... Trans...
Guide
[illegible]

West 105 Order 24281

SPECIFICATION ASSIGNMENTS

SPEC. NO.	SPEC. NAME	FORMAN
501	Cabling-Formed Cable	Various
502	Cabling-Shop formed	Various
506	Cable Rks, Ladder Equip.	W.E.Smith
512	Emer Al. Sys. & Fire Det.	M.A.Brennan
515	Misc. Fdg. Equip. 100 to 103	M.A.Brennan
518	Sdr. Make busy Fr. 100	M.A.Brennan
519	Line Choice Conn. Frs.	G.C.Ausley
526	TBR 100 & TCR 201 & STR 100	M.A.Brennan
527	Ofc. Int. Frs. 100 to 103	M.A.Brennan
530	Misc. Unit Equipment	M.A.Brennan
532	Orig. Tk. Ind. Fr. 100	G.L.Evans
535	Orig. Sdr. Test. Fr. 100	G.L.Evans
538	Serv. Obs. Equip.	M.A.Brennan
540	Dist. Sdtr. Test Fr. 100	G.L.Evans
541	Term Tol Ind Fr. 100	G.C.Ausley
545	Term Sdr. Test Fr. 100	G.C.Ausley
547	Routine Test Sets	M.A.Brennan
555	Ldg, Tr.Mtrs, Conduit	W.E.Smith
559	Misc. Desk & Swbd. Equip.	M.A.Brennan
567	Misc. Power Apparatus	W.E.Smith
568	Frwk - MDF, LDF, ER & TRDF	W.E.Smith
569	ER 300 Fuse Bay	M.A.Brennan
570	Assem & Equip MDF, LDF, TRDF	W.E.Smith
573	Dist. Jctr. Frs 100 & 101	G.L.Evans
574	Line Lk. Frs. 100,101 & 104	G.L.Evans
575	Dist. Lk. Frs. 100 & 101	G.L.Evans
576	Ofc Lk. Frs. 100 to 103	G.L.Evans
577	Inc. Lk. Frs. 100 & 101	G.C.Ausley
578	Blk. Rel. Frs. 100 & 101	G.C.Ausley
579	Dist. Sdr. Frs. 100 to 103	G.L.Evans
580	Term. Sdr. Frs. 100 & 101	G.C.Ausley
581	Orig. Mkr. Conn. Frs. 100 & 101	G.L.Evans
582	Term. Mkr. Conn. Frs. 100 & 101	G.C.Ausley
583	Flr. Alm Fr. 100	M.A.Brennan
584	Subs. Sdr. Lk. Frs. 100 & 101	G.L.Evans
585	O C T Test Frame 100	M.A.Brennan
586	Inc. Trk. Fr. 100 & 101	G.C.Ausley
587	Orig. Mkr. Frs. 100 & 102	G.L.Evans
588	Term. Mkr. Frs. 100	G.C.Ausley
589	Term Sdr. Lk. Frs. 100 & 101	G.C.Ausley
590	Drawings	M.A.Brennan

Original Signed.
G. H. PETERS

Signed ______________________

Foreman

PLANT TRAINING PRACTICES

CROSSBAR SYSTEM

PLANT TRAINING PRACTICES

CROSSBAR SYSTEM

Prepared by
Long Island Area
New York Telephone Company

Printed in U.S.A.

PLANT TRAINING PRACTICES
CROSSBAR SYSTEM

TABLE OF CONTENTS

I N D E X

LINE LINK GROUP AND CONTROL

I N D E X

SUBSCRIBER SENDER LINK AND CONTROL

SUBSCRIBER SENDER INDEX

ORIGINATING DECODER MARKER

INDEX

PURPOSE OF THE ORIGINATING DECODER MARKER

I N D E X

ORIGINATING TROUBLE INDICATOR

INDEX TERMINATING SENDER

I N D E X

TRAFFIC REGISTERS

TERMINATING MARKER

I N D E X

ARRANGEMENT OF PRIMARY AND SECONDARY SWITCHES

The number of primary switches on a line link frame varies according to the calling rate of the subscribers on that frame. There will be at least two columns on a line link frame, the first column serving 90 lines and all other columns serving 100 lines each. The reason only 90 lines are available in the first column is because the zero vertical of each switch in that column is used for no test calls.

In all cases except on two-party frames, two columns will be equipped with ten 200-point switches; these switches having four contacts at each cross point, "T," "R," "S" and "M1" leads. Since two-party lines need five contacts at each cross point to include the "M2" lead, the 100-point switch is used; that is, one with ten hold magnets or verticals instead of 20 as on the 200-point switch.

As shown on Drawing XB-1 there are thirty 200-point primary switches to serve six columns. The horizontal points of each primary switch in each horizontal group are multipled. The horizontal point of any primary switch from which the line link is wired corresponds to the secondary switch number on which it terminates and the horizontal point it is connected to on the secondary switch corresponds to the primary switch number.

There are ten secondary switches each having ten district junctors and ten line junctors. The district junctors are used for originating calls and the line junctors are used for terminating calls.

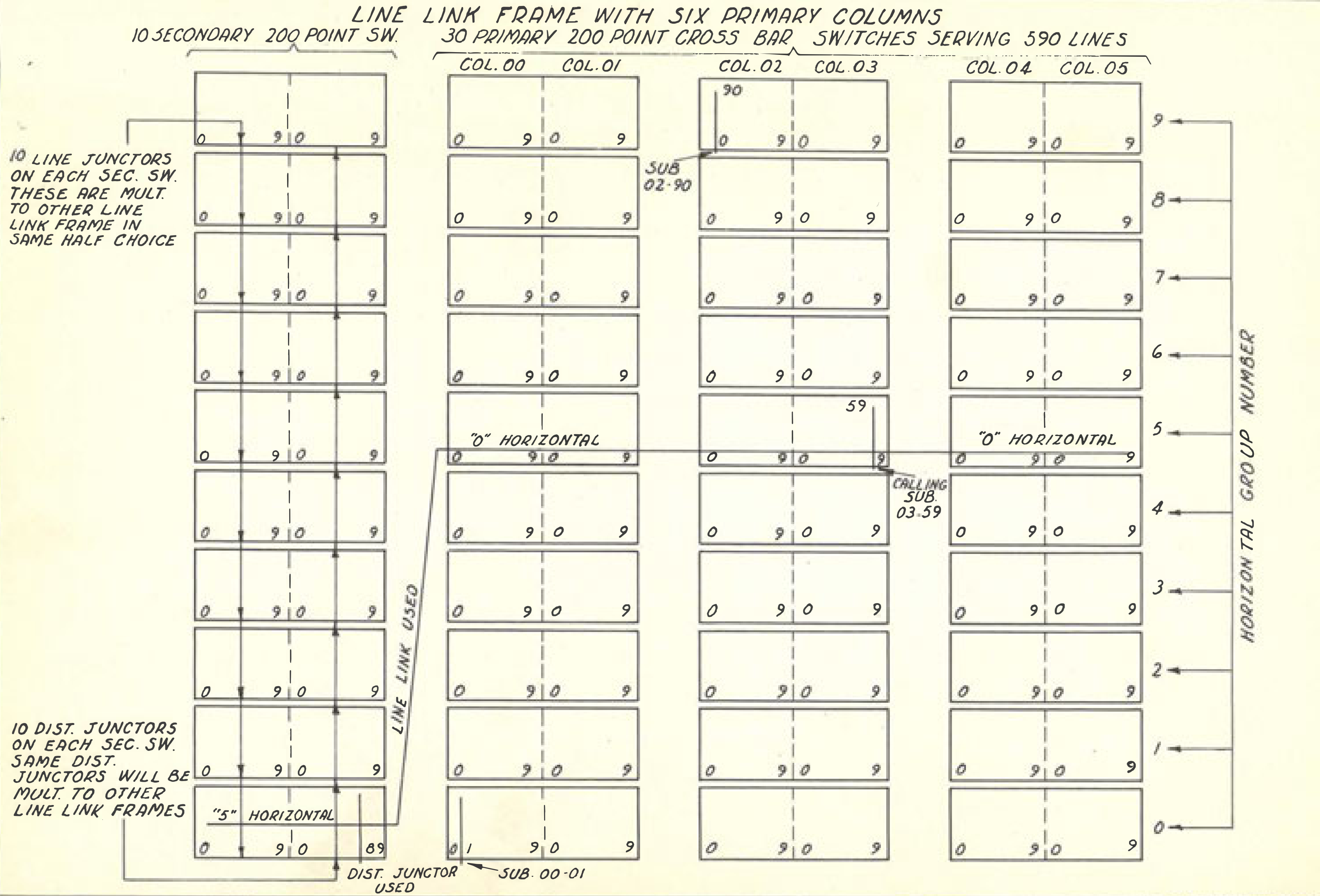
The paths between the primary and secondary switches are known as line links. There are ten line links from each horizontal group of primary switches with one line link wired to each secondary switch making a total of 100 line links per frame.

On the horizontal side of M.D.F., blocks are numbered to correspond to the column number of the line link frame and each block consists of lugs numbered from 00 to 99. The numbers 00 to 09 are for subscribers located on the zero primary switch of that column and likewise 90 to 99 are for subscribers located on number nine primary switch.

The hundred line junctors are wired from incoming link frames and are multipled to another line link frame which is in the same half choice. The meaning of a half choice will be explained when studying a terminating call. The hundred district junctors can be multipled to several other line link frames as required.

A **link** is a connecting path between primary and secondary switches, taking its name from the frame on which it is located; that is, those on line link frames are called line links and on district link frames, district links - office link frames, office links, etc.

A **junctor** is a connecting path between two frames, taking its name from the frame it is connecting to; that is, line link frame to district link frame is called a district junctor; district link frame to office link frame an office junctor, and an incoming link frame to a line link frame, a line junctor.



N. Y. TEL. CO.
G.P.S. - L.I.

LINE LINK GROUP AND CONTROL

ARRANGEMENT OF PRIMARY AND SECONDARY SWITCHES

1 | 5EW

XB-1

START AND HORIZONTAL GROUP SELECTION

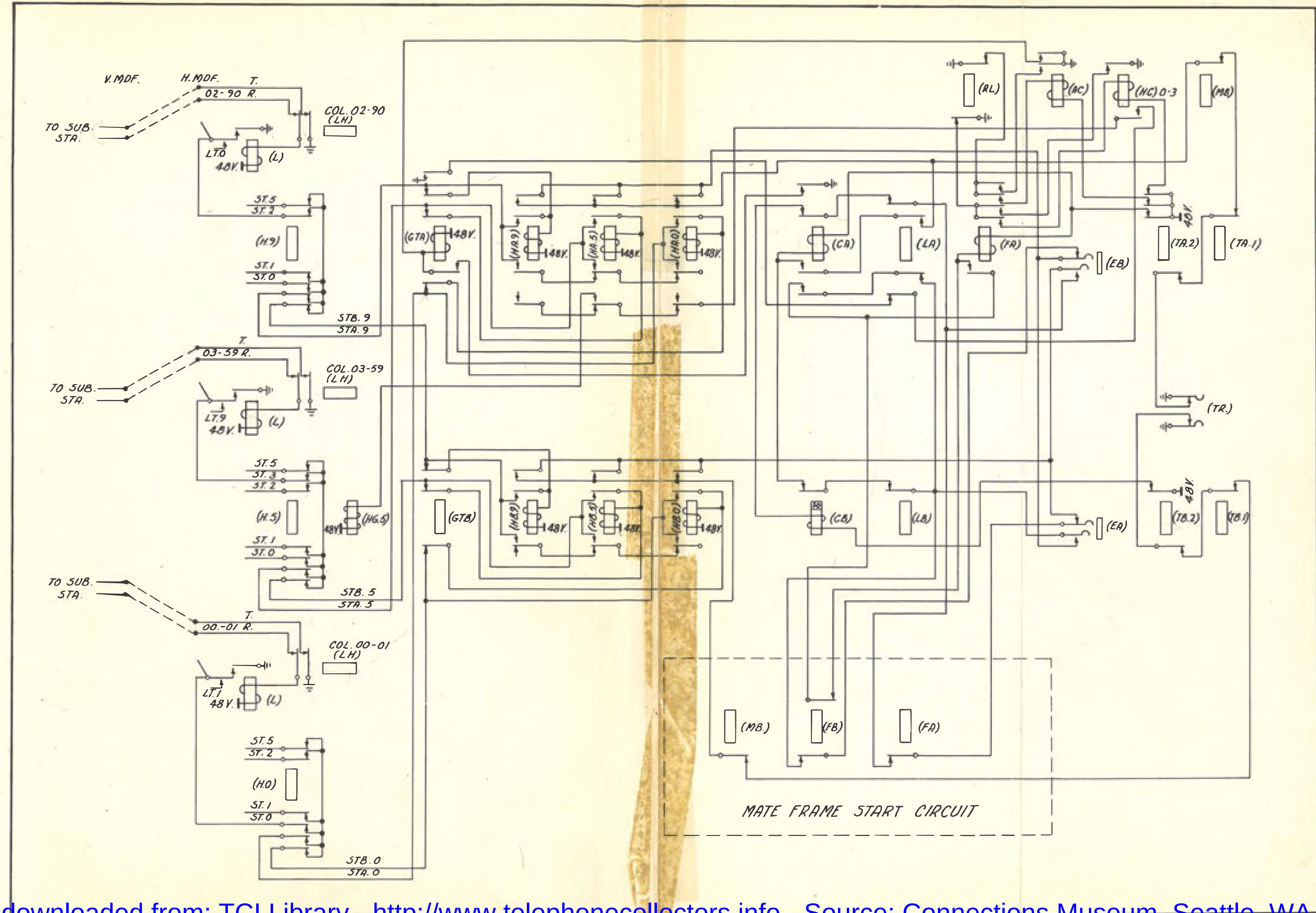
We will assume the subscriber located in column 03, switch 5 and vertical 9 is originating a call. When the subscriber removes the receiver from the hook a circuit is closed to operate the line or (L) relay associated with 03-59. Ground is closed over the start lead associated with that (L) relay (this lead is common to the ten (L) relays of this switch and column). The start lead goes through a normal contact of the (H5) relay (since this subscriber is on a number 5 primary switch) and operates relays (HA5) and (HB5).

Relay (HA5) closes a circuit for operating relay (CA) and (HB5) closes a circuit for operating relay (CB). Relays (CA) and (CB) are arranged in a chain circuit and since relay (CB) is slow to operate, relay (CA) will normally operate and remove the operating circuit of relay (CB). Relay (HA5) locks around the break contact of relay (GTA) to the same line relay ground to which it operated. The operation of relay (CA) causes the operation of relay (FA). Relay (FA) on the "home" frame and relay (FB) on the "mate" frame are arranged in a chain circuit so that both frames cannot seize the same control circuit at the same time. If the mate frame used the control circuit of this frame its (FB) relay would operate, therefore, the operating path of the "home" frame (FA) relay is through a normal contact of the (FB) relay in the mate frame to be sure the "home" control circuit is not in use serving the mate frame. With relay (FA) operated it causes relays (AC), (HC0), (HC1), (HC2) and (HC3) to operate if the "home" control circuit has returned to normal which is indicated by relay (RL) being normal. The (AC) and (HC0-3) relays are known as the connector relays and connect the frame to the "home" control circuit, these relays lock under control of relay (FA).

Relay (GTA) operates from ground on a make contact of relay (AC). Relay (GTA) is known as a gate relay, with this relay operated, calls from other horizontals cannot operate their (HA-) relay until relay (GTA) has released and it will not release until all horizontals which have their (HA) relay operated have been served.

Relay (GTA) operated closed a ground to operate a (HG) relay. The number of (HG) relay will correspond to the lowest number (HA) relay operated. In this case we have assumed relay (HA5) is operated, therefore, relay (HG5) will operate.

The (EA) and (EB) jacks are known as exercise "A" and exercise "B" jacks. They are used to force calls into the "A" side or the "B" side of frame.



LINE LINK GROUP AND CONTROL
START AND HORIZONTAL GROUP SELECTION

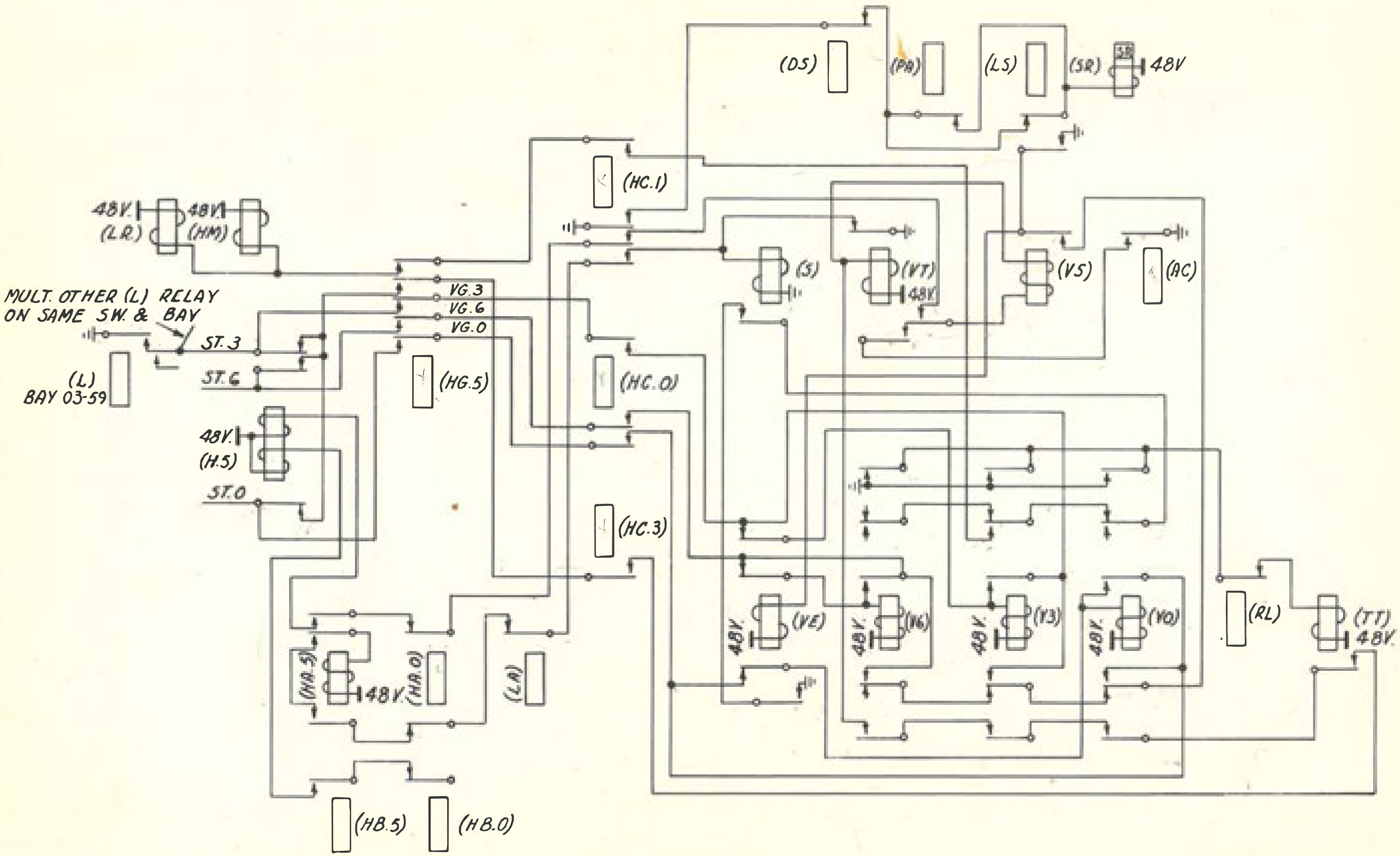
XB-2

N.Y. TEL. CO.
G.P.S. - L.I.

VERTICAL GROUP SELECTION

Relays (VO) to (V6) operate over the "VGO" to "VG6" lead through make contact of (HG-) relay, normal contacts of (H-) to ground on the operated (L) relay. Relay (TT) operates from ground supplied by the operated (V) relays. Relay (VT) now operates through the make contacts of all (V) relays, make of (TT), make of (HC3), make of (HG-), normal of (H-) to ground on the operated (L). Relay (VT) operated (1) locks in series with relay (VS) over lead "MC" to ground on relay (AC), but relay (VS) remains shunted at this time until relay (H-) operates, (2) closes its locking ground over the "TL" lead to operate relay (H-) and (3) removes the shunt from (S) relay permitting it to operate in series with relay (HA-). The (HA-) relay holds in series with relay (S).

When relay (H-) operated it separated the operating leads of the (V) relays, leaving only those leads grounded that correspond to the vertical groups containing the calling lines, and removes the shunt around relay (VS) allowing it to operate. Relays (VS) and (VT) are now held in series until the control circuit is released. Relay (VS) operated closes relay (VE) to a chain circuit through the (VO) to (V6) relays, to an operated (V) relay to ground on the "ST" lead of the operated (L) relay. Relay (VE) operated (1) opens the operating paths of the non-operated (V) relays to prevent any other (V) relays from operating during the progress of this call, (2) closes ground through relay (S) operated to the lowest number operated (V) relay over the "VS" lead through the operated (HG-) relay to operate the (LR) and (HM) relays. One (LR) and (HM) relay is associated with each ten lines on a primary switch.



N.Y. TEL. CO.
G.P.S. - L.I.

LINE LINK GROUP AND CONTROL
VERTICAL GROUP SELECTION

1 2

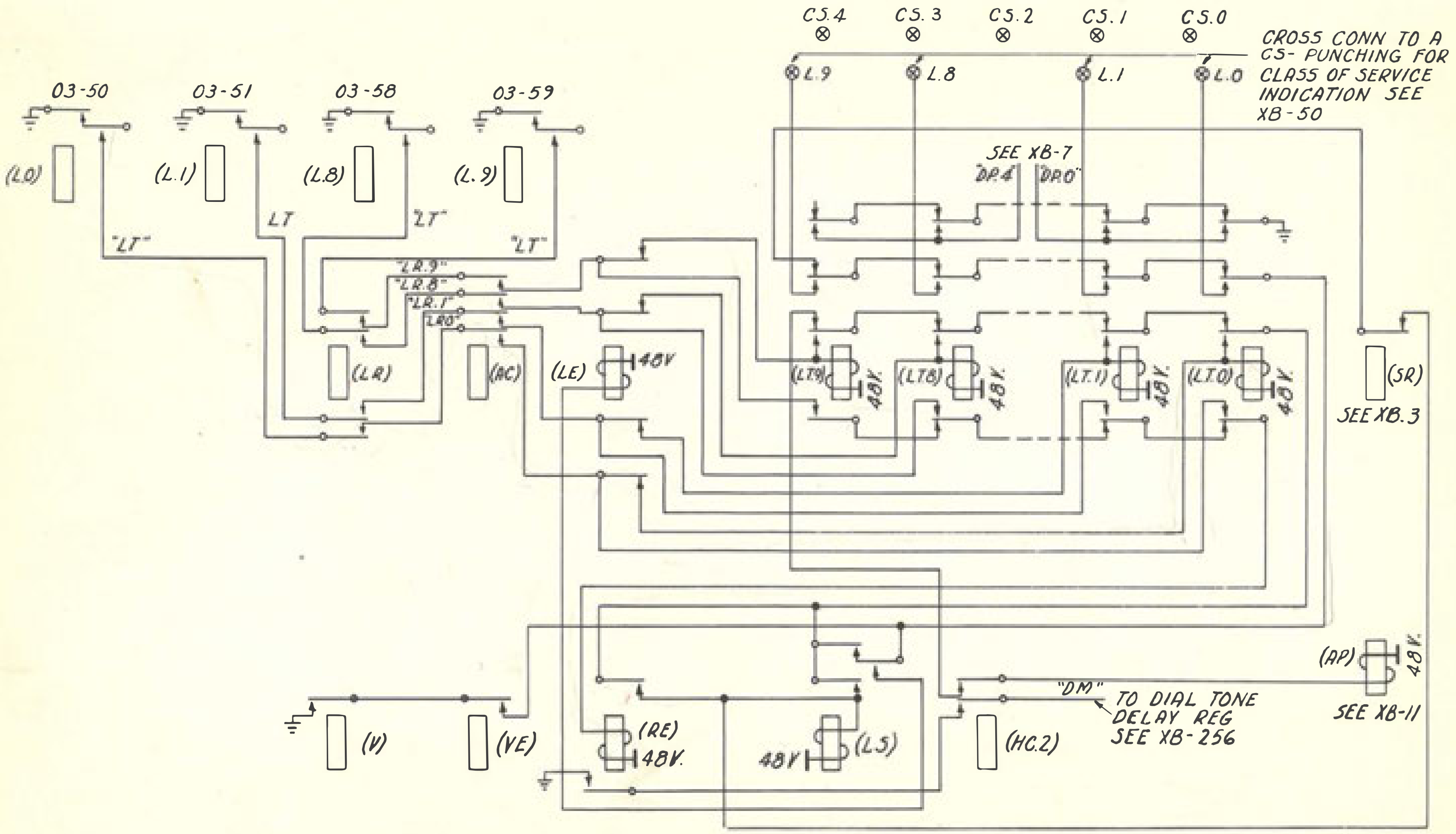
XB-3

LINE SELECTION AND IDENTIFICATION

When the (LR) relay operated the calling line could have been any one of a possible ten. Ground on the "LT" lead from the operated (L) relay operates the corresponding number (LT) relay. Assume the calling subscriber is located on 03-59, then relay (L9) would be operated and in turn operate relay (LT9) after relay (LR) operated. Ground over the lowest numbered "LR" lead and operated (LT-) relay in the chain, operates the (RE) relay. The lowest numbered (LT) relay operated also closes ground to the subscriber's sender link and control circuit over the "DP-" lead to indicate the district junctor preference and also sender preference of a selected sub-group. The "L" leads from the (LT) relays are cross-connected to a "CS-" terminal to indicate to the sender the class of service making the call.

Relay (RE) operated (1) closes ground to the "DM" lead to the dial tone delay register (see XB-256), (2) opens a circuit to the (RL) relay winding (see XB-9), (3) opens the "ON" lead (see XB-9) and (4) operates the (LS) relay to the ground used to operate the lowest numbered (LT) relay. Relay (LS) operated, (1) locks to the same ground that holds the (LT) relay operated, (2) operates the (LE) relay, (3) closes a locking ground to hold the (V) and (VE) relays when the (L) relay is released (see XB-3), (4) closes the "RL" lead in part (see XB-9), (5) closes ground to the (DS) relay for future use on the "DF" leads (see XB-7), and (6) opens one circuit to the winding of relay (SR) (see XB-3). Relay (LE) operated, prevents the operation of other (LT) relays.

In the event of a line (L) relay operating only enough to close the "ST" lead but not its "LT" lead none of the relays (LT0) to (LT9) or (RE) will be operated, when relay (SR) releases a circuit is closed to operate relay (LS) which in turn operates relay (AP) to light the (AL) lamp and sound the minor alarm. The (RL) relay will be operated by the sender link and control circuit causing the line link group and control circuit to release.



N. Y. TEL. CO. G.R.S. L.L.	LINE LINK GROUP AND CONTROL LINE SELECTION AND IDENTIFICATION	1 XB-4

DISTRICT JUNCTOR GROUP TEST - REGULAR AND RESERVE

Regular Group Test

When the (HG-) relay operated as a result of horizontal group selection, relays (T0) to (T9) were connected to the sleeves of the ten line links at the secondary switches serving that horizontal group. The (T) relays corresponding to busy line links will operate under this condition to the busy ground on the sleeve leads supplied from the district or incoming junctor circuit. Relays (TT) and (VT) were operated during vertical group selection (see XB-3).

Relays (G0) to (G9) may now be operated if their "TA" or "TB" lead has ground on it from the sender link and control circuit and its associated (T) relay is normal, indicating the line link between the primary switch making the call and the secondary switch serving the ten district junctors is idle or is not made busy. The subscriber's sender link and control circuit will ground the "TA" or "TB" lead if there are at least two idle district junctors in the group of ten, indicated by the (CA) or (CB) relay in the subscriber's sender link and control circuit being normal. The (DP) relay normal indicates the sender link and control circuit is not in use and there is an idle sender with an available path to that sender. All or none of the (G) relays may operate at this time depending upon the equipment available. If one or more (G) relays operate the preferred group of ten district junctors will be selected. If none operate the reserve test will be made.

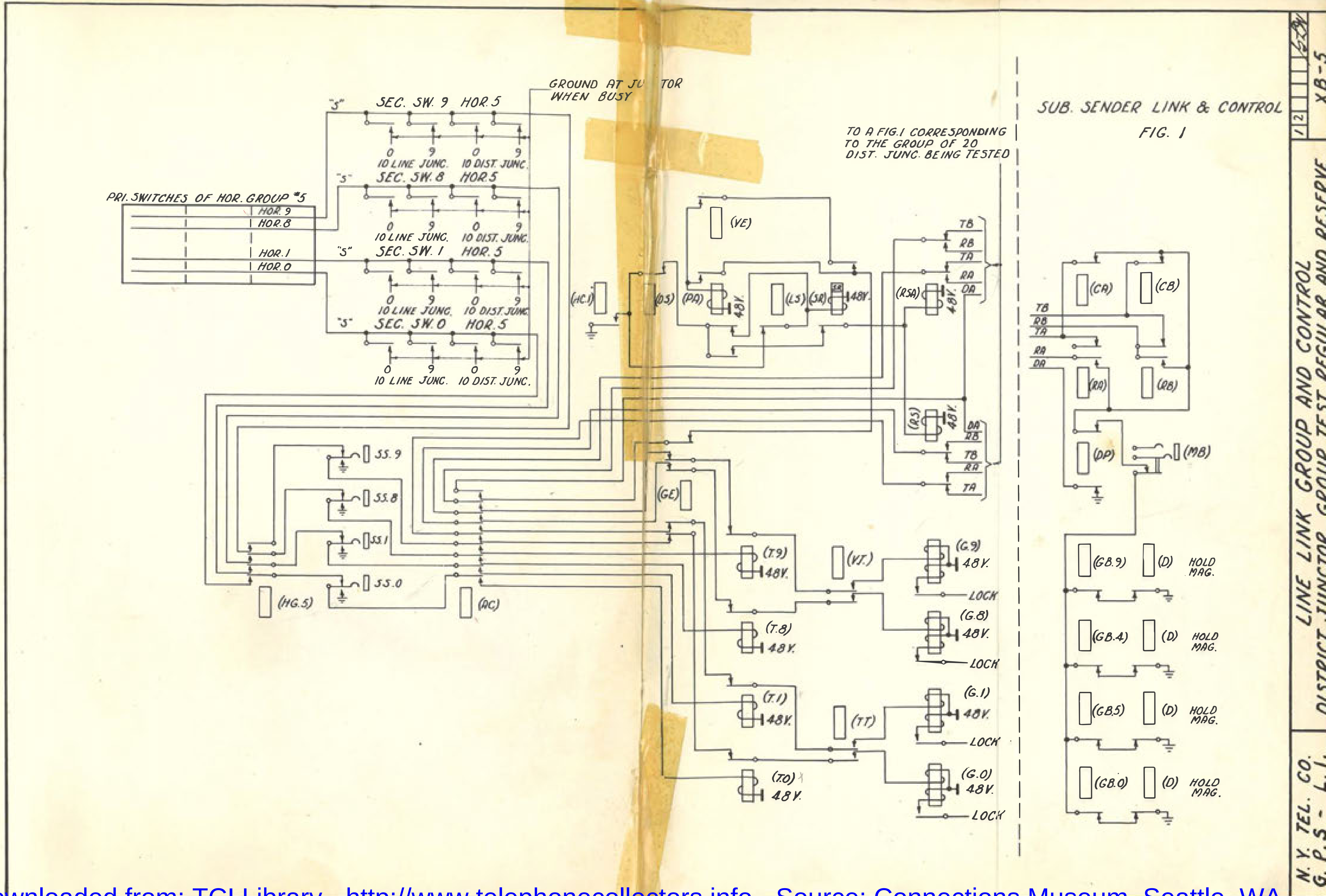
Reserve Group Test

Slow release (SR) relay operated as soon as relay (HC1) operated. During vertical group selection relay (VE) operated closing the winding of relay (PA) to the "DA" leads of sender link frames serving district junctors on this line link frame, if any of the sender link frames are idle and has an idle district junctor, its (DP) relay will be normal operating relay (PA); this opens one of the operating paths of relay (SR). When relay (LS) operated during line selection the other holding circuit for relay (SR) was opened, starting the release of slow release (SR) relay. With relay (SR) normal relays (RSA) and (RS) will operate if relay (PA) has operated due to an available sender link and control circuit and relay (DS) is normal indicating a group of district junctors have not been selected on the regular test.

