunk Frame - SD-32248-01.
- (i) Miscellaneous Alarm Circuit Register Circuit - SD-31976-01.
- (j) Outputer Connector Circuit - SD-95890-01.
- (k) Oscillator Circuit - SD-95827-01.
- (l) Pulse Generator Circuit - SD-32378-01.
- (m) Rotary Out Trunk Switch Circuit - SD-30868-01.
- (n) Selector Bank Multiple Circuit - SD-32123-01.
- (o) Traffic Register Circuit - SD-30896-01.
- (p) Traffic Usage Recorder Circuit - SD-95738-01.
- (q) Auxiliary Trunk Circuit - SD-32281-01.
- (r) Auxiliary Trunk Circuit - SD-32500-01.
- (s) Test and Line Verification Circuit - SD-32379-01.
- (t) Incoming Trunk Circuit - Loop Signaling Dial Pulsing - SD-1B002-01.
- (u) Auxiliary Timing Circuit - SD-32525-01.
- (v) Common Timing Circuit - SD-31310-01, SD-31558-01.
- (w) Signaling and Transmission Systems Compatibility Information - SD-99421-01.

#### 5. MANUFACTURING TESTING REQUIREMENTS

5.01 This outgoing trunk circuit shall be capable of performing all the functions or working limits specified in SECTION III - REFERENCE DATA, meeting all the requirements of the Circuit and Timing Requirements Tables, and battery voltage or other limits in SD-32245-01.

#### 6. TAKING EQUIPMENT OUT OF SERVICE

6.01 The circuit may be made busy by inserting a dummy plug into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy, which will be indicated by ground potential.

6.02 The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

6.03 Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time, after P1 opens sleeve ground, to insure releasing the preceding switches and freeing the customer line.

6.04 Similarly, during ground removal test, PTC prevents CS from holding the circuit locked up.

#### SECTION IV - REASONS FOR REISSUE

##### B. Changes in Apparatus

###### B.1 Added

1-18AC Resistor (PTKA), ZU Option - App. Fig. 1

##### C. Changes in Circuit Requirements Other Than Those Caused by Changes in Apparatus

C.1 The BSP figure number for relay A is changed from 366 to 728 to show the correct number.

##### D. Description of Changes

D.1 Option ZU is added in FS2 for use in offices where timed disconnect on partial dial calls if furnished by the Cross-bar Tandem Office E/W 10 digit registers or by the TSPS No. 1 Office. Option ZT shows the former wiring which is provided in SXS offices where timed disconnect is furnished by this circuit.

D.2 Option ZU eliminates false trouble tickets from being printed on false starts to the outpulser on dial 1 - type calls followed by no other digits. With option ZU, lead ST to the outpulser is held open until after the second digit has been dialed into CAMA and the circuit has completed the check of party test.

D.3 The lower half of an AK45 relay presently in the circuit (App. Fig. 1), undesignated when option ZE is furnished, is designated PTKA when option ZU is furnished.

D.4 Option ZS is added in FS2 to insure lighting the TTO lamp in the ANI-C test circuit on ground removal test.

D.5 Changes associated with options ZT and ZU are reflected in SC1, SC2, SC3, SC4 and SC5.

D.6 SC3 is modified to show that when a ground removal failure occurs, timer TM recycles for an additional 10 to 24 seconds before returning the trunk circuit to normal.

D.7 Reference to options ZS, ZT and ZU is added to notes 102 and 104, and the Option Index Table.

##### F. Changes in Description of Operation

F.1 Change, under SECTION III - REFERENCE DATA, the heading 5. TAKING EQUIPMENT OUT OF SERVICE, and paragraphs 5.01 through 5.04 to read:

6. TAKING EQUIPMENT OUT OF SERVICE, and respectively paragraphs 6.01 through 6.04.

F.2 Add to SECTION III - REFERENCE DATA:

##### 5. MANUFACTURING TESTING REQUIREMENTS

5.01 This outgoing trunk circuit shall be capable of performing all the functions or working limits specified in SECTION III - REFERENCE DATA, meeting all the requirements of the Circuit and Timing Requirements Tables, and battery voltage or other limits in SD-32245-01.

NOTE: This reissue also covers information authorized by the following appendices to issue 7B of this CD.

APPX - 1B - DWG ISS 18B  
APPX - 2D - DWG ISS 19D  
APPX - 3B - DWG ISS 20B  
APPX - 4B - DWG ISS 21B

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-LCB  
WECO DEPT 5152-GDA-WEA

JAN 10 1972

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-32245-01  
CD 7B  
RATING AT&TCO Standard  
SYSTEM Step-By-Step  
DATE September 7, 1971

ISSUE 21B  
APP. 4B

## TITLE

DWG DIST CODE D99

Step-By-Step Systems - No. 1, 350A, 355A or 35E97 - OUTGOING TRUNK  
CIRCUIT - To CAMA Office - Loop Pulsing - With ANI Type B or ANI Type  
C- For No. 1, 350A, 355A - And ANI Type C For 35E97

## DESCRIPTION

- 6.1 PROJECT
- 6.2 Reissued sheets: A1, F1  
Total reissued sheets: 2
- 6.3 This change for TELCO consideration is to change the information in the "Conn. Bat." column for the PT relay (H option) and in the "Conn. Grd." column for the PTM relay in the circuit requirement table to include the MB relay contact number required when ZC or ZE option is specified.
- 6.4 This B change does not require WECO notification to TELCO.
- 6.5 Transmission is not affected by changes in this issue.
- 6.6 Direct Current Drain Data is not affected by this issue.
- 6.7 Equipment information is not affected.
- 6.8 Equipment Design Requirements are not affected.



OCT 15 1971  
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STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

C. Changes in Circuit Requirements Other Than Those Caused  
by Changes in Apparatus

- C.1 In the "Conn Bat" column for the PT relay (H option)  
the information is changed from 4(MB) to 4 or 11 (MB).
- C.2 In the "Conn Grd" column for the PTM relay the informa-  
tion is changed from 2(MB) to 2 or 8(MB).

D. Description of Changes

- D.1 The changes in the Circuit Requirement Table were made  
to show the correct contact numbers required when option  
ZC or ZE is specified.

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DEPT 5223-MKD-MR



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DRAWING NOTICE

SD-32245-01

CD 7B

RATING AT&TCo. Std.

SYSTEM Step-By-Step

DATE November 24, 1970

ISSUE 20B  
APP. 3B

TITLE

DWG DIST CODE D99

Step-By-Step Systems - No.1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit - To  
CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No.1, 350A,  
355A - And ANI Type C For 35E97

DESCRIPTION

- 6.1 PROJECT None
- 6.2 Reissued sheets: A1, A2, B1, C2, D1, G2. Total reissued sheets: 6.
- 6.3 This change for TELCO consideration, is to correct a trouble condition which caused bell tapping at the originating station during pulsing.
- 6.31 This problem was caused by the previous addition of a diode (option ZK) in the loop, wired in series to ground on the terminal LM of the pulsing relay in FSl.
- 6.32 During pulsing when the dial contacts open the diode blocked the normal discharge of the voltage from the ringer capacitor, which remained in this state until the contacts closed at the end of pulsing. At this time the energy stored in the capacitor is shorted, allowing the current to flow in the ringer causing the ringing armature to momentarily tap the bell.
- 6.33 This trouble is corrected by placing a 1300 - ohm KS type resistor around the diode which shunts the diode and allows the ringer capacitor to discharge through the resistor and the bell tapping is eliminated.
- 6.4 Transmission is not affected by changes in this issue.
- 6.5 Direct Current Drain Data is not affected by this issue.
- 6.6 Equipment information is affected and will be covered by WECO drawing J38943N-(), which will be available on/about 12-1-70.
- 6.7 Equipment Design Requirements are not affected.



CIRCUIT DESCRIPTION

JAN 5 1971

CD-32245-01  
ISSUE 7B  
APPENDIX 3B  
DWG ISSUE 20B

STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

D. Description of Changes

- D.1 Option ZR wiring and apparatus is added in FS 1 and rated Standard.
- D.2 Option ZR is added in the Option Index and Note 104. Reference to the BT resistance, option ZR, is added in App Fig. 1.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-WCB-MR



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JUN 22 1970

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DRAWING NOTICE

SD-32245-01	ISSUE	19D
CD 7B	APP.	2D
RATING	AT&TCo Standard	
SYSTEM	Step-By-Step	
DATE	March 5, 1970	
DWG DIST CODE D99		

TITLE

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit -  
To Cama Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,  
350A, 355A - And ANI Type C For 35E97

EM/EL is not required.

DESCRIPTION

- 6.1 Project: None.
- 6.2 Reissued sheets: A1, A2, B2, C2, D1, G3. Total reissued sheets: 6.
- 6.3 This change for TELCO consideration, is to correct option Index change option ZL to read ZQ on sheets B2 & G3 and in notes 102 & 104 due to an error in option assignment, add note reference in note 104, and correct miscellaneous drafting errors throughout the drawing.
- 6.31 No additional apparatus or wiring is required.
- 6.4 This change also covers: Drafting correction.
- 6.5 D change. Does not require WECO notification to TELCO.
- 6.6 Equipment Design Requirements are not affected.



APR 22 1970

CD-32245-01  
ISSUE 7B  
APPENDIX 2D  
DWG ISSUE 19D

## CIRCUIT DESCRIPTION

STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT TO  
CAMA OFFICE, LOOP PULSING  
WITH ANI TYPE B OR ANI  
TYPE C FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

### CHANGES

#### D. Description of Changes

- D.1 Option ZQ is designated to eliminate the duplicate use of option ZL which appeared on issue 18B.
- D.2 Circuit Notes 102 and 104 are revised.
- D.3 Option ZQ appears in FS2 and CAD8.
- D.4 The Option Index has been changed to reinstate option ZL in FS1 and apparatus Fig. 1.
- D.5 The Option Index has been changed to reinstate option ZL in FS1 and apparatus Fig. 1.

D.6 In apparatus Fig. 1 resistor AI under Code; 145 is changed to read 221C.

D.7 In Note 104 under issue 9D, reference to Note 107 with R or S option is changed to read Note 109 and under issue 18B "Use in circuit standard". Column ZL, ZM, ZO, ZP is changed to read ZQ, ZN, ZO, ZP to correct drawing errors.

D.8 Option R has been removed from Circuit Note 107 and added to Circuit Note 109 for clarification.

D.9 The changes noted in D.1 through D.8 have been made on a no-record basis by agreement with the Western Electric Company.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5823-BWW-MR



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**DRAWING NOTICE**

SD-32245-01	ISSUE	18B
CD 7B	APP.	1B
RATING	AT&TCo. Standard	
SYSTEM	Step-By-Step	
DATE	August 13, 1969	

DWG DIST CODE D99

**TITLE**

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit - To  
 CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1, 350A,  
 355A - And ANI Type C For 35E97

**DESCRIPTION**

- 6.1 Reissued sheets A1, A2, B1, B2, B3, C2, D1, D2, G3. Total reissued sheets 9.
- 6.2 Failure can occur in this circuit due to a "trouble short" existing between contacts 3 and 7 of the PTM relay. This short operates the PTC relay which in turn places 900 ohms across the tip and ring operating the A relay. The timed disconnect feature then causes the C relay to operate resulting in an unguarded or open sleeve condition available to the preceding switch train. The next subscriber to seize this circuit will drop back to dial tone due to the open sleeve condition.
- 6.21 This trouble short occurs because of contact erosion due to showering type arcs. Pits and buildup conditions of contacts result, causing circuit failure.
- 6.22 This trouble is corrected by adding contact protection across the winding of the PTC and PTK relays to protect contacts 3 and 7 of the PTM relay during pulsing.
- 6.23 This change requires the addition of (2) two 185A networks (option ZM).
- 6.3 Options ZL, ZN, ZO, and ZP are designated to replace options E and B. Options E and B are rated Mfr. Disc. option ZL is used when ANI (Automatic number identification) is required. Option ZN is used when ANI is temporarily not required. Option ZO is used when ANI is temporarily not required and the circuit is equipped with a +130 volt timer. Option ZP is used when ANI is required and the circuit is equipped with a -48 volt timer.
- 6.31 This change is of D priority and only involves record of options.
- 6.4 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.5 B change. Requires WECO notification to Telco.
- 6.6 Equipment information is not affected.
- 6.7 Equipment Design Requirements will be covered in BSP Section BSP814.507 150 (J38943) iss. 4 about the fourth quarter of 1969.



STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT TO CAMA  
OFFICE, LOOP PULSING WITH ANI  
TYPE B OR ANI TYPE C FOR NO. 1,  
350A, 355A AND ANI TYPE C  
FOR 35E97

## CHANGES

B. Changes in ApparatusB.1 Added

Network 185A (PTC) Option ZM  
Network 185A (PTK) Option ZM

D. Description of Changes

- D.1 Option ZM is designated. Option ZM places 185A protection networks across the winding of the PTC and PTK relays to prevent contact erosion between 3 and 7 of the PTM relay.
- D.2 Options E and B are designated Mfr Disc.
- D.3 Options ZL, ZN, ZO, and ZP are designated. Option ZL is used when ANI (automatic number identification) is required. Option ZN is used when ANI is temporarily not required. Option ZO is used when ANI is temporarily not required and the circuit is equipped with a +130 volt timer. Option ZP is used when ANI is required and the circuit is equipped with a -48 volt timer.
- D.4 Circuit Notes 102, 104, and 109 are revised.
- D.5 Circuit Notes 113 and 307 are added.
- D.6 Circuit Notes 107 and 303 are designated Mfr Disc.
- D.7 CAD Fig. 8 is revised.

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DEPT 5823-BWW-MR



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## DRAWING NOTICE

SD-32245-01  
CD 7B  
RATING AT&TCo Std.  
SYSTEM Step-By-Step  
DATE September 25, 1968  
DWG DIST CODE 1D99

ISSUE 17B  
APP.

## TITLE

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit -  
To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,  
350A, 355A, And ANI Type C For 35E97

## DESCRIPTION

- 6.1 Reissued sheets A1, B1, C2, D1, D2. Total reissued sheets 5.
- 6.2 This circuit is reissued to revise the feature and option table to show two different arrangements for disconnecting partial dialed type calls originating in the step-by-step office.
- 6.21 The first is for use of this trunk to any CAMA office, except in a crossbar tandem office equipped with 10-digit. This requires a timing arrangement in this trunk, to time from seizure to receipt of a reversal from the CAMA office. If a reversal is not received before time out this trunk releases the connection, which frees the trunk and returns the calling customer to dial tone.
- 6.22 The second arrangement is used with crossbar tandem trunks that are served by 10-digit registers. This arrangement does not require timing in this trunk. It does require the crossbar tandem office to send a wink-off signal to this trunk on partial dial type calls, thereby causing the release of this trunk and the calling customer being returned to dial tone.
- 6.23 The Apparatus and wiring changes required to handle partial dial type calls were added to this circuit on issue 12D.
- 6.3 When this trunk disconnected it caused a false operate of the A relay in Incoming CAMA Trunk SD-32255-01, thereby starting a seizure for an incoming register.
- 6.31 To correct this trouble the idle line termination will no longer be applied during in service trunk operation. It still will be applied when the trunk is seized from the trunk test frame or when the TT jack is operated.
- 6.32 This change requires minor wiring and the idle line termination is now designated as ZL option.
- 6.4 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.5 B change. Requires WECO notification to Telco.
- 6.6 Equipment information is not affected.
- 6.7 Equipment Design Requirements are not affected.



## CIRCUIT DESCRIPTION

OCT 29 1968  
 mp  
 CD-32245-01  
 ISSUE 7B  
 DWG ISSUE 17B

STEP BY STEP SYSTEMS  
 NO. 1, 350A, 355A OR 35E97  
 OUTGOING TRUNK CIRCUIT  
 TO CAMA OFFICE  
 LOOP PULSING  
 WITH ANI TYPE B OR ANI TYPE C  
 FOR NO. 1, 350A, 355A  
 AND ANI TYPE C FOR 35E97

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SECTION I - GENERAL DESCRIPTION1. GENERAL

1.01 This outgoing trunk circuit is required in a step-by-step office arranged for automatic number identification type B or type C to complete calls to the CAMA office.

1.02 The trunk is reached by dialing a directing code through selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

1.03 During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground through the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

1.04 When the CAMA office is ready to receive the calling number, supervision is received over the trunk; the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication and then checks to see that the call is not abandoned.

1.05 When ANI type B is used in the office, the outpulser then causes the trunk to connect identification tone, generated by one of the two oscillator circuits associated with the trunk to the sleeve. This is used by the identifier to derive the calling number which is registered in the outpulser.

1.06 When ANI type C is used, the outpulser causes the trunk to connect dc pulsing voltage generated by the pulse generator to the sleeve. This is used by the Number Network and Identifier Circuit to derive the calling number which is then registered in the outpulser.

1.07 After identification the outgoing trunk conductors are transferred to the outpulser which then sends the calling number to the CAMA office, using MF signaling.

1.08 No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

1.09 At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued

for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket, after which the trunk and switches are released. On calls from 2-party message rate lines the 2-party message rate trunk circuit between the line finder and first selector is caused to cut through after outpulsing the calling number so that a ground removal test can be made at the end of the call.

1.10 Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.

SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 On seizure of the trunk by a selector, relay A operates over the loop, operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR, LTB, or ATB lead to the Traffic Register Circuit, and opens the high resistance winding of relay CS from the trunk tip and ring. B1 operated initiates a start timing in the connecting timing circuit.

1.02 Relay A closes the low resistance winding of CS in series with transformer A to the trunk to seize the incoming trunk in the CAMA office.

2. PULSING CALLED NUMBER

2.01 The A relay follows dial pulses as the customer dials the called number. When A releases on the first open, it operates the C relay which operates C1. Relay C transfers the tip and ring to resistance battery and ground, respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. Relays C and C1 hold during pulsing but release at the end of each digit, restoring the loop condition. Relay B holds over pulsing.

3. PARTY TEST

3.01 A party test is made between the first and second digits as follows.

3.02 With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized capacitor timed relay, electrically biased on its primary winding. When C1 releases, battery through the secondary winding charges capacitor C. As the capacitor charges, the current through the S winding decreases until it is less than the P or bias winding current, at which

point the relay releases. The time to release depends upon the type of test and is shown on the sequence chart.

3.03 Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110-volt option J or negative 48-volt option H through the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

#### TIP PARTY - FLAT RATE

3.04 Tip party stations are equipped with 3640-ohm or 2650-ohm ringers connected to ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48 volts through resistance lamp PT to the line. The -48 volt battery, in conjunction with the PT varistor and shunting resistor B, discharges the line when a 110-volt party test is used in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

3.05 The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

#### RING PARTY - FLAT RATE

3.06 Ring party stations will have no ground on them. The test is made as in 3.04 and 3.05 except that when PTM releases, PT should be nonoperated. RP operates through the PT back contact, opens the circuit for TP, and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48 volts through resistance lamp TP until PTC releases as described in 3.04 and 3.05. RP releases.

#### MESSAGE RATE LINES

3.07 On calls from 2-party message rate lines, the party test relay cannot test the line itself because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will,

therefore, be in the ring field for automatic number identification. Individual message rate lines will be treated as ring party lines.

3.08 As will be described later, a direct test of 2-party message rate lines is made on disconnect.

#### MULTIPARTY LINES OTHER THAN 2-PARTY

3.09 The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

3.10 Where tube sets with 3-element tubes are used on such lines and these lines have access to any trunks arranged for -110 volt party test, it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

#### CHECK OF PARTY TEST FEATURE

3.11 To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows.

#### A. Check of 110-Volt Type Party Test

3.12 C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates through either TPA or RPA operated. If TPA is operated, PTK connects resistors V and W a total of 6720 ohms to the PT relay secondary windings. This is a nonoperate for PT. When PTM releases with PT nonoperated, RP and RPA operate and lock.

3.13 With TPA, RPA, and RP operated, a ground is connected to the T lead to the outpulser connector as a tip party indication to the outpulser as described later.

3.14 If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y, Z, and inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated, TP and TPA will operate and lock.

3.15 With TP, TPA, and RPA operated and RP nonoperated, a ground is connected to the R lead to the outpulser connector as a ring party indication to the outpulser.

3.16 If the PT relay fails to operate on the 3640- or 2650-ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154-ohm operate test on the relay on which it should also fail.

Hence, only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

3.17 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated, and on this condition neither T nor R lead to the outpulser is grounded.

#### B. Check of -48 Volt Type Party Test

3.18 Relay C1, operating on the second digit, operates PTM as previously described. On release of C1, relay PTK operates through either TPA or RPA operated. At this time resistors AF and AG, a total of 5760 ohms, are connected to the PT primary and through capacitor PT to the secondary. The current flow is enough to operate PT. However, when the call is identified as tip party, a nonoperate test is made on a time basis instead of a current basis. RPA nonoperated will shorten PTM release time to 24 to 30 msec. Timing starts at the release of C1 and ends at the release of PTM. If the tertiary biasing winding and the AC bucking secondary are operative, relay PT will not operate in the allotted time of 24 to 30 msec. When PTM releases with PT nonoperated, RP and RPA operate and lock. With TPA, RPA, and RP operated, a ground is connected to the T lead to the outpulser link as a tip party indication to the outpulser as described later.