With relays (RSA) and (RS) operated the operating path for the (G) relays are now closed over the "RA" and "RB" leads; these leads will be grounded if there is at least one idle district junctor in a group of ten with an idle sender link control and an available path to an idle sender.

If none of the (G) relays should operate at this time the dial tone delay circuit operates the (RL) relay and releases the control circuit (see XB-256).

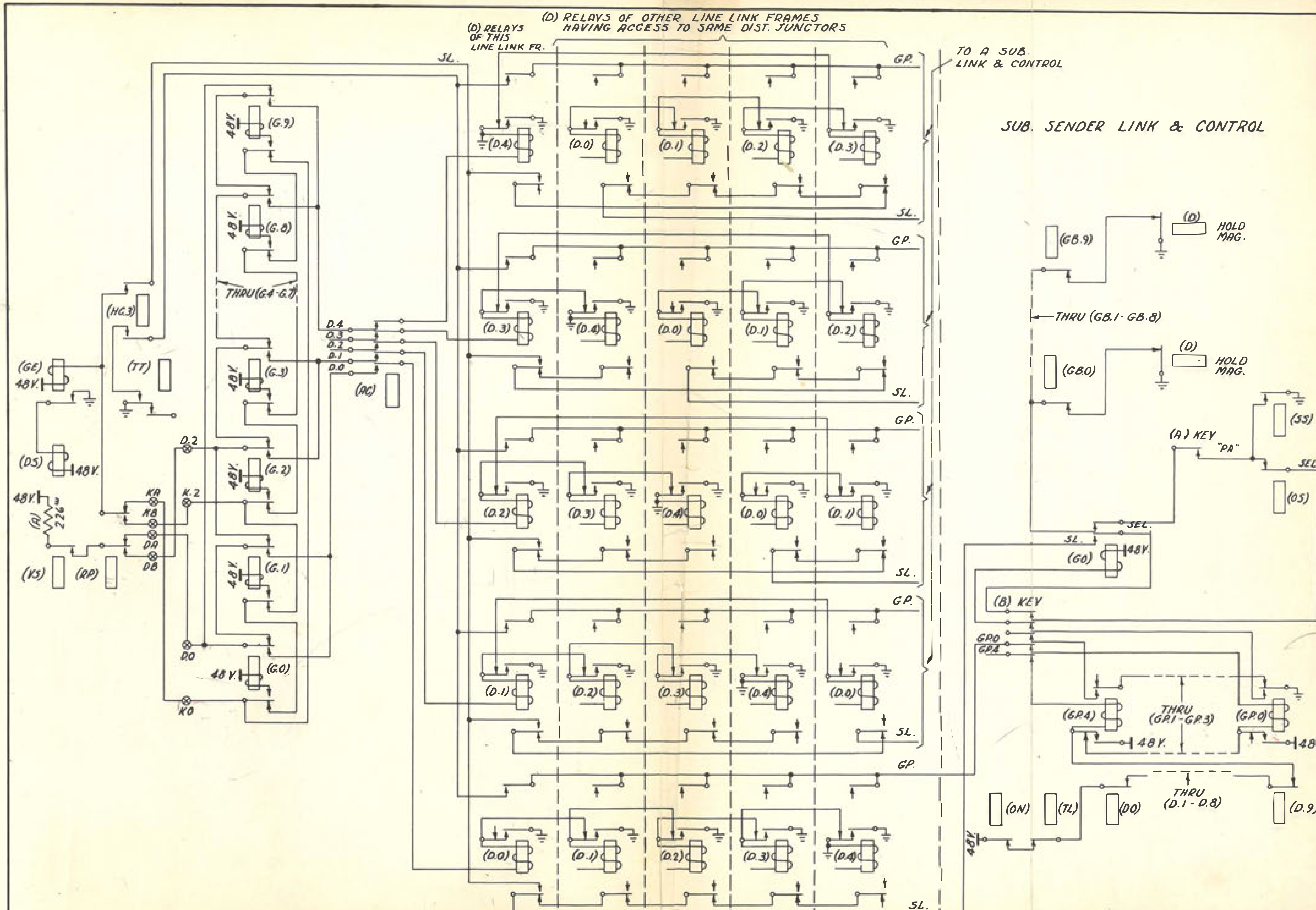
If a terminating marker is waiting to be served when relay (SR) releases and no (G) relay is operated, the marker can immediately release the control circuit, without waiting for ground on lead "DK" from the dial tone delay circuit, by connecting ground to lead "LR" which is connected to lead "DK" and uses same path as shown in XB-256 to operate relay (RL).


GROUND AT JU TOR WHEN BUSY
"5" SEC. SW. 9 HOR. 5
10 LINE JUNC. 10 DIST. JUNC.
"5" SEC. SW. 8 HOR. 5
PRI. SWITCHES OF HOR. GROUP #5
HOR. 9
HOR. 8
HOR. 1
HOR. 0
"5" SEC. SW. 1 HOR. 5
"5" SEC. SW. 0 HOR. 5
TO A FIG. 1 CORRESPONDING TO THE GROUP OF 20 DIST. JUNC. BEING TESTED
SUB. SENDER LINK & CONTROL
FIG. 1
(VE)
(HC.1)
(DS)
(PA)
(LS)
(SR)
(RSA)
(RS)
(GE)
(HG.5)
(AC)
SS.9
SS.8
SS.1
SS.0
(T.9)
(T.8)
(T.1)
(T.0)
(VT.)
(TT)
(G.9)
(G.8)
(G.1)
(G.0)
48V.
LOCK
TB RB TA RA DA
(CA)
(CB)
(RA)
(RB)
(DP)
(MB)
(GB.9)
(GB.4)
(GB.5)
(GB.0)
(D)
HOLD MAG.
LINE LINK GROUP AND CONTROL
DISTRICT JUNCTOR GROUP TEST REGULAR AND RESERVE
N.Y. TEL. CO.
G.P.S - L.I.
XB-5

SELECTING A GROUP OF 20 DISTRICT JUNCTORS AND STARTING THE SENDER LINK AND CONTROL CIRCUIT

As explained in XB-5, one or more of the (G) relays have been operated. We will assume relay (RP) is normal (this relay changes its position after each call - see XB-10). Under this condition if relay (GO) is operated it will have preference over the other (G) relays. Lead "DO" will have resistance battery place on it to operate the (DO) relay of this line link frame. With the (DO) relay operated (1) it closes a ground on lead GP to the subscriber's sender link and control circuit which serves this group of 20 district junctors, and operates a (GP) relay in that circuit corresponding to the location of these district junctors on that frame; the operated (GP) relay in turn operates its (G) relay to ground the "SL" lead to the line link frame. Ground on the "SL" lead operates the (GE) relay and locks in the preferred (G) relay.

When relay (GE) operated it opened the operating paths for all (G) relays, operates relay (DS) and opens the "DA" lead to release relay (PA) - see XB-5, opens the circuit to relays (RS) and (RSA) allowing them to release if operated (see XB-5).



LINE LINK GROUP AND CONTROL

SELECTING A GROUP OF 20 DIST. JUNCTORS AND STARTING THE SENDER LINK & CONTROL CIRCUIT

XB-6

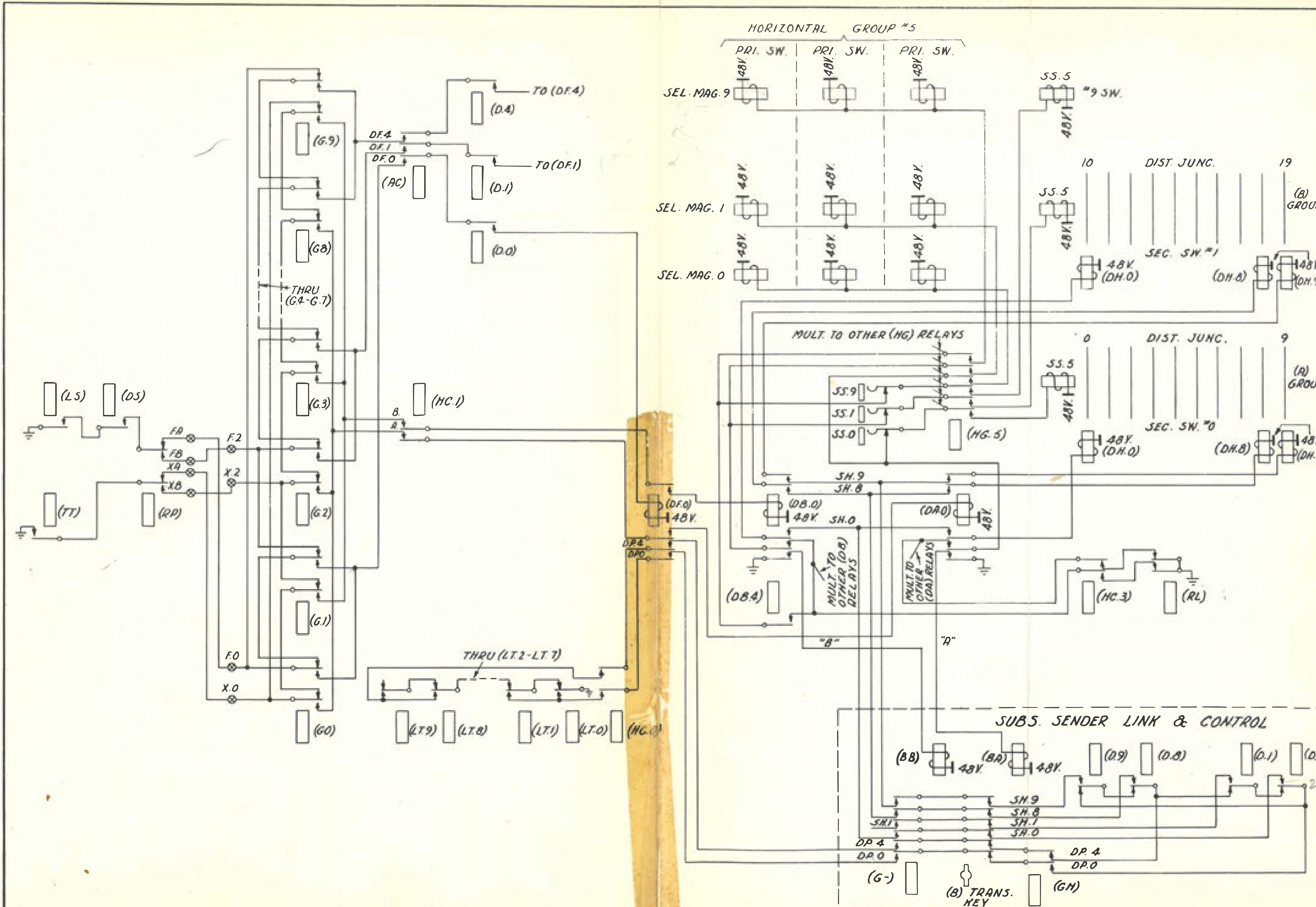
N.Y. TEL CO.

G.P.S. - L.I.

DISTRICT JUNCTOR SELECTION

When a sender link and control circuit was associated with this line link and control circuit relay (DS) operated (see XB-6). Relay (LS) operated during line selection and identification (see XB-4). Ground is now closed to operate the relay (DF) associated with the operated (D) relay. Relay (DF) operated closes ground from the operated (TT) relay to operate either the (DA) or (DB) relay associated with the (DF) relay. This determines which ten of the selected 20 district junctors is to be used. If relay (DA) operated it would operate relay (BA) in the subscriber sender link and control, likewise if relay (DB) operated it would operate relay (BB). If the (G) relay operated is an even numbered relay the (DA) relay will operate, likewise if it is odd numbered relay the (DB) relay will operate. Relay (DF) operated closes the five "DP" leads through to the sender link and control circuit; the lead grounded is determined by the (LT-) relay operated. The ground on the "DP" lead indicates the district junctor preference desired to the sender link and control. Relays (DA) or (DB) operated connects ground to operate the select magnets on the primary switches corresponding in number to the secondary switch on which the selected district junctors are located. These relays also close through the "SH" leads to operate the secondary hold magnet corresponding to the selected district junctor.

The secondary switch serving the selected group of district junctors has a select magnet operated which is associated with the operated (HG-) relay, the cross points on the secondary switch are now closed to the district junctor on the horizontal corresponding to the horizontal group of primary switches the calling subscriber is located in.



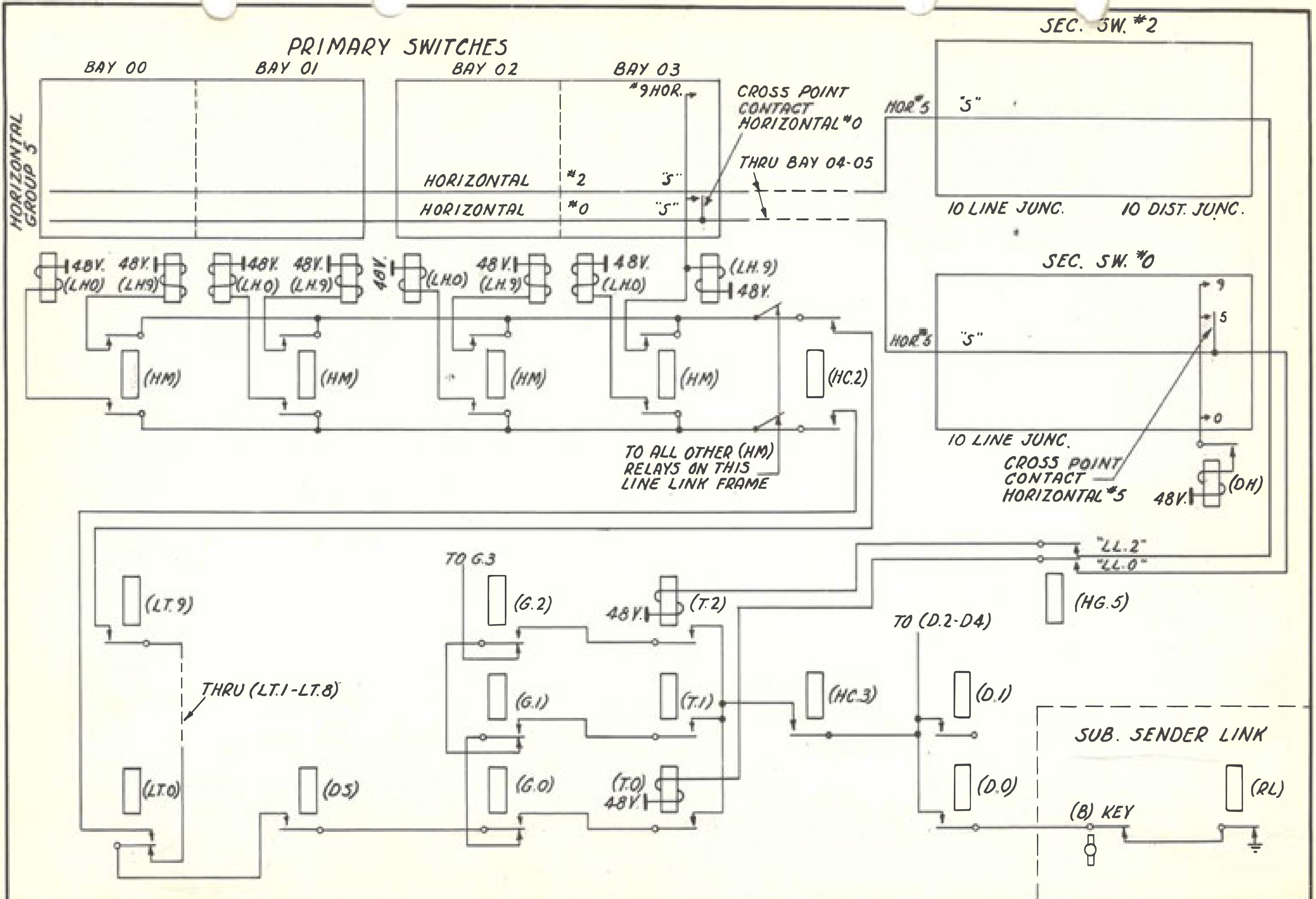
XB.7

LINE LINK GROUP AND CONTROL
DISTRICT JUNCTOR SELECTION

N.Y. TEL. CO.
G.P.S. - L.I.

OPERATION OF LINE HOLD MAGNET

As has been explained the operation of the secondary hold magnet closed the cross points on the secondary switch which with ground from the sleeve of the selected district junctor will operate the (T) relay corresponding to the secondary switch number being used. With the (T) relay operated ground is closed from a normal contact of the (RL) relay in the subscriber sender link and control circuit through the only (G) relay operated at this time to the (LT) relays; the lowest number, one of which is operated, will pass the ground on to operate the calling subscriber's primary hold magnet. Only one (HM) relay on the line link frame is operated, therefore, the proper primary hold magnet will be operated.



N.Y. TEL. CO.
G.P.S. - L.I.

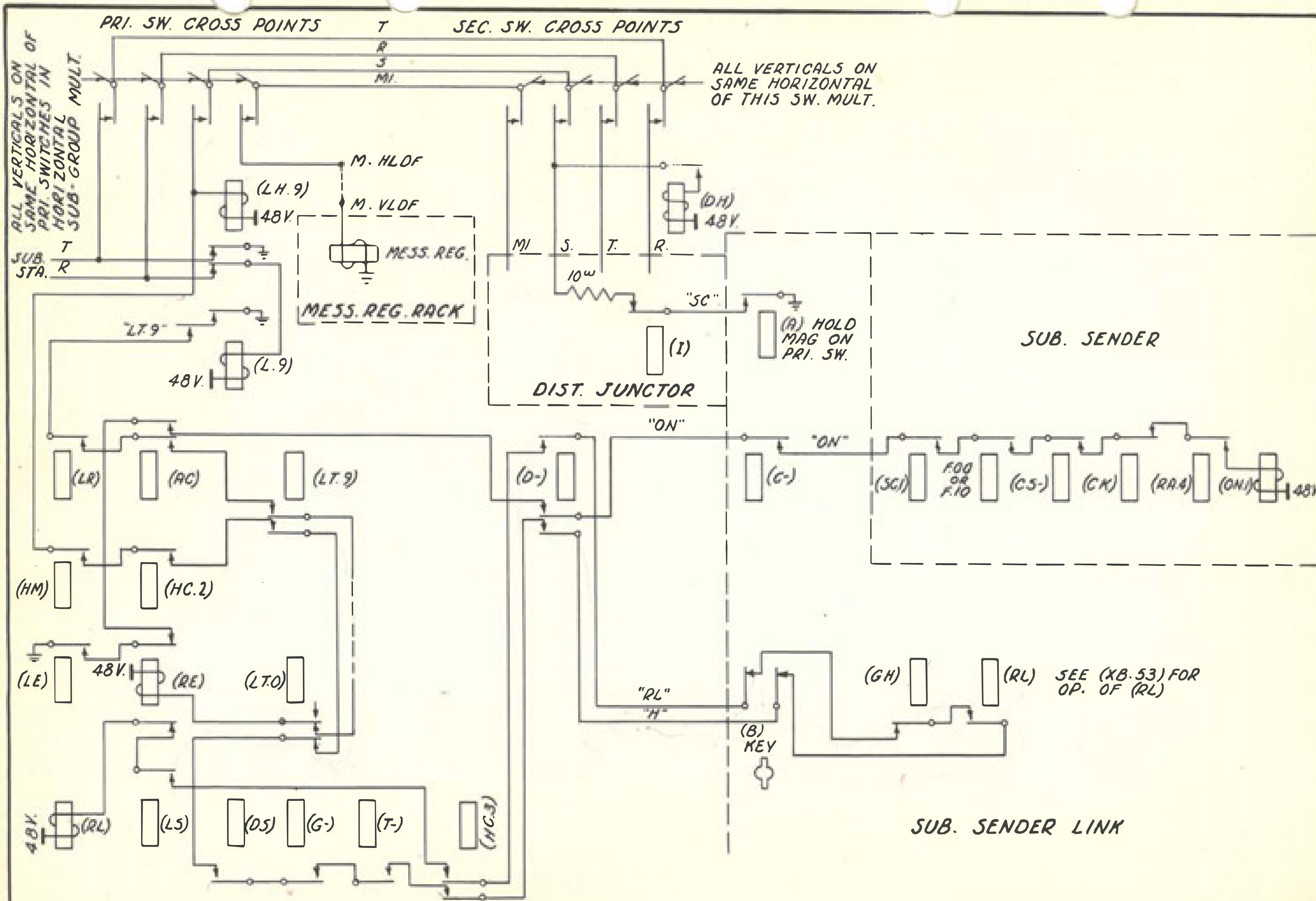
LINE LINK GROUP AND CONTROL
OPERATION OF LINE HOLD MAGNET

XB-8

INDICATION TO SENDER THAT PRI. AND SEC. HOLD MAGNETS HAVE OPERATED AND OPERATION OF LINE LINK (RL) RELAY

When the primary hold magnet operated it opened the operating path for the subscriber's (L) relay, causing it to release. The release of the (L) relay removed the ground from the "LT" lead, which released the (RE) relay. With relay (RE) normal ground is placed on the "ON" lead to the subscriber's sender link circuit and on to the subscriber's sender to operate its (ON1) relay. The sender will now give the subscriber dial tone as shown on XB-50 and also proceed to operate relay (RL) of the subscriber sender link and control circuit as shown on XB-53.

With the (RL) relay in the subscriber's sender link and control circuit operated a path is closed from ground at the operated (A) hold magnet on the primary switch of the sender link and control circuit, through the district junctor over its sleeve to the closed cross points on the secondary and primary switch, operated (HM), (HC2), operated (LT-) and (LT) chain, operated (DS), (G-), (T-), (HC3) and (D-) to the subscriber's sender link circuit over the "H" lead through the transfer key (B), operated RL, normal GH relay, transfer key (B) to the line link over lead "RL", operated (D-), (HC3), (LS), normal (RE) to battery of the (RL) relay to operate this relay in the line link control circuit.



N.Y. TEL. CO.
G. P. S. - L. I.

LINE LINK GROUP AND CONTROL

INDICATION TO SENDER THAT PRI. & SEC. HOLD MAGNETS HAVE OPERATED AND OPERATION OF LINE LINK (RL) RELAY

1

XB. 9

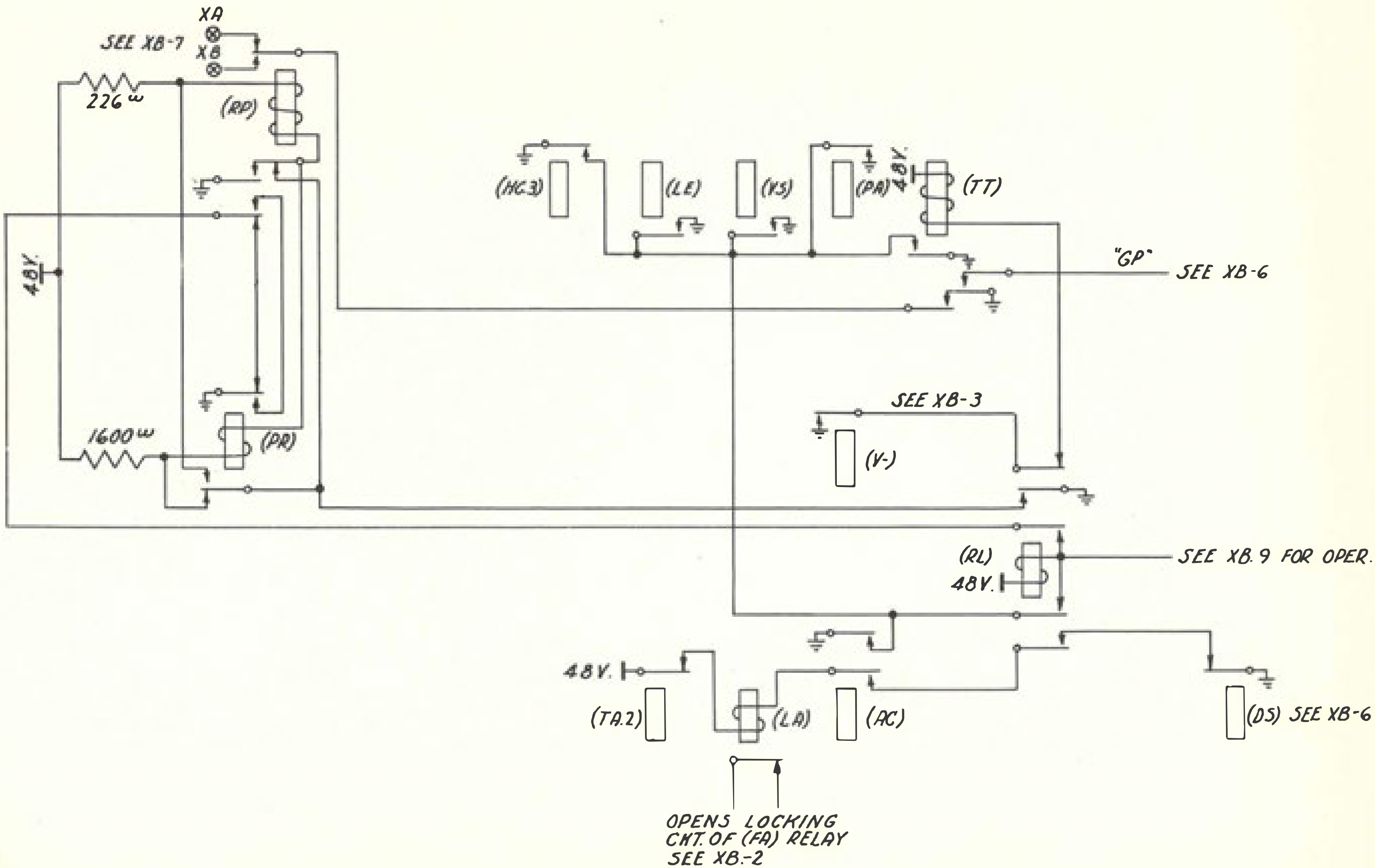
REGULAR RELEASE AND ROTATION OF DISTRICT GROUP PREFERENCE

Relay (RL) operated, (1) locks to relays (TT), (PA), (VS), (LE), (HC3), and (AC) operated, (2) also locks to the (RP) and (PR) if both are operated or normal at the time (RL) is operated, (3) releases relay (TT) which removes ground from leads "GP" (see XB-6) and "A" or "B" causing (DA) or (DB) relays to release (see XB-7), which in turn causes the sender link and control circuit to remove ground from lead "SL" thus releasing relays (G) and (GE), relay (GE) released releases, relay (DS) (see XB-6), relay (G) released causes relays (D) and (DF) to release (see XB-6 and XB-7), (4) removes ground used to operate relays (HC) and (AC) (see SB-2), (5) release primary select magnets (see XB-7).

When relay (DS) releases, relay (LA) operates. Relay (LA) operated, (1) releases relay (TA) if operated (see XB-11), (2) opens the operate circuit of relay (FA) allowing it to release when relay (TA) is normal, (3) opens the locking circuit to relay (HA) causing it to release and (4) releases relay (HG). Relay (HG) released, releases the secondary select magnets and the (T) relays which were operated during the call. Relay (FA) released, releases the (HC) relays and relay (AC). This causes relays (HM), (LR), (LA), (VS), (VT), (LS), (LT), (LE), (S) and (VE) to release.

When RL relay first operated it caused relay (RP) to operate if normal or to release if operated. Assume relays (RP) and (PR) were both normal before relay (RL) operated. When it did operate relay (RP) would operate and lock to ground on its own make contact but relay (PR) would have its battery shunted as long as relay (RL) was operated. When all locking paths for relay (RL) are removed it releases, allowing relay (PR) to operate to ground at the make contact of relay (RP). If both (RP) and (PR) had been operated before relay (RL) operated, then when it did operate, relay (RP) would be shunted down, but (PR) held operated until (RL) released, leaving them both normal at the end of the call.

The purpose of changing the position of relay (RP) after each call is to insure a change in district group preference during periods of light traffic.



N. Y. TEL. CO.
G. P. S. - L. I.

LINE LINK GROUP AND CONTROL

REGULAR RELEASE AND ROTATION OF
DISTRICT GROUP PREFERENCE

1

XB.10

TIMING CIRCUIT

Each two line link frames are arranged to work as mates, so if trouble develops in the control circuit of either frame, it will continue to serve its subscribers, using the control circuit of its mate frame. Under this condition the two mate frames use the control circuit of one of them as a common control circuit, calls being served alternately on the two frames.

When a subscriber starts a call relay (CA) operates as shown on XB-2, grounding the armature of interrupter (IA). When the IA interrupter makes its "B" contact, relay (TA) operates and locks. If the call is cleared before the "F" contact of (IA) interrupter makes the circuit functions in the regular manner and timing relays restore. However, if the "F" contact makes before the start ground is opened, relay (TA1) operates. Relay (TA1) operated opens the ground supply for relays (CA) and (FA) shown on XB-2, (1) causing the frame to disconnect from the control circuit, (2) supplements the start ground on the (IA) interrupter and locks relay (TA), (3) holds relays HA and H, (4) provides an operating circuit for relay (TA2) from contact "B" of interrupter.

The operation of relay (TA2), (1) removes one locking path of (TA1) relay, (2) lights the (AL) lamp, (3) operates the alarm and aisle pilot, (4) locks to (TR) key, (5) removes battery supply feeding relays (CA), (FA), (LA), (AC) and HC which release (see XB-2). The release of relay (CA) removes the last path for locking (TA1). The (TA1) released, removes ground holding the (HA) and (H) relays and the call will proceed to function over the "B" side of frame into the control circuit.