3.19 When the call is identified as a ring party, an operate test is made on relay PT. When PTK operates, resistors AF and AG, a total of 5760 ohms, are connected to PT as described above. With the RPA operated, relay timer PTM will release in 50 to 60 msec. This is the operate condition for relay PT. When PTM releases with PT operated, TP and TPA will operate and lock.

3.20 With TP, TPA, and RPA operated and RP nonoperated, a ground is connected to the R lead to the outpulser connector as a ring party indication to the outpulser.

3.21 If the PT relay fails to operate on the 3640- or 2650-ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5760-ohm operate test on the relay on which it should also fail. Hence, only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

3.22 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outpulser is grounded.

#### 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

##### SUPERVISION

4.01 After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating P1 which locks. P1 will not operate if B has released due to an abandonment.

##### CALLING IN OUTPULSER

4.02 P1 connects battery through resistance lamp A to the ST lead to the outpulser connector in order to get an outpulser connected to this circuit, and starts the TM timer.

4.03 The trunk and outpulser are connected together over five leads, T, R, TPT, AB, and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing, the SP lead operates the SP relay.

4.04 SP locks and removes itself from the SP lead: (1) opens the ST lead to the link, (2) stops the timer, (3) releases RP and RPA if it is a tip station (opening ground from the T lead) or releases TP, only if it is a ring station (opening ground from the R lead), (4) connects the SPL relay to the SP lead, (5) connects the MF relay to the AB lead, and (6) connects the ID relay to the R lead.

##### TESTING FOR ABANDONED CALL

4.05 Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SPL. This transfers the selector multiple T & R to the outpulser T & R, while relay SPL is holding the A operated. SPL is released when the outpulser is satisfied.

4.06 An indication is also given to the outpulser when SPL is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

##### IDENTIFYING THE LINE

4.07 When the outpulser is ready for line identification by the identifier, ID is operated. ID connects either tone from one of the oscillators (when the office is arranged for ANI type B or dc pulsing from the pulse generator) to the selector multiple sleeve. The oscillator and generator have a low dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as

a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

#### OUTPULSING CALLING NUMBER

4.08 When the outpulser is ready to send out the calling number it operates relay MF, transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS, and MF holds B until the outpulser releases. Release of the A relay during this time is ineffective.

#### RELEASE OF OUTPULSER

4.09 When the outpulser has completed its work it releases the connector, opening its connection to the trunk circuit. SP remains operated in this circuit.

#### 5. DISCONNECT

##### CALLING PARTY DISCONNECTS FIRST

5.01 When the calling party disconnects, A releases. With CS and P1 operated, C does not operate because of a shunt path through P1 to the C resistor but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. Relay A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

##### A. Ring Party

5.02 When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. B1 released with C1 operated opens the loop to the A relay preventing reseizure until C1 releases. In addition, B is prevented from reoperating until C1 has released. This protects the trunk from being reseized on the same call once release has progressed beyond the point where B is normal. When P1 releases, the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

##### B. Tip Party - Ground Removal Test

5.03 When the calling station is a tip party, relay TPA will be operated and, on disconnect by the customer, the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

5.04 Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B, and with P1 operated, operates relay C1. Relay C as noted in 5.01 does not operate. B1 and SP release and close a circuit to operate GRT through contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

5.05 GRT operating (1) closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and (2) holds TPA operated.

5.06 With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases, PTM is released after a timed interval.

5.07 If there is no ground at the station, PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve, and TPA releases GRT, which in turn releases RP and PTC. Until PTC releases, the A relay cannot be reoperated.

##### C. 2-Party Message Rate - Ground Removal Test

5.08 During the outpulsing of the calling number, as described in 4.08 and 4.09, the operation of MF grounds the C lead to the selector multiple. On calls from 2-party MR lines, this lead is carried back to the 2-MR trunk circuit and the ground causes that trunk to cut through as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

5.09 On disconnect by the 2-MR station, therefore, a ground removal test is made as described in 5.03 through 5.09.

##### D. Ground Removal Failure

5.10 When the ground removal test is started by GRT operating as described in 5.03 through 5.07, the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 9.5 to 10.5 or 10 to 23.4 seconds, depending upon which type of timer is supplied. During this time the circuit will

release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

5.11 At the end of timing TM operates, operating TMI which is slow acting. TMI releases TM, at which time a circuit is completed for operating TP, which locks.

5.12 TMI releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser.

5.13 The indication to the outpulser of ground removal failure is ground on the TPT lead for a 2-party flat rate line and ground on the AB lead for a 2-party message rate line. Relay MR operated transfers the ground to the AB lead.

5.14 When the outpulser is connected and after it has received the ground removal failure indication, it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

5.15 Identification of the calling line is made as before, the ID operating over the R lead to connect tone or dc pulsing to the sleeve.

5.16 With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

5.17 GRT released releases SP, TP, and PTC and, if operated, MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release, holds the T & R of the selector multiple open so that if a new call were to seize the trunk, the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

#### CALLED PARTY DISCONNECTS FIRST - TIMED DISCONNECT

5.18 When the calling party does not disconnect and the called party does, the trunk circuit at the CMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

5.19 CS1 operates C through P1 operated. CS releases CS1, which is slow to release, to make it insensitive to transient disturbances on the trunk. C operated opens

the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

5.20 A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1, and P1 release. B1 releases SP.

#### TIMED DISCONNECT ON PARTIAL DIAL CALLS

5.21 Upon seizure of this trunk, after the B1 relay operates, a start timing condition is initiated in the connecting timing circuit by grounding the PU9 or ST lead. The receipt of this ground results in the return of a -48 volt battery signal over the same lead to operate the PU relay. If the calling customer fails to dial the proper number of digits (partial dial condition) before a timed interval of 3 to 7 or 4 to 12 minutes, depending on the type of office, the timing circuit will ground the A9 or ET lead to operate the TMI relay. The TMI relay operated, operates the P1 relay. The P1 relay operated, operates the C relay and releases the PU relay. The C relay operated opens the incoming S lead to release the preceding circuits. When the circuits release, the holding path for the A relay is opened, so A releases. Relay A released shunts down the slow release C relay and opens the holding path for the slow release B relay. When C releases, it reconnects ground to the S lead to make this circuit appear busy. The B relay releases the B1 and P1 relays. The B1 released, releases the slow release TMI relay which removes ground from the S lead and restores the trunk to normal.

#### 6. TIMING CIRCUIT

##### AWAITING OUTPULSER FOR IDENTIFICATION

6.01 Referring to 4.02 through 4.04, P1 operating to call in the outpulser also starts the timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds when 130-volt tube timer is used or 3.8 to 4.2 seconds when 48-volt timer is used, the start circuit will be opened to prevent holding out other trunks.

##### A. 130-Volt Timer Operation

6.02 Assuming an outpulser is not connected, P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now charges through resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown, the tube is ionized and transfers to the main gap, operating the TM relay.

6.03 TM locks to ground through TMI, and this ground extinguishes the tube. TM operates TMI which is slow to operate to give the tube time to deionize. TM and TMI reconnect battery to capacitor D to discharge it through the F resistor and restore -48 volts to the control anode of the tube. TMI locks through BI operated and, unless TP is operated, releases TM.

6.04 After disconnect by the customer TMI releases from BI. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when BI releases.

#### B. 48-Volt Timer Operation

6.05 Assuming an outpulser is not connected, P1 operating applies battery to terminal 2 of timer TM. Resistors AA, AB, capacitor F, and internal components of timer TM are such that the timer will function and operate relay TM within 3.8 to 4.2 seconds.

6.06 TM locks to the applied 48 volts through TMI. TMI operates, locks to BI, and disables the timer, discharges capacitor F, and releases relay TM.

6.07 The circuit remains in this condition until disconnect. After disconnect by the customer, TMI releases from BI. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when BI releases.

#### GROUND REMOVAL FAILURE

##### A. 130-Volt Timer

6.08 Referring to 5.11 through 5.18, GRT operating starts the timer circuit by opening -48 volt battery from the control anode of the tube and from capacitor D. With GRT operated, resistor G, instead of resistor H, is included in the charging circuit for capacitor D described in 6.01 through 6.06. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

6.09 Relays TM and TMI operate and the tube is extinguished.

##### B. 48-Volt Timer

6.10 Referring to 5.11 through 5.18, GRT operating applies -48 volts to timer TM. On ground removal test resistor AB, capacitor F and timer components will cause the timer to function and operate TM within 9.5 to 10.5 seconds.

#### AWAITING OUTPULSER ON GROUND REMOVAL FAILURE

6.11 The timer is again recycled to time for 10 to 23.4 seconds with 130-volt operation or 9.5 to 10.5 seconds with 48-volt operation. As described in 5.11 through 5.18, TP operates when TM is released and TMI is operated at the end of the 10-second timing. TMI releases and its slow release gives time for capacitor D or F to discharge before again starting to charge it. TMI released with TP operated closes the start lead to the outpulser connector.

6.12 Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in 5.11 through 5.18.

6.13 If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser, the TM operates and locks to TP. TMI operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

6.14 TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TMI. The sleeve is held grounded until TMI releases, after which the preceding circuits are released and the trunk is restored to normal.

#### 7. TESTING

##### FROM TEST JACKS

7.01 Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

##### FROM TEST CIRCUIT

7.02 Relays TT and TTI and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the FR lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test, which it does by operating the TTI relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

7.03 When the outpulser is called in on a test call, the TST lead to the outpulser connector is grounded to indicate that it is a test call.

**8. MISCELLANEOUS****LAST TRUNK BUSY REGISTRATION S OPTION**

8.01 Means are provided for operating a traffic register. Ground is extended to the LTB lead when the circuit is normal. This lead, which is connected on the last trunk of an identifier group, is open whenever the circuit is busy for any reason.

**TRAFFIC USAGE RECORDER R OPTION**

8.02 Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the BR lead to the traffic usage recorder circuit; otherwise, the BR lead is grounded.

**ALL TRUNKS BUSY REGISTRATION F OPTION**

8.03 Means are provided for operating a traffic register. Ground is extended to the ATB lead when the circuit is normal. This lead is multiplied to leads of other trunks in the same group. When all trunks of the group are busy, ground is removed from the lead to the register.

**PEG COUNT**

8.04 Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead OSF to the miscellaneous circuit (for trunk frames) is grounded from the time TM is operated until TM1 operates. No registration is made on ground removal operation of the timer as GRT opens the OPF lead.

**HOLDING CIRCUIT FOR TRACING TROUBLE**

8.05 The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Miscellaneous Circuit for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure, and a ground removal test will not be made on disconnect when TR is operated.

**FUSE OPERATION**

8.06 Relay MB is normally operated through the MB resistor. If the circuit fuse is operated or is removed, MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.

**SECTION III - REFERENCE DATA****1. WORKING LIMITS****1.01 Battery Voltages**

-45 to -52 volts  
+125 to +135 volts  
-116 to -120 volts or -100 to -120 volts

**1.02 Relay Limits**

A Relay Pulsing - Maximum External Circuit Loop Resistance 1500 ohms

A Relay Supervisory - Maximum External Circuit Loop Resistance 2375 ohms

A Pulsing and Supervisory - Minimum Insulation Resistance 15,000 ohms

CS Relay - Supervisory - Maximum External Circuit Loop Resistance 7500 ohms

CS Relay - Supervisory - Minimum Insulation Resistance 30,000 ohms

PT Relay - Maximum External Circuit Loop Resistance 1500 ohms

PT Relay - Minimum Insulation Resistance 15,000 ohms.

PT Relay - Maximum Resistance to Ground at Tip Party of 2-Party FR Line 4004 ohms

Party Test Operated From	DC	Earth Potential	
		25 ~ AC	60 ~ AC
-110 -120V -CC Supply	-11V, +20V	7V	10V
-116 -120V -CC Supply	-16V, +20V	10V	14.5V
45 -52V Supply	-5V, +5V		20V

**2. FUNCTIONAL DESIGNATIONS**

None.

**3. FUNCTIONS**

3.01 When a loop is closed on the selector multiple tip and ring: to ground the sleeve lead, to hold the preceding circuits, and to close the loop to the distant office.

3.02 To repeat dial pulses on a battery and ground basis.

3.03 During the first interdigital period, to make a party test.

3.04 During the second interdigital period, to test the party test relay for nonoperate if it had operated on the party test or for operate if it had nonoperated on the party test.

3.05 When battery and ground is reversed at the distant office, to close the ST lead to the outpulser connector circuit.

3.06 When the outpulser connector has connected an outpulser circuit to this circuit:

- (a) To indicate tip or ring party by ground on the T or R lead.
- (b) To remove the party indications when the outpulser operates the SP relay.
- (c) To connect the outpulser tip and ring to the subscriber tip and ring for an abandoned call test when the outpulser operates the SP1 relay.
- (d) When the trunk is arranged for ANI type B, to connect identification tone to the selector multiple sleeve from one of the oscillators when the outpulser operates the ID relay.
- (e) When the trunk is arranged for ANI type C, to connect dc pulsing to the selector multiple sleeve from the pulse generator when the outpulser operates relay ID.
- (f) To connect the outgoing tip and ring leads to the outpulser tip and ring when the outpulser operates the MF relay.
- (g) To connect ground to the selector multiple C lead when MF is operated to cut through the 2-MR trunk if it is connected.

3.07 When a 2-MR trunk is connected, to operate and lock the MR relay after that trunk cuts through.

3.08 On hang up by the calling party:

- (a) To open the tip and ring to the distant office.
- (b) To make a ground removal test if the calling party was a tip party or either party of a 2-MR line.
- (c) To restore to normal immediately if the calling party was a ring party.
- (d) To restore to normal after the ground removal test shows the line is clear of ground.
- (e) When 130-volt tube-type timer is used, to call in the outpulser on ground removal test if the line is not clear of ground after 10 to 24 seconds.
- (f) When 48-volt type timer is used, to call in the outpulser on ground

removal test if the line is not clear of ground after 9.5 to 10.5 seconds.

- (g) On ground removal, failure to ground the TPT lead to the outpulser on a flat rate line or the AB lead on a message rate line.
- (h) To remove the failure indications when the outpulser operates the SP relay.
- (i) When the trunk is arranged for ANI type B, to connect identification tone to the sleeve when the ID is operated.
- (j) When the trunk is arranged for ANI type C, to connect dc pulsing to the sleeve when ID is operated.
- (k) To hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.

3.09 When the calling party fails to disconnect before the incoming trunk times out:

- (a) To open the sleeve to the selector multiple long enough to release the preceding switches.
- (b) When the selector multiple tip and ring leads open, to restore to normal.
- (c) To reclose ground to the selector sleeve during release of the trunk.

3.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.

3.11 To test busy when a fuse operates.

3.12 To operate a last trunk busy register or operate the traffic usage recorder.

3.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.

3.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.

3.15 When the trunk is arranged for ANI type B, to hold the connection from

releasing when the outpulser operates the TR relay.

3.16 Provides for timed disconnect on partial dial calls.

#### 4. CONNECTING CIRCUITS

- (a) Automatic Trunk Test Circuit - SD-32315-01.
- (b) Identifier Circuit - SD-95810-01.
- (c) Incoming Trunk in No. 4 Crossbar Office - SD-68480-01.
- (d) Incoming Trunk in No. 5 Crossbar Office - SD-26101-01.
- (e) Incoming Trunk in Tandem Office - SD-27036-01.
- (f) Incoming Trunk in SXS CAMA Office - SD-32255-01.
- (g) Miscellaneous Circuit for Trouble Ticketer - SD-95823-01.
- (h) Miscellaneous Circuit Trunk Frame - SD-32248-01.
- (i) Miscellaneous Alarm Circuit - Register Circuit - SD-31976-01.
- (j) Outpulser Connector Circuit - SD-95890-01.
- (k) Oscillator Circuit - SD-95827-01.
- (l) Pulse Generator Circuit - SD-32378-01.
- (m) Rotary Out Trunk Switch Circuit - SD-30868-01.
- (n) Selector Bank Multiple Circuit - SD-32123-01.
- (o) Traffic Register Circuit - SD-30896-01.
- (p) Traffic Usage Recorder Circuit - SD-95738-01.
- (q) Auxiliary Trunk Circuit - SD-32281-01.
- (r) Auxiliary Trunk Circuit - SD-32500-01.
- (s) Test and Line Verification Circuit - SD-32379-01.
- (t) Incoming Trunk Circuit - Loop Signaling Dial Pulsing - SD-1B002-01.

- (u) Auxiliary Timing Circuit - SD-32525-01.
- (v) Common Timing Circuit - SD-31310-01, SD-31558-01.
- (w) Signaling and Transmission Systems Compatibility Information - SD-99421-01.

#### 5. TAKING EQUIPMENT OUT OF SERVICE

5.01 The circuit may be made busy by inserting a dummy plug into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy, which will be indicated by ground potential.

5.02 The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

5.03 Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time, after P1 opens sleeve ground, to insure releasing the preceding switches and freeing the customer line.

5.04 Similarly, during ground removal test, PTC prevents CS from holding the circuit locked up.

#### SECTION IV - REASONS FOR REISSUE

##### D. Description of Changes

D.1 Circuit Note 102 is revised. The revised table shows that the partial dialed feature can be used when calls are completed to all types of CAMA offices, except crossbar tandem CAMA equipped with 10-digit registers.

D.2 Circuit Note 109 is revised to cover the above information and also to limit use of the trunks to only 35E97 offices equipped with nonbattery searching selectors.

D.3 Information Note 307 is removed from the drawing; it read: "This feature can only be applied when this trunk terminates in an incoming trunk which is associated with the A 3-digit incoming register circuit at the crossbar tandem office."

D.4 Circuit Note 104 is revised. The apparatus required for idle line termination is changed from ZG option to ZL option.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5823-CEH-MR

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10 Pages

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

APR 17 1968  
07

## DRAWING NOTICE

SD-32245-01

ISSUE 16B

CD 6D

APP. 7B

RATING

AT&amp;TCo. Standard

SYSTEM

Step-By-Step

DATE

February 8, 1968

## TITLE

Step-By-Step Systems - No. 1, 350A, 355A or 35E97 - Outgoing Trunk Circuit - To  
CAMA Office - Loop Pulsing - With ANI Type B or ANI Type C - For No. 1, 350A,  
355A - And ANI Type C For 35E97

## DESCRIPTION

- 6.1 Reissued sheets: A1, D1, D2  
Total reissued sheets: 3
- 6.2 This change is made to limit the use of the time out arrangement for handling partial dial type calls. It is to be applied only where this trunk terminates to an incoming trunk associated with a 3-digit incoming register circuit at the crossbar tandem office.
- 6.21 Where this circuit is used to complete calls to offices equipped with ten digit incoming registers this feature is not used.
- 6.22 This change requires no apparatus or wiring.
- 6.3 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.4 B change. Requires WECO notification to Telco.
- 6.5 Equipment information is not affected.
- 6.6 Equipment Design Requirements will be covered in BSP Section 814-507-150 (J38943) iss. 4 of the Bell System Practices about 3-1-68.



APR 2 1968

CIRCUIT DESCRIPTION

CD-32245-01  
ISSUE 6D  
APPENDIX 7B  
DWG ISSUE 16B

STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

D. Description of Changes

- D.1 Circuit Notes 102 and 109 are revised.
- D.2 Information Note 307 is added. It states when to use the timing feature for handling partially dialed calls.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5643-CEH-MR



AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

NOV 23 1966  
JK

DRAWING NOTICE

SD-32245-01	ISSUE 15AR
CD 6D	APP. 6AR
RATING AT&TCo. Std.	
SYSTEM SXS	
DATE September 27, 1966	

TITLE

Step-By-Step Systems - No. 1,350A, 355A Or 35E97 - Outgoing Trunk Circuit -  
To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,350A,  
355A - And ANI Type C For 35E97

DESCRIPTION

- 6.1 Reissued sheets A1, B2, C1, C2. Total reissued sheets 4.
- 6.2 A trouble occurs wherein a blown fuse does not release the MB relay as required to make the trunk busy.
- 6.21 This trouble occurs because battery is fed from the common timing circuit through the trunk battery wiring holding relay MB operated.
- 6.22 This trouble is corrected by the addition of a 446F diode in series with the B1 relay.
- 6.3 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.4 Equipment information is affected and will be covered by drawing J38943N to be prepared by WECO.
- 6.5 Equipment Design Requirements are not affected.



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NOV 21 1966

CIRCUIT DESCRIPTION

CD-32245-01  
ISSUE 6D  
APPENDIX 6AR  
DWG ISSUE 15AR

STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

B. Changes in Apparatus

B.1 ADDED

Design

Code

C                    446F diode - option ZC

D. Description of Changes

D.1 A 446F diode is added in series with the B1 relay.

F. Changes in CD Sections

F.1 Under 4 CONNECTING CIRCUITS, add:

(t) Incoming Trunk Circuit - Loop Signaling Dial Pulsing -  
SD-1B002-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-RRD-RMW



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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NOV 23 1966  
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## DRAWING NOTICE

SD-32245-01

ISSUE 14B

CD 6D

APP. 5B

RATING

AT&amp;TCo. Std.

A&amp;M Only For 350A &amp;

35E97

SYSTEM

SXS

DATE

September 27, 1966

## TITLE

Step-By-Step Systems - No. 1, 350A, 355A, Or 35E97 - Outgoing Trunk Circuit -  
To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,  
350A, 355A - And ANI Type C For 35E97

## DESCRIPTION

- 6.1 Reissued sheets A1, A2, B1, B2, C1, C2, D1, D2, G1, G3. Total reissued sheets 10.
- 6.2 Pulsing failures due to split pulses can occur in this circuit when pulsed from short subscriber loops.
- 6.21 The failures occur because an oscillatory circuit exists between the (A) relay windings and the (A) capacitor at the midpoint of the repeating coil.
- 6.22 In order to overcome this condition a 446F diode (ZK option) is placed in series with the ground side of the (A) relay.
- 6.3 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.4 B change. Requires WECO notification to Tel Co.
- 6.5 Equipment information is affected and will be covered by drawing J38943N-( ).
- 6.6 Equipment Design Requirements will be covered in B.S.P. Section AA231.308 (J38943) Iss 3.



1

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3

4



STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

B. Changes in Apparatus

B.1 ADDED

D-446 F diode - option ZK

D. Description of Changes

D.1 Options 2J and 2K are added.

D.2 Circuit Note 104 is revised.

D.3 Information Note 301 is revised.

D.4 Option 2E is added for contact 2(TM1) relay. This change is to correct a drafting error.

F. Changes in CD Sections

F.1 Under 4. CONNECTING CIRCUITS, add:

(q) Auxiliary Trunk Circuit - SD-32281-01.

(r) Auxiliary Trunk Circuit - SD-32500-01.

(s) Test and Line Verification Circuit - SD-32379-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-PHS-RMW



STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

A. Changed and Added Functions

A.1 This circuit is now arranged so that the feature which guards against talk-off can be added independently of the 48-volt party test feature, on an A&M Only basis.

B. Changes in Apparatus

B.1 Option ZH is added to relay CS1 and resistor CS1.

D. Description of Changes

D.1 Option ZH is added to relay CS1, resistor CS1, and wiring associated with this apparatus.

D.2 Circuit Note 108 is rated Mfr Disc.

D.3 Circuit Notes 110, 111, and 112 are added.

D.4 Information Note 306 is added.

F. Changes in CD Sections

F.1 Under SECTION II - DETAILED DESCRIPTION change 3.10 to read:

3.10 Where tube sets with 3-element tubes are used on such lines and these lines have access to any trunks arranged for -110 volt party test, it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-JJD-RMW



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK, N.Y. 10007

APR 2 1965

SD-32245-01  
CD 6D  
RATING AT&TCo. Standard  
SYSTEM Step-By-Step  
DATE January 7, 1965

ISSUE 10A  
APP. 1A

DRAWING NOTICE

TITLE

Step-By-Step Systems - No. 1, 350A, 355A Or 35E97 - Outgoing Trunk Circuit -  
To CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1,  
350A, 355A - And ANI Type C For 35E97

DESCRIPTION

- 6.1 Reissued sheets 1, 3, 4, 5, 6, 7. Total reissued sheets 6.
  - 6.2 A change is made on trunks equipped with option "H" to prevent a race condition which occurs at the completion of outpulsing calling number. This race allows a momentary operation of relay (C) which causes the trunk to release falsely. A minor wiring change is involved to hold the (CS1) relay operated during outpulsing of the calling number and this removes the momentary false operate path to the (C) relay. Option H was introduced on Issue 9D and provided a party test arrangement using -48 volts instead of -110 volts.
  - 6.3 A change is made to correct a minor drafting error. Advance information to the WECO. in the form of an SDC was correct; no change is required in the manufacturing information.
  - 6.4 A change is made to correct the sequence charts.
  - 6.5 The Current Drain Data for this circuit is not affected by changes on this issue.
  - 6.6 Equipment information is not affected.
  - 6.7 Equipment Design Requirements are not affected.
- No engineering letter will be issued.



STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

CHANGES

D. Description of Changes

- D.1 Contact MF 8 fixed is now connected to ground and contact MF 8 make is now connected to winding terminal U of relay CS1.
- D.2 Contact B1 1 fixed was formerly connected to contact P1 7 fixed. Contact B1 1 fixed is now connected to winding terminal U of relay B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2364-JJD-JEM



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
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SEP 30 1964  
ISSUE  
APP.

9D

## DRAWING NOTICE

SD-32245-01  
CD 6D  
RATING AT&TCo. Std.  
SYSTEM Step-by-Step  
DATE June 12, 1964

## TITLE

Step-by-Step Systems - No. 1, 350A 355A Or 35E97 - OUTGOING TRUNK CIRCUIT - To  
CAMA Office - Loop Pulsing - With ANI Type B Or ANI Type C - For No. 1, 350A  
355A - And ANI Type C For 35E97

## DESCRIPTION

- 6.1 Reissued sheets 1-10  
Total reissued sheets 10  
Added sheets 11-14  
Total added sheets 4
- 6.2 A feature has been added to the trunk that will allow its' use in SXS offices arranged for ANI (Type C).
- 6.21 The above feature requires the use of option K. When operating in 35E97 offices option A is also required.
- 6.3 A feature has been added which will provide a means of making party test using -48 volts. This feature has been added to eliminate the need of supplying -CC potential to the trunk.
- 6.31 The feature in 6.3 (option H) is rated Std. The previous method of making party test using -CC potential, option J, is rated Mfr. Disc. for ANI Type B and will never be used with ANI Type C.
- 6.32 This change eliminates the need for a 307B inductor, 20A varistor and a KS-13490 resistor. The code of six 19 type resistors and the PT relay code is changed from 28QAP to 28OFN. The trunk will not require -CC potential. Two 542G capacitors are added. Circuit changes are involved.
- 6.33 This change should be coordinated with the Automatic Trunk Test Circuit SD-32315-01 Issue 4D.
- 6.4 A semiconductor type timing circuit which requires only -48 volts for its operation is added to the trunk on an optional basis. This timer is to be used in place of the tube type when it is not desirable to supply +130 volts to the trunk.
- 6.41 The semiconductor type timer requires a D3 circuit pack which consists of 3 transistors, 2 diodes, 2 varistors, 7 resistors, and a capacitor. The code of a wire spring relay, resistors and capacitors associated with the timer are changed. Minor circuit changes are also involved.



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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## DRAWING NOTICE

SD-32245-01

CD

RATING

SYSTEM

DATE

6D

AT&amp;TCo. Std.

Step-by-Step

June 12, 1964

Page  
ISSUE  
APP.2  
9D

## TITLE

## DESCRIPTION

- 6.42 The semiconductor timer is designated option F and the tube type option G.
- 6.5 A feature is added which, thru the use of strapping on the trunk terminal strip, will permit this circuit to operate as a NON ANI trunk. This is intended as a temporary feature which is to be used prior to the installation of ANI into the office.
- 6.6 A change has been added to the trunk which will prevent talk off when this trunk is used with E & M to loop converters, and single frequency signaling.
- 6.61 The above change is part of option H and requires an added wire spring relay, an 18 type resistor and minor circuit changes. The previous circuitry was designated option J.
- 6.7 The Current Drain Data for this circuit is as follows:

CURRENT DRAIN IN AMPERE HOURS PER BUSY HOUR OR CCS-48V TalkFor No. 1Bat Grd

List 1 in CCS

.0115 ---/

List 2

.230 .375

For 350A Or 35E97

List 1 in AH/BH

.268 ---

List 2

.230 .375

For 355A

Combined List 1 &amp; 2 in AH/BH

.268 .440

For Separate Lists use same drain as 350A above

For No. 1, 350A, 355A Or 35E97

+130V Sig. Bat

List 1 - .0001 AH/BH



AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7

Page 3  
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APP.

DRAWING NOTICE

SD-32245-01  
CD 6D  
RATING AT&T Co. Std.  
SYSTEM Step-by-Step System  
DATE June 12, 1964

TITLE

DESCRIPTION

- 6.8 D change. Requires WECO. notification to Tel. Co.
- 6.9 Equipment information is affected and has been covered by drawing SDC's 8A, B, C, D.
- 6.10 Equipment Design Requirements will be covered in B. S. P. Section AA231.308 (J38943) Iss 1.

An engineering letter issued - P. E. L. 7331.



STEP BY STEP SYSTEMS  
NO. 1, 350A, 355A OR 35E97  
OUTGOING TRUNK CIRCUIT  
TO CAMA OFFICE  
LOOP PULSING  
WITH ANI TYPE B OR ANI TYPE C  
FOR NO. 1, 350A, 355A  
AND ANI TYPE C FOR 35E97

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## SECTION I - GENERAL DESCRIPTION

### 1. GENERAL

1.01 This outgoing trunk circuit is required in a step-by-step office arranged for automatic number identification type B or type C to complete calls to the CAMA office.

1.02 The trunk is reached by the dialing of a directing code through selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

1.03 During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground through the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

1.04 When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned.

1.05 When ANI type B is used in the office the outpulser then causes the trunk to connect identification tone, generated by one of the two oscillator circuits associated with the trunk to the sleeve. This is used by the identifier to derive the calling number which is registered in the outpulser.

1.06 When ANI type C is used the outpulser causes the trunk to connect dc pulsing voltage generated by the pulse generator to the sleeve. This is used by the Number Network and Identifier Circuit to derive the calling number which is then registered in the outpulser.

1.07 After identification the outgoing trunk conductors are transferred to the outpulser which then sends the calling number to the CAMA office, using MF signaling.

1.08 No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

1.09 At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket after which the trunk and switches are released. On calls from 2-party message rate lines the 2-party message rate trunk circuit between the line finder and first selector is caused to cut through after outpulsing the calling number so that a ground removal test can be made at the end of the call.

1.10 Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.



SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR, LTB, or ATB lead to the Traffic Register Circuit, and opens the high resistance winding of relay CS from the trunk tip and ring.

1.02 Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

2. PULSING CALLED NUMBER

2.01 The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates C1. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and C1 hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

3. PARTY TEST

3.01 A party test is made between the first and second digits as follows.

3.02 With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized capacitor timed relay, electrically biased on its primary winding. When C1 releases battery through the secondary winding charges capacitor C. As the capacitor charges the current through the S winding decreases until it is less than the P or bias winding current at which point the relay releases. The time to release depends upon the type of test and are shown on the sequence chart.

3.03 Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110-volt option J or negative 48-volt option H through the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

TIP PARTY - FLAT RATE

3.04 Tip party stations are equipped with 3640-ohm or 2650-ohm ringers connected to ground. Relay PT operates in series with

the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48 volts through resistance lamp PT to the line. The -48 volt battery in conjunction with the PT varistor and shunting resistor B discharges the line when 110-volt party test is used in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

3.05 The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

RING PARTY - FLAT RATE

3.06 Ring party stations will have no ground on them. The test is made as in 3.04 and 3.05 except that when PTM releases, PT should be nonoperated. RP operates through the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48 volts through resistance lamp TP until PTC releases as described in 3.04 and 3.05. RP releases.

MESSAGE RATE LINES

3.07 On calls from 2-party message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification. Individual message rate lines will be treated as ring party lines.

3.08 As will be described later a direct test of 2-party message rate lines is made on disconnect.

MULTIPARTY LINES OTHER THAN 2-PARTY

3.09 The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

3.10 Where tube sets with 3-element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

**CHECK OF PARTY TEST FEATURE**

3.11 To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

**A. Check of 110-Volt Type Party Test**

3.12 C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates through either TPA or RPA operated. If TPA is operated, PTK connects resistor V and W, a total of 6720 ohms to the PT relay, secondary windings. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

3.13 With TPA, RPA, and RP operated, a ground is connected to the T lead to the output pulser connector as a tip party indication to the output pulser as described later.

3.14 If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y, Z and inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

3.15 With TP, TPA, and RPA operated and RP nonoperated a ground is connected to the R lead to the output pulser connector as a ring party indication to the output pulser.

3.16 If the PT relay fails to operate on the 3640- or 2650-ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154-ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the output pulser is grounded.

3.17 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the output pulser is grounded.

**B. Check of -48 Volt Type Party Test**

3.18 C, operating on the second digit, operates PTM as previously described. On release of C, relay PTK operates through either TPA or RPA operated. At this time resistors AF and AG, a total of 5760 ohms, are connected to the PT primary and through capacitor PT to the secondary. The current flow is enough to operate PT. However, when the call is identified as tip party a nonoperate test is made on a time basis instead

of a current basis. RPA nonoperated will shorten PTM release time to 24 to 30 milliseconds. Timing starts at the release of C and ends at the release of PTM. If the tertiary biasing winding and the AC bucking secondary are operative relay PT will not operate in the allotted time of 24 to 30 milliseconds. When PTM releases with PT nonoperated RP and RPA operated and lock. With TPA, RPA, and RP operated, a ground is connected to the T lead to the output pulser link as a tip party indication to the output pulser as described later.

3.19 When the call is identified as a ring party an operate test is made on relay PT. When PTK operates resistors AF and AG, a total of 5760 ohms, are connected to PT as described above. With the RPA operated relay timer PTM will release in 50 to 60 milliseconds. This is the operate condition for relay PT. When PTM releases with PT operated TP and TPA will operate and lock.

3.20 With TP, TPA, and RPA operated and RP nonoperated a ground is connected to the R lead to the output pulser connector as a ring party indication to the output pulser.

3.21 If the PT relay fails to operate on the 3640- or 2650-ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5760-ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the output pulser is grounded.

3.22 If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the output pulser is grounded.

**4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER****SUPERVISION**

4.01 After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating P1 which locks. P1 will not operate if B has released due to an abandonment.

**CALLING IN OUTPUT PULSER**

4.02 P1 connects battery through resistance lamp A to the ST lead to the output pulser connector in order to get an output pulser connected to this circuit, and starts the TM timer.

4.03 The trunk and output pulser are connected together over five leads, T, R, TPT,

AB, and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead operates the SP relay.

4.04 SP locks and removes itself from the SP lead, (1) opens the ST lead to the link, (2) stops the timer, (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead, (4) connects the SP1 relay to the SP lead, (5) connects the MF relay to the AB lead, and (6) connects the ID relay to the R lead.

#### TESTING FOR ABANDONED CALL

4.05 Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outpulser T & R, relay SP1 holding the A operated. SP1 is released when the outpulser is satisfied.

4.06 An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

#### IDENTIFYING THE LINE

4.07 When the outpulser is ready for line identification by the identifier, ID is operated. ID connects either tone from one of the oscillators when the office is arranged for ANI type B or dc pulsing from the pulse generator, to the selector multiple sleeve. The oscillator and generator have a low dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

#### OUTPULSING CALLING NUMBER

4.08 When the outpulser is ready to send out the calling number it operates relay MF transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS and MF holds B until the outpulser releases. Release of the A relay during this time is ineffective.

#### RELEASE OF OUTPULSER

4.09 When the outpulser has completed its work it releases the connector, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### CALLING PARTY DISCONNECTS FIRST

5.01 When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path through P1 to the C resistor but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### A. Ring Party

5.02 When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. B1 released with C1 operated opens the loop to the A relay preventing reseizure until C1 releases. In addition, B is prevented from reoperating until C1 has released. This protects the trunk from being reseized on the same call once release has progressed beyond the point where B is normal. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### B. Tip Party - Ground Removal Test

5.03 When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

5.04 Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in 5.01 does not operate. B1 and SP release and close a circuit to operate GRT through contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

5.05 GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

5.06 With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from C1 to delay closure of ground to the PT

contacts. This ground now comes from GRT operated. When C1 releases PTM is released after a timed interval.

5.07 If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### C. 2-Party Message Rate - Ground Removal Test

5.08 During the outpulsing of the calling number as described in 4.08 and 4.09 the operation of MF grounds the C lead to the selector multiple. On calls from 2-party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut through as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

5.09 On disconnect by the 2 MR station therefore, a ground removal test is made as described in 5.03 through 5.09.

#### D. Ground Removal Failure

5.10 When the ground removal test is started by GRT operating as described in 5.03 through 5.07 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 9.5 to 10.5 or 10 to 23.4 seconds depending upon which type of time is supplied. During this time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

5.11 At the end of timing TM operates, operating TM1 which is slow acting. TM1 releases TM at which time a circuit is completed for operating TP which locks.

5.12 TM1 releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser.

5.13 The indication to the outpulser of ground removal failure is ground on the TPT lead for a 2-party flat rate line and ground on the AB lead for a 2-party message rate line. Relay MR operated transfers the ground to the AB lead.

5.14 When the outpulser is connected and after it has received the ground removal failure indication it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

5.15 Identification of the calling line is made as before, the ID operating over the R lead to connect tone or dc pulsing to the sleeve.

5.16 With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

5.17 GRT released releases SP, TP, and PTC and, if operated, MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

#### CALLED PARTY DISCONNECTS FIRST - TIMED DISCONNECT

5.18 When the calling party does not disconnect and the called party does, the trunk circuit at the CMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

5.19 CS1 operates C through P1 operated. CS releases CS1 which is slow to release to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

5.20 A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1, and P1 release. B1 releases SP.

#### 6. TIMING CIRCUIT

##### AWAITING OUTPULSER FOR IDENTIFICATION

6.01 Referring to 4.02 through 4.04; P1 operating to call in the outpulser, also starts the timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds when 130-volt tube timer is used or 3.8 to 4.2 seconds when 48-volt timer is used, the start circuit will be opened to prevent holding out other trunks.

A. 130-Volt Timer Operation

6.02 Assuming an outpulser is not connected: P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now charges through resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

6.03 TM locks to ground through TML, and this ground extinguishes the tube. TM operates TML which is slow to operate to give the tube time to deionize. TM and TML reconnect battery to capacitor D to discharge it through the F resistor and restore -48 volt to the control anode of the tube. TML locks through B1 operated and unless TP is operated, releases TM.

6.04 After disconnect by the customer TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

B. 48-Volt Timer Operation

6.05 Assuming an outpulser is not connected P1 operating applies battery to terminal 2 of timer TM. Resistors AA, AB, capacitor F, and internal components of timer TM are such that the timer will function and operate relay TM within 3.8 to 4.2 seconds.

6.06 TM locks to the applied 48 volts through TML. TML operates, locks to B1, and disables the timer discharges capacitor F and releases relay TM.

6.07 The circuit remains in this condition until disconnect. After disconnect by the customer TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

GROUND REMOVAL FAILUREA. 130-Volt Timer

6.08 Referring to 5.11 through 5.18, GRT operating starts the timer circuit by opening -48 volt battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in 6.01 through 6.06. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

6.09 Relays TM and TML operate and the tube is extinguished.

B. 48-Volt Timer

6.10 Referring to 5.11 through 5.18 GRT operating applies -48 volts to timer TM. On ground removal test resistor AB, capacitor F and timer components will cause the timer to function and operate TM within 9.5 to 10.5 seconds.

AWAITING OUTPULSER ON GROUND REMOVAL FAILURE

6.11 The timer is again recycled to time for 10 to 23.4 seconds with 130-volt operation or 9.5 to 10.5 seconds with 48-volt operation. As described in 5.11 through 5.18, TP operates when TM released and TML operated at the end of the 10-second timing. TML releases and its slow release gives time for capacitor D or F to discharge before again starting to charge it. TML released with TP operated closes the start lead to the outpulser connector.

6.12 Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in 5.11 through 5.18.

6.13 If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser, the TM operates and locks to TP. TML operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

6.14 TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TML. The sleeve is held grounded until TML releases after which the preceding circuits are released and the trunk is restored to normal.

7. TESTINGFROM TEST JACKS

7.01 Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

FROM TEST CIRCUIT

7.02 Relays TT and TTI and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the FR lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TTI relay. This relay gives access to other leads

required for the test and opens the trunk conductor tip and ring.

7.03 When the outpulser is called in on a test call the TST lead to the outpulser connector is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### LAST TRUNK BUSY REGISTRATION S OPTION

8.01 Means are provided for operating a traffic register. Ground is extended to the LTB lead when the circuit is normal. This lead which is connected on the last trunk of an identifier group is open whenever the circuit is busy for any reason.

### TRAFFIC USAGE RECORDER R OPTION

8.02 Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the BR lead to the traffic usage recorder circuit, otherwise the BR lead is grounded.

### ALL TRUNKS BUSY REGISTRATION F OPTION

8.03 Means are provided for operating a traffic register. Ground is extended to the ATB lead when the circuit is normal. This lead is multiplied to leads of other trunks in the same group. When all trunks of the group are busy ground is removed from the lead to the register

## PEG COUNT

8.04 Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead OSF to the miscellaneous circuit (for trunk frames) is grounded from the time TM is operated until TM1 operates. No registration is made on ground removal operation of the timer as GRT opens the OPF lead.