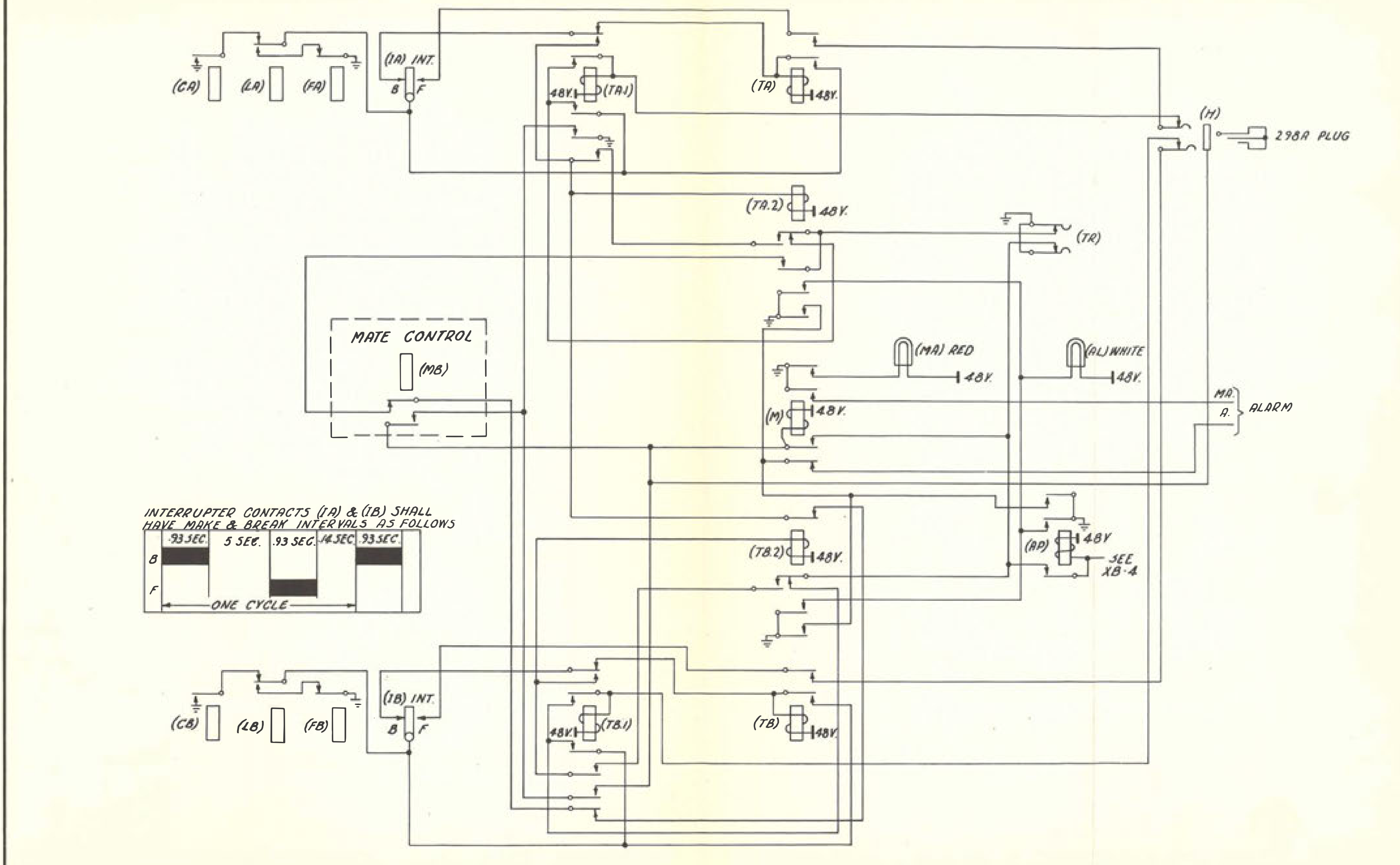
The "A" side of the start circuit is now out of service and subsequent calls proceed through the "B" side of the frame into the mate control circuit.

If the trouble that caused the time alarm condition was in the control circuit, no further time out will occur after the initial time out had taken place. If, however, the trouble was in the frame equipment and a call is blocked after starting through the "B" side of start circuit, relays (TB), (TB1) and (TB2) will function to remove the "B" side of frame from service. The operation of relay (TB1), opens the locking circuit for relay (TA2) and restores the "A" side of frame to service. Each time a call is blocked, a transfer is made from one side of start circuit to the other. Approximately six seconds is allowed to serve each call before an alarm functions.

When alarms have been coming in on a frame and the trouble has not been located due to the transfer, a 298-A plug may be inserted in the (H) or hold jack to prevent operating the (TA1) or (TB1) relays as the case may be, but provides a path to operate the (M) relay at a time when the (TA1) or (TB1) relay would normally operate. Relay (M) operated sounds the major alarm and lights the red (MA) light of the associated frame. With this condition the switchman can observe how far the call has advanced and determine where the circuit failure occurred.

Maintenance Forces are cautioned to take these readings quickly and remove plug from the (H) jack as both originating and terminating calls are blocked under this condition.

When the mate frame control circuit is plugged busy, indicated by its (MB) relay operated, the (M) relay will operate when the (TA1) relay operates, sounding the major alarm. Should the (TA1) relay stick up or be falsely operated and a time out occurs to operate relay (TB1), the (M) relay will also operate under this condition.



XB-11

LINE LINK GROUP AND CONTROL
TIMING CIRCUIT

N.Y. TEL. CO.
G.P.S. - L.I.

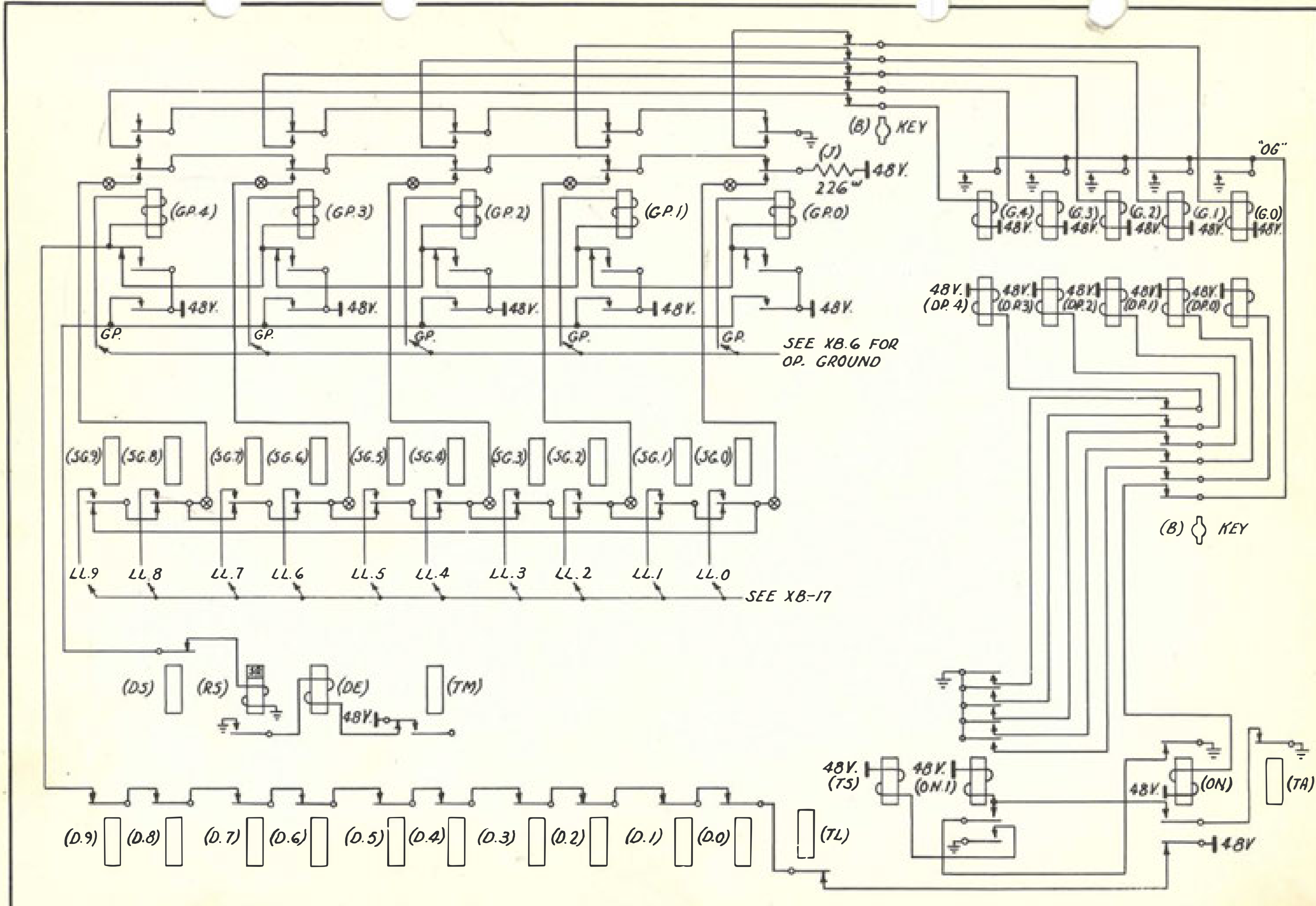
DISTRICT GROUP SELECTION

When the line link frame determined which group of 20 district junctors were to be used for the call it placed ground on the "GP" lead to operate a (GP) relay in the sender link and control circuit serving that group of districts, see XB-6. There are 100 district junctors associated with a sender link and control circuit. They are divided into five groups of 20, known as groups 0-4.

One or all (GP0) to (GP4) relays may operate simultaneously depending upon the number of line link and group control circuits that may be trying to serve calls at the same instant. Only one (GP-) relay will be effective if more than one has operated and this relay (1) operates the (G-) relay associated with it, (2) connects the sender group preference battery from resistance (J) to an (SG-) relay and (3) operates relay (RS).

The operated (G-) relay (1) connects ground to lead "OG" causing relay (ON) to operate, (2) connects ground to "SL" lead of the line link and group control circuit as an indication that the call will be served by some district of the associated group of 20 district junctors, see XB-6, and (3) closes a number of other leads which will be explained later. The operation of relay (RS) operates relay (DE). Relay (ON) operated: (1) opens the operating circuit of the (GP0) to (GP4) relays so that none of these relays can reoperate until relay (ON) releases at the completion of the call, (2) operates relay (ON1) and (3) grounds the off normal ground lead. Relay (ON1) operated (1) operates relays (DP0) to (DP4), (2) locks to the off normal ground lead and (3) operates relay (TS).

The operation of relays (DP0) to (DP4) removes ground from the TA, TB, RA, RB and DA leads to line link frames, thus causing all five of the associated district groups to test busy to the line link frames using these district junctors.



N. Y. TEL. CO.
G. P. S. - L. I.

SUB. SENDER LINK AND CONTROL
DISTRICT GROUP SELECTION

1

XB-15

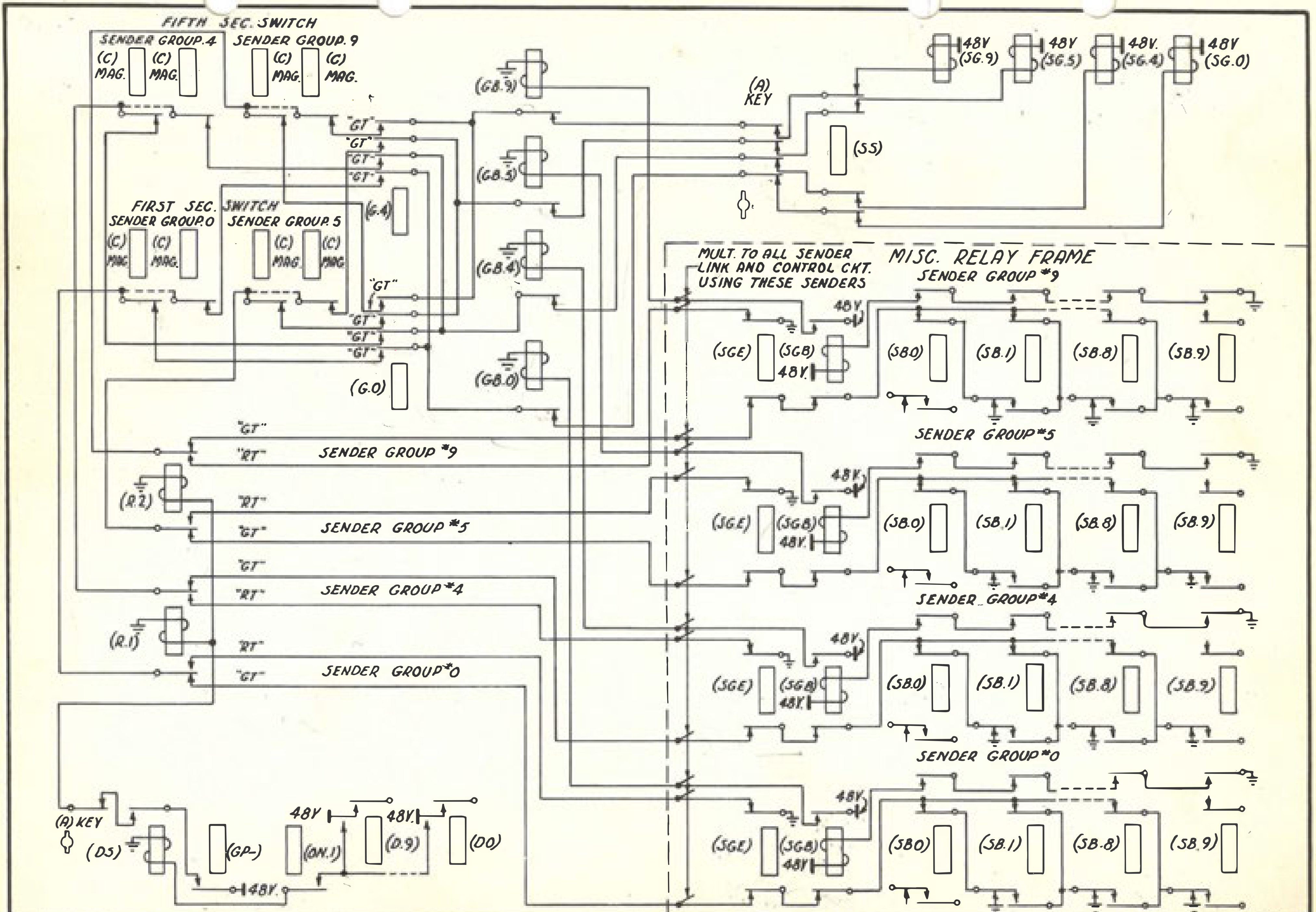
REGULAR AND RESERVE SENDER GROUP TEST

Regular Sender Group Test

When a (G-) relay operates it closes ten "GT" leads through to off normal contacts of (C) hold magnets on the secondary switches which may be used as sender links between the primary switches on which the selected group of district junctors are located and the five secondary switches which serve the ten sub-groups of senders. From the normal contacts of the (c) hold magnets to normal contacts of relays (R1) and (R2) over "GT" leads to relays on the miscellaneous relay frame, if the sub-group is not in use the (SGE) relay will be normal and if all senders are not busy or the sub-group made busy relay (SGB) will be normal, if relay (SGB) is operated it will operate the (GB-) relay in the sender link and control circuit opening the operating path for the (SG-) relay. When a sender is idle its (SB-) relay is normal. With any two of the (SB-) relays in a sub-group normal the "GT" lead will be grounded, operating the (SG-) relay in the sender link and control circuit, indicating (1) that there are at least two senders in the sub-group idle, (2) the group is not made busy and (3) not being used by another sender link and control circuit, (4) that there is an idle sender link between the primary switch being used and the secondary switch serving the sub-group of senders.

Reserve Sender Group Test

If sender sub-group selection has not been made before relay (DS) operates, this selection will be made on a "reserve" basis since the operation of relay (DS) indicates that an interval has elapsed which would normally be sufficient to complete sender sub-group selection. The operation of relay (DS) causes relays (R1) and (R2) to operate which in turn disconnect the sender sub-group test relays (SGO) to (SG9) from the "GT" leads and connect them to the ten "RT" leads. The (SGO) to (SG9) relays can operate to ground on the "RT" leads provided the corresponding links are idle. The fact that the (GB-) and (SGE) relays are normal, is an indication that the sender sub-group is not made busy by the "make busy" jack on the sender make busy frame or not held busy by another control circuit and that there is at least one idle sender in the sub-group, relay (SGB) will operate from ground supplied through the series contacts of the (SB-) relays. Relay (SGB) operated (1) closes a traffic register circuit for recording the number of times that all senders of the sub-group are busy, see XB-260, (2) lights a lamp on the sender make busy frame which is primarily intended as a guard signal, (3) removes ground from the "GT" leads, and (4) connects battery to the associated (GB-) relays of all sender link and control circuits served by the sender sub-group. The operation of a (GB-) relay will prevent the corresponding (SG-) relay from operating if there are no idle senders in the sub-group.



N.Y. TEL. CO.
G.P.S. - L.I.

SUB. SENDER LINK AND CONTROL
REGULAR AND RESERVE SENDER GROUP TEST

XB.16

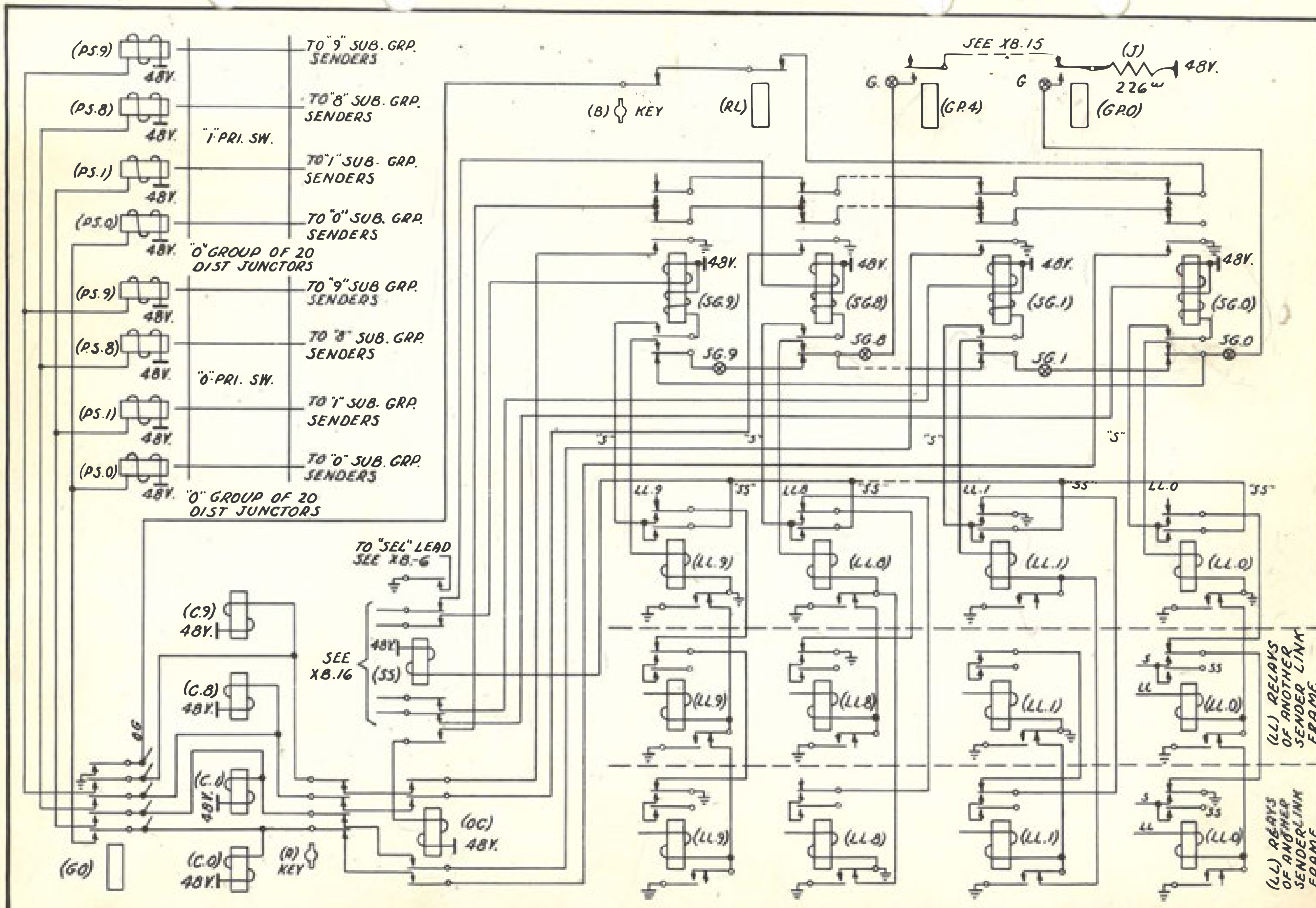
SENDER GROUP SELECTION

With one or more (SG-) relays operated, a circuit is closed from battery at resistance (J) through (GP-) relay contacts to the selecting contacts of the (SG-) relay and from thence to the associated (LL) relay corresponding to the available sender sub-group nearest to the preferred sender sub-group. The (LL) relay is connected to ground and operates when battery is supplied by its associated (SG-) relay.

with the same sdr. grp.

The [redacted] (LL) relays of different sender link frames [redacted]. are connected in a chain circuit, giving a preference to some sender link frame. The preference is arranged so a sender link frame will have first choice in some sender sub-groups and intermediate or last in other sender sub-groups.

Relay (LL) operated: (1) prevents other sender link control circuits from subsequently seizing the sender sub-group, (2) closes the circuit for holding the (SG-) relay operated which has previously operated the (LL) relay, and (3) operates the (SS) relay. When relay (SS) operates, (1) it opens the operating circuits for relays (SG0) to (SG9), see XB-16, (2) closes an auxiliary circuit of ground to the "PA" and "SEL" leads so that the line link and group control circuit will not be dismissed if the last available path is used to serve the call, see XB-6, and (3) prepares the circuit for operating the (OC) relay. Since only one (LL-) relay has operated it follows that only one (SG-) relay will have a holding circuit after relay (SS) has operated. Hence, all (SG-) relays will release except the relay having the holding circuit and when this occurs relay (OC) operates and in turn operates the corresponding (C) relay and the associated (PS) primary selecting magnets under control of the operated (SG-) relay. Since only one (G-) relay is operated the primary selecting magnets are operated on the primary switches serving the selected group of district junctors.



N.Y. TEL. CO.
G.P.S. - L.I.

SUB. SENDER LINK AND CONTROL
SENDER GROUP SELECTION

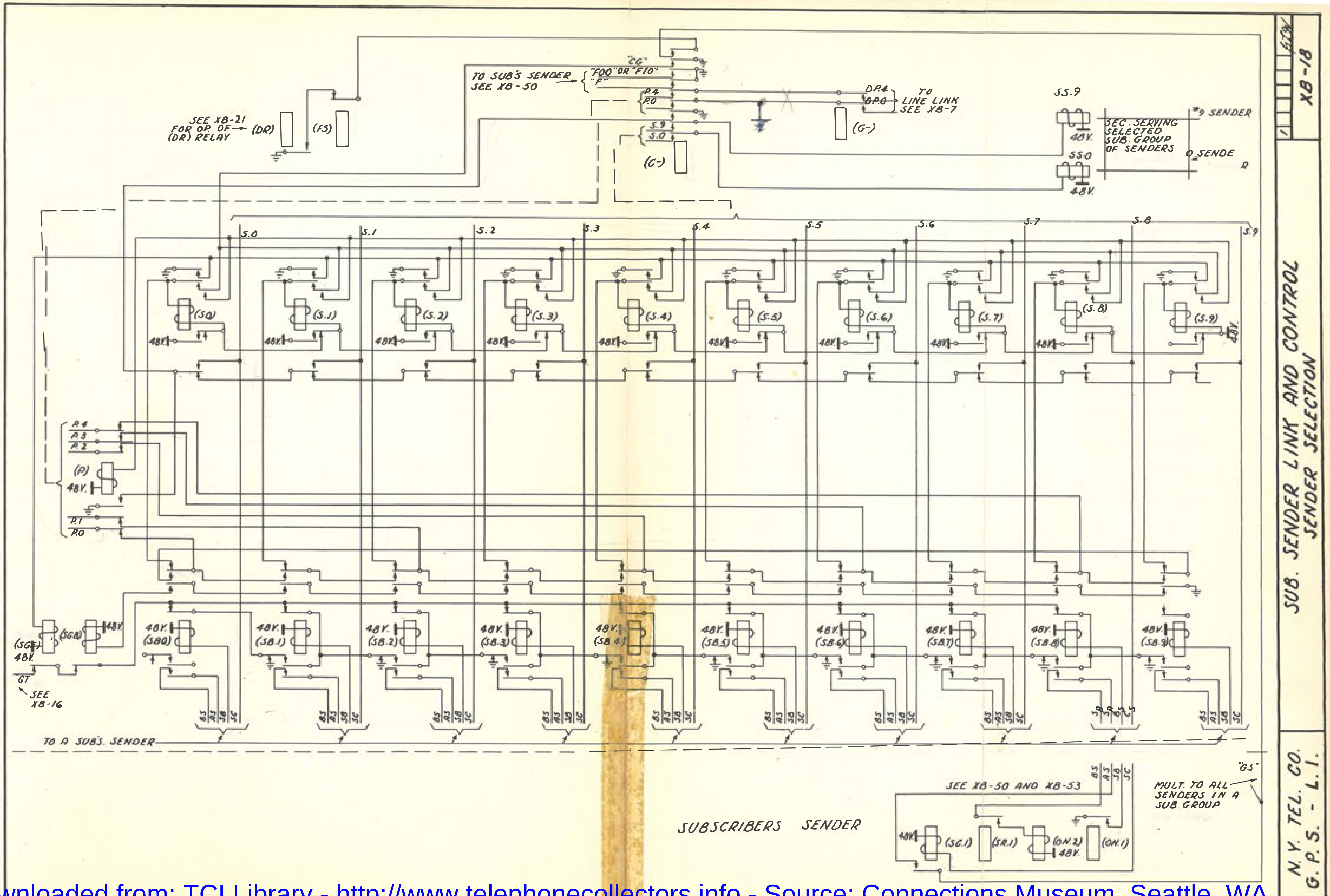
XB.17

SENDER SELECTION

When relay (C-) operates as described in XB-17 it (1) connects ground to the frame indicating leads "F00" or "F10" and "F" as an indication which will be used later by the originating decoder marker to identify the district link and connector frame on which the district junctor serving the call is located, if the district frame number is under 10 lead "F00" will be used, if 10 to 19 lead "F10" will be used, (2) closes leads "RL," "ON," "GS" and "SL" to sender relays, see XB-50, and XB-53, (3) closes the class of service leads "CS0" to "CS7" to the sender connecting relays, (4) ~~closes the leads "P0" to "P4" to the associated sub-group of senders, one of these leads being connected to ground by the line link and group control circuit, see XB-7~~, (5) closes ground for holding any of the relays (S0) to (S9) operated until the connection is completed and (6) closes secondary select magnets (SS0) to (SS9) to relays (S0) to (S9).

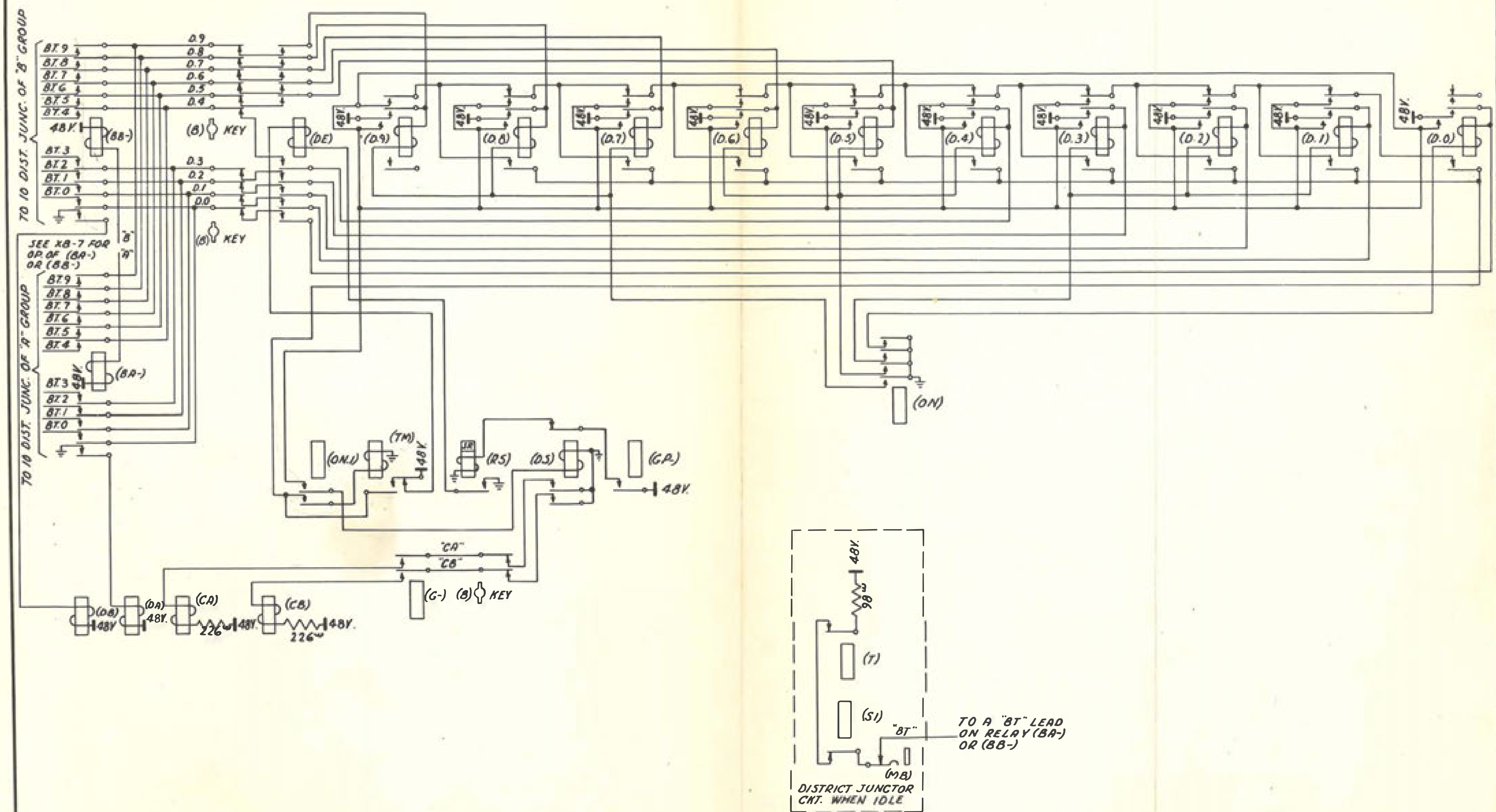
When a sender is idle, ground will not be connected to its associated "SB" lead so that the corresponding (SB-) relay will be normal. If one or more of the (SB0) to (SB9) relays are normal, the ground that is supplied by the operated (LT-) relay of the line link group and control circuit over the "DP-" lead will ground one of the "P" leads and operate a (S-) relay of an idle sender nearest in preference to the preferred sender. The operated (S-) relay (1) locks to ground furnished by relay (C) over lead "CG," (2) selects the sender to be used to serve the call, (3) grounds the "SC" lead to the selected sender and also operates the secondary select magnet at the horizontal level the selected sender appears on the secondary switch serving the selected sub-group of senders under control of relay (C-), (4) operates relay (P) which opens the preference leads, (5) operates relay (SGB) which opens the "GT" and "RT" leads, see XB-16.

When relay (ON1) of the selected sender operates, it grounds lead "SB" to operate the (SB-) relay associated with that sender. When relay (SB-) operates, it (1) opens the test lead to its associated (S-) relay, (2) connects lead "AS" to lead "BS" for controlling the ground which is to hold the established connection so that the connection will not be held by the sender unless its (SB-) relay is operated, (3) closes its series contacts for the "group busy" indication to the winding of relay (SGB) and (4) removes its indication from the "GT" lead.