## HOLDING CIRCUIT FOR TRACING TROUBLE

8.05 The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Miscellaneous Circuit for trouble ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

## FUSE OPERATION

8.06 Relay MB is normally operated through the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.

**SECTION III - REFERENCE DATA****1. WORKING LIMITS****1.01 Battery Voltages**

-45 to -52 volts  
 +125 to +135 volts  
 -116 to -120 volts or  
 -100 to -120 volts

**1.02 Relay Limits**

A Relay Pulsing - Maximum External Circuit Loop Resistance 1500 ohms

A Relay Supervisory - Maximum External Circuit Loop Resistance 2375 ohms

A Pulsing & Supervisory - Minimum Insulation Resistance 15,000 ohms

CS Relay - Supervisory - Maximum External Circuit Loop Resistance 7500 ohms

CS Relay - Supervisory - Minimum Insulation Resistance 30,000 ohms

PT Relay - Maximum External Circuit Loop Resistance 1500 ohms

PT Relay - Minimum Insulation Resistance 15000 ohms.

PT Relay - Maximum Resistance to Ground at Tip Party of 2-Party F.R. Line 4004 ohms

Party Test Operated From	Earth Potential		
	DC	25~ AC	60~ AC
-110 -120V -CC Supply	-11V, +20V	7V	10V
-116 -120V -CC Supply	-16V, +20V	10V	14.5V
45 -52V Supply	-5V +5V		20V

**2. FUNCTIONAL DESIGNATIONS**

None.

**3. FUNCTIONS**

3.01 When a loop is closed on the selector multiple tip and ring, to ground the sleeve lead, to hold the preceding circuits, and to close the loop to the distant office.

3.02 To repeat dial pulses on a battery and ground basis.

3.03 During the first interdigital period, to make a party test.

3.04 During the second interdigital period, to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.

3.05 When battery and ground is reversed at the distant office, to close the ST lead to the outputer connector circuit.

3.06 When the outputer connector has connected an outputer circuit to this circuit:

- To indicate tip or ring party by ground on the T or R lead.
- To remove the party indications when the outputer operates the SP relay.
- To connect the outputer tip and ring to the subscriber tip and ring for an abandoned call test when the outputer operates the SP1 relay.
- When the trunk is arranged for ANI type B, to connect identification tone to the selector multiple sleeve from one of the oscillators when the outputer operates the ID relay;
- When the trunk is arranged for ANI type C, to connect dc pulsing to the selector multiple sleeve from the pulse generator when the outputer operates relay ID.
- To connect the outgoing tip and ring leads to the outputer tip and ring when the outputer operates the MF relay;
- To connect ground to the selector multiple C lead when MF is operated to cut through the 2 MR trunk if it is connected.

3.07 When a 2 MR trunk is connected, to operate and lock the MR relay after that trunk cuts through.

3.08 On hang up by the calling party:

- To open the tip and ring to the distant office.
- To make a ground removal test if the calling party was a tip party or either party of a 2 MR line.
- To restore to normal immediately if the calling party was a ring party.
- To restore to normal after the ground removal test shows the line is clear of ground.
- When 130-volt tube type timer is used, to call in the outputer on ground removal test if the line is not clear of ground after 10 to 24 seconds.
- When 48-volt type timer is used, to call in the outputer on ground removal test if the line is not clear of ground after 9.5 to 10.5 seconds.
- On ground removal failure to ground the TPT lead to the outputer on a

flat rate line or the AB lead on a message rate line.

(h) To remove the failure indications when the outpulser operates the SP relay.

(i) When the trunk is arranged for ANI type B, to connect identification tone to the sleeve when the ID is operated.

(j) When the trunk is arranged for ANI type C, to connect dc pulsing to the sleeve when ID is operated.

(k) To hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.

3.09 When the calling party fails to disconnect before the incoming trunk times out:

(a) To open the sleeve to the selector multiple long enough to release the preceding switches.

(b) When the selector multiple tip and ring leads open, to restore to normal.

(c) To reclose ground to the selector sleeve during release of the trunk.

3.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.

3.11 To test busy when a fuse operates.

3.12 To operate a last trunk busy register or operate the traffic usage recorder.

3.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.

3.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.

3.15 When the trunk is arranged for ANI type B, to hold the connection from releasing when the outpulser operates the TR relay.

#### 4. CONNECTING CIRCUITS

(a) Automatic Trunk Test Circuit - SD-32315-01.

(b) Identifier Circuit - SD-95810-01.

(c) Incoming Trunk in No. 4 Crossbar Office - SD-68480-01.

(d) Incoming Trunk in No. 5 Crossbar Office - SD-26101-01.

(e) Incoming Trunk in Tandem Office - SD-27036-01.

(f) Incoming Trunk in SXS CAMA Office - SD-32255-01.

(g) Miscellaneous Circuit for Trouble Ticketer - SD-95823-01.

(h) Miscellaneous Circuit Trunk Frame - SD-32248-01.

(i) Miscellaneous Alarm Circuit - Register Circuit - SD-31976-01.

(j) Outpulser Connector Circuit - SD-95890-01.

(k) Oscillator Circuit - SD-95827-01.

(l) Pulse Generator Circuit - SD-32378-01.

(m) Rotary Out Trunk Switch Circuit - SD-30868-01.

(n) Selector Bank Multiple Circuit - SD-32123-01.

(o) Traffic Register Circuit - SD-30896-01.

(p) Traffic Usage Recorder Circuit - SD-95738-01.

#### 5. TAKING EQUIPMENT OUT OF SERVICE

5.01 The circuit may be made busy by inserting a dummy plug into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

5.02 The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

5.03 Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

5.04 Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

SECTION IV - REASONS FOR REISSUEA. Changed and Added Functions

- A.1 This circuit can now be arranged to operate in offices using ANI type C.
- A.2 This circuit can now be arranged to operate 35E97 type offices using ANI type C.
- A.3 This circuit is now arranged to make party test using -48 volts.
- A.4 When option F is used a semiconductor type timer that functions with -48 volts is provided.
- A.5 This trunk can now be arranged to operate temporarily as a non-ANI trunk.
- A.6 A change has been made to present talk off when E and M to loop converter are used with this trunk.

B. Changes in ApparatusB.1 ADDED TO APP FIG. 1

Relay	CS1	AG12	Option H
Relay	TM	AF50	Option F
Resistor	CS1	18BH	Option H
Resistor	AA	145A	Option F
Resistor	AB	145A	Option F
Resistor	AC	18BH	Option F
Capacitor	F	437QA	Option F
Circuit Pack	TM	D3	Option F

B.2 SUPERSEDED OPTION J CONSISTING OF

Relay	PT	Code	280AP
Resistor	V	Code	18JU
Resistor	W	Code	18KB
Resistor	X	Code	19FJ
Resistor	Y	Code	18BT
Resistor	Z	Code	18FS
Resistor	B	Code	KS13492,L3
Resistor	D	Code	18DA
Inductor	PT	Code	307B
Varistor	PT	Code	20A

B.3 SUPERSEDED BY OPTION N CONSISTING OF

Relay	PT	Code	280FN
Capacitor	(2)PT	Code	542G
Resistor	AD	Code	19RT
Resistor	AE	Code	19CL
Resistor	AF	Code	19WD
Resistor	AG	Code	18CR
Resistor	PT	Code	19AAT
Resistor	AH	Code	18EM

B.4 Option M added to relay TR AF110.B.5 OPTION G ADDED TO THE FOLLOWING APPARATUS OF FIG. 1

Relay	TM	Code	AF57
Capacitor	D	Code	437A
Capacitor	E	Code	439A

Tube	TM	Code	346C
Resistor	F	Code	KS13492,L3
Resistor	G	Code	145A
Resistor	H	Code	145A
Resistor	J	Code	KS13492,L3
Resistor	K	Code	18DA

C. Changes in Requirements Other Than Those Caused by Changes in Apparatus

- C.1 The following changes were made in the timing requirements for relay TM option G.

- (a) Note 4 was added to the first test.
- (b) In the second test (10.4 - 23.4), all test clip data, send key information, Recording Switching information, and remarks were replaced by Notes 4 and 5.
- (c) The maximum time for TM was changed from 23,420 milliseconds to 23,400 milliseconds.
- (d) Test Set Preparation for operate test of relay C1 secondary is changed to B/G.

D. Description of Changes

- D.1 Option K is added to enable the use of this circuit in offices arranged for ANI type C.
- D.2 Option M is added to existing circuitry for use when operation with ANI type B is required.
- D.3 Option F is added to provide a semiconductor timing circuit which will operate from -48 volts.
- D.4 Option G is added to existing circuitry for use when a 130-volt tube type timer is required.
- D.5 Option A is added to enable the use of this circuit in 35E97 type offices arranged for ANI type C.
- D.6 Option H is added to:
- (a) Provide a party test which will operate from -48 volts.
- (b) Prevent the called end from releasing the trunk with a release signal which is less than 140 msec long.
- D.7 Option J is added and rated Mfr Disc. for use where option H is not provided.
- D.8 The coin control fuse is rated Mfr Disc.
- D.9 Option B is added for use where operation is temporarily not required.
- D.10 Option E is added to existing circuitry for use when ANI operation is required.

BELL TELEPHONE LABORATORIES, INCORPORATED

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## DRAWING NOTICE

SD-32245-01

ISSUE

8L

CD 5D

APP.

3B

RATING AT&amp;TCo. Standard

SYSTEM Step-By-Step

DATE July 10, 1962

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit - Loop  
Pulsing - Automatic Number Identification - To CAMA Office

## DESCRIPTION

- 6.1 Reissued sheets: -1 and -9 - Total reissued sheets 2.
- 6.2 Trouble tickets may be printed erroneously during testing if the battery potential at the ANI trunks drops below 48.5 volts, since the Automatic Trunk Test circuit depends on this minimum voltage to successfully complete tests.
- 6.21 It has been found in some step-by-step offices that on the basis of the present practice of fusing the ANI trunks at the miscellaneous fuse board, that if location for mounting these trunks is an unusually long distance from the fuse bay, the voltage drop may be sufficient to reduce the voltage at the trunk to less than 48.5 volts during peak load periods.
- 6.22 This condition is corrected on this reissue by adding provision for connection to a fuse panel on each ANI trunk frame as standard to insure a minimum of 48.5 volts. Connection to miscellaneous fuse board is rated "Mfr. Disc."
- 6.23 CAD 1 is changed to make provision for cabling to the frame fuse panel.
- 6.3 Miscellaneous circuit SD-32248-01 on issue 4B will reflect the necessary apparatus and wiring for provision of frame fuse panels.
- 6.4 The Current Drain Data for this circuit is not affected by changes on this issue.
- 6.5 B Change. Requires WECO. notification to Tel. Co.
- 6.6 Equipment information will be covered by drawings J95108B and J95108L-( ).
- 6.7 Equipment Design Requirements will be covered in BSP Section AA388.009 (J95108) Iss. 2 Appx. 3.

No engineering letter will be issued.



**CIRCUIT DESCRIPTION**

**CD-32245-01**  
**Issue 5-D**  
**Appendix 3-B**  
**Dwg. Issue 8-B**

**STEP-BY-STEP SYSTEMS**  
**NO. 1, 350A OR 355A**  
**OUTGOING TRUNK CIRCUIT**  
**LOOP PULSING**  
**AUTOMATIC NUMBER IDENTIFICATION**  
**TO CAMA OFFICE**

**CHANGES**

**D. DESCRIPTION OF CHANGES**

**D.1 In CAD 1 48V Battery and Ground were**  
**formerly provided only from Misc. Fuse**  
**Panel. This provision is now rated M.D. and**  
**is replaced by a frame fuse panel as a stan-**  
**dard for providing 48V Battery and Ground.**

**BELL TELEPHONE LABORATORIES, INCORPORATED**

**DEPT. 2363-WAO'C-FBB-D3**



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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## DRAWING NOTICE

SD-32245-01	ISSUE	7AR
CD 5D	APP.	2AR
RATING	AT&TCo. Standard	
SYSTEM	Step-By-Step	
DATE	July 10, 1962	

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit - Loop Pulsing - Automatic Number Identification - To CAMA Office

## DESCRIPTION

- 6.1 Reissued sheets: -1, -2, -3, -4, -5, -6, -7, -8 and -9 - Total reissued sheets 9.
- 6.2 A trouble ticket is printed and an alarm sounded when a calling party reoriginates a call immediately after abandoning a partially dialed number. This condition may occur after 3 or 4 digits have been dialed when working into Crossbar Tandem Cama, since on an abandonment they return a battery reversal. This type of trouble may possibly occur in other Cama systems under certain conditions.
- 6.21 This type of trouble ticket may occur whenever the trunk is released and is reseized before all relays are normal. In release of the trunk one of the party test relays is released earlier than the remaining party relays. Should the reseizure by the same subscriber occur before the trunk is normal, it is possible then to change the party information originally registered. This change occurring with a reversal signal from the tandem end, due to the abandonment, can cause a premature identification attempt by the ANI equipment. This attempt can result in a trouble ticket being printed.
- 6.22 The conditions noted are corrected by preventing reseizure of the trunk once the release has progressed to the point where relay B1 releases, until the circuit returns to normal.
- 6.23 This change requires only wiring changes to correct the condition.
- 6.3 Circuit requirement table changes and other changes of a minor nature are also included on this issue with the agreement of the WECO.
- 6.4 The Current Drain Data for this circuit is not affected by changes on this issue.
- 6.5 Equipment information will be covered by drawing J95108K-( ).
- 6.6 Equipment Design Requirements are not affected.
- No engineering letter will be issued.

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STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

## CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER  
THAN THOSE CAUSED BY CHANGES IN  
APPARATUS

C.1 Requirements have been revised on the following relays: A, C, C1, GRT, MR, PT, PTC, PTK, PTM, SP, SP1, TR, TT. Under timing requirement for PTM, changed 50-57.5 to read 50-60.

## D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Contact 4(B1) was formerly connected to 4M(P1) and 1B(A); 10(B) was connected to 7B(P1); 1M(TP) was connected to 7B(B1) and B(A) was connected to wdg. terminal 8 of (A) transformer.

D.2 Contact 9(C1) and 9(GRT) were formerly not used.

D.3 In Circuit Note 104 use of "R" option is rated A&M Only and reference is made to Note 107. Reference to "R" option is removed from Note 102.

D.4 Punching A38 is used to simplify testing the PT relay.

D.5 Note 302 is reworded to clarify use of "S" option. Note 303 is added.

D.6 SC1 through 5 are changed to reflect circuit changes indicated above and correct errors.

D.7 SC6 is added.

D.8 CAD 1 is changed.

## F. CHANGES IN CD SECTIONS

F.1 In paragraph 4.1, Section II add new sentence at end of paragraph: "P1 will not operate if B has released, due to an abandonment."

F.2 In paragraph 5.11, Section II add new sentences after second sentence in paragraph. "B1 released with C1 operated opens the loop to the A relay preventing re-seizure until C1 releases. In addition, B is prevented from reoperating until C1 has released. This protects the trunk from being re-seized on the same call once release has progressed beyond the point where B is normal."

F.3 In paragraph 4, Section III, first paragraph, change initial sentence to read: "The circuit may be made busy by inserting a dummy plug into test jack T which grounds the selector multiple sleeve."

## F.4 SECTION III - REFERENCE DATA

## 3. CONNECTING CIRCUITS

3.12 Incoming Trunk in SXS CAMA Office -  
SD-32255-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2363-WAO'C-FBB-D1



SEP 28 1961

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AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

## DRAWING NOTICE

SD-32245-01  
CD 5D  
RATING AT&TCo Standard  
SYSTEM Step-By-Step  
DATE June 26, 1961

ISSUE 6B  
APP. 1B

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit -  
Loop Pulsing - Automatic Number Identification - To CAMA Office

## DESCRIPTION

- 6.1 Reissued sheets: 1, 2, 4, 5, 6, 7, 9 - Total reissued sheets 7.
- 6.2 This circuit is reissued to provide a circuit wiring change which will reduce the drain on the -110V coin control supply, used by this circuit for the party test features. Options "N" and "Q" cover the new and old wiring respectively.
- 6.3 Other changes of a minor nature have been made to agree with the latest manufacturing information. These changes are made in agreement with the manufacturer.

- 6.4 The Current Drain Data for this circuit is as follows:

Current Drain in Ampere Hours Per Busy Hour Or CCS

<u>For No. 1</u>	<u>-48V Talk</u>	
	<u>Bat.</u>	<u>Grd.</u>
List 1 in CCS	.0115	-
List 2	.230	.375

<u>For 350A</u>		
List 1 in AH/BH	.268	-
List 2	.230	.375

<u>For 355A</u>		
Combined List 1 & 2 in AH/BH	.268	.440
For separate lists use same drain as 350A above		

<u>For No. 1, 350A or 355A</u>	
<u>-110 Coin Control</u>	<u>+130V Sig. Bat.</u>
List 1 - .00014 AH/BH	List 1 - .001 AH/BH

- 6.6 Equipment information is affected and will be covered by J-95108K- ( ).
- 6.7 Equipment Design Requirements are covered in BSP Section AA388.099 (J-95108) Iss. 2, Appx. 2.

No engineering letter will be issued.



# CIRCUIT DESCRIPTION

CD-32245-01  
Issue 5-D  
Appendix 1-B  
Dwg. Issue 6-B

## STEP-BY-STEP SYSTEMS NO. 1, 350A OR 355A OUTGOING TRUNK CIRCUIT LOOP PULSING AUTOMATIC NUMBER IDENTIFICATION TO CAMA OFFICE

### CHANGES

#### D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 "N" option is added and rated Standard  
"N" option is added to reduce the current drain on the -110V supply used for party test operation in this circuit.
- D.2 "Q" option is designated and is rated M.D.
- D.3 Options "N" and "Q" are added to the option index and note 104.
- D.4 Note 107 is changed to include "R" option as a "No Record" option.
- D.5 The value of the (H) Resistor is changed from 0.63 meg, to 0.626 meg, which is the preferred value. The code is unchanged.
- D.6 Reference "On Same Frame" is added to the multiplying information on the "LU" lead. CAD1 is changed to agree.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT.2335-WAO'C-ASM-C15



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

JUL 27 1960

SD-32245-01

ISSUE 5D  
APP.

CD 5D

RATING AT&TCo Std.

SYSTEM Step-By-Step

DATE Jan. 4, 1960

DRAWING NOTICE

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A -  
Outgoing Trunk Circuit - Loop Pulsing - Automatic  
Number Identification - To CAMA Office

DESCRIPTION

6.1 Reissued sheets: 1, 4, 5, 8, 9 & 10 - Total reissued sheets 6.

6.2 This circuit is reissued to change lead designation "OPF" to "OSF"  
and to change the connecting circuit information for the "OSF" lead.

No record is being kept on this change since there has been no manufacture  
in accordance with the previous arrangement.

6.3 The Current Drain Data for this circuit is not affected by changes  
on this issue.

6.4 Equipment information is not affected.

6.5 Equipment Design Requirements are not affected.

No engineering letter will be issued.



STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

TABLE OF CONTENTS	PAGE	<u>SECTION I - GENERAL DESCRIPTION</u>
<u>SECTION I - GENERAL DESCRIPTION</u>		1. GENERAL
1. GENERAL	1	This outgoing trunk circuit is required in a step-by-step office arranged for Automatic Number Identification to complete calls to the CAMA office.
<u>SECTION II - DETAILED DESCRIPTION</u>		
1. SEIZURE	2	The trunk is reached by the dialing of a directing code thru selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.
2. PULSING CALLED NUMBER	2	
3. PARTY TEST	2	
4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER	3	During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground thru the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.
5. DISCONNECT	4	
6. TIMING CIRCUIT	5	
7. TESTING	5	
8. MISCELLANEOUS	6	
<u>SECTION III - REFERENCE DATA</u>		
1. WORKING LIMITS	6	When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned. It then causes the trunk to connect identification tone generated by one of the two oscillator circuits on the trunk bay to the sleeve. This is used by the identifier to derive the calling number which is registered in the outpulser. After identification the tone is removed and the outgoing trunk conductors are transferred to the link tip and ring and the outpulser then sends the calling number to the CAMA office, using MF signaling.
2. FUNCTIONS	6	
3. CONNECTING CIRCUITS	7	
4. TAKING EQUIPMENT OUT OF SERVICE	7	
<u>SECTION IV - REASONS FOR REISSUE</u>	8	
		No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.
		At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a

trouble ticket after which the trunk and switches are released. On calls from two party message rate lines the two party message rate trunk circuit between the line finder and first selector is caused to cut thru after outpulsing the calling number so that a ground removal test can be made at the end of the call.

Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.

## SECTION II - DETAILED DESCRIPTION

### 1. SEIZURE

On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay Bl. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR or ATB lead to the Traffic Register Circuit and opens the high resistance winding of relay CS from the trunk tip and ring.

Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

### 2. PULSING CALLED NUMBER

The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates Cl. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and Cl hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

### 3. PARTY TEST

A party test is made between the first and second digits as follows:

With relay Cl operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized condenser timed relay, electrically biased on its ~~secondary~~ winding. When Cl releases battery thru the secondary winding charges condenser C. As the condenser charges the current thru the "S" winding decreases until it is less than the "P" or bias winding current at which point the relay releases. The time to release depends upon the time constant of the charging path and is such that PTM will release in approximately 0.050 sec.