SUB. SENDER LINK AND CONTROL
SENDER SELECTION
XB-18
N.Y. TEL. CO.
G.P.S. - L.I.
TO SUB'S SENDER
SEE XB-50
"CG"
"FOO" OR "F10"
"F"
SEE XB-21
FOR OP. OF
(DR) RELAY
(DR)
(FS)
P.4
P.0
S.9
S.0
(G-)
DP.4
DP.0
TO
LINE LINK
SEE XB-7
SS.9
SS.0
48V.
SEC. SERVING
SELECTED
SUB. GROUP
OF SENDERS
#9 SENDER
0 SENDER
S.0
S.1
S.2
S.3
S.4
S.5
S.6
S.7
S.8
S.9
(S.0)
(S.1)
(S.2)
(S.3)
(S.4)
(S.5)
(S.6)
(S.7)
(S.8)
(S.9)
P.4
P.3
P.2
(P)
48V.
P.1
P.0
(SGE)
(SG8)
(SB.0)
(SB.1)
(SB.2)
(SB.3)
(SB.4)
(SB.5)
(SB.6)
(SB.7)
(SB.8)
(SB.9)
GT
SEE
XB-16
BS
AS
SB
SC
TO A SUB'S. SENDER
SEE XB-50 AND XB-53
"GS"
MULT. TO ALL
SENDERS IN A
SUB GROUP
SUBSCRIBERS SENDER
(SG.1)
(SR.1)
(ON.2)
(ON.1)

INDICATING WHICH DISTRICT JUNCTORS ARE IDLE IN SELECTED GROUP OF TEN

When ground is connected to an "SL" lead, it causes the preferred line link and group control circuit to hold or lock to the sender link and control circuit, see XB-6, and at the same time causes it to connect ground to an "A" or a "B" lead corresponding to the group of ten districts in which it has decided to place its call, see XB-7. Ground on the selected "A" or "B" lead causes the corresponding (BA-) or (BB-) relay of a group of 20 district junctors to operate, which in turn (1) operates the corresponding (DA-) or (DB-) relay and (2) connects 10 "busy test" BT leads of the associated group of 10 districts through the operated (DE) relay contacts to the district junctor selecting relays (DO) to (D9). When a district junctor is idle it connects battery to its BT lead so that the corresponding (D-) relay will operate for the idle district condition, ground being furnished from the (ON) relay contacts. When any of the relays (DO) to (D9) operate, they will lock to ground furnished by relay (ON). When any relays (DO) to (D9) operate, a circuit is closed for operating relay (DS) which (1) operates relays (CA-) and (CB-) corresponding to the group of 20 district junctors which is serving the call, (2) releases relay (RS) which is slow to release and (3) closes the circuit for operating relays (R1) and (R2), see XB-16. Relay (TM) operates and locks to relay (ON1) if there are two or more (DO) to (D9) relays operated and will not operate if only one (DO) to (D9) relay operates. If only one (DO) to (D9) relay operates during the combined releasing times of relays (RS) and (DE), the circuit assumes that the last idle district junctor circuit is being used to serve the call in which case a circuit is closed later when relay (SL) operates and relay (TM) normal to operate the district junctor group busy traffic register, see XB-255. If relay (TM) operates, it indicates that there are at least two idle districts available for serving the call and opens the path to the district group busy register. Relay (TM) operated also releases relay (DE) immediately without waiting for the slow release (RS) relay to release.



SUB. SENDER LINK AND CONTROL

INDICATING WHICH DISTRICT JUNCTORS ARE IDLE IN SELECTED GROUP OF TEN

XB-19

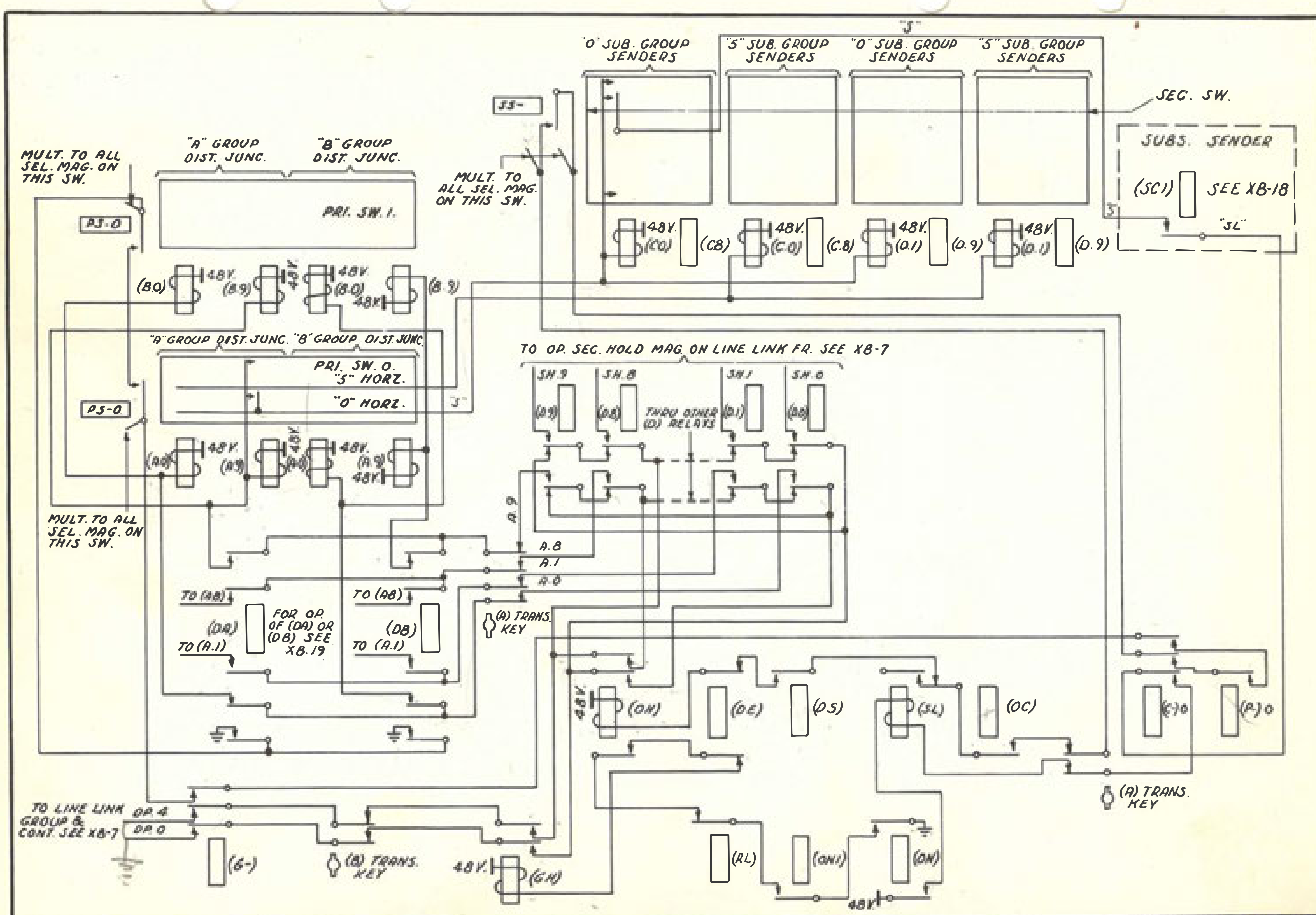
N.Y. TEL. CO.
G.P.S. - L.I.

OPERATION OF PRIMARY AND SECONDARY HOLDING MAGNETS AND (SL) RELAY

When a (C-) relay has operated and the pair of primary select magnets corresponding to the selected sub-group of senders has operated on the two primary switches serving the selected group of district junctors, see XB-17, and one of the (S-) relays has operated a secondary select magnet, see XB-18, a circuit is closed to operate relay (OH). When relay (OH) operates it operates relay (GH) which connects ground furnished over one of the "DPO" to "DP4" leads from the line link and group control circuit through contacts of relay (OH) to one of the "AO" to "A9" leads corresponding with the selected or preferred district junctor circuit. This causes the associated (A) and (B) primary switch holding magnets to operate, which in turn extends the ground over lead "S" to the (C) and (D) secondary switch holding magnets. When the (C) holding magnet operates, it connects ground to the "S" lead of the selected sender and this ground is then closed through the operated (SC1) of the sender to the "SL" lead of the subscriber's sender link circuit to operate the (SL) relay, indicating that the primary and secondary holding magnets have operated. The (B) and (D) holding magnets are checked, operated later over the "T" and "R" leads from the subscriber's line through to the sender circuit.

When relay (GH) operated it locked under control of relay (RL) and connects ground, over one of the "DPO" to "DP4" leads from the line link and group control circuit, to one of the "SHO" to "SH9" leads corresponding with the selected or preferred district junctor circuit. This causes the secondary holding magnet of the line link and group control circuit to operate and lock to ground supplied to lead "SC" through the district junctor circuit by the off normal contact of the (A) holding magnet, see XB-7 and XB-9.

When the secondary holding magnet of the line link and group control circuit operates, it operates a (T-) relay to operate the calling subscriber's line holding magnet.



N. Y. TEL. CO.
G. P. S. - L. I.

SUB. SENDER LINK AND CONTROL

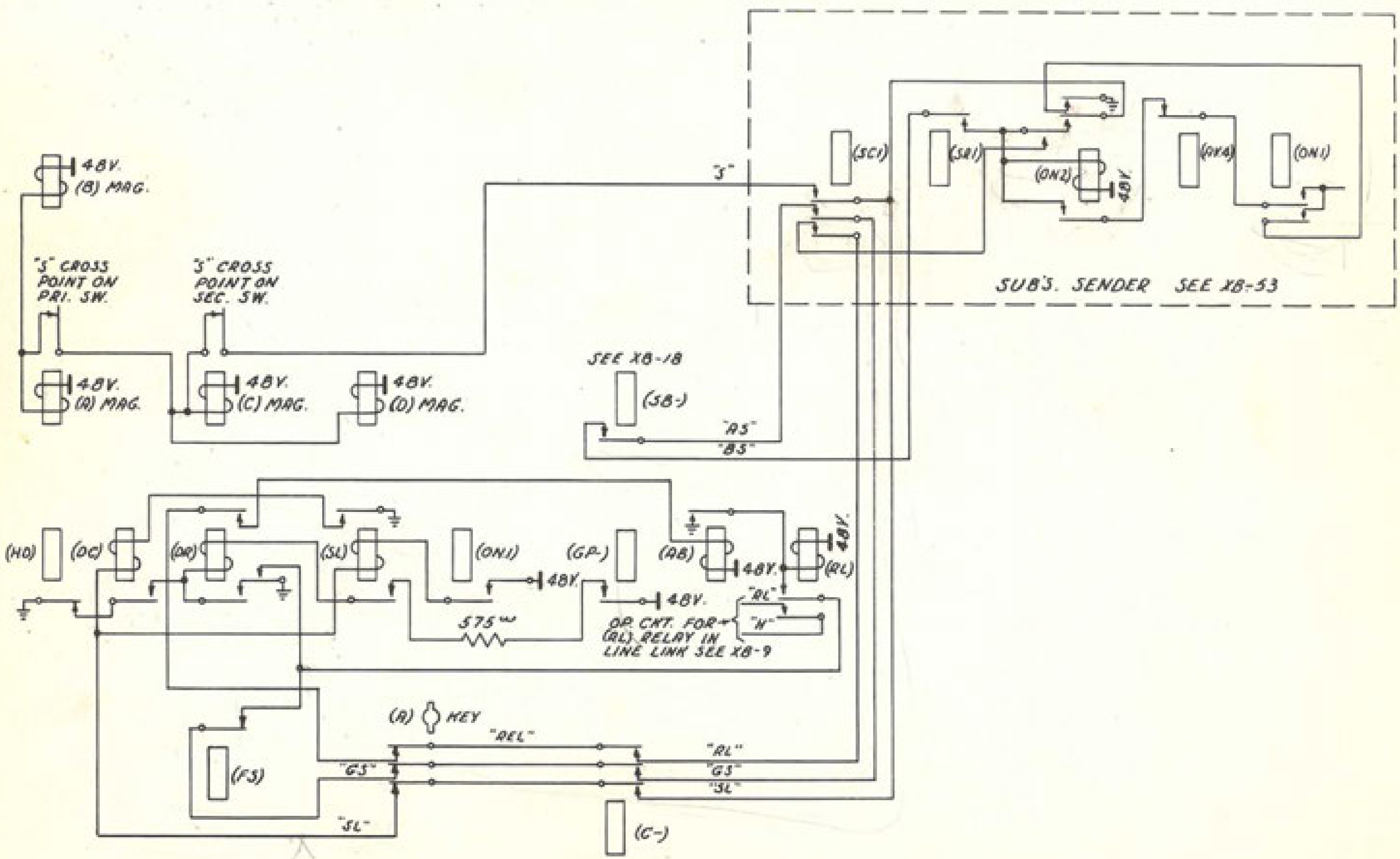
OPERATION OF PRIMARY AND SECONDARY HOLDING MAGNETS AND ALSO (SL) RELAY

XB.-20

DOUBLE CONNECTION TEST, HOLD OF PRIMARY AND SECONDARY HOLDING MAGNETS AND OPERATION OF (RL) RELAY

When relay (SL) operated ~~at~~ it released relay (OH), with relay (OH) released, it opens the ground that it previously supplied over one of the "A" leads for operating the proper set of (A) and (B) holding magnets, see XB-20. This causes the previously operated (A), (B), (C) and (D) holding magnets to hold over lead "S" to lead "SL" in series with the winding of relay (DC) to ground supplied by the (SL) relay. The ground supplied through the winding of relay (DC) is used to hold the established connection and at the same time this holding current is sufficient to operate relay (DC). Relay (DC) will not operate if the sleeve of the established connection is crossed with the holding ground of another busy connection since the operating winding of relay (DC) is shunted under this condition. If relay (DC) does not operate, then the timing relays (W), (Z), (TA), (TB), (AR) and (DS) function to operate an alarm to indicate that a trouble condition has occurred, see XB-22.

If relay (DC) operates, it will operate relay (DR), with relay (DR) operated ground is connected to lead "GS" as an indication to the sender that it should connect ground to the sleeve for holding the established connection, this is done by operating relay (ON2) in the subscriber's sender. The sender also grounds the "RL" to operate relay (AB) which in turn operates the (RL) relay which starts the release of the sender link and control circuit.



N. Y. TEL. CO. G. P. S. - L. I.	SUB. SENDER LINK AND CONTROL DOUBLE CONNECTION TEST, HOLD OF PRI. AND SEC. HOLDING MAGNETS AND OPERATION OF (RL) RELAY	1 XB-21

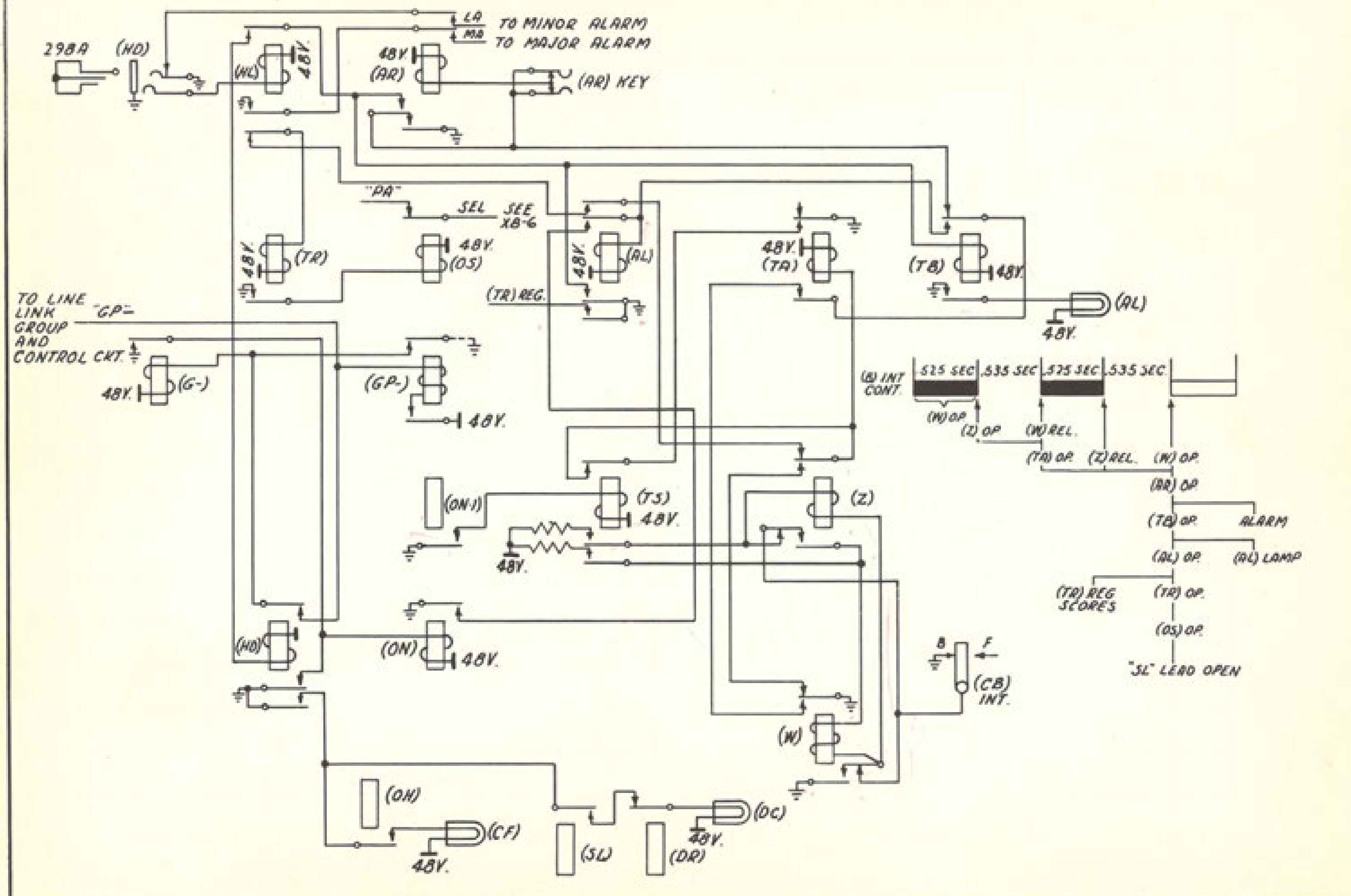
TIMING RELAYS AND USE OF HOLD JACK

The principal function of relays (TS), (W), (Z), (TA), (TB), (TR), (OS), (AR) and (AL) is to time each call in order to dismiss the calling line link and group control circuit within a short interval if a trouble condition is encountered, this timing interval may vary from 1.6 seconds to 2.6 seconds. These relays also serve to record the number of such trouble conditions and also operate an alarm and score a register each time that such a condition occurs.

Relay (TS) operates when relay (ON1) operates to start timing, when the "B" contact of interrupter (CB) makes relay (W) operates relay (Z) being shunted until the interrupter "B" contact breaks at which time relay (Z) operates, at the next make of the interrupter contact "B" relay (W) is shunted down, operating relay (TA) and at the break of the interrupter contact (Z) releases, at the next make of the interrupter relay (W) operates, causing relay (AR) to operate and lock under control of the (AR) key and sounds the alarm, relay (TB) now operates, lighting (AL) lamp and operating relay (AL) which operates the (TR) register for this sender link control circuit and operates relay (TR). Operated (TR) relay operates relay (OS) to open the "SL" lead to the line link group and control circuit so it may serve its call to another or the same sender link and control circuit.

When a particular sender link and control circuit alarm continues to come in, a plug may be inserted in the (HD) jack in order to observe how far the call has progressed and what equipment is being used by the call. With a plug in the hold jack a failure causes the major alarm to sound and holds the 100 district junctors on the sender link frame out of service as well as causing the line link group and control circuit making the call to time out and use its mate control circuit. The hold jack should be used with great care due to delaying a call and holding equipment out of service.

With a plug in the hold jack a time out may cause the (CF) lamp to light indicating the failure occurred with relay (OH) operated, see XB-20. If the (DC) lamp lights it indicates the failure occurred after relay (SL) operated and with relay (DR) normal.



N.Y. TEL. CO.
G.P.S. - L.I.

SUB. SENDER LINK AND CONTROL
TIMING RELAYS AND USE OF HOLD JACK

XB. 22

FALSE STARTS BEFORE AND AFTER RELAY (GH) OPERATES

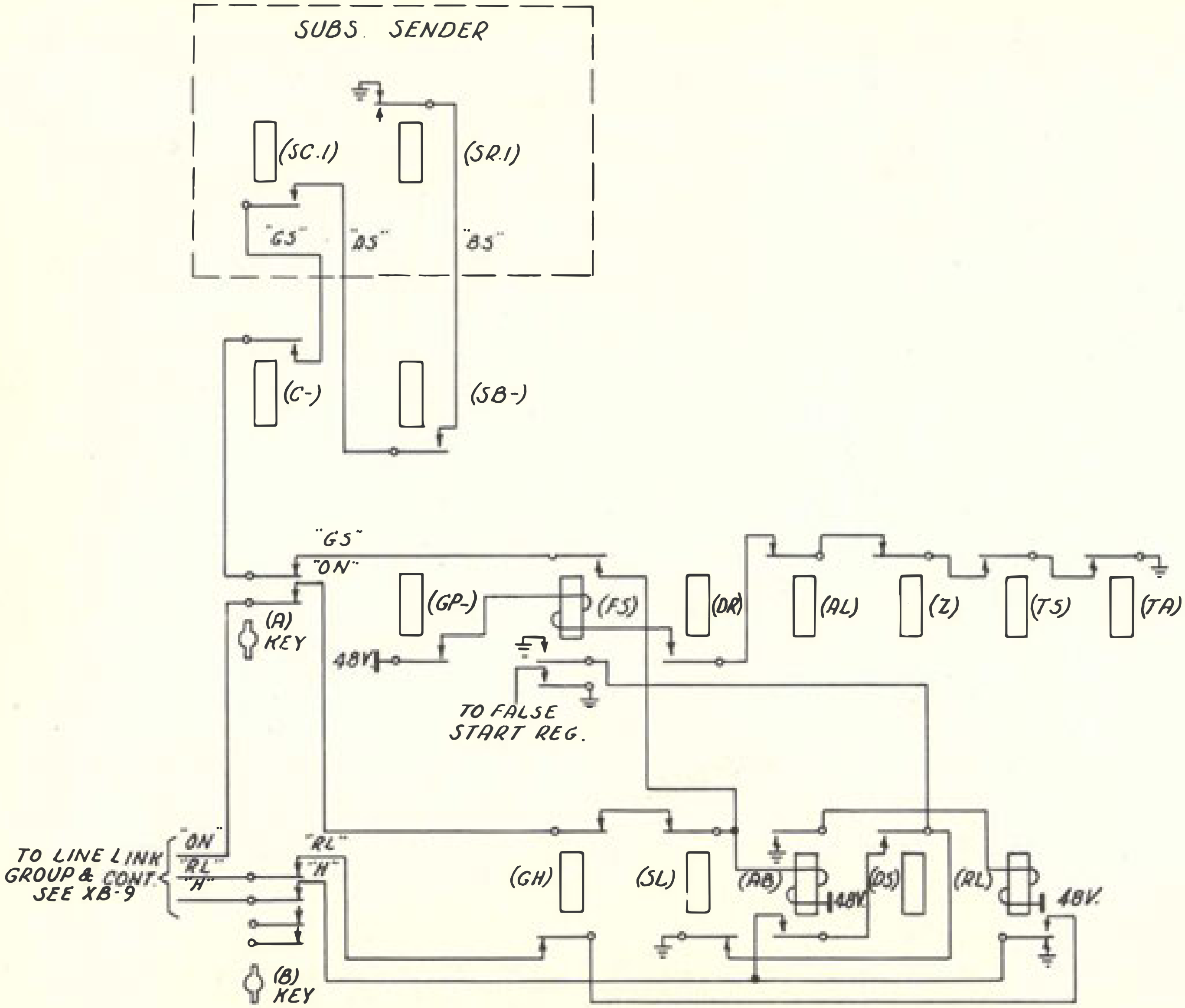
Calls Abandoned Before (GH) Operates

If the calling subscriber disconnects before relay (GH) operates, the line link and group control circuit connects ground to lead "ON" operating the (AB) relay which in turn operates relay (RL). When relay (DS) operates, see XB-19, ground from normal contacts of relay (SL) is closed through to the "RL" lead of the line link group and control circuit operating its RL relay to release that circuit and then the sender link and control circuit will restore in the normal manner.

Calls Abandoned After Relay (GH) Operates

If the calling subscriber disconnects after relay (GH) operates, the abandoned call cannot be recognized until the sender circuit has progressed to the point of testing the dialing tip and ring leads for line closure. If the tip and ring test open due to the subscriber hanging up or a trouble condition wherein the tip and ring conductors through the switches of the established connection are actually open, the (SR1) relay in the sender circuit will not operate.

When relay (DR) operates, see XB-21, and the timing relay function, the (FS) relay operates, in turn scores the false start register of the sender link and control circuit and closes a circuit to operate relay (AB) from ground at normal contacts of relay (SR1) in the sender. Relay (AB) in turn operates relay (RL). The (RL) relay operated, releases the (GH) relay, see XB-20. A circuit is now closed from ground on a make contact of relay (FS) through make contacts of relays (DS), (AB) and (RL) and normal contact of relay (GH) to the "RL" lead of the line link and group control circuit to release that circuit. The sender link and control circuit now releases in the normal manner.



N. Y. TEL. CO.
G. P. S. - L. I.

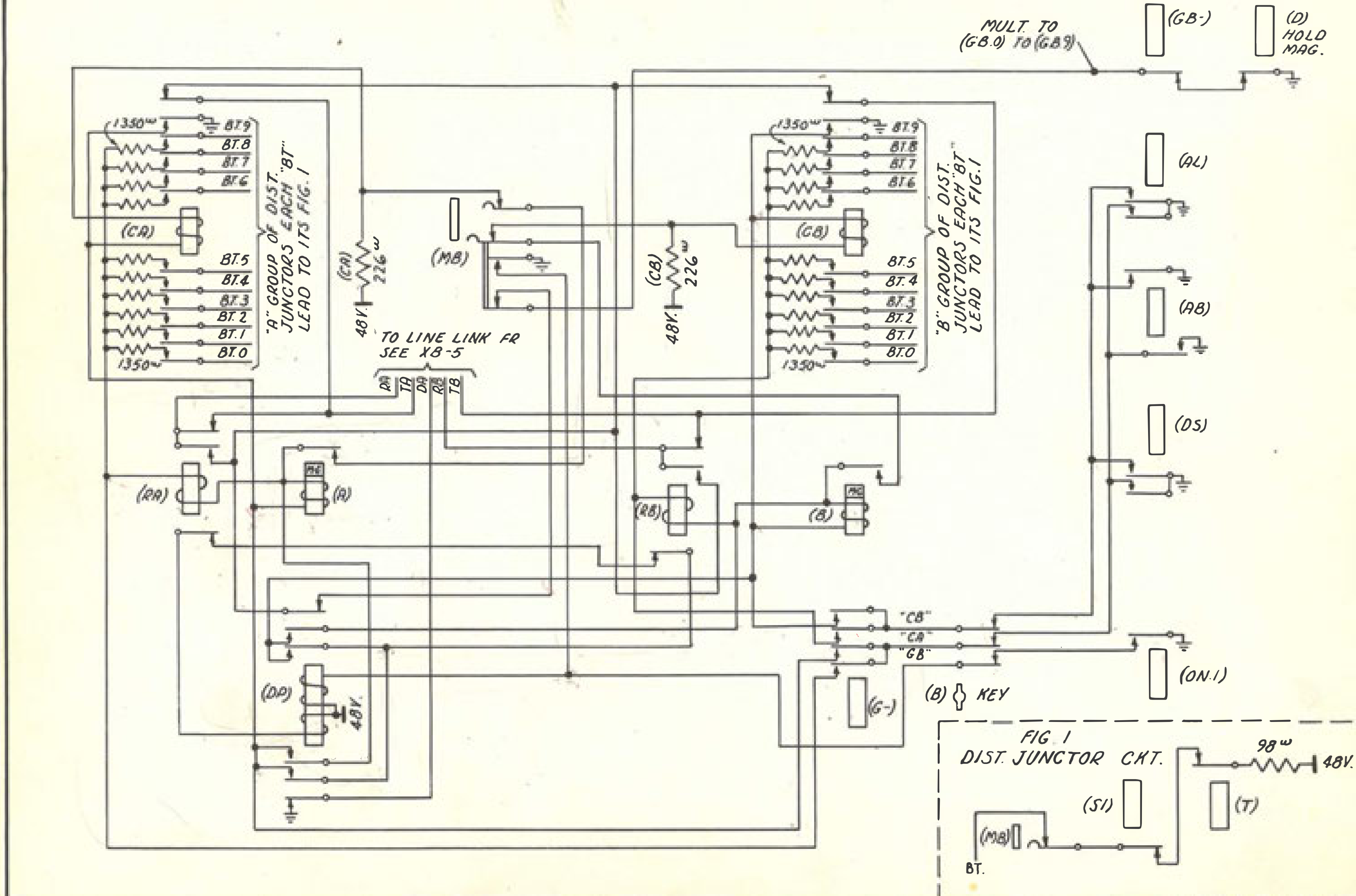
SUB. SENDER LINK AND CONTROL
FALSE STARTS BEFORE AND AFTER RELAY (GH) OPERATES

XB-23

DISTRICT GROUP INDICATION TOWARD THE LINE LINK AND GROUP CONTROL CIRCUITS

As shown on XB-15 when relay (ON1) operates the five (DP) relays operate, one for each group of 20 district junctors, with any one or all of the relays (DS), (AB) or (AL) operated a circuit is closed to operate and lock relays (CA) and (CB) associated with the group of 20 district junctors which is serving the call. Relay (CA) operated closes through 10 "BT" leads to the 10 district junctors in the (A) group and likewise relay (CB) closes through 10 "BT" leads to the 10 district junctors in the (B) group, these leads will be used to determine whether there is one or more than one district still available in the group of 10 districts that served the call. Relays (RA), (A), (RB) and (B) remain normal until the shunt is removed by the release of relay (G). Relay (DP) will remain operated through the normal contacts of relays (RA) and (RB). At this time if there is one idle district in a group of 10 districts, battery through 98 ohms over the "BT" lead and 1350 ohms will operate the (RA) or (RB) relay, releasing relay (DP). Since relays (A) and (B) are marginal they will not operate under this condition, but if two or more districts in a group of 10 are idle the effective resistance to battery will be lowered allowing relay (A) or (B) to operate. When relay (A) operates it shunts the operating battery of relay (CA) causing it to release, relay (B) treats relay (CB) in a like manner. If during this test none of the 20 districts are idle the (RA) and (RB) relays will remain normal holding relay (DP) operated until one of these relays operate. With relay (DP) operated ground is removed from the "DA" lead to the line link group and control circuits and also the possible paths to ground for leads "TA," "TB," "RA" and "RB" are open, thus indicating to the line link group and control circuits that these districts are not available to serve a call.

Assume there were at least two idle districts in (A) group and that the sender link and control circuit was not in use indicated by relay (DP) being normal, the group was not made busy and there was an available sender and link to that sender indicated by a normal (GB-) relay and associated (D) holding magnet. Under these conditions ground would be present on lead "TA" due to relay (CA) being normal, relay (DP) normal, (MB) jack normal, relay (GB-) normal and holding magnet (D) normal. With only one district available relay (CA) will be operated opening the ground to lead "TA" but lead "RA" will be closed to ground due to relay (RA) being operated.



N.Y. TEL. CO.
G.P.S. - L.I.

SUB. SENDER LINK AND CONTROL.

DISTRICT GROUP INDICATION TOWARD THE LINE
LINE LINK AND GROUP CONTROL CIRCUITS

1 2

XB-24

RECEIVING DIAL TONE

When the sender link and control circuit has selected an idle sender, ground is placed on the "SC" lead causing the sender (SC1) relay to operate, also the (SC2) relay will operate if the (F) hold magnet is normal as will be the case under normal conditions. The (SC2) releases when the (F) hold magnet operates in order to remove the "F" lead ground from the select magnets and not interfere with recording dial registration.

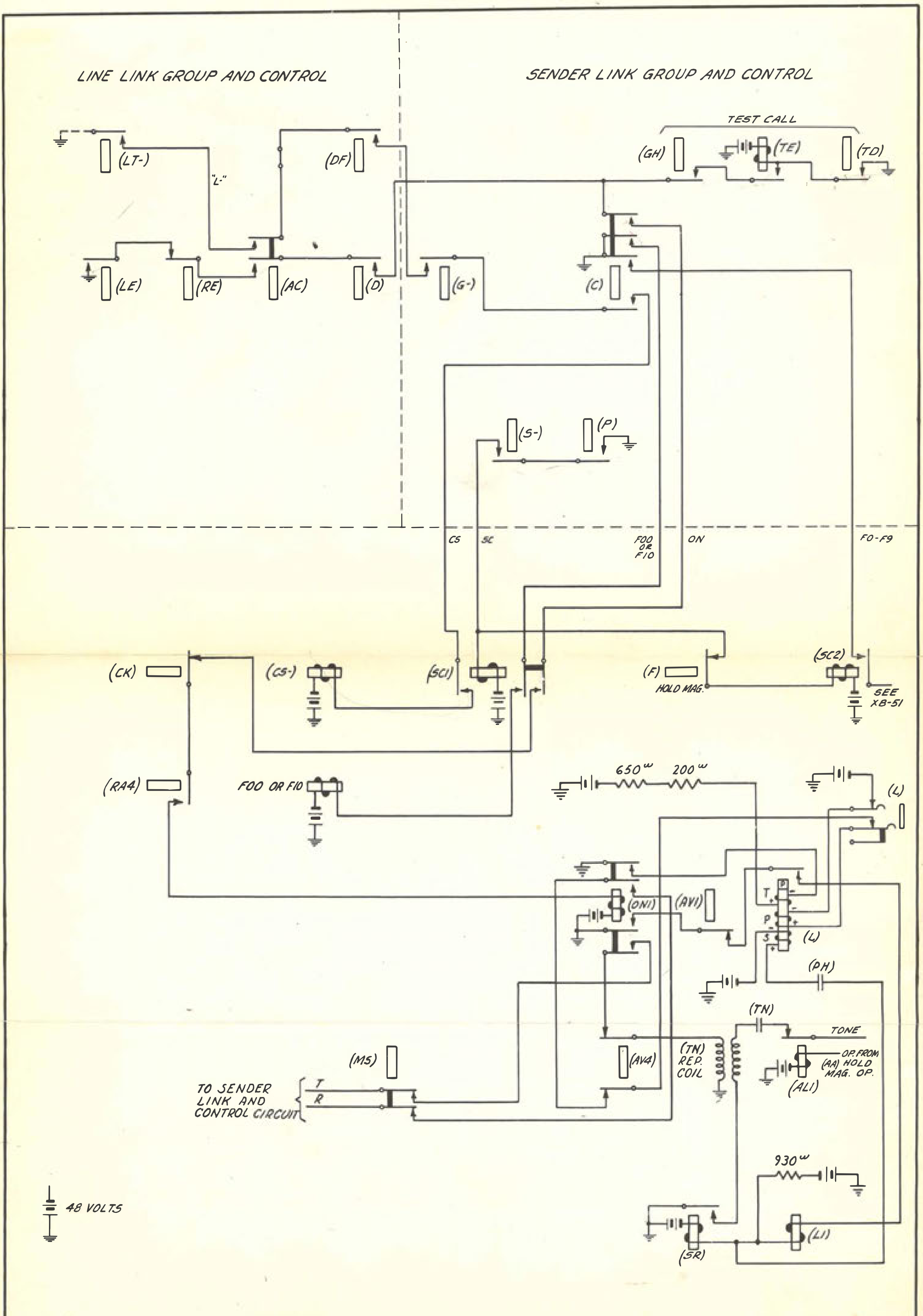
The operation of the (SC1) relay closes through several leads from the sender link and control circuit to the sender, among them the "CS" leads to indicate the class of service originating the call. The particular "CS" lead grounded by the (LT-) relay in the line link group and control circuit operates the (CS-) relay in the sender for that class of call. The operated (SC1) relay also closes through the "F00" and "F10" leads one of which will be grounded, the "F00" lead for district frames 0 to 9 and the "F10" lead for district frames 10-19.

The operation of relay (SC2) closed through the F0-F9 leads, one of which will be grounded depending upon the district frame being used. For example if district frame eleven was being used the "F10" and "F1" leads would be grounded.

When the frame indication has been made on the sender crossbar switch (which will be described later), relay (RA4) operates, closing a circuit to operate relay (ON1) from ground on the "ON" lead. This lead is grounded as soon as the line link group and control circuit has operated its primary hold magnet which causes the subscriber's (L) relay to release, in turn releasing relay (RE).

With relay (ON1) operated the tip and ring are closed allowing the sender (L) relay to operate over the subscriber loop. The operation of relay (L) and (ON1) allows relays (SR) and (L1) to operate in series. Relay (SR) operated places ground on one side of the dial tone induction coil giving the calling subscriber dial tone until relay (AL1) operates, which occurs after one digit has been dialed and caused hold magnet (AA) to operate.

The (CK) relay does not normally operate, but if two or more (CS) relays should operate or both the (F00) and (F10) relays should operate, or if two cross points for frame indication should be closed the (CK) relay will operate opening the "ON" lead, thus blocking the call causing the sender link and control circuit to time out and select another sender.



N. Y. TEL. CO.
G.P.S. ... 1-1

SUBSCRIBER SENDER
RECEIVING DIAL TONE

XB-50

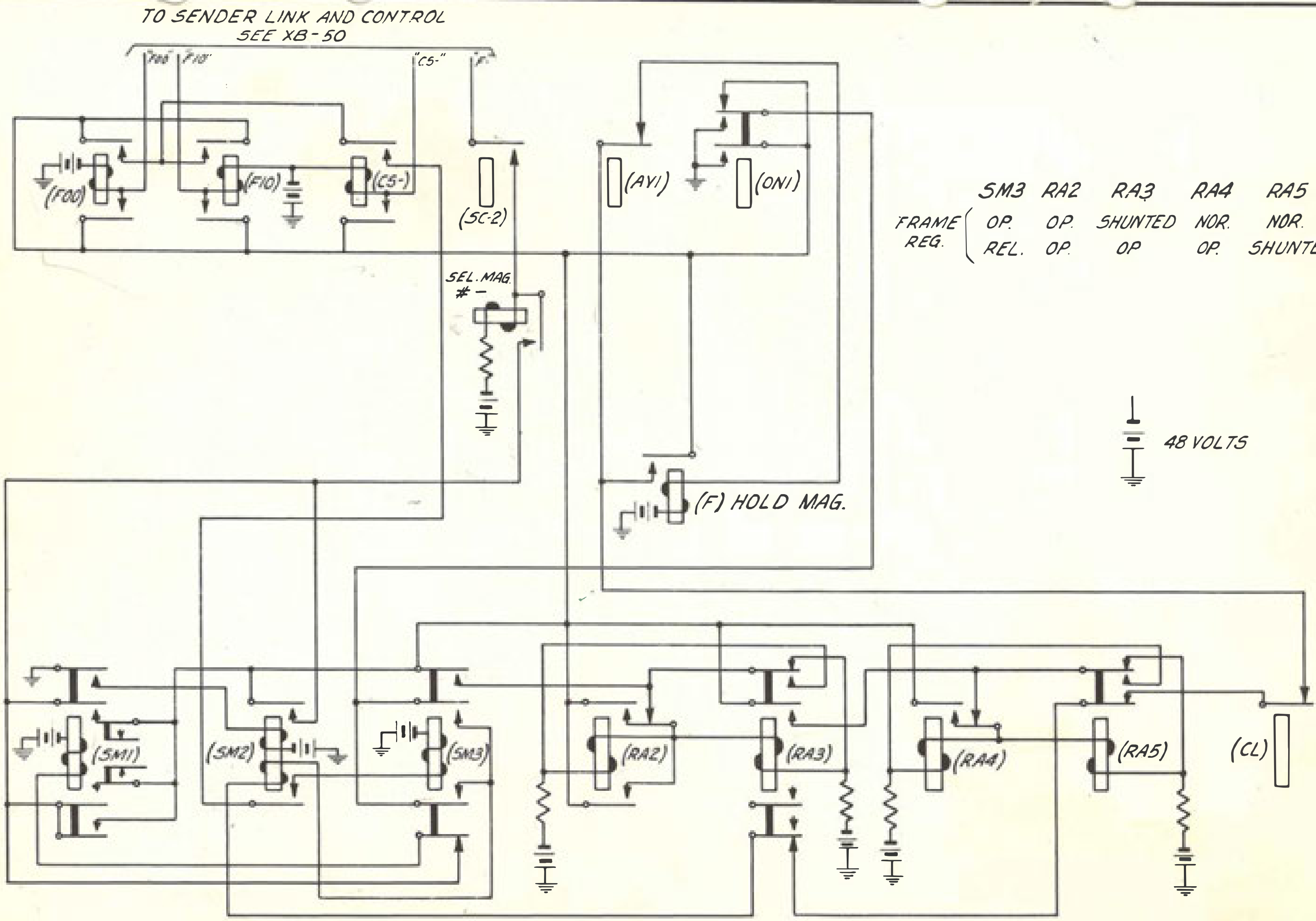
RECORDING DISTRICT FRAME INDICATION

When relay (SC2) was operated by the grounded "SC" lead from the sender link and control circuit, one of the "FO" to "F9" leads were grounded. Each of these leads were connected to the select magnets of the sender cross bar switch, lead "FO" going to zero select magnet and so on until lead "F9" which is connected to nine select magnet.

The operation of the select magnet corresponding to the grounded "F" lead closes ground to operate relay (SM1) through the normal contacts of relay (SM3). Relay (SM1) operated places off normal ground, which is supplied at this time by an operated (FOO), (F10) or (CS-) relay to lock the operated select magnet; also operated (SM1) caused relay (SM2) to operate, this relay also places off-normal ground to hold the select magnet. A circuit is now closed to operate relay (SM3). Relay (SM3) operated causes relay (RA2) to operate and shunts the operating battery for relay (RA3). The operation of relay (SM3) causes relay (SM1) to release, but (SM2) relay does not release since it is held in series with the (F) hold magnet.

When the (F) hold magnet operates it locks to off-normal ground and shunts the battery which is holding relay (SM2), causing it to release, which in turn causes the select magnet and relay (SM3) to release. The release of relay (SM3) removes the shunt from relay (RA3) allowing it to operate which in turn causes (RA4) to operate and shunts the operating battery for relay (RA5).

As was explained in RECEIVING DIAL TONE, with relay (RA4) operated a circuit was closed in part for the "ON" lead which allowed relay (ON1) to operate.



		SM3	RA2	RA3	RA4	RA5
FRAME REG.	OP.	OP.	OP.	SHUNTED	NOR.	NOR.
	REL.	OP.	OP.	OP.	OP.	SHUNTED

N. Y. TEL. CO.
G.P.S. L.I.

SUBSCRIBER SENDER
RECORDING DISTRICT FRAME INDICATION

XB-51

TWO PARTY TESTS AND CHECKS

If a sender is wired to serve two party subscribers, tests are made to determine whether the tip or the ring party is calling when a two-party message rate line calls, but these tests are omitted and the time intervals required to make them are eliminated when a line of any other class calls. The class of call is determined by the (CS-) relay which operates immediately after relays (SC-1) and (SC-2) when the link control circuit grounds the "SC" lead.

When a line of another class calls, relay (ON3) operates at once from a contact of the (CS-) relay serving that class, and it remains operated throughout the call. This cuts through the "T" and "R" leads so that the (L) relay can operate at once after relay (ON1) operates.

When a two-party message rate line calls, the line is tested for a 1000 ohm ringer ground, which indicates a tip party, by connecting the winding of relay (TP) to both sides of the line before dialing starts. The same test is made again after dialing is completed, and if the two tests agree the call proceeds. If they disagree, it is blocked and the sender times out. If relay (TP) does not operate on either test, indicating the ring party calling, it is operated locally through a resistance high enough to test its operation under extreme line conditions, after the sender has cut through the district and is ready for release. If it fails to operate, the call is not blocked but the sender is held busy, times out, and cannot be restored by priming but must be attended to by the maintenance force.

Relays (CS-) and (ON1) in operating connect the winding of relay (TP) to the "T" and "R" leads. If relay (TP) operates, indicating a tip party is calling, it will operate relay (TP1) to register the tip party for later transmission to the decoder. Relay (TP1) will lock for the duration of the call.

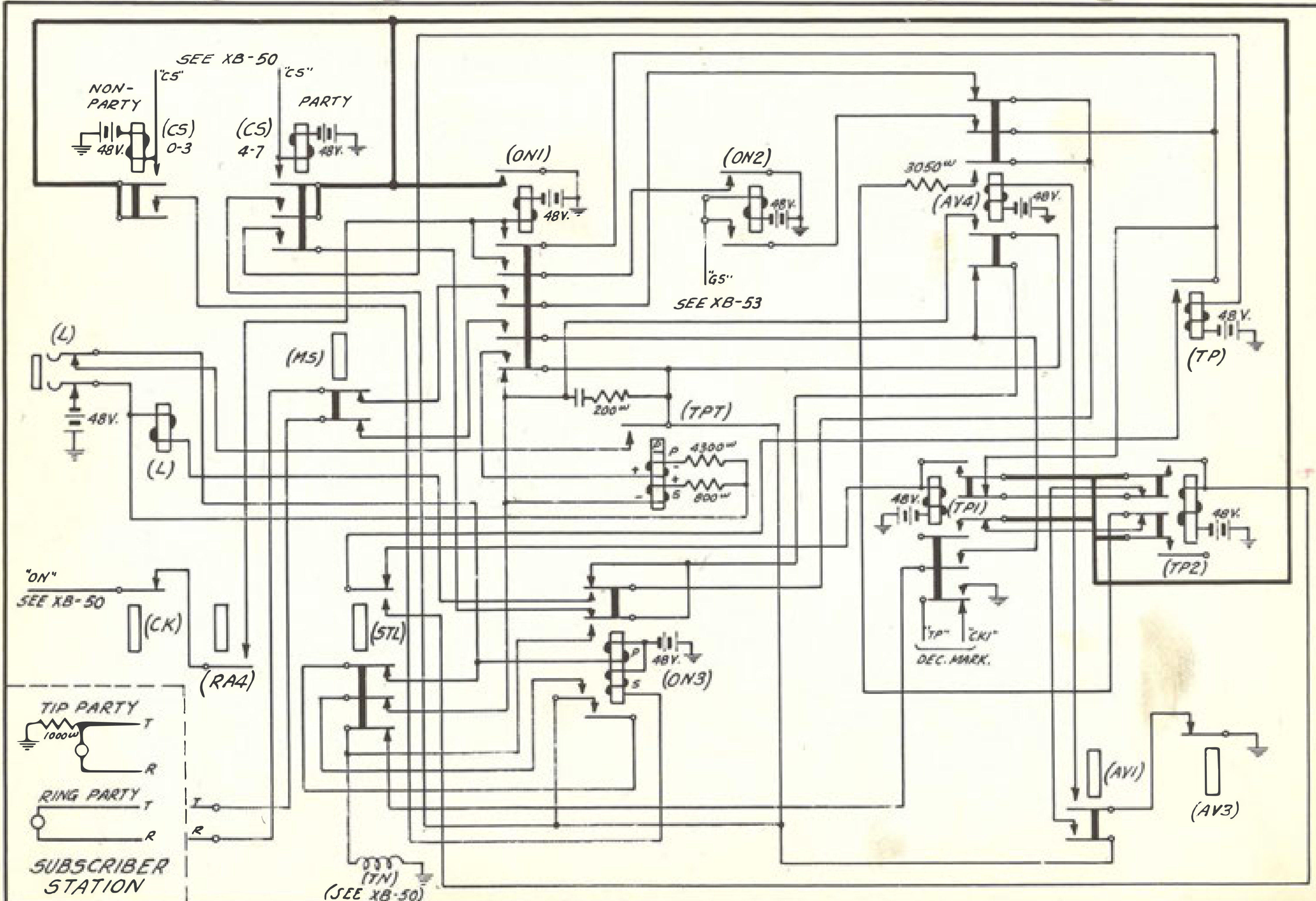
Sufficient time for relay (TP) to operate is measured by the slow operation of the condenser timed relay (TPT). When the (CS-) relay operates, it connects ground through a back contact of relay (ON1) to the secondary winding of relay (TPT), which will set it on its back contact if it should happen to be on its front contact. The condenser will have been discharged through this same back contact of relay (ON1). When relay (ON1) operates after the registration of the frame number and class of service, it opens direct ground from the secondary winding of relay (TPT), and connects it to the primary winding. Current will start to flow through the primary winding, tending to move the armature over to the front contact, but current will also start to flow through the secondary winding to charge the condenser. The secondary winding being stronger, the relay will hold to its back contact for a short time, but as the condenser charges the secondary current decreases until finally the armature will move to close the front contact, then relay (ON3) will operate and lock through a back contact of relay (STL).

With relay (ON3) operated ground is connected through a back contact of relay (STL) to the secondary winding of relay (TPT), restoring that relay to its back contact and discharging the condenser. Relay (ON3) operated also disconnects the "T" and "R" leads from the winding of relay (TP) and connects them to the (TN) repeating coil and (L) relay. Relay (L) can now operate and proceed to give the subscriber dial tone. If the tip party is calling, relay (TP1) connects the "T" lead to the (TN) repeating coil as soon as it operates, which is before relay (ON3) operates. This is to discharge the line and prevent tapping the ring party bell when relay (ON3) does operate.

When dialing has been completed, relay (STL) operates. This releases relay (ON3), breaks direct ground from the secondary winding of relay (TPT), transfers the connection of the contact of relay (TP) from the winding of relay (TP1) to that of relay (TP2) and breaks the circuits just described for discharging the line through the (TN) repeating coil and a front contact of relay (TP1). The release of relay (ON3) connects the "T" and "R" leads again to the winding of relay (TP), disconnecting them from the (TN) coil and the (L) relay. It also bridges a path about the front contact of relay (L) so that the release of relay (L) will be without effect, relay (SR) holding up. If relay (TP) operates, it operates relay (TP2) which locks up.

Sufficient time for relay (TP) to operate is again measured by relay (TPT). The breaking of ground from the secondary winding of relay (TPT) by the operation of relay (STL) does not at once stop the flow of current in that winding, but simply starts it to charging the condenser. When the condenser is charged, relay (TPT) makes its front contact and operates relay (ON3) again. This time relay (ON3) neither locks or restores relay (TPT) to its back contact, both these circuits having been broken at back contacts of relay (STL). But relay (TPT) continuing on its front contact, it continues to hold relay (ON3). Relay (ON3) operated transfers the "T" and "R" leads from the winding of relay (TP) to the (TN) coil and the (L) relay, and removes the bridge from the front contact of relay (L) so that the sender may recognize an abandoned call. If the tip party is calling, relay (TP2) connects the "T" lead to the (TN) repeating coil to discharge the line and prevent bell tapping.

After dialing is completed and relay (STL) operated, the sender completes its selections and then operates relays (AV1) and (AV2), releases relay (AV3) and operates relay (AV4). The operation of relay (AV4) releases relay (ON2) and the link switches. Relay (ON1) releases after relay (ON2) if the tip party is calling, but if it is the ring party relay (ON1) is held up by a circuit through front contacts of relays (CS-) and (AV1), and back contacts of relays (TP2) and (TP1). Relay (AV4) operated connects ground to the secondary winding of relay (TPT), making it break its front contact and also release relay (ON3). Relay (TP) now operates through both the tip and ring back contacts of relay (ON3), a front contact of (AV4), a 3050 ohm resistance, and back contacts of (TP1) and (TP2). Relay (TP) operated, operates relay (TP2) which breaks the circuit just described for holding relay (ON1) and also breaks the circuit to the winding of relay (TP). Until relay (TP) releases it holds relay (ON1) through the locking contact of relay (TP2). If this operating test of relay (TP) fails, or if on any call relay (TP) sticks up, relay (ON1) will be held until released manually.



N. Y. TEL. CO.
G. P. S. L. I.

SUBSCRIBER SENDER
TWO PARTY TESTS AND CHECKS

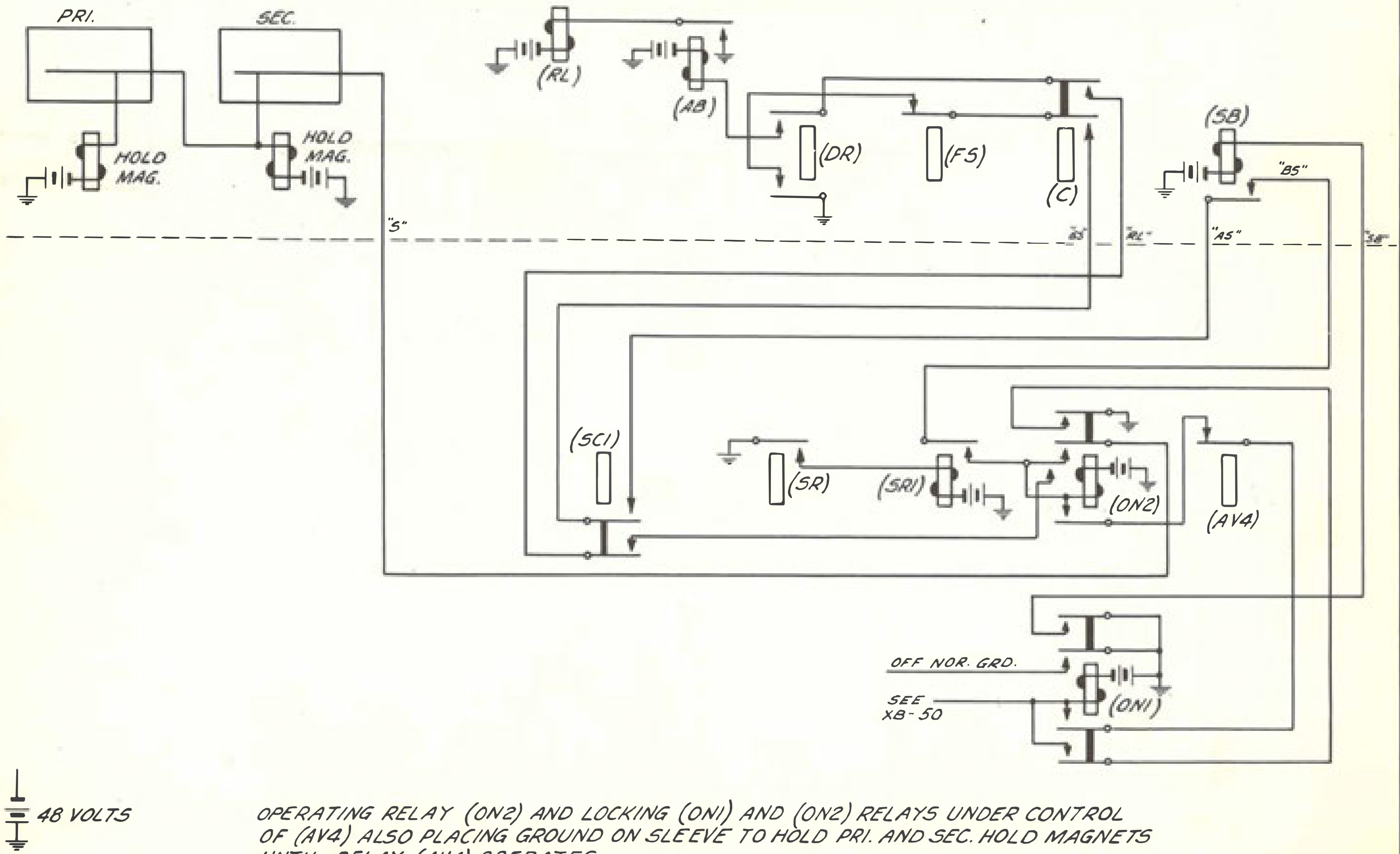
1 2

XB-52

HOLDING SENDER LINK HOLD MAGNETS AND RELEASE OF CONTROL CIRCUIT

When relay (ON1) of the sender operated, the "SB" lead was grounded to operate its associated (SB) relay in the sender link and control circuit, to indicate a sender busy condition to other calls as long as this sender is held. With relay (SB) operated, ground is placed on the "BS" lead to operate relay (ON2) which locks relay (ON1) and itself under control of relay (AV4). Relay (ON2) operated also places ground on the sleeve to hold the sender link and control primary and secondary hold magnets. Also relay (ON2) places ground on the "RL" lead to the sender link and control circuit to start the release of that circuit.

SENDER LINK AND CONTROL CIRCUIT



OPERATING RELAY (ON2) AND LOCKING (ON1) AND (ON2) RELAYS UNDER CONTROL OF (AV4) ALSO PLACING GROUND ON SLEEVE TO HOLD PRI. AND SEC. HOLD MAGNETS UNTIL RELAY (AV4) OPERATES

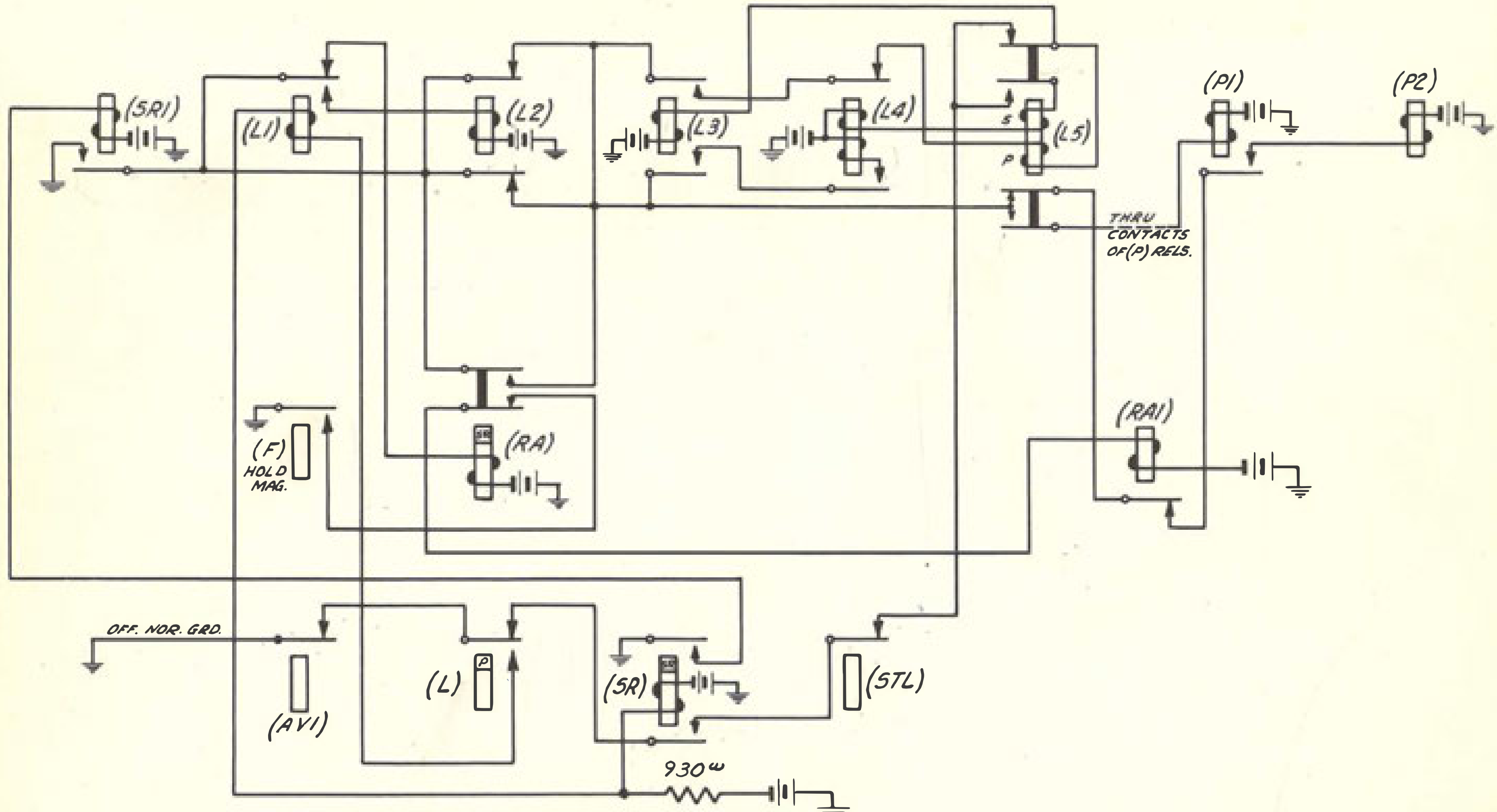
N.Y. TEL. CO. G.P.S. L.I.	SUBSCRIBER SENDER HOLDING SENDER LINK HOLD MAGNETS AND RELEASE OF CONTROL CIRCUIT	XB-53

OPERATION & RELEASE OF RELAY (L5) DUE TO DIAL PULSES

The polarized relay (L) operated when the tip and ring leads were cut through from the calling line to its winding, and remains operated except for a momentary release on each break of the dial until the sender is disconnected, unless the subscriber hangs up to abandon the call. Relays (LI) and (L2) operate and release with (L). Relays (SR) and (SR1) operate on the first operation of relay (L) and release when the call is completed or abandoned. The (SR) relay being slow release type holds up while the (L) relay releases during dial pulses, and in turn holds relay (SR1).

Relay (RA) operates through a back contact of relay (LI) on the first dial break of each digit dialed and remains operated throughout that series of pulses despite the repeated momentary breaking of its operating path. It releases each time the dial comes to rest after sending pulses for one digit. The (RA1) relay operates and releases in reverse to the (RA) relay, except that it cannot operate for the first time until the (F) hold magnet operates.

Relays (L3), (L4) and (L5) serve to transmit the dial pulses, represented by back contact closures of relay (L), over two leads alternately to the pulse counting relays. Relay (L3) operates when relay (L) releases on the first dial break of each digit, and relay (L5) operates by its primary winding in series with relay (L3) when relay (L) operates on the following dial closure. Relay (L4) operates in series with the secondary winding of relay (L5) when relay (L) releases on the second dial break, and that causes relay (L3) to release, but relay (L5) is still held up by its secondary winding. Then when relay (L) operates on the following closure, relays (L4) and (L5) both release. Any possibility of relay (L4) releasing before relay (L3), and thereby preventing the release of relays (L3) and (L5), is prevented by locking the secondary winding of relay (L4) to a front contact of relay (L3). The cycle repeats for every two pulses of the digit. If the number of pulses is even, the last pulse leaves the three relays normal. If the number is odd, relay (L4) is left normal and relays (L3) and (L5) release after the last pulse because the operation of relay (L2) and the release of relay (RA) break all ground connections which could hold them up. The important fact for future reference is that each odd pulse of a digit operates relay (L5) and each even pulse releases it.