Also when Cl releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110 volt battery thru the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

### 3.1 Tip Party - Flate Rate

Tip party stations are equipped with 3640 ohm or 2650 ohm ringers connected to ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48V thru resistance lamp PT to the line. The -48V battery in conjunction with the PT varistor and shunting resistor B discharges the line in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

### 3.2 Ring Party - Flat Rate

Ring party stations will have no ground on them. The test is made as in par. 3.1 except that when PTM releases, PT should be nonoperated. RP operates thru the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48V thru resistance lamp ~~PT~~ until PTC releases as described in par. 3.1. RP releases.

### 3.3 Message Rate Lines

On calls from message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification.

As will be described later a direct test of two party message rate lines is made on disconnect.

## 3.4 Multiparty Lines Other Than Two Party

\* The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

Where tube sets with three element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

## 3.5 Check of Party Test Feature

To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates thru either TPA or RPA operated. If TPA is operated, PTK connects resistor V and W, a total of 6720 ohms to the PT relay, secondary windings. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

With TPA, RPA and RP operated, a ground is connected to the T lead to the outpulser link as a tip party indication to the outpulser as described later.

If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y and Z inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

With TP, TPA and RPA operated and RP nonoperated a ground is connected to the R lead to the outpulser link as a ring party indication to the outpulser.

If the PT relay fails to operate on the 3640 or 2650 ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154 ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outpulser is grounded.

## 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

## 4.1 Supervision

After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating P1 which locks.

## 4.2 Calling in Outpulser

P1 connects battery thru resistance lamp A to the ST lead to the outpulser connector in order to get an outpulser connected to this circuit, and starts the TM timer.

The trunk and outpulser are connected together over five leads, T, R, TPT, AB and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead operates the SP relay.

SP locks and removes itself from the SF lead, (1) opens the ST lead to the link (2) stops the timer (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead (4) connects the SP1 relay to the SP lead (5) connects the MF relay to the AB lead and (6) connects the ID relay to the R lead.

## 4.3 Testing for Abandoned Call

Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outpulser T & R, relay SP1 holding the A operated. SP1 is released when the outpulser is satisfied.

An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

## 4.4 Identifying the Line

When the outpulser is ready for line identification it operates ID. ID connects tone from one of the oscillators to the selector multiple sleeve. This circuit is low in dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

## 4.5 Outpulsing Calling Number

When the outpulser is ready to send out the calling number it operates relay MF

\* THIS CKT. MAY BE USED FOR OPER. IDENTIFIED TRAFFIC ON A TEMP. BASIS BY BLOCKING OPERATED THE (SP) RELAY.  
(SEE NOTE 303 ON CD-32245-012.)

transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS and MF holds B until the outpulser releases. Release of the A relay during this time is ineffective.

#### 4.6 Release of Outpulser

When the outpulser has completed its work it releases the link, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### 5.1 Calling Party Disconnects First

When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path thru P1 to the C resistance but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### 5.11 Ring Party

When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### 5.12 Tip Party - Ground Removal Test

When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in paragraph 5.11 does not operate. B1 and SP release and close a circuit to operate GRT thru contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from C1 to delay closure of ground to the PT contacts. This ground now comes from GRT

operated. When C1 releases PTM is released after a timed interval.

If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### 5.13 Two Party Message Rate - Ground Removal Test

During the outpulsing of the calling number as described in paragraph 4.5 the operation of MF grounds the C lead to the selector multiple. On calls from two party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut thru as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

On disconnect by the 2 MR station therefore, a ground removal test is made as described in paragraph 5.12.

#### 5.14 Ground Removal Failure

When the ground removal test is started by GRT operating as described in paragraph 5.12 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 10-23.4 sec during which time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

At the end of timing TM operates, operating TM1 which is slow acting. The tube is extinguished when TM operates and before TM1 operates. TM1 releases TM at which time a circuit is completed for operating TP which locks.

TM1 releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser.

The indication to the outpulser of ground removal failure is ground on the TPT lead for a two party flat rate line and ground on the AB lead for a two party message rate line. Relay MR operated transfers the ground to the AB lead.

When the outpulser is connected and after it has received the ground removal failure indication it operates relay SP.

SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

Identification of the calling line is made as before, the ID operating over the R lead to connect tone to the sleeve.

With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

GRT released releases SP, TP and PTC and, if operated MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

## 5.2 Called Party Disconnects First - Timed Disconnect

When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

CS operates C thru P1 operated. C is slow to operate due to its short circuited secondary to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, Bl and P1 release. Bl releases SP.

## 6. TIMING CIRCUIT

### 6.1 Awaiting Outpulser for Identification

Referring to paragraph 4.2, P1 operating to call in the outpulser, also starts the tube timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds, the start circuit will be opened to prevent holding out other trunks.

Assuming an outpulser is not connected: P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now charges thru resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

TM locks to ground on the TM1, and this ground extinguishes the tube. TM operates TM1 which is slow to operate to give the tube time to deionize. TM and TM1 reconnect battery to capacitor D to discharge it thru the F resistor and restore -48V to the control anode of the tube. TM1 locks thru Bl operated and unless TP is operated, releases TM.

After disconnect by the customer TM1 releases from Bl. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when Bl releases.

### 6.2 Ground Removal Failure

Referring to paragraph 5.14, GRT operating starts the timer circuit by opening -48V battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in paragraph 6.1. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

Relays TM and TM1 operate and the tube is extinguished.

### 6.3 Awaiting Outpulser on Ground Removal Failure

The timer is again recycled to time for 10 to 23.4 sec. As described in paragraph 5.14 TP operates when TM released and TM1 operated at the end of the 10 second timing. TM1 releases and its slow release gives time for capacitor D to discharge before again starting to charge it. TM1 released with TP operated closes the start lead to the outpulser connector.

Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in paragraph 5.14.

If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser the TM operates, extinguishes the tube and locks to TP. TM1 operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TM1. The sleeve is held grounded until TM1 releases after which the preceding circuits are released and the trunk is restored to normal.

## 7. TESTING

### 7.1 From Test Jacks

Test jacks T and TT provide access to the selector multiple and the outgoing

ends of the trunk circuit for testing with test sets.

## 7.2 From Test Circuit

Relays TT and TTI and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the "FR" lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TTI relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

When the outpulser is called in on a test call the TST lead to the outpulser connector is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### 8.1 Last Trunk Busy Registration "S" Option

Means are provided for operating a traffic register. Ground is extended to the LTB lead when the circuit is normal. This lead which is connected on the last trunk of an identifier group is open whenever the circuit is busy for any reason.

### 8.2 Traffic Usage Recorder "R" Option

Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the "BR" lead to the traffic usage recorder circuit, otherwise the "BR" lead is grounded.

### 8.3 Peg Count

Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead "OSP" to the miscellaneous circuit (for trunk frames) is grounded from the time TM is operated until TMI operates. No registration is made on ground removal operation of the timer as GRT open the "OPF" lead.

### 8.4 Holding Circuit for Tracing Trouble

The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Misc. Ckt. for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

## 8.5 Fuse Operation

Relay MB is normally operated thru the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.

## SECTION III - REFERENCE DATA

### 1. WORKING LIMITS

#### 1.1 Battery Voltages

-45 to -52V  
+125 to +135V  
-116 to -120V or  
-100 to -120V

#### 1.2 Relay Limits

- 1.21 A relay pulsing - max. ext. ckt. loop res. 1500 ohms
- A relay supv. - max. ext. ckt. loop res. 2375 ohms
- A pulsing & supv. - min. ins. res. 15,000 ohms
- CS relay - supv. - max ext. ckt. loop res. 7500 ohms
- CS relay - supv.-min. ins. res. 30,000 ohms
- PT relay - max. ext. ckt. loop res. 1500 ohms
- PT relay - min. ins. res. 15,000 ohms
- PT relay - max. res. to grd. at tip party of 2 party F.R. line 4004 ohms

-CC SUPPLY	EARTH POTENTIAL			
	DC	25AC	60AC	
-100 to -120V	-11V, +20V	7V	10	
-116 to -120V	-16V, +20V	10V	14.5V	

### 2. FUNCTIONS

- 2.01 When a loop is closed on the selector multiple tip and ring to ground the sleeve lead to hold the preceding circuits and to close the loop to the distant office.
- 2.02 To repeat dial pulses on a battery and ground basis.
- 2.03 During the first interdigital period to make a party test.
- 2.04 During the second interdigital period to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 2.05 When battery and ground is reversed at the distant office to close the ST lead to the outpulser connector circuit.
- 2.06 When the outpulser connector has connected an outpulser circuit to this circuit,

- 2.061 to indicate tip or ring party by ground on the T or R lead;
- 2.062 to remove the party indications when the outpulser operates the SP relay;
- 2.063 to connect the outpulser tip and ring to the subscriber tip and ring for an abandoned call test when the outpulser operates the SP1 relay;
- 2.064 to connect identification tone to the selector multiple sleeve from one of the oscillators when the outpulser operates the ID relay;
- 2.065 to connect the outgoing tip and ring leads to the outpulser tip and ring when the outpulser operates the MF relay;
- 2.066 to connect ground to the selector multiple C lead when MF is operated to cut thru the 2 MR trunk if it is connected.
- 2.07 When a 2 MR trunk is connected to operate and lock the MR relay after that trunk cuts thru.
- 2.08 On hang up by the calling party,
- 2.081 to open the tip and ring to the distant office;
- 2.082 to make a ground removal test if the calling party was a tip party or either party of a 2 MR line;
- 2.083 to restore to normal immediately if the calling party was a ring party;
- 2.084 to restore to normal after the ground removal test shows the line is clear of ground;
- 2.085 on ground removal test when the line is not clear of ground after 10-24 sec. to call in the outpulser;
- 2.086 on ground removal failure to ground the TPT lead to the outpulser on a flat rate line or the AB lead on a message rate line;
- 2.087 to remove the failure indications when the outpulser operates the SP relay;
- 2.088 to connect identification tone to the sleeve when the ID is operated;
- 2.089 to hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.
- 2.09 When the calling party fails to disconnect before the incoming trunk times out,

- 2.091 to open the sleeve to the selector multiple long enough to release the preceding switches;
- 2.092 when the selector multiple tip and ring leads open to restore to normal;
- 2.093 to reclose ground to the selector sleeve during release of the trunk.
- 2.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.
- 2.11 To test busy when a fuse operates.
- 2.12 To operate a last trunk busy register or operate the traffic usage recorder.
- 2.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.
- 2.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test-Circuit.
- 2.15 To hold the connection from releasing when the outpulser operates the TR relay.

### 3. CONNECTING CIRCUITS

- 3.01 Selector Bank Multiple Circuit - SD-32123-01.
- 3.02 Incoming Trunk in #4 Crossbar Office - SD-68480-01.
- 3.03 Incoming Trunk in #5 Crossbar Office - SD-26101-01.
- 3.04 Incoming Trunk in Crossbar Tandem Office - SD-27010-01.
- 3.05 Outpulser Connector Circuit - SD-95890-01.
- 3.06 Auto. Trk. Ckt. - SD-32315-01.
- 3.07 Oscillator Circuit - SD-95827-01.
- 3.08 Misc. Circuit for Trouble Ticketer - SD-95823-01.
- 3.09 Rotary Out Trunk Switch Ckt. - SD-30868-01.
- 3.10 Misc. Ckt. Trunk Frame - SD-32248-01.
- 3.11 Traffic Usage Recorder Circuit - SD-95738-01.

### 4. TAKING EQUIPMENT OUT OF SERVICE

The circuit may be made busy by plugging into test jack T which grounds the

selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

#### SECTION IV - REASONS FOR REISSUE

##### CHANGES

##### B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	346B E.T. (TM)	346C E.T. (TM)

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

C.1 Under remarks for the (C1) and (PTK) relays, removed reference to "Strap 2L-2U(C1)" and "Strap 2L-2U(PTK)" respectively.

##### D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Designation of "OPF" lead changed to "OSF".

D.2 Reference "To Traffic Reg. Ckt., To Misc. Alm. Ckt. (REG.)" as connecting information for the "OSF" lead is removed and is replaced by "To Misc. Ckt.-Trunk Frame".

D.3 Reference "In Same Ident. Group" is added to the multiplying information on the "OSF" lead.

D.4 The code of the (TM) tube is changed to 346C replacing the 346B, now Mfr. Disc.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2335-WAO'C-FEB-LK

NOV 24 1959

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY. NEW YORK 7

## DRAWING NOTICE

SD-32245-01  
CD 4D  
RATING AT&TCo Std.  
SYSTEM Step-By-Step  
DATE September 23, 1959

ISSUE 4D  
APP.

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk  
Circuit - Loop Pulsing - Automatic Number Identification -  
To CAMA Office

## DESCRIPTION

- 6.1 Reissued sheets: 1, 2, 3, 9, 10 - Total reissued sheets 5.
- 6.2 This circuit is reissued to specify a separate ground supply to the oscillators. This is designated "E". CAD1 is changed to provide for this ground.
- 6.3 Current Drains are not affected.
- 6.4 Equipment information is not affected.
- 6.5 Equipment Design Requirements are not affected.

An engineering letter will be issued.

THE  
OFFICE OF THE  
ATTORNEY GENERAL  
STATE OF NEW YORK  
ALBANY



NOV 24 1959

CD-32245-01  
Issue 4-D  
Dwg. Issue 4-D

CIRCUIT DESCRIPTION

STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

This outgoing trunk circuit is required in a step by step office arranged for Automatic Number Identification to complete calls to the CAMA office.

The trunk is reached by the dialing of a directing code thru selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground thru the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned. It then causes the trunk to connect identification tone generated by one of the two oscillator circuits on the trunk bay to the sleeve. This is used by the identifier to derive the calling number

which is registered in the outpulser. After identification the tone is removed and the outgoing trunk conductors are transferred to the link tip and ring and the outpulser then sends the calling number to the CAMA office, using MF signaling.

No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket after which the trunk and switches are released. On calls from two party message rate lines the two party message rate trunk circuit between the line finder and first selector is caused to cut thru after outpulsing the calling number so that a ground removal test can be made at the end of the call.

Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.



SECTION II - DETAILED DESCRIPTION**1. SEIZURE**

On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR or ATB lead to the Traffic Register Circuit and opens the high resistance winding of relay CS from the trunk tip and ring.

Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

**2. PULSING CALLED NUMBER**

The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates C1. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and C1 hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

**3. PARTY TEST**

A party test is made between the first and second digits as follows:

With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized condenser timed relay, electrically biased on its secondary winding. When C1 releases battery thru the secondary winding charges condenser C. As the condenser charges the current thru the "S" winding decreases until it is less than the "P" or bias winding current at which point the relay releases. The time to release depends upon the time constant of the charging path and is such that PTM will release in approximately 0.050 sec.

Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110 volt battery thru the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

**3.1 Tip Party - Flat Rate**

Tip party stations are equipped with 3640 ohm or 2650 ohm ringers connected to

ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48V thru resistance lamp PT to the line. The -48V battery in conjunction with the PT varistor and shunting resistor B discharges the line in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

**3.2 Ring Party - Flat Rate**

Ring party stations will have no ground on them. The test is made as in par. 3.1 except that when PTM releases, PT should be nonoperated. RP operates thru the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48V thru resistance lamp TP until PTC releases as described in para. 3.1. RP releases.

**3.3 Message Rate Lines**

On calls from message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification.

As will be described later a direct test of two party message rate lines is made on disconnect.

**3.4 Multiparty Lines Other Than Two Party**

The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

Where tube sets with three element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

### 3.5 Check of Party Test Feature

To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates thru either TPA or RPA operated. If TPA is operated, PTK connects resistor V and W, a total of 6720 ohms to the PT relay, secondary windings. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

With TPA, RPA and RP operated, a ground is connected to the T lead to the outputpulser link as a tip party indication to the outputpulser as described later.

If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y and Z inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

With TP, TPA and RPA operated and RP nonoperated a ground is connected to the R lead to the outputpulser link as a ring party indication to the outputpulser.

If the PT relay fails to operate on the 3640 or 2650 ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154 ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the outputpulser is grounded.

If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outputpulser is grounded.

## 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

### 4.1 Supervision

After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating P1 which locks.

### 4.2 Calling in Outputpulser

P1 connects battery thru resistance lamp A to the ST lead to the outputpulser connector in order to get an outputpulser connected to this circuit, and starts the TM timer.

The trunk and outputpulser are connected together over five leads, T, R, TPT, AB and SP. When the outputpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead is operates the SP relay.

SP locks and removes itself from the SP lead, (1) opens the ST lead to the link (2) stops the timer (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead (4) connects the SP1 relay to the SP lead (5) connects the MF relay to the AB lead and (6) connects the ID relay to the R lead.

### 4.3 Testing for Abandoned Call

Before going ahead with the call, the outputpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outputpulser T & R, relay SP1 holding the A operated. SP1 is released when the outputpulser is satisfied.

An indication is also given to the outputpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

### 4.4 Identifying the Line

When the outputpulser is ready for line identification it operates ID. ID connects tone from one of the oscillators to the selector multiple sleeve. This circuit is low in dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

### 4.5 Outputpulsing Calling Number

When the outputpulser is ready to send out the calling number it operates relay MF transferring the trunk T & R to the outputpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS and MF holds B until the outputpulser releases. Release of the A relay during this time is ineffective.

#### 4.6 Release of Outpulser

When the outpulser has completed its work it releases the link, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### 5.1 Calling Party Disconnects First

When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path thru P1 to the C resistance but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### 5.11 Ring Party

When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### 5.12 Tip Party - Ground Removal Test

When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in paragraph 5.11 does not operate. B1 and SP release and close a circuit to operate GRT thru contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from

C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases PTM is released after a timed interval.

If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### 5.13 Two Party Message Rate - Ground Removal Test

During the outpulsing of the calling number as described in paragraph 4.5 the operation of MF grounds the C lead to the selector multiple. On calls from two party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut thru as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

On disconnect by the 2 MR station therefore, a ground removal test is made as described in paragraph 5.12.

#### 5.14 Ground Removal Failure

When the ground removal test is started by GRT operating as described in paragraph 5.12 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 10-23.4 sec during which time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

At the end of timing TM operates, operating TM1 which is slow acting. The tube is extinguished when TM operates and before TM1 operates. TM1 releases TM at which time a circuit is completed for operating TP which locks.

TM1 releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser.

The indication to the outpulser of ground removal failure is ground on the TPT lead for a two party flat rate line and ground on the AB lead for a two party message rate line. Relay MR operated transfers the ground to the AB lead.

When the outpulser is connected and after it has received the ground removal failure indication it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

Identification of the calling line is made as before, the ID operating over the R lead to connect tone to the sleeve.

With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

GRT released releases SP, TP and PTC and, if operated MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

## 5.2 Called Party Disconnects First - Timed Disconnect

When the calling party does not disconnect and the called party does, the trunk circuit at the CMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

CS operates C thru P1 operated. C is slow to operate due to its short circuited secondary to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1 and P1 release. B1 releases SP.

## 6. TIMING CIRCUIT

### 6.1 Awaiting Outpulser for Identification

Referring to paragraph 4.2, P1 operating to call in the outpulser, also starts the tube timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds, the start circuit will be opened to prevent holding out other trunks.

Assuming an outpulser is not connected: P1 operating opens battery from the control anode of the tube and the D

capacitor which has been held discharged. D now charges thru resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

TM locks to ground on the TML, and this ground extinguishes the tube. TM operates TML which is slow to operate to give the tube time to deionize. TM and TML reconnect battery to capacitor D to discharge it thru the F resistor and restore -48V to the control anode of the tube. TML locks thru B1 operated and unless TP is operated, releases TM.

After disconnect by the customer TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

### 6.2 Ground Removal Failure

Referring to paragraph 5.14, GRT operating starts the timer circuit by opening -48V battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in paragraph 6.1. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

Relays TM and TML operate and the tube is extinguished.

### 6.3 Awaiting Outpulser on Ground Removal Failure

The timer is again recycled to time for 10 to 23.4 sec. As described in paragraph 5.14 TP operates when TM released and TML operated at the end of the 10 second timing. TML releases and its slow release gives time for capacitor D to discharge before again starting to charge it. TML released with TP operated closes the start lead to the outpulser connector.

Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in paragraph 5.14.

If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser the TM operates, extinguishes the tube and locks to TP. TML operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TML. The sleeve is held grounded until TML releases after which the preceding circuits are released and the trunk is restored to normal.

## 7. TESTING

### 7.1 From Test Jacks

Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

### 7.2 From Test Circuit

Relays TT and TTL and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the "FR" lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TTL relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

When the outpulser is called in on a test call the TST lead to the outpulser connector is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### 8.1 Last Trunk Busy Registration "S" Option

Means are provided for operating a traffic register. Ground is extended to the

LTB lead when the circuit is normal. This lead which is connected on the last trunk of an identifier group is open whenever the circuit is busy for any reason.

### 8.2 Traffic Usage Recorder "R" Option

Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the "BR" lead to the traffic usage recorder circuit, otherwise the "BR" lead is grounded.

### 8.3 Peg Count

Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead "OPF" to the traffic register circuit is grounded from the time TM is operated until TML operates. No registration is made on ground removal operation of the timer as GRT open the "OPF" lead.