48 VOLTS

(L)	(L3)	(L4)	(L5)	
REL	OP			ODD PULSE
OP	Hold ~~OP~~		OP	
REL	REL	OP	Hold ~~OP~~	EVEN PULSE
OP	REL	REL	REL	

N. Y. TEL. CO.
G.P.S. L.I.

SUBSCRIBER SENDER
OPERATION AND RELEASE OF RELAY (L5) DUE TO DIAL PULSES

1 2

XB-54

COUNTING PULSES OF EACH DIGIT BY THE OPERATION AND RELEASE OF (L5) RELAY

The pulses of each digit are counted on relays (P1) to (P6), which are operated in rotation by alternate closure of the front and back bottom contacts of relay (L5) and each of which locks until released by the operation of another, or by the operation of relays (RA1) and (SM1) at the end of a series of pulses.

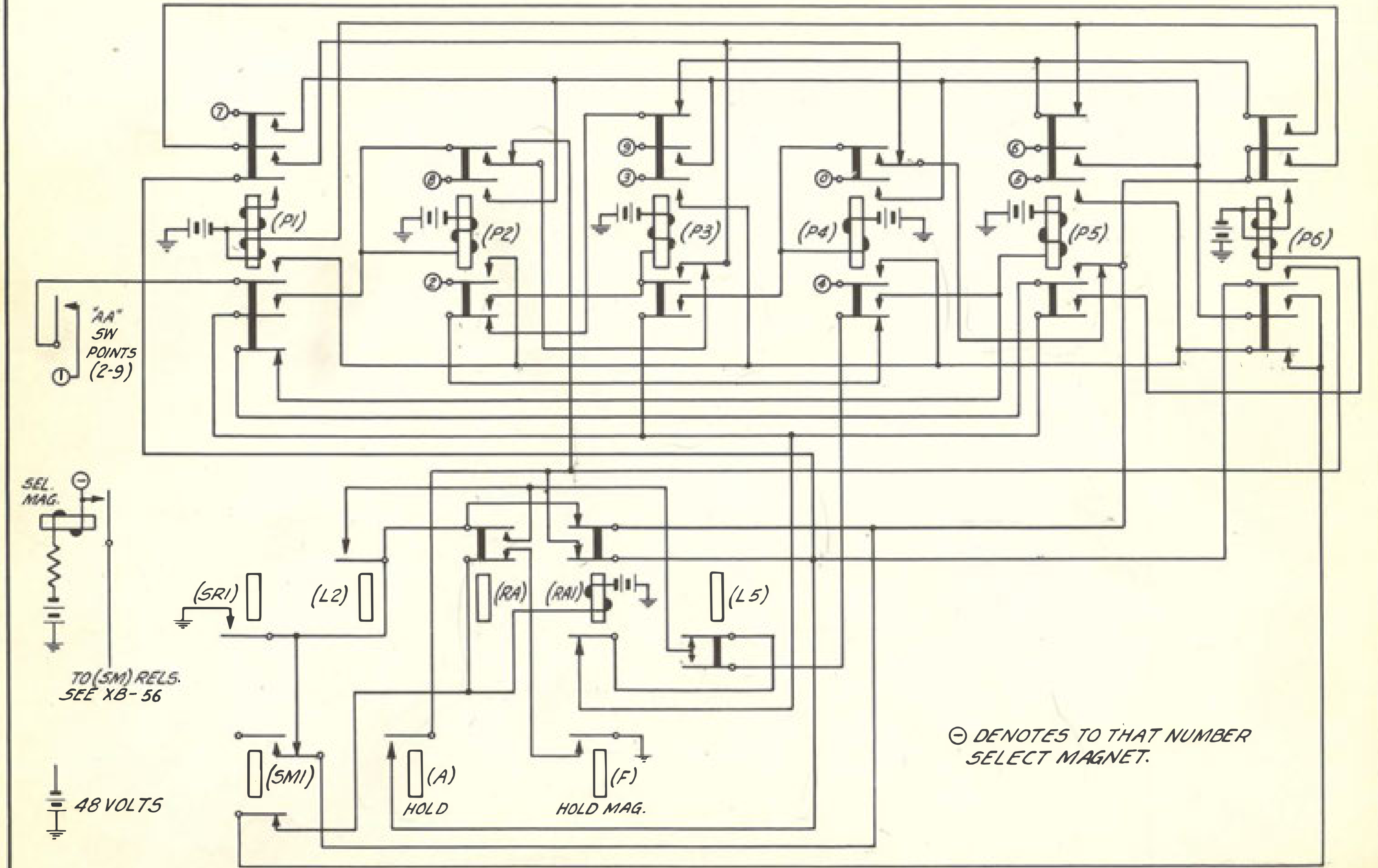
The first pulse of a digit operates relay (L5) as has been described, connecting ground through back contacts of relays (P4), (P2), (P3) and (P5) to operate relay (P1) which locks through back contacts of relays (P2), (P3), (P4) and (P5). The second pulse releases relay (L5) connecting ground through back contact of (RA1) and front of (P1) to operate (P2) which releases (P1) and locks itself through the same path which previously locked (P1). The third pulse operates (L5) connecting ground through back contact of (P4) and front of (P2) to operate (P3), which unlocks (P2) and locks itself. The fourth pulse acts similarly to operate (P4) and release (P3), and the fifth pulse to operate (P5) and release (P4). The sixth pulse operates (P6) through front contact of (P5) and (P6) locks up for the remainder of the digit but does not unlock (P5). The seventh pulse operates (P1) again, this time operating and locking through front contacts of (P6), instead of back contacts of (P5) and releasing (P5). The eighth, ninth and tenth pulses operate (P2), (P3) and (P4) respectively, each (P) relay as it operates unlocking the one ahead of it. The (P) relays operated after each pulse are tabulated below:

Pulse	(P) Relays
1	(P1)
2	(P2)
3	(P3)
4	(P4)
5	(P5)
6	(P5)-(P6)
7	(P1)-(P6)
8	(P2)-(P6)
9	(P3)-(P6)
10	(P4)-(P6)

When relay (RA) releases at the end of the first series of pulses some one (not number one) of the ten select magnets operates in accordance with the number dialed and the (P) relay or relays then operated. Before the release of relay (RA) can be effective in operating a select magnet, hold magnet (F) must have been properly operated by the district frame indication, to ground the contact of (RA). This is to insure that the first dialed digit cannot be registered on the (F) vertical of the switch, in case the district frame registration fails for any reason.

The select magnet passes its operating ground on to operate relay, (SM1) in the same manner as RECORDING FRAME INDICATION.

When relay (SM1) operated it broke the last locking path for the (P) relays. Relay (RA1) having operated in parallel with the select magnet, whatever (P) relays are operated then release. The (SM1) relay operated also breaks the operating path of the select magnet, but before breaking either of these circuits relay (SM1) closes a circuit to lock itself and the select magnet.



⊖ DENOTES TO THAT NUMBER SELECT MAGNET.

N.Y. TEL. CO.
G.P.S. L.I.

SUBSCRIBER SENDER

COUNTING PULSES OF EACH DIGIT BY THE OPERATION & RELEASE OF (L5) REL.

XB-55

OPERATION OF HOLD MAGNETS FOR DIALED DIGITS

When a select magnet operates from the (P) relays for the first digit, its operating ground causes relay (SM1) to operate. With relay (SM1) operated relay (SM2) operates through its primary winding and causes relay (SM3) to operate, this in turn releases relay (SM1). A circuit is closed from ground through the secondary winding of relay (SM2) front contact of relay (RA3), and back contacts of relays (RA5), (CL) and (PS) to the winding of the (A) hold magnet; and another circuit from ground through back contact of relay (AV1), front contact of relay (RA3) and back contacts of the (C) and (B) hold magnets to the winding of the (AA) hold magnet. These circuits operate the (A) and (AA) hold magnets, and the first also holds (SM2) after (SM1) releases.

The hold magnets close the contacts of the cross points at the level of the operated select magnet. Both hold magnets lock up and when both have operated the locking ground for hold magnet (A) short circuits the secondary winding of relay (SM2), which releases followed by (SM3). The operated hold magnet operates relay (AL1) which removes dial tone.

When relay (SM1) operated it broke the last locking path for the (P) relays, relay (RA1) having operated in parallel with the select magnet, whatever (P) relays are operated then release. Relay (SM1) operated also breaks the operating path of the select magnet, but before breaking either of these circuits relay (SM1) closes a circuit to lock both itself and the select magnet.

Relay (SM2) operated closes another circuit to lock the select magnet after relay (SM1) has released. The select magnet finally releases when relay (SM2) releases after the operation of both (A) and (AA) hold magnets.

All digits that are dialed after the first, are registered in the same way on the succeeding registers upon the successive releases of relay (RA). Each register after the (A) has one hold magnet which closes the contacts of one cross point.

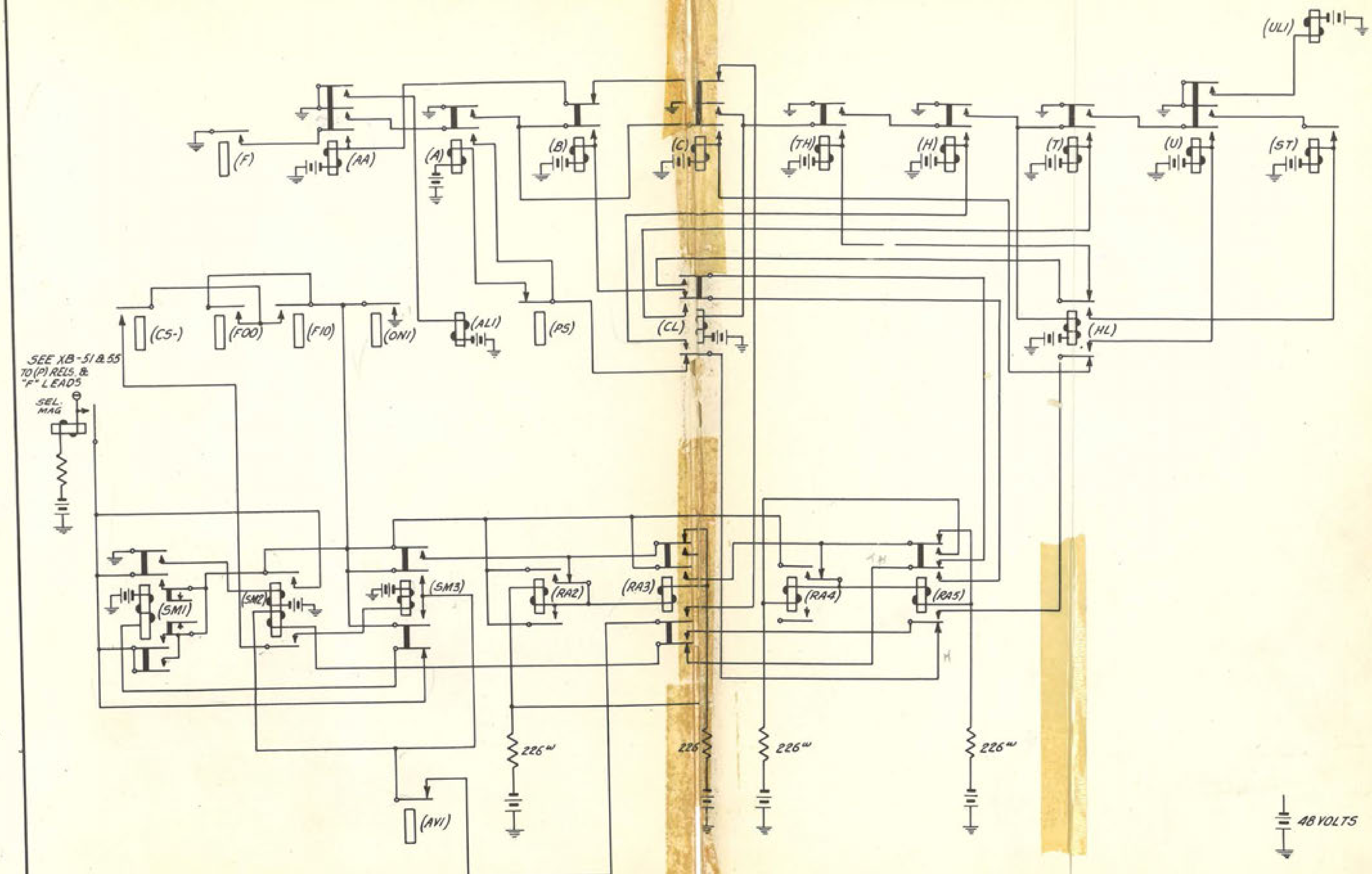
The hold magnet operating path from contacts of relay (SM3) through secondary winding of (SM2) is steered to the successive hold magnets by transfer contacts on relays (RA3), (RA5), (CL) and (HL). The operating path from contacts of relay (SM3) which does not go through secondary winding of relay (SM2) is effective only to operate the (AA) hold magnet, being open at a front contact of relay (RA3) during the registration of the frame and the second dialed digit, and open at the back contacts of the (B) and (C) hold magnets during later dial registration. In general a contact on each hold magnet provides a locking ground for the next one.

Each time a registration is made the operation and release of relay (SM3) causes the (RA2), (RA3), (RA4) and (RA5) relays to function as shown in the following table:

Reg.	SM3	RA2	RA3	RA4	RA5
F	O	O	N	N	N
	N	O	O	O	N

Reg.	SM3	RA2	RA3	RA4	RA5
AA & A	O	N	O #	O #	N
	N	N	N	O #	O
~~B~~ C	O	O	N	O #	O #
	N	O #	O	N	O #
C TH	O	N	O #	N	O #
	N	N	N	N	N
TH H	O	O	N	N	N
	N	O #	O	O	N
~~H~~ T	O	N	O #	O #	N
	N	N	N	O #	O
~~T~~ U	O	O	N	O #	O #
	N	O #	O	N	O #
~~U~~ ST	O	N	O #	N	O #
	N	N	N	N	N
~~ST~~	~~O~~	~~O~~	~~N~~	~~N~~	~~N~~
	~~N~~	~~O~~	~~O~~	~~O~~	~~N~~

The office code is registered on the (A), (B) and (C) registers and the numerical digits are registered on the (TH), (H), (T) (U) registers and the station or fifth numerical digit on the (ST) register.



XB-56

SUBSCRIBER SENDER
OPERATION OF HOLD MAGNETS FOR DIALED DIGITS

N.Y. TEL. CO. L.I.
G.P.S.

OPERATION OF (DST) RELAY AND FUNCTIONS OF (TR) RELAYS

Relay (DST) operates when the operation of relay (CL) shows that the office code has been dialed, or when the (O) cross point on the (AA) register closes showing that zero has been dialed for a first digit, or when relay (PS) operates to indicate that dialing has not commenced in the time allowed by the timing circuit or that the sender has been primed out.

Relay (DST) operated connects battery to leads "ST" and "CBS" to the decoder connector, with the effect that the latter connects the sender to an idle decoder over about 60 leads as soon as the connector and a decoder are available.

Office code and other information passes from the sender to the decoder over some of these leads, after decoding, selection information passes from the decoder to the sender over other leads.

After decoding and making progress in its function of establishing a connection through district and office frames, the decoder grounds lead "DC", which is one of the leads through the decoder connector, and so operates relay (DC). The ground applied by the decoder, besides operating relay (DC), also operates the (F) relay in the district junctor, which in turn operates (LC) relay in the district link and connector circuit where another ground is supplied to it by the decoder marker. This second ground holds relay (DC) locked up for a time after the direct connection between sender and decoder is broken by the release of the decoder connector.

When the decoder has sent its selection information to the sender and has also operated relay (DC), it grounds lead "RL" through the decoder connector. This operates relay (DRL), which locks up for as long as (DST) remains operated, which is for the duration of the use of the sender on the call unless a second trial should be required. Relay (DRL) breaks the "ST" lead, thereby releasing the decoder connector and breaking all direct connections between sender and decoder. Relay (DRL) also grounds the "LR" lead to the sender link to lock up certain relays in the district junctor which may have been operated directly by the decoder marker.

The sender is still in indirect communication with the decoder marker through the sender link and the district junctor. When the decoder marker has completed its work of establishing a connection from the calling line through the district and office frames, it removes ground from the "DC" lead and relay (DC) releases. This signals the sender to proceed with its work.

If the decoder marker encounters trouble in receiving information from the sender in decoding or in transmitting information to the sender, or if it finds all trunks of both regular and alternate routes to the desired point busy and also all overflow trunks busy, it sends a trouble release by grounding lead "TRL" and so operates relay (TRI), which releases relay (DST), which breaks the "ST" lead, thereby releasing the connector and breaking all direct connections between the sender and decoder marker. Lead "TRL" being broken with the rest, relay (TR2) operates in series with relay (TR1). Relay (DST) now reoperates with the result that a second connection is made through the decoder connector to the decoder. This may be the same decoder as before, but usually will be a different one, since the first decoder holds itself busy momentarily after sending a trouble release. Relay (TR2) being operated on the second trial, lead "AR" to the decoder will be grounded to notify the decoder to use the alternate route to the desired point, if there is an alternate route. The second decoder marker will now try to establish the connection.

If the first decoder marker encounters either trouble or an all paths busy condition when trying to establish connection to a chosen idle trunk or overflow trunk after its direct connection with the sender through the decoder connector has been broken down, it sends a trouble release by grounding momentarily lead "TR" through the district and sender link. The (DC) relay being operated at that time causes the "TRL" lead to receive this ground, operating the (TR) relays in the same manner as if the lead had been grounded via the decoder connector, which would cause the release of the (DST) and (DRL) relays; also all selection register relays and all relays fed by off-normal battery. The operation of relay (TR2) operates relay (DST) again with the result that a second connection is made through the decoder connector to a decoder. Relay (TR2) being operated on the second trial, lead "AR" to the decoder marker will be grounded to the desired point if there is an alternate route. The second decoder marker will try to establish the connection in all other respects the same as the first did.

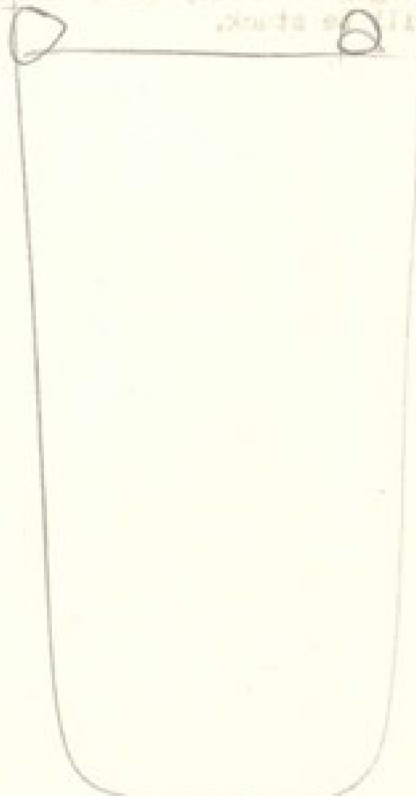
If the first decoder functions successfully and is dismissed but the sender in making selections beyond receives an overflow signal because of a distant panel type selector running to overflow or tell tale, or because of some trouble affecting a crossbar terminating sender, relays (AV2) and (AV3) will connect a ground for a moment only to the "TRL" lead. This momentary ground causes the (TR) relays to function as has been described.

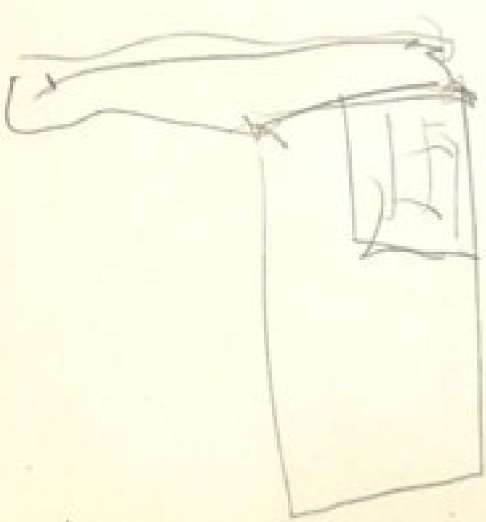
For the brief time between a first and a second trial, while relay (DRL) is normal, the ground on the "LR" lead through the sender link to the district is broken in order to release relays locked up in the district and allow them to be reused.

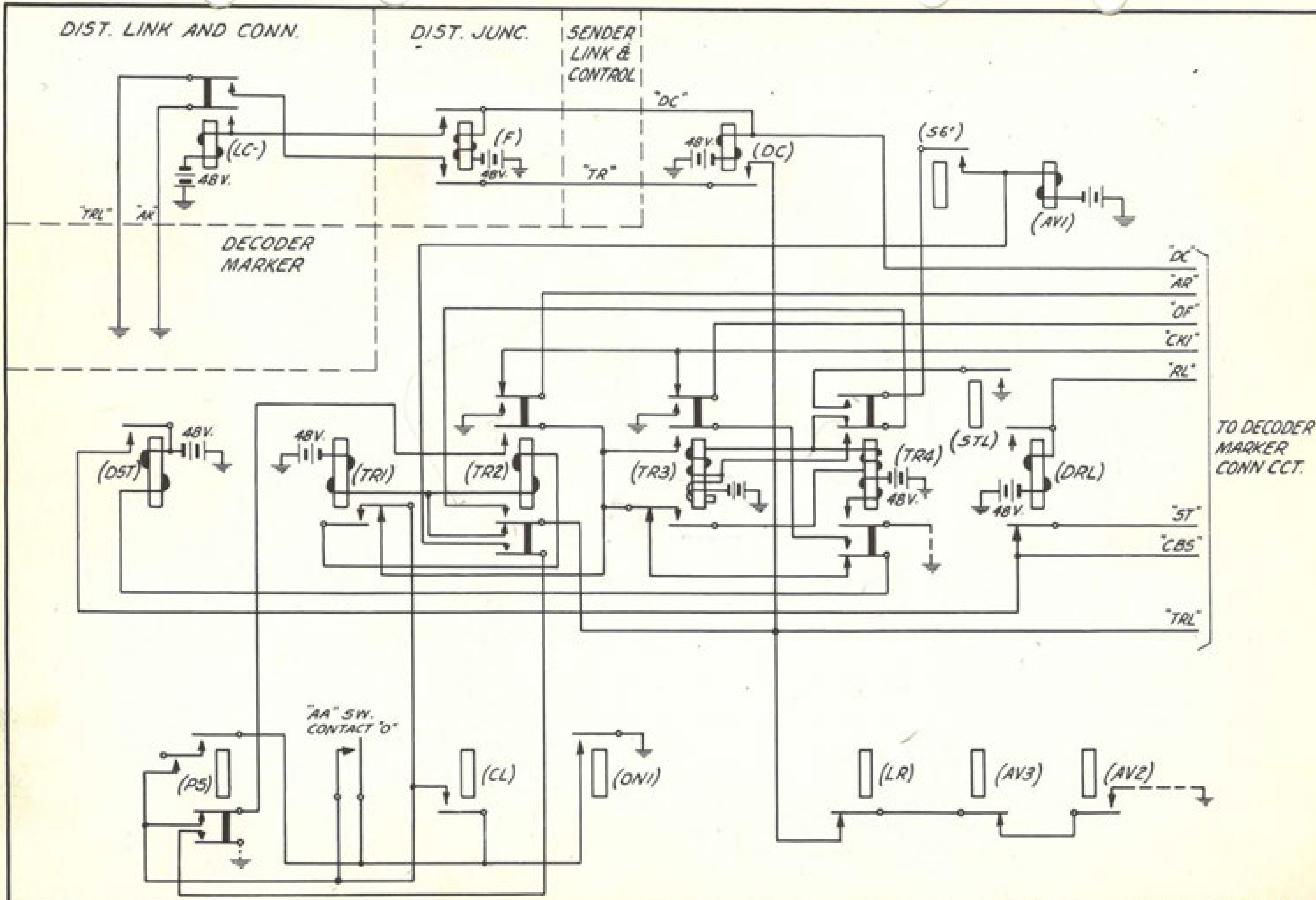
If both first and second trials with the decoder result in a trouble condition the "TRL" lead will be grounded a second time which will cause relays (DST) and (DRL) to release and relays (TR3) and (TR4) to operate. Relay (TR3) being operated on the third trial, lead "OF" to the decoder will be grounded to notify the decoder to establish connection to an overflow trunk. The decoder will send selection information to the sender, operate relay (DC), operate relay (DRL), connect the district to an overflow trunk, and release relay (DC) just as it would function for connecting to a regular trunk. In case it cannot find an idle overflow trunk, or finding one cannot find an idle path to it, it will nevertheless operate relay (DC), operate relay (DRL) and release relay (DC), just as if it had succeeded in making the connection.

For a brief time between a second and a third trial, while (TR3) is operated and (TR4) is normal, the "LR" lead through the sender link to the district is broken in order to release relays locked up in the district and allow them to be reused.

If the third trial encounters any one of the conditions which cause a retrial, the "TRL" lead will be momentarily grounded a third time. Relays (TR1), (TR2), (TR3) and (TR4) all being locked up, this ground will shunt down and release (TR3), but (TR4) will hold by its secondary winding. Relay (DST) releases and breaks the "ST" lead, releasing the decoder connector if still engaged. Relay (TR3) cannot reoperate, neither can (DST), and the sender will be stuck.







N. Y. TEL. CO.	SUBSCRIBER SENDER	1 2 3
G. P. S. L. I.	OPERATION OF THE DECODER START RELAY (DST) ALSO OPERATION OF (TR) RELAYS FROM "TRL" LEAD TO GIVE ALTERNATE ROUTE OR OVERFLOW INDICATION TO DECODER MARKER	XB - 57

TIMING FOR STATION DELAY

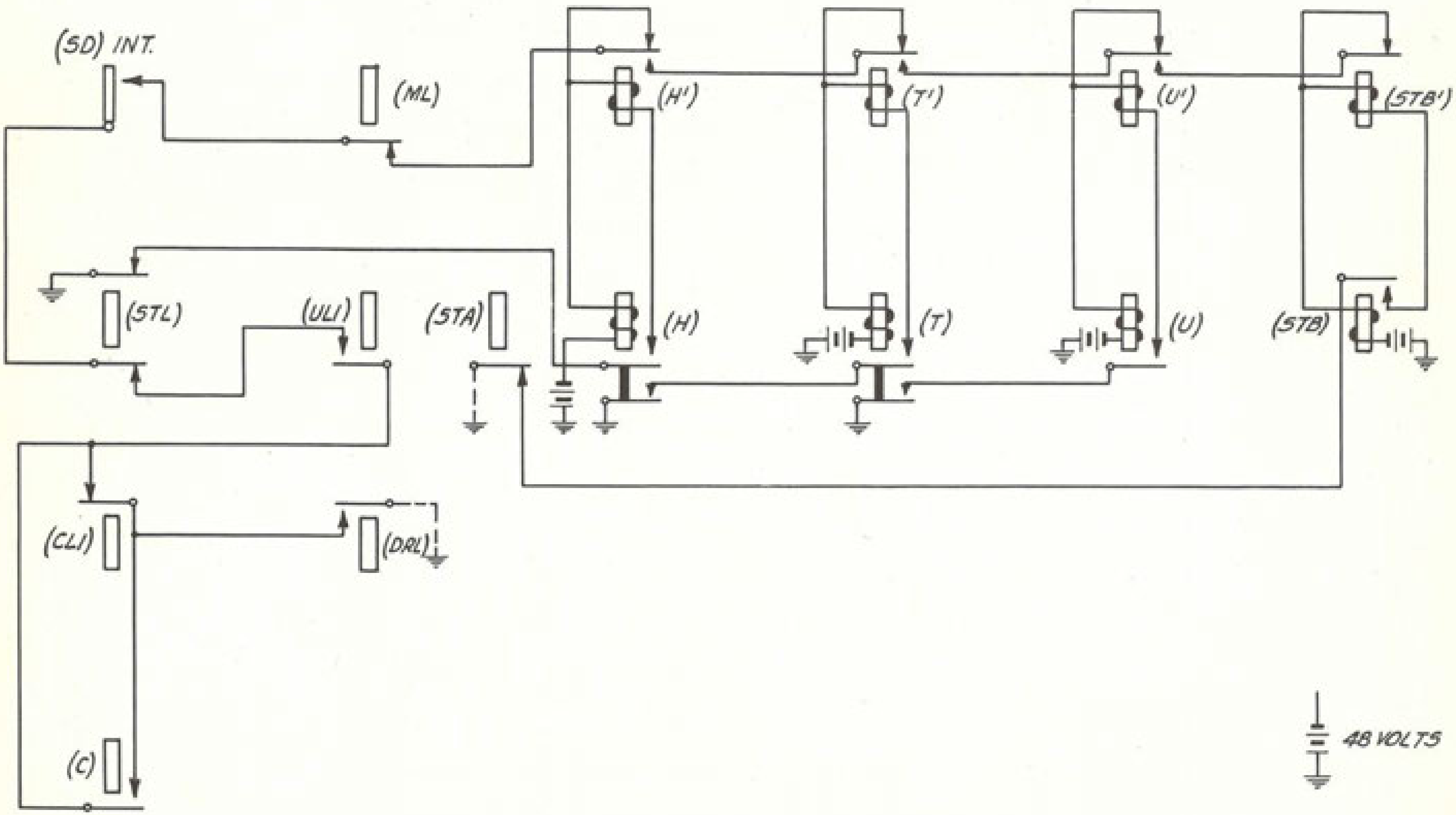
When units have been dialed and the decoder has sent a release signal, interrupter (SD) is grounded by the off-normal ground through a front contact of (DRL) and back contact of relay (CL1), or front contact of relay (C), front contact of relay (UL1), back contact of relay (STL) to interrupter (SD). This ground is maintained on the interrupter until relay (STL) operates. If no station or fifth numerical digit is expected, relay (STL) operates at once as has been described. If one is expected, relay (STL) operates by the operation of relay (STA) or (STB') when it is received, or else when from three to five seconds have elapsed.

Interrupter (SD) counts its cycles on relays (H), (H'), (T), (T'), (U), (U'), (STB) and (STB'), each cycle causing one pair of relays to operate and lock up. Each cycle takes about one second and relay (STB') operates in from three to five seconds after the interrupter is grounded, depending upon what stage of the cycle the interrupter is in when it is first grounded.

The operation of relay (STB') operates relay (STL) provided relay (RA) is normal. Relay (STL) operated unlocks relay (H) and (H'), which in turn causes the release of relays (T), (T'), (U) and (U'). Relays (STB) and (STB') remain locked to off-normal ground through back contact of relay (STA).

If the calling subscriber starts to dial a fifth numerical digit when his time is nearly up, relay (STB') may operate before the digit is registered, but it must not stay up nor must it be allowed to interfere with the registration of the digit. Relay (RA) operating on the first pulse breaks the circuit by which (STB') normally operates relay (STL) (See XB-59) so relay (STL) cannot operate prematurely to stop the counting of pulses. When the digit is registered, relays (STA) and (STA') operate followed by relay (STL) and relay (STA) breaks the locking circuit to relays (STB) and (STB'), releasing them.

When relay (STL) operates it locks to prevent it from releasing in case an additional accidental dial pulse should operate relay (RA) after the legitimate dialing has been completed.



N. Y. TEL. CO.
G. P.S. L.I.

SUBSCRIBER SENDER
TIMING FOR STATION DELAY

1 SDW
XB-58

INDICATION THAT DIALING IS COMPLETED

Relay (STL) operates on all calls after dialing has been completed and the decoder has sent a regular release signal to the sender, in order to indicate that certain functions may proceed and also to prevent false registration on the station register in case of belated dialing or switchhook manipulation.

Either relay (STA) or (STB') must operate in order to operate relay (STL). Relay (STA) operates in case the call is for a manual office and the called station number is 10000 or over. Relay (STB') operates on all other calls.

On permanent signal, dial zero and official code calls, whether routed direct or through tandem, the decoder operates (CL3) to show that no number is expected, and then when relay (DRL) operates to release the decoder from the sender, relays (STB) and (STB') operate in series to off-normal ground.