### 8.4 Holding Circuit for Tracing Trouble

The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Misc. Ckt. for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

### 8.5 Fuse Operation

Relay MB is normally operated thru the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.



SECTION III - REFERENCE DATA

## 1. WORKING LIMITS

## 1.1 Battery Voltages

-45 to -52V  
 +125 to +135V  
 -116 to -120V or  
 -100 to -120V

## 1.2 Relay Limits

- 1.21 A relay pulsing - max. ext. ckt. loop  
 res. 1500 ohms  
 A relay supv. - max. ext. ckt. loop  
 res. 2375 ohms  
 A pulsing & supv. - min. ins. res.  
 15,000 ohms  
 CS relay - supv. - max. ext. ckt. loop  
 res. 7500 ohms  
 CS relay - supv. - min. ins. res.  
 30,000 ohms  
 PT relay - max. ext. ckt. loop res.  
 1500 ohms  
 PT relay - min. ins. res. 15,000 ohms  
 PT relay - max. res. to grd. at tip  
 party of 2 party F.R. line 4004 ohms

## EARTH POTENTIAL

-CC SUPPLY	DC	25 AC	60 AC
-100 to -120V	-11V, +20V	7V	10
-116 to -120V	-16V, +20V	10V	14.5V

## 2. FUNCTIONS

- 2.01 When a loop is closed on the selector multiple tip and ring to ground the sleeve lead to hold the preceding circuits and to close the loop to the distant office.
- 2.02 To repeat dial pulses on a battery and ground basis.
- 2.03 During the first interdigital period to make a party test.
- 2.04 During the second interdigital period to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 2.05 When battery and ground is reversed at the distant office to close the ST lead to the outputer connector circuit.
- 2.06 When the outputer connector has connected an outputer circuit to this circuit,
- 2.061 to indicate tip or ring party by ground on the T or R lead;
- 2.062 to remove the party indications when the outputer operates the SP relay;

2.063 to connect the outputer tip and ring to the subscriber tip and ring for an abandoned call test when the outputer operates the SP1 relay;

2.064 to connect identification tone to the selector multiple sleeve from one of the oscillators when the outputer operates the ID relay;

2.065 to connect the outgoing tip and ring leads to the outputer tip and ring when the outputer operates the MF relay;

2.066 to connect ground to the selector multiple C lead when MF is operated to cut thru the 2 MR trunk if it is connected.

2.07 When a 2 MR trunk is connected to operate and lock the MR relay after that trunk cuts thru.

2.08 On hang up by the calling party,

2.081 to open the tip and ring to the distant office;

2.082 to make a ground removal test if the calling party was a tip party or either party of a 2 MR line;

2.083 to restore to normal immediately if the calling party was a ring party;

2.084 to restore to normal after the ground removal test shows the line is clear of ground;

2.085 on ground removal test when the line is not clear of ground after 10-24 sec. to call in the outputer;

2.086 on ground removal failure to ground the TPT lead to the outputer on a flat rate line or the AB lead on a message rate line;

2.087 to remove the failure indications when the outputer operates the SP relay;

2.088 to connect identification tone to the sleeve when the ID is operated;

2.089 to hold the GRT relay from the outputer over the SP lead and restore the trunk and preceding circuits to normal when the outputer opens this lead.

2.09 When the calling party fails to disconnect before the incoming trunk times out,

2.091 to open the sleeve to the selector multiple long enough to release the preceding switches;

- 2.092 when the selector multiple tip and ring leads open to restore to normal;
- 2.093 to reclose ground to the selector sleeve during release of the trunk.
- 2.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.
- 2.11 To test busy when a fuse operates.
- 2.12 To operate a last trunk busy register or operate the traffic usage recorder.
- 2.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.
- 2.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.
- 2.15 To hold the connection from releasing when the outpulser operates the TR relay.

### 3. CONNECTING CIRCUITS

- 3.01 Selector Bank Multiple Circuit - SD-32123-01.
- 3.02 Incoming Trunk in #4 Crossbar Office - SD-68480-01.
- 3.03 Incoming Trunk in #5 Crossbar Office - SD-26101-01.
- 3.04 Incoming Trunk in Crossbar Tandem Office - SD-27010-01.
- 3.05 Outpulser Connector Circuit - SD-95890-01.

- 3.06 Auto. Trk. Ckt. - SD-32315-01.
- 3.07 Oscillator Circuit - SD-95827-01.
- 3.08 Misc. Circuit for Trouble Ticketer - SD-95823-01.
- 3.09 Traffic Register Circuit - SD-30896-01.
- 3.10 Misc. Alm. Ckt. 355A - SD-31976-01.
- 3.11 Rotary Out Trunk Switch Ckt. - SD-30868-01.
- 3.12 Misc. Ckt. Trunk Frame - SD-32248-01.
- 3.13 Traffic Usage Recorder Circuit - SD-95738-01.

### 4. TAKING EQUIPMENT OUT OF SERVICE

The circuit may be made busy by plugging into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

SECTION IV - REASONS FOR REISSUE

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The ground supply to the oscillator  
circuit on lead "G" sheet 3E2 formerly

was circuit ground. It is changed to "B"  
ground. Circuit ground is now "A".

D.2 Equipment Note 203 is added. CAD1 is  
changed to provide for the "B" ground  
in D.1.

All other headings under Changes, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2335-CDK-FBB-WM



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7JUN 25 1959  
*LW*

## DRAWING NOTICE

SD-32245-01  
CD 3D  
RATING AT&TCo. Std.  
SYSTEM Step-By-Step  
DATE March 20, 1959ISSUE 3D  
APP.

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A -  
Outgoing Trunk Circuit - Loop Pulsing -  
Automatic Number Identification - To CAMA Office

## DESCRIPTION

- 6.1 Reissued sheets: 1 to 6, 8 to 10 - Total reissued sheets 9.
- 6.2 This circuit is reissued to provide for connecting to Outpulser Connector Circuit SD-95890-01 in place of Outpulser Link Circuit SD-95812-01, which is being completely replaced.
- A 13J resistance lamp (A) is required in place of the 18AG resistor (A) in the start lead. Resistor A1 is redesignated A.
- 6.2 A fast or operated relay TR is required to function properly with the outpulser. The AF13 is changed to AF110 for this purpose.
- 6.3 Provision is made for operating a "Last Trunk Busy" register in place of an "All Trunks Busy" Traffic register.
- The above are made on a no record basis on agreement with WECO since this circuit is not yet manufactured.
- 6.4 Current Drains are not affected.
- 6.5 Equipment information will be covered by drawing J-95108K-( ).
- 6.6 Equipment Design Requirements are not affected.
- No engineering letter will be issued.



STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

This outgoing trunk circuit is required in a step by step office arranged for Automatic Number Identification to complete calls to the CAMA office.

The trunk is reached by the dialing of a directing code thru selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground thru the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser connector circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned. It then causes the trunk to connect identification tone generated by one of the two oscillator circuits on the trunk bay to the sleeve. This is used by the identifier to derive the calling number

which is registered in the outpulser. After identification the tone is removed and the outgoing trunk conductors are transferred to the link tip and ring and the outpulser then sends the calling number to the CAMA office, using MF signaling.

No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket after which the trunk and switches are released. On calls from two party message rate lines the two party message rate trunk circuit between the line finder and first selector is caused to cut thru after outpulsing the calling number so that a ground removal test can be made at the end of the call.

Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.



SECTION II - DETAILED DESCRIPTION**1. SEIZURE**

On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR or ATB lead to the Traffic Register Circuit and opens the high resistance winding of relay CS from the trunk tip and ring.

Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

**2. PULSING CALLED NUMBER**

The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates C1. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and C1 hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

**3. PARTY TEST**

A party test is made between the first and second digits as follows:

With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized condenser timed relay, electrically biased on its secondary winding. When C1 releases battery thru the secondary winding charges condenser C. As the condenser charges the current thru the "S" winding decreases until it is less than the "P" or bias winding current at which point the relay releases. The time to release depends upon the time constant of the charging path and is such that PTM will release in approximately 0.050 sec.

Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110 volt battery thru the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

**3.1 Tip Party - Flat Rate**

Tip party stations are equipped with 3640 ohm or 2650 ohm ringers connected to

ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48V thru resistance lamp PT to the line. The -48V battery in conjunction with the PT varistor and shunting resistor B discharges the line in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

**3.2 Ring Party - Flat Rate**

Ring party stations will have no ground on them. The test is made as in par. 3.1 except that when PTM releases, PT should be nonoperated. RP operates thru the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48V thru resistance lamp TP until PTC releases as described in para. 3.1. RP releases.

**3.3 Message Rate Lines**

On calls from message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification.

As will be described later a direct test of two party message rate lines is made on disconnect.

**3.4 Multiparty Lines Other Than Two Party**

The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

Where tube sets with three element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

### 3.5 Check of Party Test Feature

To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

Cl operating on the second digit operates PTM as previously described. On the release of Cl, relay PTK operates thru either TPA or RPA operated. If TPA is operated, PTK connects resistors V and W, a total of 6720 ohms to the PT relay, secondary winding. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

With TPA, RPA and RP operated, a ground is connected to the T lead to the outpulser link as a tip party indication to the outpulser as described later.

If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y and Z inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

With TP, TPA and RPA operated and RP nonoperated a ground is connected to the R lead to the outpulser link as a ring party indication to the outpulser.

If the PT relay fails to operate on the 3640 or 2650 ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154 ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outpulser is grounded.

## 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

### 4.1 Supervision

After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating Pl which locks.

### 4.2 Calling in Outpulser

Pl connects battery thru resistance lamp A to the ST lead to the outpulser connector in order to get an outpulser connected to this circuit, and starts the TM timer.

The trunk and outpulser are connected together over five leads, T, R, TPT, AB and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead is operates the SP relay.

SP locks and removes itself from the SP lead, (1) opens the ST lead to the link (2) stops the timer (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead (4) connects the SP1 relay to the SP lead (5) connects the MF relay to the AB lead and (6) connects the ID relay to the R lead.

### 4.3 Testing for Abandoned Call

Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outpulser T & R, relay SP1 holding the A operated. SP1 is released when the outpulser is satisfied.

An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

### 4.4 Identifying the Line

When the outpulser is ready for line identification it operates ID. ID connects tone from one of the oscillators to the selector multiple sleeve. This circuit is low in dc resistance to hold the preceding circuits. ID also connects the resistance lamp battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

### 4.5 Outpulsing Calling Number

When the outpulser is ready to send out the calling number it operates relay MF transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS.

If the customer abandons during this time the loop to the CAMA office is opened by the A relay, both stopping the MF signals and giving a disconnect signal to the distant end. MF holds B until the outpulser releases. This minimizes the unproductive

use of CAMA office circuits to distant points and prevents the release and re-seizure of this circuit before the distant end is normal.

#### 4.6 Release of Outpulser

When the outpulser has completed its work it releases the link, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### 5.1 Calling Party Disconnects First

When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path thru P1 to the C resistance but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### 5.11 Ring Party

When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### 5.12 Tip Party - Ground Removal Test

When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in paragraph 5.11 does not operate. B1 and SP release and close a circuit to operate GRT thru contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from

C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases PTM is released after a timed interval.

If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### 5.13 Two Party Message Rate - Ground Removal Test

During the outpulsing of the calling number as described in paragraph 4.5 the operation of MF grounds the C lead to the selector multiple. On calls from two party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut thru as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

On disconnect by the 2 MR station therefore, a ground removal test is made as described in paragraph 5.12.

#### 5.14 Ground Removal Failure

When the ground removal test is started by GRT operating as described in paragraph 5.12 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 10-23.4 sec during which time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

At the end of timing TM operates, operating TML which is slow acting. The tube is extinguished when TM operates and before TML operates. TML releases TM at which time a circuit is completed for operating TP which locks.

TML releases and with TP operated closes the ST lead to the outpulser connector circuit to call for an outpulser.

The indication to the outpulser of ground removal failure is ground on the TPT lead for a two party flat rate line and ground on the AB lead for a two party message rate line. Relay MR operated transfers the ground to the AB lead.

When the outpulser is connected and after it has received the ground removal failure indication it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

Identification of the calling line is made as before, the ID operating over the R lead to connect tone to the sleeve.

With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

GRT released releases SP, TP and PTC and, if operated MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

#### 5.2 Called Party Disconnects First - Timed Disconnect

When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

CS operates C thru P1 operated. C is slow to operate due to its short circuited secondary to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1 and P1 release. B1 releases SP.

### 6. TIMING CIRCUIT

#### 6.1 Awaiting Outpulser for Identification

Referring to paragraph 4.2, P1 operating to call in the outpulser, also starts the tube timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds, the start circuit will be opened to prevent holding out other trunks.

Assuming an outpulser is not connected: P1 operating opens battery from the control anode of the tube and the D

capacitor which has been held discharged. D now charges thru resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

TM locks to ground on the TMI, and this ground extinguishes the tube. TM operates TMI which is slow to operate to give the tube time to deionize. TM and TMI reconnect battery to capacitor D to discharge it thru the F resistor and restore -48V to the control anode of the tube. TMI locks thru B1 operated and unless TP is operated, releases TM.

After disconnect by the customer TMI releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

#### 6.2 Ground Removal Failure

Referring to paragraph 5.14, GRT operating starts the timer circuit by opening -48V battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in paragraph 6.1. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

Relays TM and TMI operate and the tube is extinguished.

#### 6.3 Awaiting Outpulser on Ground Removal Failure

The timer is again recycled to time for 10 to 23.4 sec. As described in paragraph 5.14 TP operates when TM released and TMI operated at the end of the 10 second timing. TMI releases and its slow release gives time for capacitor D to discharge before again starting to charge it. TMI released with TP operated closes the start lead to the outpulser connector.

Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in paragraph 5.14.

If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser the TM operates, extinguishes the tube and locks to TP. TMI operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TML. The sleeve is held grounded until TML releases after which the preceding circuits are released and the trunk is restored to normal.

## 7. TESTING

### 7.1 From Test Jacks

Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

### 7.2 From Test Circuit

Relays TT and TTL and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the "FR" lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TTL relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

When the outpulser is called in on a test call the TST lead to the outpulser connector is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### 8.1 Last Trunk Busy Registration "S" Option

Means are provided for operating a traffic register. Ground is extended to the

LTB lead when the circuit is normal. This lead which is connected on the last trunk of an identifier group is open whenever the circuit is busy for any reason.

### 8.2 Traffic Usage Recorder "R" Option

Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the "BR" lead to the traffic usage recorder circuit, otherwise the "BR" lead is grounded.

### 8.3 Peg Count

Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead "OPF" to the traffic register circuit is grounded from the time TM is operated until TML operates. No registration is made on ground removal operation of the timer as GRT open the "OPF" lead.

### 8.4 Holding Circuit for Tracing Trouble

The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Misc. Ckt. for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

### 8.5 Fuse Operation

Relay MB is normally operated thru the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.



SECTION III - REFERENCE DATA

## 1. WORKING LIMITS

## 1.1 Battery Voltages

-45 to -52V  
 +125 to +135V  
 -116 to -120V or  
 -100 to -120V

## 1.2 Relay Limits

- 1.21 A relay pulsing - max. ext. ckt. loop res. 1500 ohms  
 A relay supv. - max. ext. ckt. loop res. 2375 ohms  
 A pulsing & supv. - min. ins. res. 15,000 ohms  
 CS relay - supv. - max. ext. ckt. loop res. 7500 ohms  
 CS relay - supv. - min. ins. res. 30,000 ohms  
 PT relay - max. ext. ckt. loop res. 1500 ohms  
 PT relay - min. ins. res. 15,000 ohms  
 PT relay - max. res. to grd. at tip party of 2 party F.R. line 4004 ohms

-CC SUPPLY	EARTH POTENTIAL			
	DC	25 AC	60 AC	
-100 to -120V	-11V, +20V	7V	10	
-116 to -120V	-16V, +20V	10V	14.5V	

## 2. FUNCTIONS

- 2.01 When a loop is closed on the selector multiple tip and ring to ground the sleeve lead to hold the preceding circuits and to close the loop to the distant office.
- 2.02 To repeat dial pulses on a battery and ground basis.
- 2.03 During the first interdigital period to make a party test.
- 2.04 During the second interdigital period to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 2.05 When battery and ground is reversed at the distant office to close the ST lead to the outpulser connector circuit.
- 2.06 When the outpulser connector has connected an outpulser circuit to this circuit,
- 2.061 to indicate tip or ring party by ground on the T or R lead;
- 2.062 to remove the party indications when the outpulser operates the SP relay;

2.063 to connect the outpulser tip and ring to the subscriber tip and ring for an abandoned call test when the outpulser operates the SPI relay;

2.064 to connect identification tone to the selector multiple sleeve from one of the oscillators when the outpulser operates the ID relay;

2.065 to connect the outgoing tip and ring leads to the outpulser tip and ring when the outpulser operates the MF relay;

2.066 to connect ground to the selector multiple C lead when MF is operated to cut thru the 2 MR trunk if it is connected.

2.07 When a 2 MR trunk is connected to operate and lock the MR relay after that trunk cuts thru.

2.08 On hang up by the calling party,

2.081 to open the tip and ring to the distant office;

2.082 to make a ground removal test if the calling party was a tip party or either party of a 2 MR line;

2.083 to restore to normal immediately if the calling party was a ring party;

2.084 to restore to normal after the ground removal test shows the line is clear of ground;

2.085 on ground removal test when the line is not clear of ground after 10-24 sec. to call in the outpulser;

2.086 on ground removal failure to ground the TPT lead to the outpulser on a flat rate line or the AB lead on a message rate line;

2.087 to remove the failure indications when the outpulser operates the SP relay;

2.088 to connect identification tone to the sleeve when the ID is operated;

2.089 to hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.

2.09 When the calling party fails to disconnect before the incoming trunk times out,

2.091 to open the sleeve to the selector multiple long enough to release the preceding switches;

- 2.092 when the selector multiple tip and ring leads open to restore to normal;
- 2.093 to reclose ground to the selector sleeve during release of the trunk.
- 2.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.
- 2.11 To test busy when a fuse operates.
- 2.12 To operate a last trunk busy register or operate the traffic usage recorder.
- 2.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.
- 2.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.
- 2.15 To hold the connection from releasing when the outpulser operates the TR relay.

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- 3.11 Rotary Out Trunk Switch Ckt. - SD-30868-01.
- 3.12 Misc. Ckt. Trunk Frame - SD-32248-01.
- 3.13 Traffic Usage Recorder Circuit - SD-95738-01.

### 4. TAKING EQUIPMENT OUT OF SERVICE

The circuit may be made busy by plugging into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

SECTION IV - REASON FOR REISSUE

CHANGES

B. CHANGES IN APPARATUS

B.1	Removed	Replaced By
	(A) Res. 18AG	(A) Res. Lamp 13J
	(TR) Rel. AF13	(TR) Rel. AF110

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The designation of the "A1" res. 18CN is changed to "A."

D.2 Connecting circuit SD-95812-01 "Out-pulser Link Circuit" is replaced by "Outpulser Connector Circuit" SD-95890-01.

D.3 The "BR" lead to Traffic Register Ckt. or Misc. Alm. Ckt. (Reg) is changed to "LTB" and the multiple is removed. This provides for "last trunk busy" registration instead of "all trunks busy" reg.

D.4 CAD1 is revised to provide frame local cable leads from the trunk unit to the (TP-) relays of the outpulser connector ckt, and CAD's 2, 3, 4, 5 and 6 are revised to change all trunks busy to last trunk busy.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2336-CDK-RCD



FEB 12 1959

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AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

DRAWING NOTICE

SD-32245-01

CD 2D

RATING AT&TCo Std.

SYSTEM Step-By-Step

DATE Nov 5, 1958

ISSUE 2D  
APP.

2 Pages

TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit -  
Loop Pulsing - Automatic Number Identification - To CAMA Office

DESCRIPTION

- 6.01 Contacts 4-5 and 6-7 of the (A) relay are relocated to prevent mutilation of the M.F. pulses of the calling number, if the customer dials extra digits.
- 6.02 Contact 9 of the (Pl) relay is relocated to prevent a false trouble record from being taken by the outpulser if a momentary trunk reversal is encountered during dialing.
- 6.03 Connecting information on leads to the test circuit is changed because of the addition of misc. frame circuit relays in these leads. The "FR" and "TTO" leads are added. No additional apparatus is required.
- 6.04 Multiplying information on leads to the oscillator and identifier circuits is changed to indicate the division of identifier circuits into two groups when more than 6 office units are to be served. Equipment note 201 is added to clarify this change.
- 6.05 Minor changes are made in sequence charts. Repeat coil options in App Fig. 1 and transmission requirements table are changed to agree with Note 102.
- 6.06 Optional connection is provided to the traffic usage recorder circuit. "R" and "S" options are added.
- 6.07 Connection is made to the traffic register circuit for peg count registration of timeouts on failure to reach an outpulser.
- 6.08 CAD figure changes are made to agree with the above changes.
- 6.09 In agreement with the WECO all the above changes are to be made on a "no record" basis.



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## DRAWING NOTICE

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RATING AT&amp;TCo Std.

SYSTEM Step-By-Step

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Page 2

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit -  
Loop Pulsing - Automatic Number Identification - to CAMA Office

## DESCRIPTION

6.10 Current Drains are as follows:

Current Drain in Ampere Hours Per Busy Hour or CCS  
48V Talk

<u>For No. 1</u>	<u>Bat</u>	<u>Grd.</u>
List 1 in CCS	.0115	-
List 2	.230	.375

<u>For 350A</u>		
List 1 in AH/BH	.268	-
List 2	.230	.375

<u>For 355A</u>		
List 1 & 2 in AH/BH	.268	.440

For No. 1, 350A or 355A  
-110 Coin Control  
List 1, .0026 AH/BH  
+130V Sig. Bat.  
List, .0001 AH/BH

6.11 Equipment information will be covered by J-95108K-( ).

6.12 Equipment Design Requirements are not affected.

No engineering letter will be issued.



FEB 12 1959

*HB*

CIRCUIT DESCRIPTION

GD-32245-01  
Issue 2-D  
Dwg. Issue 2-D

STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

This outgoing trunk circuit is required in a step by step office arranged for Automatic Number Identification to complete calls to the CAMA office.

The trunk is reached by the dialing of a directing code thru selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground thru the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser link circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned. It then causes the trunk to connect identification tone generated by one of the two oscillator circuits on the trunk bay to the sleeve. This is used by the identifier to derive the calling number

which is registered in the outpulser. After identification the tone is removed and the outgoing trunk conductors are transferred to the link tip and ring and the outpulser then sends the calling number to the CAMA office, using MF signaling.

No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket after which the trunk and switches are released. On calls from two party message rate lines the two party message rate trunk circuit between the line finder and first selector is caused to cut thru after outpulsing the calling number so that a ground removal test can be made at the end of the call.

Provision is made for access to the trunk from a common Automatic Trunk Test Circuit. Other tests can be made with the standard test sets using test jacks provided for that purpose.



SECTION II - DETAILED DESCRIPTION

## 1. SEIZURE

On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR or ATB lead to the Traffic Register Circuit and opens the high resistance winding of relay CS from the trunk tip and ring.

Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

## 2. PULSING CALLED NUMBER

The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates C1. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and C1 hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

## 3. PARTY TEST

A party test is made between the first and second digits as follows:

With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized condenser timed relay, electrically biased on its secondary winding. When C1 releases battery thru the secondary winding charges condenser C. As the condenser charges the current thru the "S" winding decreases until it is less than the "P" or bias winding current at which point the relay releases. The time to release depends upon the time constant of the charging path and is such that PTM will release in approximately 0.050 sec.

Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110 volt battery thru the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

## 3.1 Tip Party - Flat Rate

Tip party stations are equipped with 3640 ohm or 2650 ohm ringers connected to

ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48V thru resistance lamp PT to the line. The -48V battery in conjunction with the PT varistor and shunting resistor B discharges the line in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

## 3.2 Ring Party - Flat Rate

Ring party stations will have no ground on them. The test is made as in par. 3.1 except that when PTM releases, PT should be nonoperated. RP operates thru the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48V thru resistance lamp TP until PTC releases as described in para. 3.1. RP releases.

## 3.3 Message Rate Lines

On calls from message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification.

As will be described later a direct test of two party message rate lines is made on disconnect.

## 3.4 Multiparty Lines Other Than Two Party

The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

Where tube sets with three element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

### 3.5 Check of Party Test Feature

To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

C1 operating on the second digit operates PTM as previously described. On the release of C1, relay PTK operates thru either TPA or RPA operated. If TPA is operated, PTK connects resistors V and W, a total of 6720 ohms to the PT relay, secondary winding. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

With TPA, RPA and RP operated, a ground is connected to the T lead to the outpulser link as a tip party indication to the outpulser as described later.

If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y and Z inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

With TP, TPA and RPA operated and RP nonoperated a ground is connected to the R lead to the outpulser link as a ring party indication to the outpulser.

If the PT relay fails to operate on the 3640 or 2650 ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154 ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outpulser is grounded.

## 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

### 4.1 Supervision

After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating P1 which locks.

### 4.2 Calling in Outpulser

P1 connects resistance battery to the ST lead to the outpulser link in order to get an outpulser connected to this circuit, and starts the TM timer.

The trunk and outpulser are connected together over five leads, T, R, TPT, AB and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead it operates the SP relay.

SP locks and removes itself from the SP lead, (1) opens the ST lead to the link (2) stops the timer (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead (4) connects the SP1 relay to the SP lead (5) connects the MF relay to the AB lead and (6) connects the ID relay to the R lead.

### 4.3 Testing for Abandoned Call

Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outpulser T & R, relay SP1 holding the A operated. SP1 is released when the outpulser is satisfied.

An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

### 4.4 Identifying the Line

When the outpulser is ready for line identification it operates ID. ID connects tone from one of the oscillators to the selector multiple sleeve. This circuit is low in dc resistance to hold the preceding circuits. ID also connects resistance battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

### 4.5 Outpulsing Calling Number

When the outpulser is ready to send out the calling number it operates relay MF transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS.

If the customer abandons during this time the loop to the CAMA office is opened by the A relay, both stopping the MF signals and giving a disconnect signal to the distant end. MF holds B until the outpulser releases. This minimizes the unproductive

use of CAMA office circuits to distant points and prevents the release and re-seizure of this circuit before the distant end is normal.

#### 4.6 Release of Outpulser

When the outpulser has completed its work it releases the link, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### 5.1 Calling Party Disconnects First

When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path thru P1 to the C resistance but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### 5.11 Ring Party

When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### 5.12 Tip Party - Ground Removal Test

When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in paragraph 5.11 does not operate. B1 and SP release and close a circuit to operate GRT thru contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from

C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases PTM is released after a timed interval.

If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### 5.13 Two Party Message Rate - Ground Removal Test

During the outpulsing of the calling number as described in paragraph 4.5 the operation of MF grounds the C lead to the selector multiple. On calls from two party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut thru as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

On disconnect by the 2 MR station therefore, a ground removal test is made as described in paragraph 5.12.

#### 5.14 Ground Removal Failure

When the ground removal test is started by GRT operating as described in paragraph 5.12 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 10-23.4 sec during which time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

At the end of timing TM operates, operating TML which is slow acting. The tube is extinguished when TM operates and before TML operates. TML releases TM at which time a circuit is completed for operating TP which locks.

TML releases and with TP operated closes the ST lead to the outpulser link circuit to call for an outpulser.

The indication to the outpulser of ground removal failure is ground on the TPT lead for a two party flat rate line and ground on the AB lead for a two party message rate line. Relay MR operated transfers the ground to the AB lead.

When the outputpulser is connected and after it has received the ground removal failure indication it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

Identification of the calling line is made as before, the ID operating over the R lead to connect tone to the sleeve.

With ID and GRT operated, RPA, if operated, is released and TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outputpulser circuit.

GRT released releases SP, TP and PTC and, if operated MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

## 5.2 Called Party Disconnects First - Timed Disconnect

When the calling party does not disconnect and the called party does, the trunk circuit at the CMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

CS operates C thru P1 operated. C is slow to operate due to its short circuited secondary to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1 and P1 release. B1 releases SP.

## 6. TIMING CIRCUIT

### 6.1 Awaiting Outputpulser for Identification

Referring to paragraph 4.2, P1 operating to call in the outputpulser, also starts the tube timer circuit so that if the outputpulser is not connected within a period of 2 to 4.7 seconds, the start circuit will be opened to prevent holding out other trunks.

Assuming an outputpulser is not connected: P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now charges thru resistors F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

TM locks to ground on the TM1, and this ground extinguishes the tube. TM operates TM1 which is slow to operate to give the tube time to deionize. TM and TM1 reconnect battery to capacitor D to discharge it thru the F resistor and restore -48V to the control anode of the tube. TM1 locks thru B1 operated and unless TP is operated, releases TM.

After disconnect by the customer TM1 releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

### 6.2 Ground Removal Failure

Referring to paragraph 5.14, GRT operating starts the timer circuit by opening -48V battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in paragraph 6.1. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

Relays TM and TM1 operate and the tube is extinguished.

### 6.3 Awaiting Outputpulser on Ground Removal Failure

The timer is again recycled to time for 10 to 23.4 sec. As described in paragraph 5.14 TP operates when TM released and TM1 operated at the end of the 10 second timing. TM1 releases and its slow release gives time for capacitor D to discharge before again starting to charge it. TM1 released with TP operated closes the start lead to the outputpulser link.

Timing will be stopped when the trunk restores to normal as a result of the outputpulser releasing GRT as described in paragraph 5.14.

If the outputpulser is not connected, or if for any other reason the trunk is not released by the outputpulser the TM operates, extinguishes the tube and locks

to TP. TM1 operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

TM operating with TP operated releases GRT which releases TP and PTC. TP releases TM which releases TM1. The sleeve is held grounded until TM1 releases after which the preceding circuits are released and the trunk is restored to normal.

## 7. TESTING

### 7.1 From Test Jacks

Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

### 7.2 From Test Circuit

Relays TT and TTI and their associated contacts provide access from the Automatic Trunk Test Circuit. Relay TT is first operated over the test circuit. Operation of the TT relay grounds the "FR" lead to the miscellaneous circuit on the trunk frame, which operates and cuts through trunk leads required for testing. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TTI relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

When the outpulser is called in on a test call the TST lead to the outpulser link is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### 8.1 All Trunks Busy Registration "S" Option

Means are provided for operating a traffic register. Ground is extended to the BR or ATB lead when the circuit is normal. The lead is open whenever the circuit is busy for any reason.

### 8.2 Traffic Usage Recorder "R" Option

Whenever the circuit is busy except when out of service for test (plug in T jack), ground is opened from the "BR" lead to the traffic usage recorder circuit, otherwise the "BR" lead is grounded.

### 8.3 Peg Count

Whenever the timing circuit functions on failure to obtain an outpulser for line identification, lead "OPF" to the traffic register circuit is grounded from the time TM is operated until TMI operates. No registration is made on ground removal operation of the timer as GRT open the "OPF" lead.

### 8.4 Holding Circuit for Tracing Trouble

The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Misc. Ckt. for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

### 8.5 Fuse Operation

Relay MB is normally operated thru the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.



SECTION III - REFERENCE DATA

## 1. WORKING LIMITS

## 1.1 Battery Voltages

-45 to -52V  
 +125 to +135V  
 -116 to -120V or  
 -100 to -120V

## 1.2 Relay Limits

- 1.21 A relay pulsing - max. ext. ckt. loop res. 1500 ohms  
 A relay supv. - max. ext. ckt. loop res. 2375 ohms  
 A pulsing & supv. - min. ins. res. 15,000 ohms  
 CS relay - supv. - max. ext. ckt. loop res. 7500 ohms  
 CS relay - supv. - min. ins. res. 30,000 ohms  
 PT relay - max. ext. ckt. loop res. 1500 ohms  
 PT relay - min. ins. res. 15,000 ohms  
 PT relay - max. res. to grd. at tip party of 2 party F.R. line 4004 ohms

-CC SUPPLY	EARTH POTENTIAL			
	DC	25~AC	60~AC	
-100 to -120V	-11V, +20V	7V	10	
-116 to -120V	-16V, +20V	10V	14.5V	

## 2. FUNCTIONS

- 2.01 When a loop is closed on the selector multiple tip and ring to ground the sleeve lead to hold the preceding circuits and to close the loop to the distant office.
- 2.02 To repeat dial pulses on a battery and ground basis.
- 2.03 During the first interdigital period to make a party test.
- 2.04 During the second interdigital period to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 2.05 When battery and ground is reversed at the distant office to close the ST lead to the outpulser link circuit.
- 2.06 When the outpulser link has connected an outpulser circuit to this circuit,
- 2.061 to indicate tip or ring party by ground on the T or R lead;
- 2.062 to remove the party indications when the outpulser operates the SP relay;
- 2.063 to connect the outpulser tip and ring to the subscriber tip and ring for an abandoned call test when the outpulser operates the SP1 relay;
- 2.064 to connect identification tone to the selector multiple sleeve from one of the oscillators when the outpulser operates the ID relay;
- 2.065 to connect the outgoing tip and ring leads to the outpulser tip and ring when the outpulser operates the MF relay;
- 2.066 to connect ground to the selector multiple C lead when MF is operated to cut thru the 2 MR trunk if it is connected.
- 2.07 When a 2 MR trunk is connected to operate and lock the MR relay after that trunk cuts thru.
- 2.08 On hang up by the calling party,
- 2.081 to open the tip and ring to the distant office;
- 2.082 to make a ground removal test if the calling party was a tip party or either party of a 2 MR line;
- 2.083 to restore to normal immediately if the calling party was a ring party;
- 2.084 to restore to normal after the ground removal test shows the line is clear of ground;
- 2.085 on ground removal test when the line is not clear of ground after 10-24 sec. to call in the outpulser;
- 2.086 on ground removal failure to ground the TPT lead to the outpulser on a flat rate line or the AB lead on a message rate line;
- 2.087 to remove the failure indications when the outpulser operates the SP relay;
- 2.088 to connect identification tone to the sleeve when the ID is operated;
- 2.089 to hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.
- 2.09 When the calling party fails to disconnect before the incoming trunk times out,
- 2.091 to open the sleeve to the selector multiple long enough to release the preceding switches;

- 2.092 when the selector multiple tip and ring leads open to restore to normal;
- 2.093 to reclose ground to the selector sleeve during release of the trunk.
- 2.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.
- 2.11 To test busy when a fuse operates.
- 2.12 To operate an all trunks busy register or operate the traffic usage recorder.
- 2.13 To operate a peg count register when the timing circuit functions, except on ground removal operation.
- 2.14 To operate test relays and give access to various leads when selected by the Automatic Trunk Test Circuit.
- 2.15 To hold the connection from releasing when the outpulser operates the TR relay.

### 3. CONNECTING CIRCUITS

- 3.01 Selector Bank Multiple Circuit - SD-32123-01.
- 3.02 Incoming Trunk in #4 Crossbar Office - SD-68480-01.
- 3.03 Incoming Trunk in #5 Crossbar Office - SD-26101-01.
- 3.04 Incoming Trunk in Crossbar Tandem Office - SD-27010-01.
- 3.05 Outpulser Link Circuit - SD-95812-01.

- 3.06 Auto. Trk. Ckt. - SD-32315-01.
- 3.07 Oscillator Circuit - SD-95827-01.
- 3.08 Misc. Circuit for Trouble Ticketer - SD-95823-01.
- 3.09 Traffic Register Circuit - SD-30896-01.
- 3.10 Misc. Alm. Ckt. 355A - SD-31976-01.
- 3.11 Rotary Out Trunk Switch Ckt. - SD-30868-01.
- 3.12 Misc. Ckt. Trunk Frame - SD-32248-01.
- 3.13 Traffic Usage Recorder Circuit - SD-95738-01.

### 4. TAKING EQUIPMENT OUT OF SERVICE

The circuit may be made busy by plugging into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

SECTION IV - REASONS FOR REISSUE

CHANGES

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

C.1 Reference to test Note 5 on Sheet 1 is added for the (PTM) relay.

D. DESCRIPTION OF CIRCUIT CHANGES

D.01 All references to "Outpulser, Identifier and Trunk Test Circuit" changed to "Misc. Circuit - Trunk Frame."

D.02 Connecting information for the "TT" lead changed to "Automatic Trunk Test Circuit."

D.03 Added "on same frame" to the multiplying information on the test leads.

D.04 "FR" lead and associated (TT) relay contact added.

D.05 Multiplying information added on the "S" and "G" leads to the oscillator circuit.

D.06 Multiplying information on the "OSC" leads to the identifier circuit is changed.

D.07 Minor changes are made in sequence charts SC1 to SC4.

D.08 Battery is replaced by ground on the winding of the (TT) relay.

D.09 Fusing requirements in Note 101 for +130V and -110V batteries is changed from 1 per ckt. to 1 per frame. 48V TB is changed to 48V talk.

D.10 Contact 4-5 and 6-7 of the (A) relay are relocated to prevent mutilation of M.F. pulses of the calling number, if extra digits are dialed.

D.11 Contact 9 of the (D1) relay is relocated to prevent a false trouble record from being taken by the outpulser if a momentary trunk reversal occurs during dialing.

D.12 In App. Fig. 1 Options "T", "V", "W" and "X" are changed to "X", "W", "V" and "T" respectively to agree with Note 105.

D.13 In transmission test requirements table Option "S" is changed to "V" to agree with Note 105.

D.14 CAD 1 is revised to reflect D.1-D.6, D.9, D.16, D.17 & D.18, and to cover inter trunk multiple by frame local cable. CAD's 2-6 are revised to cover R and S optional wiring of the "BR" lead. CAD 8 is added.

D.15 Equipment Note 201 is added.

D.16 "CL" lead redesignated "XCL" to agree with connecting circuits.

D.17 "R" and "S" options are added to provide for optional connection to the Traffic Register Circuit or to the Traffic Usage Recorder Circuit. The (T) jack contacts are relocated to be effective only on the all trunks busy registration. Reference is added in Note 102.

D.18 Connection is made to the Traffic Register Circuit or Misc. Alm. Ckt. - 355A Register Circuit to provide a peg count of time outs on failure to reach an outpulser for line identification.

D.19 The "TTO" lead to the Misc. Ckt. - Trk. Frame is added.

All other headings under Changes, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2336-WAOC-RCD-ME



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

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SD-32245-01 (10 Shts)ISSUE 1  
CD 1 APP.  
RATING AT&TCo Std.  
SYSTEM Step-By-Step - Ckt.  
DATE February 13, 1958

## DRAWING NOTICE

## TITLE

Step-By-Step Systems - No. 1, 350A Or 355A - Outgoing Trunk Circuit -  
Loop Pulsing - Automatic Number Identification - To CAMA Office

## DESCRIPTION

6.1 This circuit provides an outgoing trunk for #1 Step-By-Step, 350A and 355A dial offices which are arranged for Automatic Number Identification to complete calls to CAMA offices. This circuit includes a party test feature and repeats pulsing on a battery and ground basis.

6.2 Current Drains are available.

6.3 Equipment information will be covered by J-95108K.

6.4 Equipment Design Requirements will be covered in B.S.P. Section AA388.099 (J95108), Iss. 4, Appx. 4.

An engineering letter will be issued.



STEP-BY-STEP SYSTEMS  
NO. 1, 350A OR 355A  
OUTGOING TRUNK CIRCUIT  
LOOP PULSING  
AUTOMATIC NUMBER IDENTIFICATION  
TO CAMA OFFICE

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

This outgoing trunk circuit is required in a step by step office arranged for Automatic Number Identification to complete calls to the CAMA office.

The trunk is reached by the dialing of a directing code thru selectors. It serves as an ordinary battery ground repeater to transmit the called number to the CAMA office incoming equipment.

During the time between the first and second digits a test is made of the line to determine whether it is a tip or ring party, the tip party being identified by ground thru the station ringer. During the time between the second and third digits a test is made to determine whether the party test relay is in proper adjustment.

When the CAMA office is ready to receive the calling number, supervision is received over the trunk and the trunk circuit then bids for an outpulser by way of the outpulser link circuit. The outpulser first receives the party indication, and then checks to see that the call is not abandoned. It then causes the trunk to connect identification tone generated by one of the two oscillator circuits on the trunk bay to the sleeve. This is used by the identifier to derive the calling number which is registered in the outpulser. After identification the tone is removed and the outgoing trunk conductors are transferred to the link tip and ring and the

outpulser then sends the calling number to the CAMA office, using MF signalling.

No further supervision is received or needed since all the information necessary to charge for the call is in the CAMA office.

At the end of the call, when the calling customer disconnects, a ground removal test is made if the call had been from a tip party or if the call had been from a 2-party message rate line. This is to insure against charging a customer falsely because of a trouble ground on the line. The ground removal test is continued for a short time and then if a ground is present the outpulser will be recalled to make a trouble ticket after which the trunk and switches are released. On calls from two party message rate lines the two party message rate trunk circuit between the line finder and first selector is caused to cut thru after outpulsing the calling number so that a ground removal test can be made at the end of the call.

No ground removal test will be made if the trunk circuit releases as a result of time out in the CAMA office incoming trunk circuit when the calling party fails to disconnect. Under this condition the trunk circuit will "wink off" the switches.

Provision is made for access to the trunk from a common Outpulser, Identifier, Trunk Test Circuit. Pulsing and other tests can be made with the standard test sets using test jacks provided for that purpose.



SECTION II - DETAILED DESCRIPTION

## 1. SEIZURE

On seizure of the trunk by a selector, relay A operates over the loop operating relay B which operates relay B1. B grounds the sleeve to hold the preceding circuits and to make the trunk test busy. B also prepares the pulsing circuit, opens the BR or ATB lead to the Traffic Register Circuit and opens the high resistance winding of relay CS from the trunk tip and ring.

Relay A closes the low resistance winding of CS in series with repeat coil A to the trunk to seize the incoming trunk in the CAMA office.