On calls where a number is dialed, but from the character of the terminating office and the first few digits of the number, it is evident that no station or fifth numerical digit is to be expected, relays (STB) and (STB') operate in series to off-normal ground through the operated (DRL) and (UL1) relays and other contacts depending upon the conditions, when the units digit has been registered. If relay (CL1) is not operated by the decoder, as on a full selector call to panel or a PCI tandem call with number, or a restricted code call which has been re-routed to an operator, the path from relay (DRL) to (UL1) relay is through the back contact of the transfer of (CL1). If relay (CL1) is operated by the decoder, as on a full selector call to crossbar or a PCI direct call, relays (C) and (C') operate in series through the front contact of relay (DRL) and the front contact of the transfer of relay (CL1), and then the path for operating relay (STB') from relays (DRL) and (UL1) is through a front contact of relay (C). There are two paths from (UL1) to the winding of relay (STB'), as follows:

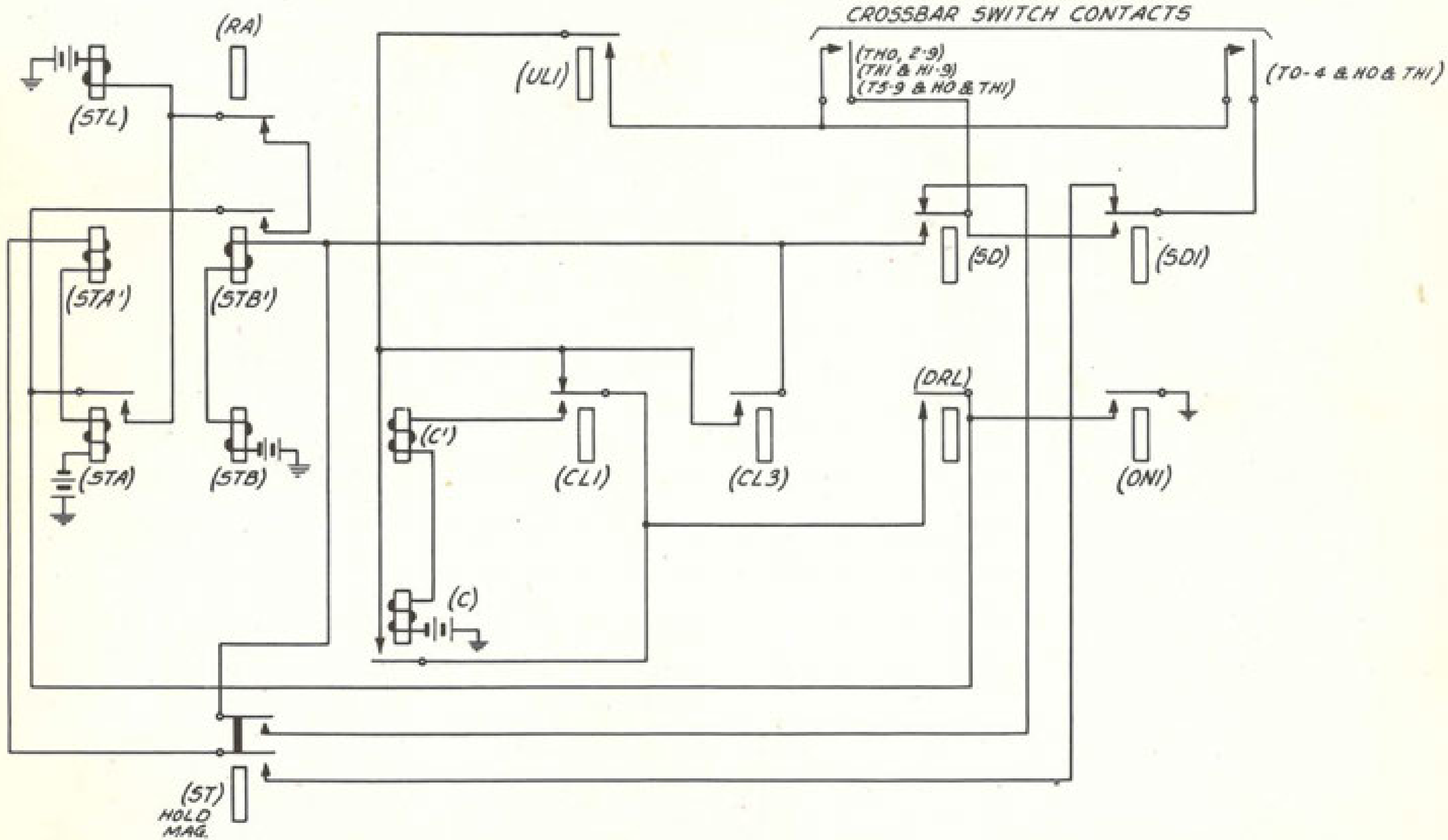
First, when the number does not begin with three digits from 100 to 104, and relay (SD) is operated by the decoder to show that the terminating office has no party lines with station letters, the path is through contacts on the (TH) (H) and (T) registers and the front contact of the transfer of relay (SD).

Second, when the number does begin with three digits from 100 to 104, but relay (SD1) is operated as well as relay (SD), to show that there are no numbers of 10,000 and over in the terminating office, as well as no party lines with station letters, the path is through contacts on the (TH), (H) and (T) registers and the front contacts of the transfers of both (SD1) and (SD) relays.

If a station digit is possible (SD) is not operated, and if it is actually dialed (STB) and (STB') operate in series through a back contact of relay (SD) and front contact of the (ST) hold magnet.

If a 5-digit number is possible (SD1) is not operated, and if it is actually dialed (STA) and (STA') operate in series through a back contact of relay (SD1) and front contact of hold magnet (ST).

If a station digit or a 5-digit number is possible but is not actually dialed, a station delay period of time is measured off after units is dialed, and then relay (STB) and (STB') are operated, as described in Timing For Station Delay.



RELAY (STA) OPERATES IF CALL IS FOR MANUAL OFFICE WITH NUMBERS 10000 OR OVER.
RELAY (STB') OPERATES FOR ALL OTHER CALLS.
ON PERMANENT SIGNAL, DIAL ZERO & OFFICIAL CODE CALLS, DECODER OPERATES REL. (CL3)

N. Y. TEL. CO. G.P.S. L.I.	SUBSCRIBER SENDER INDICATING THAT DIALING IS COMPLETED	1 2 GOW XB-59

PROGRESS OF THE SELECTION SEQUENCE

On any class of call routed through a two wire office selector the (SO) relay is normal and relay (S3) is operated until relay (DC) releases indicating that the crossbar switches have operated to the selected trunk; then relay (S3') operates in series with (S3).

When a skip office call is sent, relay (SO) is operated, which operates relay (S6) and then relay (S6') in the same manner as (S3') was operated above.

The sequence relays are operated as follows for the several stages up to and including trunk test:

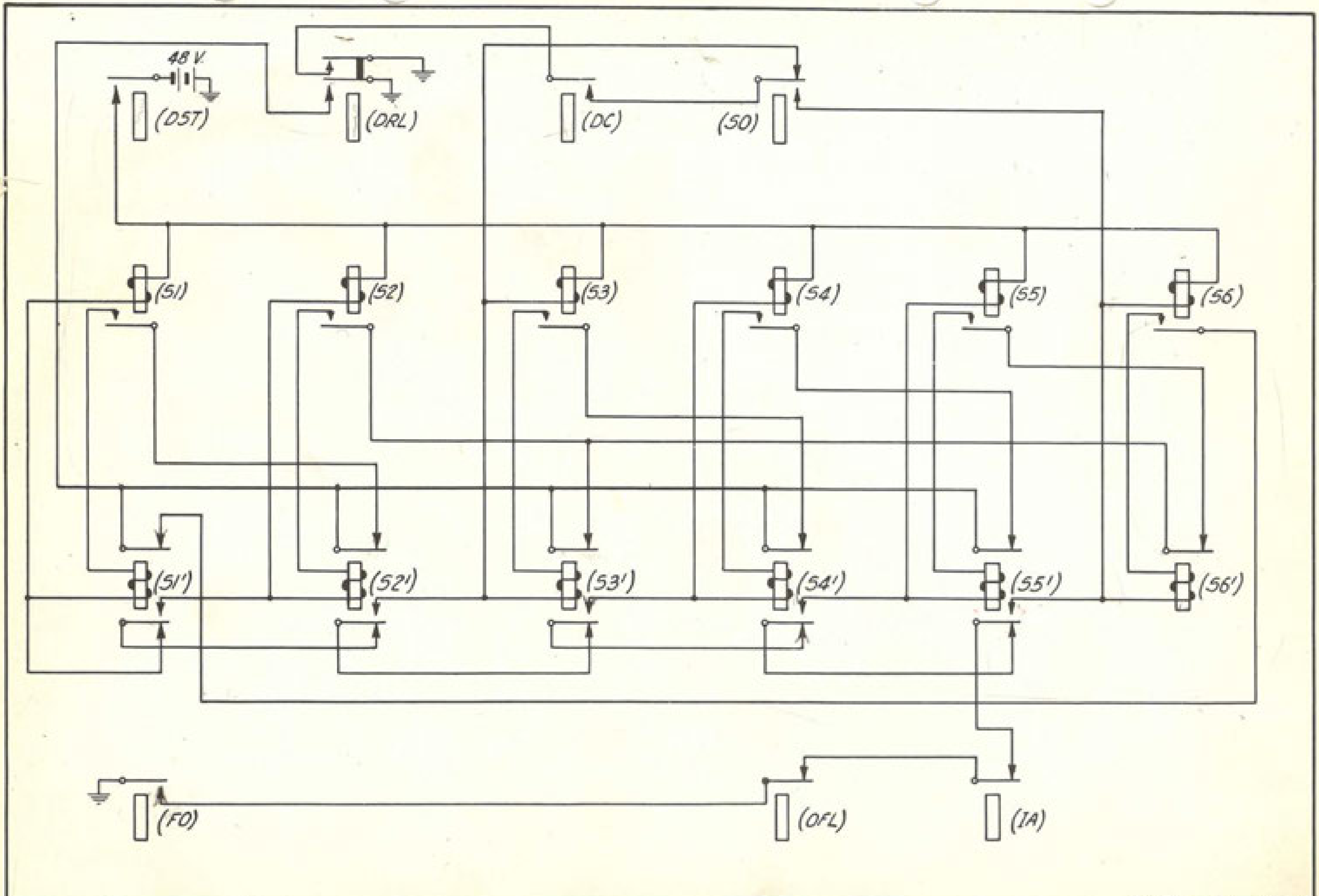
(S3) - (S3')	First office test	No FS Relays oper.
(S4) - (S4')	First office brush selection	
(S5) - (S5')	First office group selection	
(S6) - (S6')	Trunk test	

The sender is arranged to make second office selections, but this feature is not shown.

On a full selector call to either panel or crossbar office the sequence relays are operated as follows for stages after trunk test:

(S1) - (S1')	Incoming brush selection	FS 1 + 2 oper.
(S2) - (S2')	Incoming group selection	
(S3) - (S3')	Final brush selection	
(S4) - (S4')	Final tens selection	
(S5) - (S5')	Final units selection	FS 1-2-3 oper.
(S6) - (S6')	Incoming advance	

On a P C I call relays (S6) - (S6') remain operated after trunk test throughout the P C I pulsing.



N. Y. TEL. CO
GPS. L.I.

SUBSCRIBER SENDER
PROGRESS OF THE SELECTION SEQUENCE

1 2 SJW
XB-60

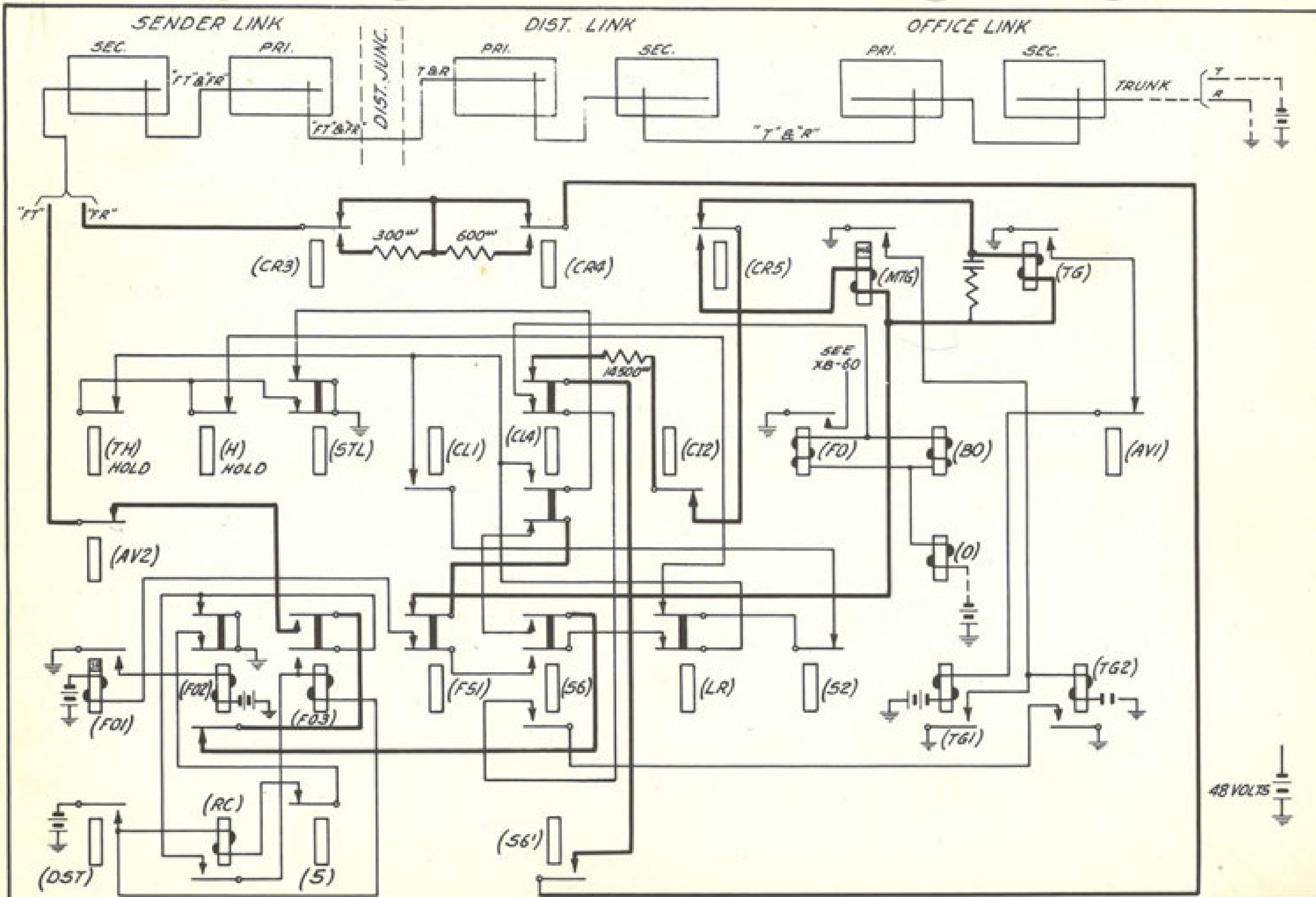
FULL MECHANICAL TRUNK TEST

The fundamental is closed when relays (S6') and (FO3) are operated. If the call is skip office relay (S6') operates upon the release of relay (DC) which occurs when the decoder establishes connection to a trunk relay (S6) having operated upon the operation of relay (DC) or upon the completion of distant office selections. Relay (FO3) operates upon the release of relays (FO1) and (FO2), which occurs when the dialing proceeds far enough to operate the (TH) hold magnet or (H) hold magnet, according to the class of call, which has been explained. The completion of distant office selections, if any, releases relay (S5').

If the trunk is in a group containing non-repeating ground cut-off incomings, relay (MTG) is cut into the fundamental by the operation of relay (CR5). Otherwise relay (TG) is used. Whichever relay is used operates to battery and ground from the distant end of the trunk.

The operation of relay (TG) operates relay (TG1) which in turn operates relay (TG2), or the operation of relay (MTG) operates relay (TG2). Relay (TG2) operates relays (O), (BO) and (FO) through front contacts of relay (S6) and back of relay (CL4). These relays prepare the circuit for incoming brush selection.

The purpose of the 14500 ohm resistance in trunk test is to prevent the line relay of the panel incoming selector or the crossbar incoming trunk from operating until relay (STP) is in the circuit and the sender is otherwise ready to count pulses.



N. Y. TEL. CO.
G.P.S. L.I.

SUBSCRIBER SENDER
FULL MECHANICAL TRUNK TEST

1	2					GW

XB-61

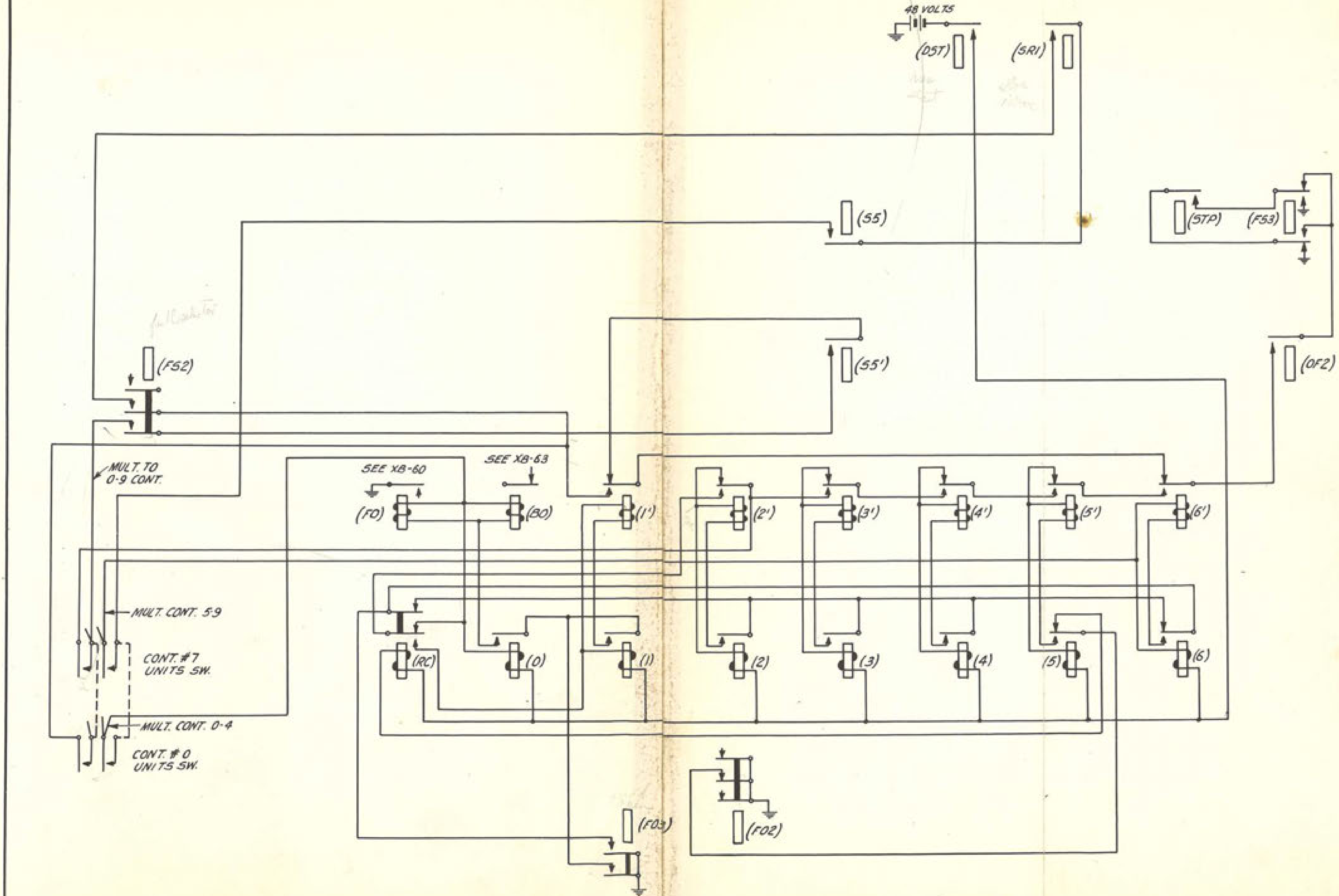
OPERATION OF COUNTING RELAYS DURING UNITS SELECTION

Final units selection is made with relays (S5) and (S5') operated, starting when relay (FO3) operates to close the fundamental circuit after the completion of final tens selection and the dialing of units.

The (STP) relay sends pulses through contacts of relays (S5') and (S5) and the (U) register to the counting relays.

Assume seven was registered for units, the first operation of relay (STP) would operate counting relay (2) and the release of relay (STP) would operate relays (2) and (2') in series under control of relay (6). The next pulse would operate relay (1) which locks in series with relay (1') at the end of the pulse. With relay (1') operated and, since the units number is between 5 and 9, relay (6) operates on the next pulse and locks in series with relay (6') at the end of the pulse. The next pulse operates relay (5) which locks in series with relay (5') at the end of the pulse. Relay (5) operating causes relay (RC) to release. The pulses continue until relays (2) and (2') are again operated. The next pulse operates relay (0) through normal contact of relay (RC). At the end of the pulse relays (FO) and (BO) operates in series with relay (0). The operation of relay (BO) opens the fundamental circuit which stops pulsing.

The circuit now prepares for incoming advance.



XB-62

SUBSCRIBER SENDER
OPERATION OF COUNTING RELAYS DURING UNITS SELECTION

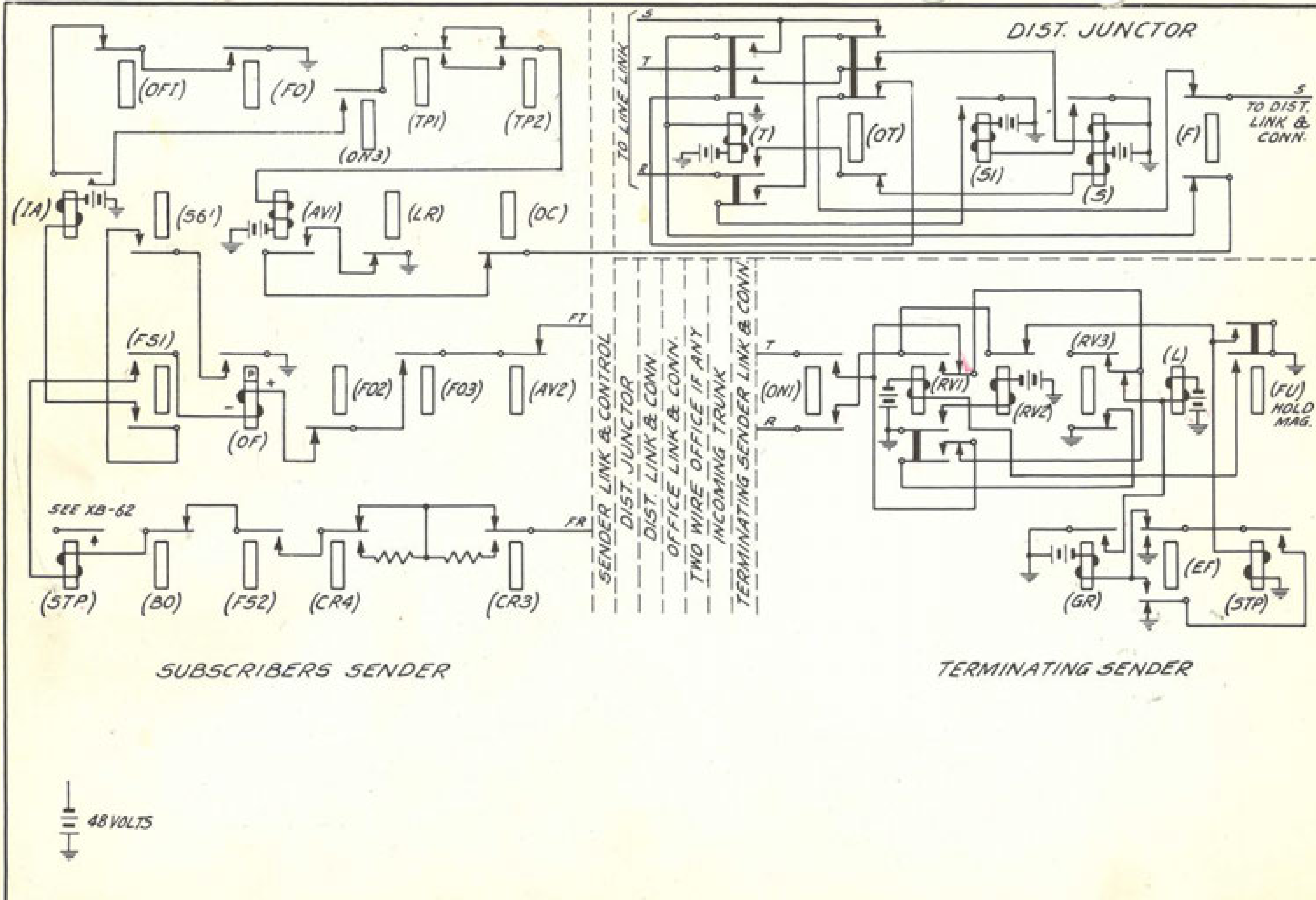
N.Y. TEL. CO.
G.P.S.
L.I.

FUNDAMENTAL CIRCUIT DURING INCOMING AND FINAL SELECTIONS ALSO INCOMING ADVANCE

During the incoming and final selections and incoming advance the fundamental circuit is closed from the "FT" lead through back contact of relay (AV2), front contact of relay (FO3), back contact of relay (FO2), the operating winding of relay (OF) shunted by its non-inductive winding, front contact of relay (FS1), winding of relay (STP), back contact of relay (BO), front contact of relay (FS2) and compensating resistance, as set by relays (CR3) and (CR4), to the "FR" lead.

If the call is going to a crossbar office, a (STP) relay in the terminating sender operates in series with the (STP) relay in the subscriber sender. The operation of the (STP) relay in the terminating sender operates relay (GR) which grounds the tip causing the (STP) relays of both senders to release.

In order to simulate incoming advance on a call to a crossbar office, when final units have been recorded, relay (RV1) is operated in the terminating sender to send reverse battery and ground to the subscriber sender causing relay (OF) to operate and in turn operate relay (IA).



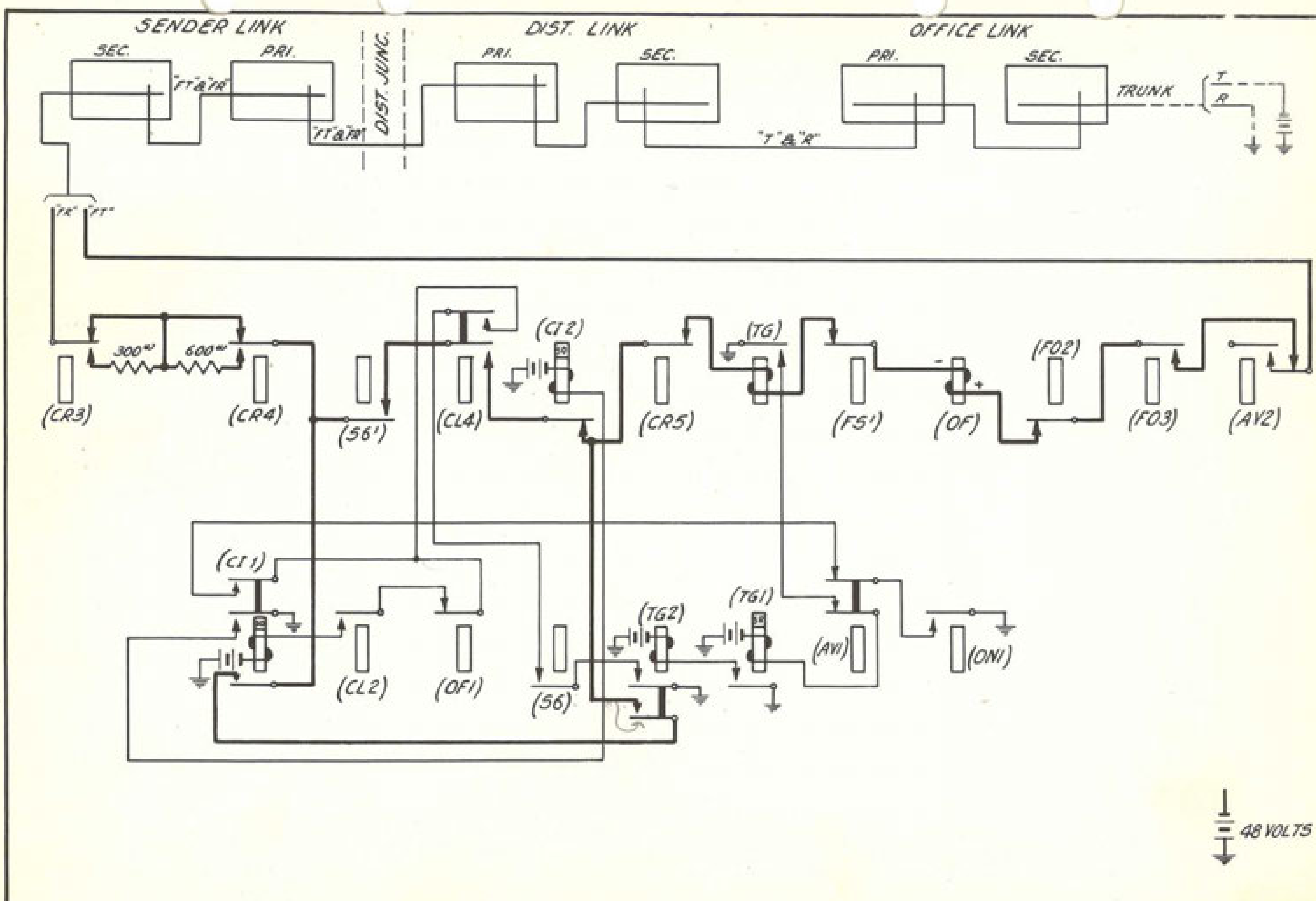
N. Y. TEL. CO. G. P. S. L. I.	SUBSCRIBER SENDER FUNDAMENTAL CIRCUIT DURING INCOMING & FINAL SELECTIONS ALSO INC. ADVANCE	1 2 XB-63

P C I TRUNK TEST

On all P C I calls relays (CL2) and (CL4) are operated by the decoder.

The fundamental circuit is closed when relays (S6') and (FO3) are operated. Relay (S6') operates upon the release of relay (DC) when the decoder establishes connection to a trunk if the call is skip office, relay (S6) having operated upon the operation of relay (DC), or upon the completion of distant office selections. Relay (FO3) operates upon the release of relay (FO2) and operation of relay (RC) which occur when the completion of dialing operates relay (STL).

Relay (TG) operates to battery from the distant end of the trunk but relay (OF) does not operate because of its polarity. With relay (TG) operated it operates relay (TG1) which in turn operates relay (TG2). The operation of relay (TG2) closes a circuit to operate relay (CI1) which locks until relay (AV1) operates after P C I pulses have been sent. Relay (CI2) operates to a make contact of relay (CI1). The (TG) relays hold operated until the trunk is assigned at the distant end, when they release to start P C I pulsing.



N. Y. TEL. CO. G.P.S. L.I.	SUBSCRIBER SENDER P.C.I. TRUNK TEST
1 2 3	XB-64

GENERATION OF P C I PULSES

The P C I pulsing circuit consists of start pulse relay (SP), pulse generating relays (PG), (PG1), (PG2) and (PG3), grounding relay (GR), pulse tip and ring relays (PT) and (PR), relay (12) which supplements leads 1 and 2 from the registered digits on the crossbar switch, relay (34) which supplements leads 3 and 4 from the registered digits on the crossbar switch, and final pulse relay (FP).