## 2. PULSING CALLED NUMBER

The A relay follows dial pulses as the customer dials the called number. When A releases on the first open it operates the C relay which operates C1. C transfers the tip and ring to resistance battery and ground respectively. Successive operations and releases of A interrupts this battery and ground, thereby transmitting pulses which aid the pulsing relay in the incoming trunk circuit. C and C1 hold during pulsing but release at the end of each digit restoring the loop condition. B holds over pulsing.

## 3. PARTY TEST

A party test is made between the first and second digits as follows:

With relay C1 operated while the first digit is being dialed, relay PTM is operated on its secondary winding. PTM is a polarized condenser timed relay, electrically biased on its secondary winding. When C1 releases battery thru the secondary winding charges condenser C. As the condenser charges the current thru the "S" winding decreases until it is less than the "P" or bias winding current at which point the relay releases. The time to release depends upon the time constant of the charging path and is such that PTM will release in approximately .050 sec.

Also when C1 releases relay PTC operates immediately to apply the party test relay PT to the line. The A relay is removed but held operated by a preliminary make on PTC. Negative 110 volt battery thru the PT secondary winding is applied to both tip and ring but the contacts of PT are held open until PTM releases. This allows time for the PT to settle down in either operated or nonoperated position after being applied to the line.

## 3.1 Tip Party - Flat Rate

Tip party stations are equipped with 3640 ohm or 2650 ohm ringers connected to

ground. Relay PT operates in series with the ringer and when PTM releases, TP is operated, followed by TPA. TP opens the circuit to RP. TP also removes PT from the line and instead connects -48V thru resistance lamp PT to the line. The -48V battery in conjunction with the PT varistor and shunting resistor B discharges the line in such a way as to prevent bell tapping at customer stations and also prevents false release of relay A when it is reapplied to the line.

The circuit for PTC is opened by PTM also. PTC is slow to release due to the shunting action of the secondary winding in series with the 55-ohm part of resistor T. Its time is governed both by the shunt and by the time it takes for TPA to operate and open the shunt. This allows time for the discharge of the line just described before restoring the A relay winding to the line. The maximum time will not exceed the interdigital time. TP releases after PTC.

## 3.2 Ring Party - Flat Rate

Ring party stations will have no ground on them. The test is made as in par. 3.1 except that when PTM releases, PT should be nonoperated. RP operates thru the PT back contact, opens the circuit for TP and operates RPA which locks and opens the circuit to PTC. RP disconnects the test relay and connects the line to -48V thru resistance lamp TP until PTC releases as described in para. 3.1. RP releases.

## 3.3 Message Rate Lines

On calls from message rate lines the party test relay cannot test the line itself, because of the intervening message rate trunk circuit. The party test will be made in that circuit, however. The test in this circuit will result in a ring party indication regardless of whether the party is tip or ring. All such lines will, therefore, be in the ring field for automatic number identification.

As will be described later a direct test of two party message rate lines is made on disconnect.

## 3.4 Multiparty Lines Other Than Two Party

The party test on all such stations will be indicated as ring party but calls from these lines will be operator identified at the CAMA office as a result of the identifier and outpulser operation.

Where tube sets with three element tubes are used on such lines it will be necessary for the control gaps on negative stations to be bridged instead of grounded to avoid bell tapping and possible false tip party test.

### 3.5 Check of Party Test Feature

To insure against faulty functioning of the party test relay PT, a check is made of its operate if it had nonoperated and of its nonoperate if it had operated. This is done at the end of the second digit as follows:

Cl operating on the second digit operates PTM as previously described. On the release of Cl, relay PTK operates thru either TPA or RPA operated. If TPA is operated, PTK connects resistors V and W, a total of 6720 ohms to the PT relay, secondary winding. This is a nonoperate for PT. When PTM releases with PT nonoperated RP and RPA operate and lock.

With TPA, RPA and RP operated, a ground is connected to the T lead to the outpulser link as a tip party indication to the outpulser as described later.

If RPA is operated on the party test, TPA will be nonoperated when PTK operates, and a total of 5154 ohms, consisting of resistors X, Y and Z inductor PT, will be connected to the PT relay secondary winding. This is an operate condition for PT. When PTM releases with PT operated TP and TPA will operate and lock.

With TP, TPA and RPA operated and RP nonoperated a ground is connected to the R lead to the outpulser link as a ring party indication to the outpulser.

If the PT relay fails to operate on the 3640 or 2650 ohm ringer ground of a tip party, the RPA will be operated and TPA will be nonoperated when the check test is made. This imposes the 5154 ohm operate test on the relay on which it should also fail. Hence only the RP and RPA relays are finally operated and neither T nor R lead to the outpulser is grounded.

If the PT relay operates on party test and then does not meet the nonoperate test it is assumed that the relay is not in proper adjustment. In this case only the TP and TPA are finally operated and on this condition neither T nor R lead to the outpulser is grounded.

### 4. CAMA OFFICE READY TO RECEIVE CALLING NUMBER

#### 4.1 Supervision

After the called number is pulsed to the CAMA office and when the equipment in that office is ready to receive the calling number, a reversal is sent back to this trunk circuit. CS operates operating Pl which locks.

### 4.2 Calling in Outpulser

Pl connects resistance battery to the ST lead to the outpulser link in order to get an outpulser connected to this circuit, and starts the TM timer.

The trunk and outpulser are connected together over five leads, T, R, TPT, AB and SP. When the outpulser is connected it takes note of the party information on the T or R lead previously described. Then after testing the SP lead it operates the SP relay.

SP locks and removes itself from the SP lead, (1) opens the ST lead to the link (2) stops the timer (3) releases RP and RPA if a tip station, opening ground from the T lead or releases TP only if a ring station, opening ground from the R lead (4) connects the SP1 relay to the SP lead (5) connects the MF relay to the AB lead and (6) connects the ID relay to the R lead.

### 4.3 Testing for Abandoned Call

Before going ahead with the call, the outpulser tests to see that the customer is still connected to the trunk by operating relay SP1. This transfers the selector multiple T & R to the outpulser T & R, relay SP1 holding the A operated. SP1 is released when the outpulser is satisfied.

An indication is also given to the outpulser when SP1 is nonoperated of an abandoned call by ground on the AB lead when B1 releases.

### 4.4 Identifying the Line

When the outpulser is ready for line identification it operates ID. ID connects tone from one of the oscillators to the selector multiple sleeve. This circuit is low in dc resistance to hold the preceding circuits. ID also connects resistance battery to the T lead as a check that it has operated. ID prevents A from releasing during the identification. ID is released when identification is completed.

### 4.5 Outpulsing Calling Number

When the outpulser is ready to send out the calling number it operates relay MF transferring the trunk T & R to the outpulser T & R. MF prevents the operation of C since opening the trunk T & R releases CS.

If the customer abandons during this time the loop to the CAMA office is opened by the A relay, both stopping the MF signals and giving a disconnect signal to the distant end. MF holds B until the outpulser releases. This minimizes the unproductive

use of CAMA office circuits to distant points and prevents the release and re-seizure of this circuit before the distant end is normal.

#### 4.6 Release of Outpulser

When the outpulser has completed its work it releases the link, opening its connection to the trunk circuit. SP remains operated in this circuit.

### 5. DISCONNECT

#### 5.1 Calling Party Disconnects First

When the calling party disconnects, A releases. With CS and P1 operated C does not operate because of a shunt path thru P1 to the C resistance but C1 operates, its circuit having been transferred by P1 to the A contacts. The circuit to slow release B is opened. A also opens the loop ahead to the CAMA office to start releasing the circuits in that office. CS releases but does no work.

#### 5.11 Ring Party

When the calling station is a ring party as indicated by TPA and RPA being operated, the circuit releases immediately. B releases B1 and opens the circuit to P1. When P1 releases the sleeve ground is opened to release the preceding circuits. P1 is slow release to provide time for the CAMA office circuits to restore to normal before permitting reselection of this circuit.

#### 5.12 Tip Party - Ground Removal Test

When the calling station is a tip party relay TPA will be operated and on disconnect by the customer the line is held while a test is made for removal of the tip ground to insure that a tip station had not been falsely charged due to a trouble ground on a call from a ring station.

Relay A releases and opens the loop to the distant office to release the circuits there, opens the circuit to slow release relay B and with P1 operated operates relay C1. Relay C as noted in paragraph 5.11 does not operate. B1 and SP release and close a circuit to operate GRT thru contacts of slow release relay P1. GRT operates PTC which provides a locking path for GRT.

GRT operating closes ground to the selector multiple sleeve to hold the preceding circuits before P1 releases and holds TPA operated.

With PTC operated a test of the line is made by PT in a manner similar to that previously described. PTM operates from

C1 to delay closure of ground to the PT contacts. This ground now comes from GRT operated. When C1 releases PTM is released after a timed interval.

If there is no ground at the station PT will be nonoperated when PTM releases and RP will operate. RP opens the circuit to TPA and to the selector multiple sleeve and TPA releases GRT which in turn releases RP and PTC. Until PTC releases the A relay cannot be reoperated.

#### 5.13 Two Party Message Rate - Ground Removal Test

During the outpulsing of the calling number as described in paragraph 4.5 the operation of MF grounds the C lead to the selector multiple. On calls from two party MR lines this lead is carried back to the 2 MR trunk circuit and the ground causes that trunk to cut thru as on operator calls. When MF releases ground is returned on the C lead which operates MR. Since on the party test a ring station was indicated, TPA and RPA are operated which would prevent GRT from operating. However, MR contacts shunt the RPA contacts allowing GRT to operate.

On disconnect by the 2 MR station therefore, a ground removal test is made as described in paragraph 5.12.

#### 5.14 Ground Removal Failure

When the ground removal test is started by GRT operating as described in paragraph 5.12 the timing circuit is also started. If a ground is still on the line when PTM releases, PT will be operated and the circuit will not release. The ground may be due to a trouble or to the customer trying to reoriginate. The circuit times for 10-23.4sec during which time the circuit will release if PT releases. If it has not released at the end of this time it is assumed there is a trouble condition and the outpulser is called in to make a trouble record.

At the end of timing TM operates, operating TML which is slow acting. The tube is extinguished when TM operates and before TML operates. TML releases TM at which time a circuit is completed for operating TP which locks.

TML releases and with TP operated closes the ST lead to the outpulser link circuit to call for an outpulser.

The indication to the outpulser of ground removal failure is ground on the TPT lead for a two party flat rate line and ground on the AB lead for a two party message rate line. Relay MR operated transfers the ground to the AB lead.

When the outpulser is connected and after it has received the ground removal failure indication it operates relay SP. SP locks and removes itself from the SP lead and connects the secondary winding of the GRT relay to the SP lead.

Identification of the calling line is made as before, the ID operating over the R lead to connect tone to the sleeve.

With ID and GRT operated, TPA is released, opening the primary winding of the GRT and placing the GRT relay and final release of the circuit under control of the outpulser circuit.

GRT released releases SP, TP and PTC and, if operated MR. GRT opens the sleeve to release the preceding circuits and free the line. PTC being slightly slow to release holds the T & R of the selector multiple open so that if a new call were to seize the trunk the previously operated relays would be normal before the A & B relays are operated. This delay, however, is not long enough to prevent holding the preceding selector.

#### 5.2 Called Party Disconnects First - Timed Disconnect

When the calling party does not disconnect and the called party does, the trunk circuit at the CAMA office will, after a delay interval of about 13 seconds minimum, release and reverse the polarity of the trunk pair releasing CS.

CS operates C thru P1 operated. C is slow to operate due to its short circuited secondary to make it insensitive to transient disturbances on the trunk. C operated opens the sleeve to the selector multiple to release the preceding circuits. When one of these opens the tip and ring, A releases.

A shunts C down and opens B. When C releases it reconnects ground to the sleeve to make the trunk appear busy until B, B1 and P1 release. B1 releases SP.

No ground removal test is made when the circuit releases on timed disconnect. During the wink off, that is while the sleeve is open to release the preceding circuits, TPA releases so that GRT cannot operate.

### 6. TIMING CIRCUIT

#### 6.1 Awaiting Outpulser for Identification

Referring to paragraph 4.2, P1 operating to call in the outpulser, also starts the tube timer circuit so that if the outpulser is not connected within a period of 2 to 4.7 seconds, the start circuit will be opened to prevent holding out other trunks.

Assuming an outpulser is not connected: P1 operating opens battery from the control anode of the tube and the D capacitor which has been held discharged. D now charges thru resistor F and H and relay TM to +130 volts on resistor K. When the voltage at the control gap reaches breakdown the tube is ionized and transfers to the main gap operating the TM relay.

TM locks to ground on the TML, and this ground extinguishes the tube. TM operates TML which is slow to operate to give the tube time to deionize. TM and TML reconnect battery to capacitor D to discharge it thru the F resistor and restore -48V to the control anode of the tube. TML locks thru B1 operated and unless TP is operated, releases TM.

After disconnect by the customer TML releases from B1. If a tip party had called, no ground removal test is made since both TPA and RPA are still operated when B1 releases.

#### 6.2 Ground Removal Failure

Referring to paragraph 5.14, GRT operating starts the timer circuit by opening -48V battery from the control anode of the tube and from capacitor D. With GRT operated resistor G instead of resistor H is included in the charging circuit for capacitor D described in paragraph 6.1. This resistor increases the time constant of the circuit so that it will take from 10 to 23.4 seconds before the voltage on the control anode of the tube is high enough to break down the control gap and fire the tube.

Relays TM and TML operate and the tube is extinguished.

#### 6.3 Awaiting Outpulser on Ground Removal Failure

The timer is again recycled to time for 10 to 23.4 sec. As described in paragraph 5.14 TP operates when TM released and TML operated at the end of the 10 second timing. TML releases and its slow release gives time for capacitor D to discharge before again starting to charge it. TML released with TP operated closes the start lead to the outpulser link.

Timing will be stopped when the trunk restores to normal as a result of the outpulser releasing GRT as described in paragraph 5.14.

If the outpulser is not connected, or if for any other reason the trunk is not released by the outpulser the TM operates, extinguishes the tube and locks

to TP. TM1 operates and opens battery from the ST lead to prevent holding up the access of other trunks to the outpulser.

TM operating with TP operated releases GRT which releases TPA, TP and PTC. TP releases TM which releases TM1. The sleeve is held grounded until TM1 releases after which the preceding circuits are released and the trunk is restored to normal.

## 7. TESTING

### 7.1 From Test Jacks

Test jacks T and TT provide access to the selector multiple and the outgoing ends of the trunk circuit for testing with test sets.

### 7.2 From Test Circuit

Relays TT and TT1 and their associated contacts provide access from the Outpulser, Identifier, Trunk Test Circuit. Relay TT is first operated over the test circuit. A class indication is given on the CL lead. The selector multiple sleeve is closed to the test circuit so that it may test the trunk for busy before making it busy and proceeding with the test which it does by operating the TT1 relay. This relay gives access to other leads required for the test and opens the trunk conductor tip and ring.

When the outpulser is called in on a test call the TST lead to the outpulser link is grounded to indicate that it is a test call.

## 8. MISCELLANEOUS

### 8.1 Traffic Registration

Means are provided for operating a traffic register. Ground is extended to the BR or ATB lead when the circuit is normal. The lead is open whenever the circuit is busy for any reason.

### 8.2 Holding Circuit for Tracing Trouble

The TR relay may be operated by the outpulser over the TPT lead with MF operated when it is desired to hold the circuit for tracing trouble. TR locks to battery on LU lead from the Misc. Ckt. for Trouble Ticketer. TR grounds the selector multiple sleeve to hold the connection. This operation will only take place on a regular identification and not on ground removal failure and a ground removal test will not be made on disconnect when TR is operated.

### 8.3 Fuse Operation

Relay MB is normally operated thru the MB resistor. If the circuit fuse is operated or is removed MB releases and closes ground to the sleeve of the selector multiple to make the circuit busy.



SECTION III - REFERENCE DATA

## 1. WORKING LIMITS

## 1.1 Battery Voltages

-45 to -52V  
 +125 to +135V  
 -116 to -120V or  
 -100 to -120V

## 1.2 Relay Limits

- 1.21 A relay pulsing - max. ext. ckt. loop res. 1500 ohms  
 A relay supv. - max. ext. ckt. loop res. 2375 ohms  
 A pulsing & supv. - min. ins. res. 15,000 ohms  
 CS relay - supv. - max. ext. ckt. loop res. 7500 ohms  
 CS relay - supv. - min. ins. res. 30,000 ohms  
 PT relay - max. ext. ckt. loop res. 1500 ohms  
 PT relay - min. ins. res. 15,000 ohms  
 PT relay - max. res. to grd. at tip party of 2 party F.R. line 4004 ohms

-CC SUPPLY	EARTH POTENTIAL		
	DC	25~AC	60~AC
-100 to -120V	-11V, +20V	7V	10
-116 to -120V	-16V, +20V	10V	14.5V

## 2. FUNCTIONS

- 2.01 When a loop is closed on the selector multiple tip and ring to ground the sleeve lead to hold the preceding circuits and to close the loop to the distant office.
- 2.02 To repeat dial pulses on a battery and ground basis.
- 2.03 During the first interdigital period to make a party test.
- 2.04 During the second interdigital period to test the party test relay for non-operate if it had operated on the party test or for operate if it had nonoperated on the party test.
- 2.05 When battery and ground is reversed at the distant office to close the ST lead to the outpulser link circuit.
- 2.06 When the outpulser link has connected an outpulser circuit to this circuit,
- 2.061 to indicate tip or ring party by ground on the T or R lead;
- 2.062 to remove the party indications when the outpulser operates the SP relay;
- 2.063 to connect the outpulser tip and ring to the subscriber tip and ring for an abandoned call test when the outpulser operates the SP1 relay;
- 2.064 to connect identification tone to the selector multiple sleeve from one of the oscillators when the outpulser operates the ID relay;
- 2.065 to connect the outgoing tip and ring leads to the outpulser tip and ring when the outpulser operates the MF relay;
- 2.066 to connect ground to the selector multiple C lead when MF is operated to cut thru the 2 MR trunk if it is connected.
- 2.07 When a 2 MR trunk is connected to operate and lock the MR relay after that trunk cuts thru.
- 2.08 On hang up by the calling party,
- 2.081 to open the tip and ring to the distant office;
- 2.082 to make a ground removal test if the calling party was a tip party or either party of a 2 MR line;
- 2.083 to restore to normal immediately if the calling party was a ring party;
- 2.084 to restore to normal after the ground removal test shows the line is clear of ground;
- 2.085 on ground removal test when the line is not clear of ground after 10-24 sec. to call in the outpulser;
- 2.086 on ground removal failure to ground the TPT lead to the outpulser on a flat rate line or the AB lead on a message rate line;
- 2.087 to remove the failure indications when the outpulser operates the SP relay;
- 2.088 to connect identification tone to the sleeve when the ID is operated;
- 2.089 to hold the GRT relay from the outpulser over the SP lead and restore the trunk and preceding circuits to normal when the outpulser opens this lead.
- 2.09 When the calling party fails to disconnect before the incoming trunk times out,
- 2.091 to open the sleeve to the selector multiple long enough to release the preceding switches;

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2.092 when the selector multiple tip and ring leads open to restore to normal;

2.093 to reclose ground to the selector sleeve during release of the trunk;

2.094 to cancel ground removal test.

2.10 To test busy when battery and ground are reversed from the distant office when the trunk is normal.

2.11 To test busy when a fuse operates.

2.12 To operate an all trunks busy register.

2.13 To operate test relays and give access to various leads when selected by the Outpulser, Identifier, Trunk Test Circuit.

2.14 To hold the connection from releasing when the outpulser operates the TR relay.

### 3. CONNECTING CIRCUITS

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

3.02 Incoming Trunk in #4 Crossbar Office - SD-68480-01.

3.03 Incoming Trunk in #5 Crossbar Office - SD-26101-01.

3.04 Incoming Trunk in Crossbar Tandem Office - SD-27010-01.

3.05 Outpulser Link Circuit - SD-95812-01.

3.06 Outpulser, Identifier, Trunk Test Circuit - SD-95815-01.

3.07 Oscillator Circuit - SD-95827-01.

3.08 Misc. Circuit for Trouble Ticketer - SD-95823-01.

3.09 Traffic Register Circuit - SD-30896-01.

3.10 Misc. Alm. Ckt. 355A - SD-31976-01.

3.11 Rotary Out Trunk Switch Ckt. - SD-30868-01.

### 4. TAKING EQUIPMENT OUT OF SERVICE

The circuit may be made busy by plugging into test jack T which grounds the selector multiple sleeve. Before making the circuit busy in this manner a test should be made on the sleeve of the jack to insure that the trunk is not busy which will be indicated by ground potential.

The circuit may also be made busy from the incoming trunk circuit at the distant office by a reversal of the tip and ring which will operate CS. CS applies ground to the selector multiple sleeve.

Should this operation take place while this circuit is releasing, C1 being operated prevents closing ground to the sleeve by CS until enough time after P1 opens sleeve ground to insure releasing the preceding switches and freeing the customer line.

Likewise during ground removal test PTC prevents CS from holding the circuit locked up.

BELL TELEPHONE LABORATORIES, INCORPORATED

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