Relay (PG) is a non-biased condenser-timed polarized relay. It cannot be said to operate or release, but it closes its front contact when energized in one direction by its primary winding, closes its back contact when energized in the other direction by its primary winding and remains on either contact or between the contacts when not energized. When current is first closed through the primary in either direction, its force is more than neutralized by an opposing current in its secondary winding, the source of which is the charge or discharge of the timing condenser. When the condenser has been charged or discharged, current ceases to flow in the secondary and the primary causes the armature to move from one contact to the other. The actual time of operation varies somewhat with variations in voltage, resistance and relay adjustment. It averages about .069 second per single operation.

When relay (PG) closes its front contact, relays (CI1) and (SP) being operated, it grounds out the 300 ohm battery and so starts opposing currents in the two windings. At first the effect of the secondary winding is stronger and the front contact is held closed, but as the condenser discharges the current in the secondary dies down, until the effect of the primary becomes the stronger, when the relay breaks its front contact and closes its back contact. Now the battery through 300 ohms is not grounded out and currents start in the two windings in directions reversed from what they were before. At first the effect of the secondary winding is stronger and the back contact is held closed, but as the condenser charges the current in the secondary dies down until the effect of the primary becomes the stronger, when the relay breaks its back contact and closes its front contact. Then the cycle repeats.

In sending out P C I pulses after the trunk assignment key has been depressed and relay (TG2) has released, relay (PG) pulses as just described with relay (PG1) operating every time relay (PG) closes its back contact. The pulsing must start with the timing condenser discharged and the (PG) relays in a definite condition, with relay (PG) closing its back contact, relays (PG1) and (PG2) operated and relay (PG3) normal. The condenser is discharged and relay (PG) set on its back contact when relay (CL2) operating with relay (SP) normal, grounds out the 300 ohm resistance. When trunk test is made, relay (CI1) operates, which operates relay (PG1), which in turn operates relay (PG2), but relay (PG3) cannot operate because its winding is shunted.

With relay (TG2) normal after relays (PG2) and (CI2) have operated, relay (SP) operates and then relays (PG) and (PG1) start continuous pulsing. Relay (PG2) being operated and locked and relay (PG3) normal before the pulsing begins, the first release of relay (PG1) removes the shunt from relay (PG3) allowing it to operate. The next operation of relay (PG1) shunts relay (PG2) causing it to release, leaving relay (PG3) operated. The next release of relay (PG1) releases relay (PG3). The next operation of relay (PG1) operates relay (PG2) and so the cycle repeats. Each complete cycle, which generates four pulses to transmit one digit, proceeds as follows:

Pulse	(PG1)	(PG2)	(PG3)
1	Up	Up	Down
2	Down	Up	Up
3	Up	Down	Up
4	Down	Down	Down

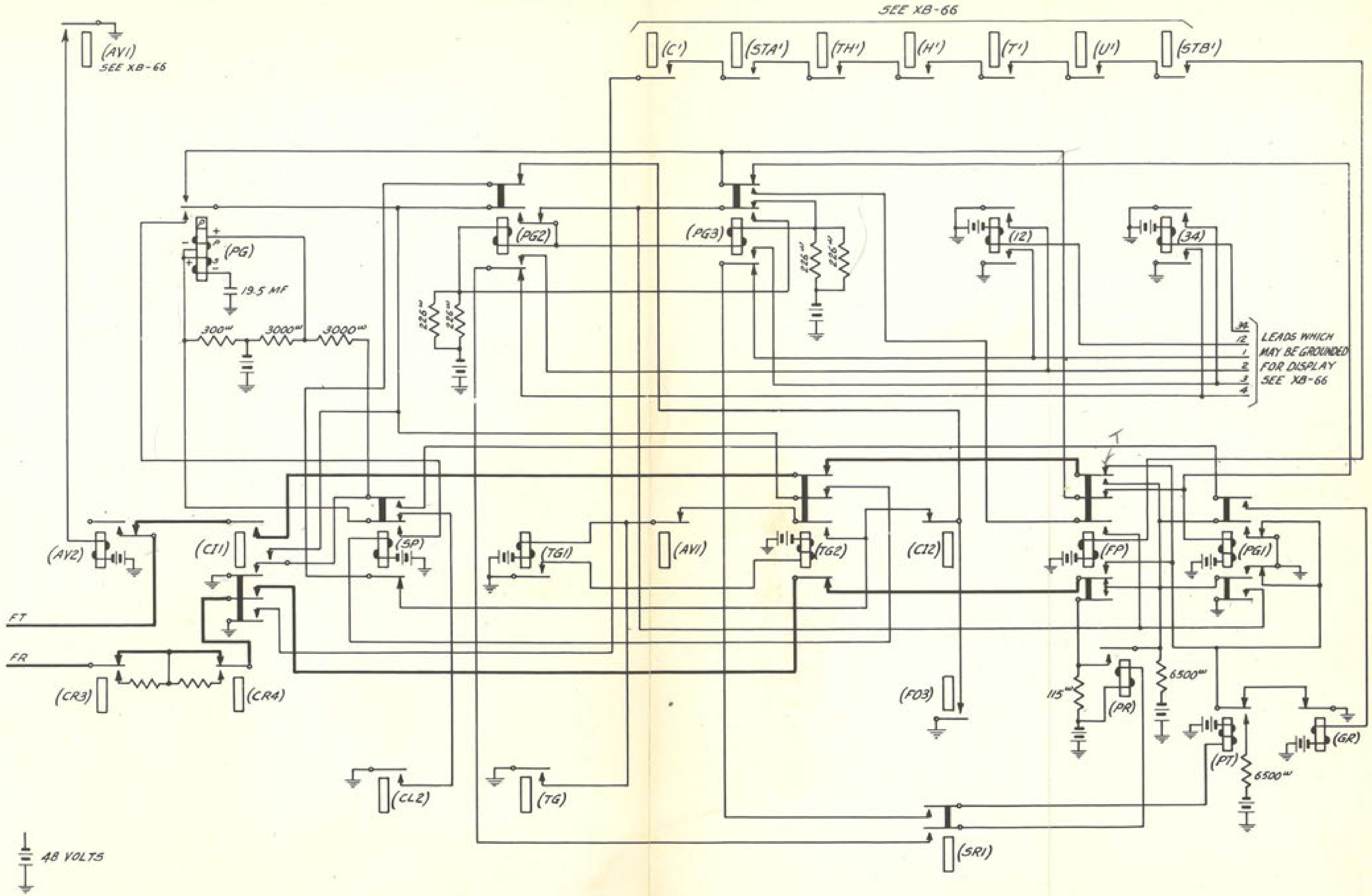
When operated relay (PG1) grounds the "FR" lead for a positive or blank odd pulse, when normal it grounds the "FT" lead for a negative even pulse. Relay (GR) operates with relay (PG1) but slightly delayed.

The winding of relay (PT) is connected to lead "1" of the dial register when relay (PG3) is normal and to lead "3" of the dial register when relay (PG3) is operated. When relay (PT) operates, it connects 6500 ohms battery to the "FT" lead giving the light positive pulse. When relay (PT) is normal it connects ground through back contact of relay (GR) to the "FT" lead, so that both sides of the trunk are grounded momentarily to discharge the trunk capacity. Relay (GR) operates immediately after (PG1), after which the "FT" lead is open to give the blank pulse. For the first pulse relay (PG1) is operated in advance, but relay (GR) does not operate until relay (SP) operates to start the pulsing.

The winding of relay (PR) is connected to lead "2" of the dial register when relay (PG2) is operated and to lead "4" of the dial register when relay (PG2) is normal. Relay (PR) operates when a heavy negative even pulse is required and is normal when a light negative even pulse is required. Operated it connects 115 ohm battery to the "FR" lead, giving the heavy negative pulse. Normal it leaves 6500 ohm battery connected to the "FR" lead, giving the light negative pulse.

After the entire number has been transmitted, relay (FP) is operated. A blank pulse is sent after the fourth pulse of the unit digit with relay (PG) on its back contact, relay (PG1), (PG2) and (FP) operated and relay (PG3) normal. Then relay (PG) breaks its back contact, releasing relay (PG1) which lets relay (PG3) operate. Relay (FP) operated reverses the connections between the "FT" and "FR" leads and the contacts of relay (PG1), and also connects the 115 ohm resistance battery to the "FT" lead, so the release of relay (PG1) starts a heavy positive pulse. After the heavy positive pulse has lasted for the usual time of the pulse, relay (PG) closes it back contact. Usually that would operate relay (PG1), terminating the pulse and releasing relay (PG2); but this time, since relays (FP) and (PG3) are both operated, the back contact of relay (PG) is cut off from relay (PG1) and connected instead to release relay (PG2) directly. Relay (AV1) operates upon the release of relay (PG2) - See (XB-66). The heavy positive pulse continues until the fundamental is broken by the operation of relay (AV2).

The operation of relay (AV1) marks the completion of the sender's functions on the call. Besides starting the sender to releasing it also immediately releases the (CI) relays - See (XB-64), which stops the pulsing and opens the "FT" and "FR" leads from the pulsing circuit.



XB-65

SUBSCRIBER SENDER
GENERATION OF P.C.I. PULSES

N.Y. TEL. CO. L.I.
G.P.S.

CONNECTION OF PULSING CIRCUIT TO DIAL REGISTER

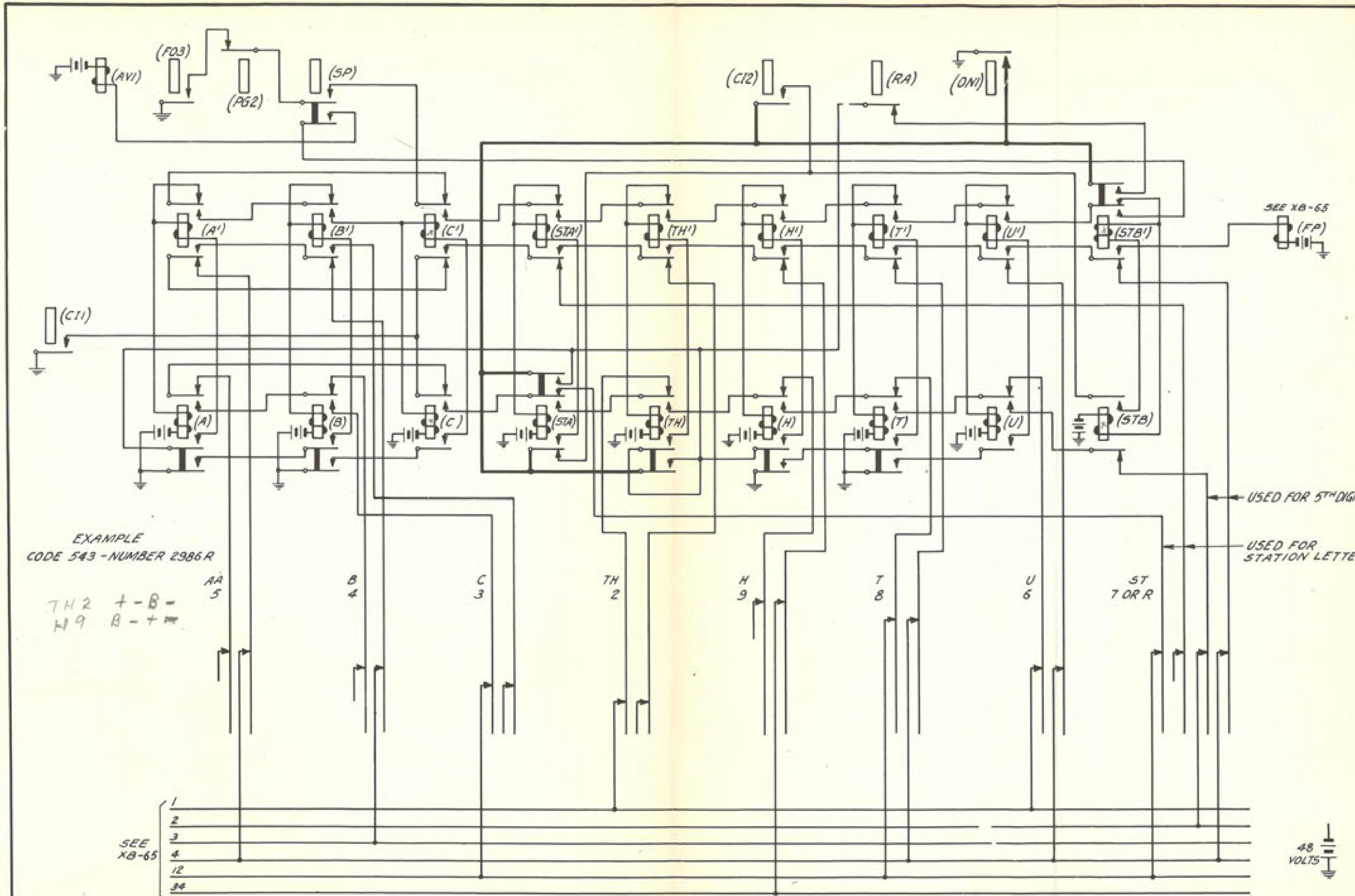
As has been explained under Generation of PCI Pulses, leads 1, 2, 3, 4, 12 and 34 are connected to the (PG) relays from dial register crossbar switch. The leads which are grounded for a particular number depend upon the pulses required for that number. For example, if the pulses required were positive, heavy negative, blank, heavy negative, leads "1", "2" and "4" would be grounded to operate relays which would produce these pulses.

When a PCI call is routed through tandem and the called number is under 10,000, relays (STB) and (STB') will have been operated in advance. When a PCI call is routed through tandem and the called number is 10,000 or over, relays (STA) and (STA') will have been operated in advance. When a PCI call is routed direct, relays (C) and (C') are operated in addition to (STA) and (STA') for numbers of 10,000 or over or (STB) and (STB') for numbers under 10,000. (See XB-59)

The setting of relays (STA), (STA'), (STB), (STB'), (C) and (C') determine which vertical of the dial register crossbar switch will have ground supplied to its leads for grounding the necessary leads "1", "2", "3", "4", "12" and "34" for the desired number.

Assuming that the PCI call was direct with a number of 10,000 or over, relays (C), (C'), (STA) and (STA') would have been operated. Relay (CI1) would have operated on trunk test. Ground now would be placed on the (TH) vertical of the crossbar switch, under control of normal (TH) relay, to place ground on either, both or none of leads "1" and "2", depending on the requirements of the registered thousand number. Likewise ground is placed on the thousands vertical for leads "3" and "4" under control of relay (TH') normal.

When the first two pulses of the number have been sent, relay (PG2) releases operating relay (TH) and shunting relay (TH'). The operation of relay (TH) opens the ground supply for leads "1" and "2" of the thousands and closes the ground supply for lead "1" and "2" of the hundreds, in order to prepare the proper relays in the pulse generating circuit for these pulses when needed. When the thousands pulses have been completed, relay (PG2) operates allowing relay (TH') to operate and lock in series with relay (TH). The hundreds pulses are now sent and when relay (PG2) operates after the first two pulses relay (H) operates and then (H') in the same manner as the thousands relays functioned. This continues until relay (STB) and (STB') have operated at which time the final positive pulse is sent and then the pulsing circuit is opened and the sender starts to release as has been explained.



XB-66

SUBSCRIBER SENDER
CONNECTION OF PULSING CIRCUIT TO DIAL REGISTER

N.Y. TEL. CO. L.I.
G.P.S.

TIMING CIRCUIT AND TROUBLE CONDITIONS WITH MONITORING

Whenever ground is connected to interrupter (TM), with the (TM) 1-4 relays normal, they function in the following manner to measure time intervals. The interrupter breaks for 10 seconds and makes for 10 seconds.

BREAK	MAKE	BREAK	MAKE	BREAK	MAKE	BREAK	MAKE	BREAK
None	(TM1)Op.	(TM1)Op.	(TM1)Rel.	(TM1)Rel.	(TM1)Op.	(TM1)Op.	(TM1)Rel.	(TM1)Rel.
		(TM2)Op.	(TM2)Op.	(TM2)Rel.	(TM2)Rel.	(TM2)Op.	(TM2)Op.	(TM2)Rel.
		(TM3)Op.	(TM3)Op.	(TM3)Op.	(TM3)Op.	(TM3)Rel.	(TM3)Rel.	(TM3)Rel.
				(TM4)Op.	(TM4)Op.	(TM4)Op.	(TM4)Op.	(TM4)Op.

Timing for Dialing to Start

When the sender is seized the timing circuit starts to measure a period of from 20 to 40 seconds. If the first digit is registered in that time the timing circuit is restored and starts again. Otherwise a permanent signal is registered and the call is routed to a permanent signal trunk.

The (TM) interrupter is connected to an off-normal ground lead through back contact of relay (AL1), and when relay (ON1) grounds that off-normal lead the (TM) relays start to function.

If a digit is dialed within the prescribed time it registers on the (A) and (AA) registers and relay (AL1) operates from a front contact of the (AA) hold magnet to lock up for the remainder of the connection. Relay (AL1) operated breaks ground from the (TM) interrupter and any operated (TM) relays release. When the (TM) relays are normal, relay (AL2) operates, to lock up for the remainder of the connection unless relay (ML) should be operated.

If a digit is not dialed within the prescribed time relay (TM4) operates and locks and causes relay (PS) to operate and lock. The timing continues and if the call is not disposed of in 40 seconds (or more,) relays (TM3) and (TM2) both release, causing relay (SS) to operate and lock. This operates relay (ML) which calls in the monitor.

Timing for Dialing to Finish, Except Stations

When the first digit has been dialed the timing circuit starts again to measure a period of from 30 to 50 seconds. If the units digit is registered in that time, or the office code completed in case of an operator call without number, the timing circuit is restored and starts again. Otherwise the sender monitor is called in to supervise.

When relay (AL2) operates on the restoration of the timing circuit after the registration of the first digit, it grounds the (TM) interrupter through a back contact of relay (UL1). This starts the (TM) relays on another cycle.

If the units digit is dialed within the prescribed time it registers on the (U) register and relay (UL1) operates from a front contact of the (U) hold magnet, to stay up for the remainder of the connection. When the dialing is completed on an operator call without number relay (STL) is operated, which operates relay (UL1), to stay up for the remainder of the connection. Relay (UL1) operated breaks ground from the (TM) interrupter and any operated (TM) relays release. When they are all normal relay (UL2) operates, to lock up for the remainder of the connection.

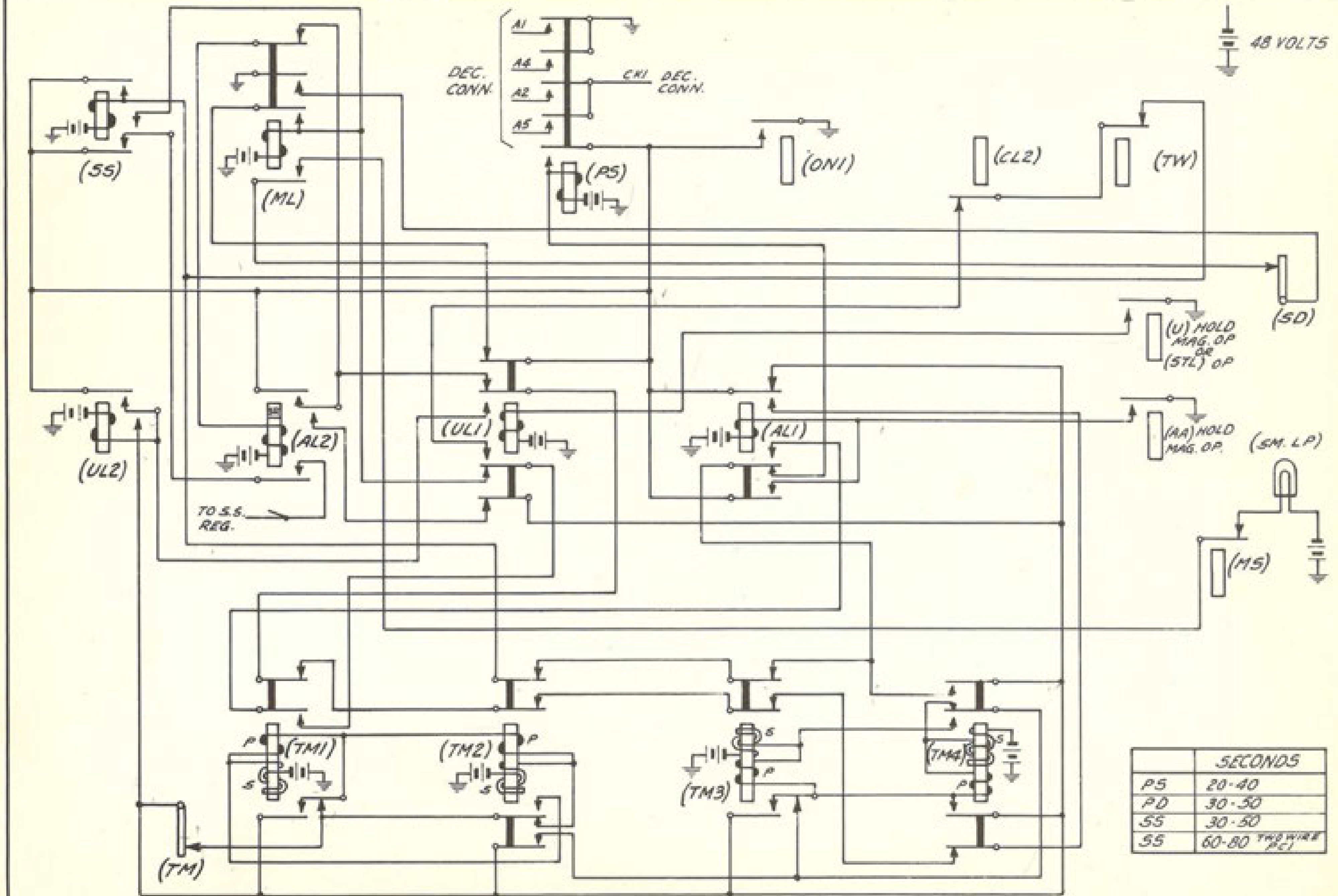
If the dialing is not completed within the prescribed time relay (TM4) operates and locks in 20 to 40 seconds, and 10 seconds later relay (TM1) operates and causes relay (ML) to operate and lock. This calls in the monitor, but if the dialing is completed before the monitor answers, relay (UL1) operates, restoring the (TM) relays and (ML) relay and the connection proceeds as if there had been no delay.

Timing for Release

When dialing has been completed (excluding registration on the stations register,) the timing circuit starts again to measure a period of from 30 to 50 seconds, unless the call is routed through a distant office selector or is of a PCI class, when the period measured is from 60 to 80 seconds. If the call is not disposed of and the sender released in that time, the sender monitor is called in to supervise.

When relay (UL2) operates on the restoration of the timing circuit after the completion of dialing, it grounds the (TM) interrupter and so starts the (TM) relays on another cycle.

If the sender is not released within 30 to 50 seconds, and the (TW) and (CL2) relays are normal, relay (TM4) operates and locks in 20 to 40 seconds, and 10 seconds later relay (TM1) operates and causes relay (SS) to operate and lock. If the sender is not released in 60 to 80 seconds, with relays (TW) or (CL2) or both being operated, relays (TM3) and (TM2) release and with relay (TM4) locked operated, relay (SS) will operate and lock, causing relay (ML) to operate and call in the monitor, but if the sender is released before the sender monitor answers, relays (SS), (ML), and all other relays release and the sender signal is extinguished.



	SECONDS
PS	20-40
PD	30-50
SS	30-50
SS	60-80 TWO WIRE PCI

N. Y. TEL. CO.
G.P.S. L.I.

SUBSCRIBERS SENDER
TIMING CIRCUIT & TROUBLE CONDITIONS WITH MONITORING

1 BTW.
XB - 67

I N D E X

Coin Supervisory or Key Pulsing Sender Link
and Controller Circuit

Coin Supervisory or Key Pulsing Sender Link and Controller Circuit

Junctor or Trunk Group Selection

When this circuit is used to select an idle key pulsing sender, it is started from ground on a start lead from an "A" switchboard district junctor being used by the operator. Likewise, when this circuit is used to select an idle coin supervisory circuit for a coin district junctor, ground is placed on the start lead.

The controller circuit may serve one hundred "A" switchboard district junctors or one hundred coin district junctors. Although the circuits are alike in both cases, separate frames are required since the "A" switchboard district junctors are connected to key pulsing senders, while the coin district junctors are connected to coin supervisory circuits.

There are two controller circuits associated with each frame, known as the "A" and "B" controller circuits; the wiring is so arranged that some groups of district junctors will have preference to the "A" controller and other groups preference to the "B" controller.

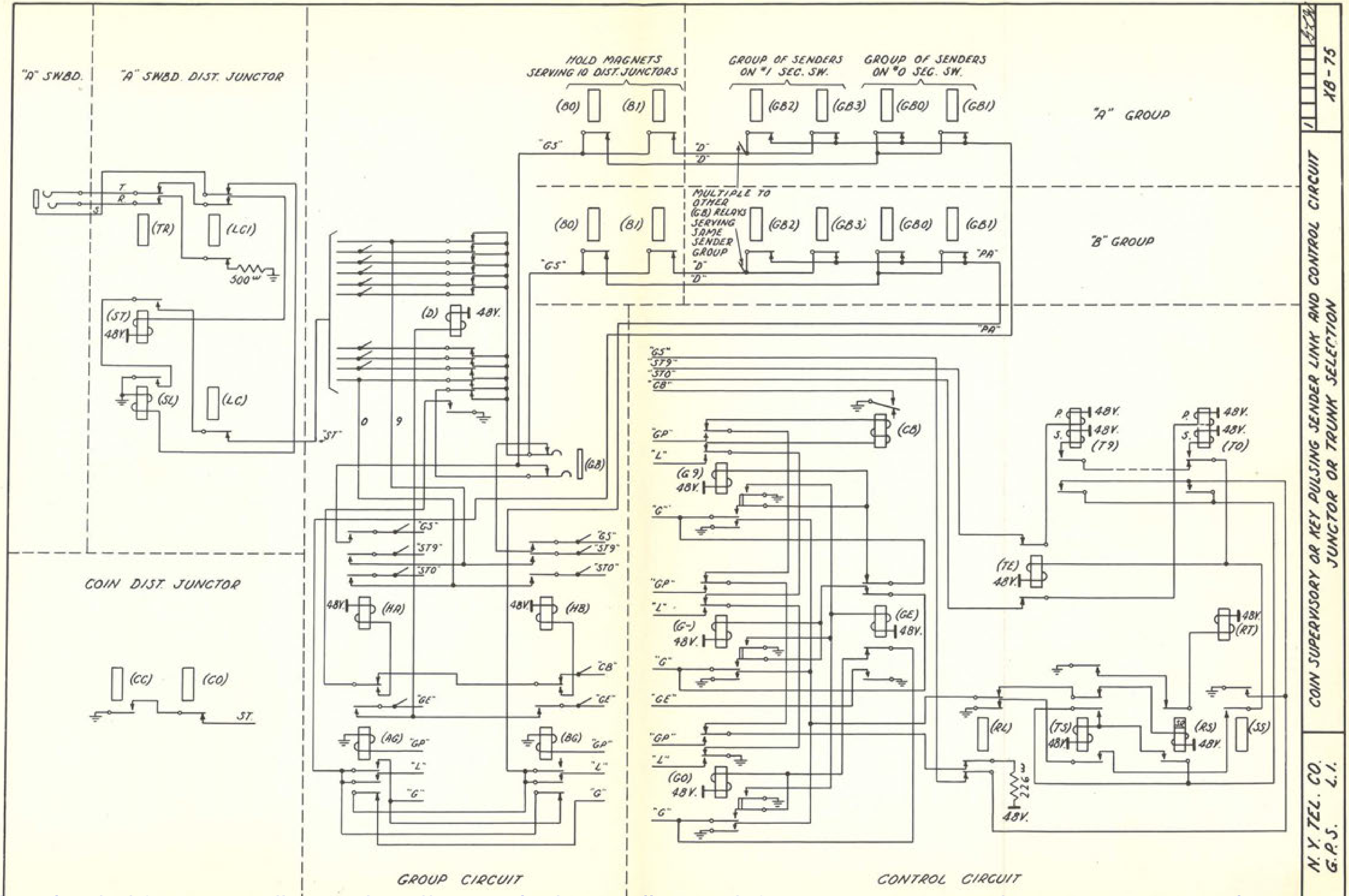
Ground on the "ST" lead operates a (G-) relay in the controller circuit associated with both the "A" and "B" groups of links which correspond to that group of ten district junctors, provided there are paths available over idle links to idle senders or coin supervisory circuits through both controller circuits. This circuit is through the (D) relay normal, through the primary hold (B) magnets normal, through relay (GB-) normal over the "PA" leads, through the (AG) and (BG) relays normal, over the "G" lead through the (GE) relay normal, to the windings of the (G-) relays. There are ten (G-) relays in each controller circuit corresponding to the ten groups of junctors. The ten (G-) relays of each controller circuit are chained so that when simultaneous calls are received only one of the associated (AG) or (BG) relays will have preference.

When both controller circuits are idle, the lowest numbered operated (G-) relays cause a corresponding (AG) or (BG) relay to operate. The (AG) and (BG) relays corresponding to the same group of junctors are arranged in a chain circuit so that only one of the associated (G-) relays remains operated. The (G-) relay of one of the "A" or "B" groups of links locks through its associated operated (AG) or (BG) relay. The (G-) relay operated (1) operates the (AG) or (BG) relay, (2) releases the (CB) relay which grounds the "CB" lead to start timing, (3) closes ground through relay (RL) and (TS) normal to operate relay (RS) and (4) operates relay (GE). Relay (GE) operated (1) opens the operate circuits to the (G) relays, (2) closes ground over the "GE" lead to the (AG) or (BG) relay for use in operating relay (D). The operation of the (AG) or (BG) relays operates the associated (D) relay from ground over the "GE" lead from the operated (GE) relay. Relay (D) operated, operates the (HA) or (HB) relay associated with the control circuit which is to handle the call, as determined by the action of the (G), (AG) and (BG) relays. The (D) relay operated, individualizes the ten "ST" leads so that they can be used for identifying or selecting the junctor that started the call. When the (G-) and (AG-) or (BG-) relays corresponding to that group of junctors in the other

Junctor or Trunk Group Selection (Cont'd)

controller circuit release, that controller circuit is released from this call and is made available to handle calls for other groups. Slow release relay (RS) operates to prepare the operate circuit for relay (TS) and when released by the operation of relay (TS) allows a short interval to test for sender or coin supervisory circuit groups having two or more idle circuits before making this selection on reserve basis, this is controlled by relay (RT) which operates with relay (RS) normal and relay (TS) operated.

The contacts of the operated (HA) or (HB) relay close through the ten "ST" leads from the ten junctors of the group being served to the primary windings of the ten relays designated (TO) to (T9). One or more of these relays may operate depending upon the number of simultaneous calls started in the group or all may operate if relay (D) is slow to open its break contacts. The operation of one or more (T-) relays operates relay (TS) from ground on the lowest numbered operated (G-) relay, through its associated (AG) or (BG) relay operated, over the "PA" lead, through relay (GB) normal, through the primary hold (B) magnet normal, over the "GS" lead, through relay (HA) or (HB) operated, through relay (RL) normal, through the (T-) relay, through relay (RS) operated to winding of relay (TS). Relay (TS) operated locks and causes relay (RS) to start to release. Relay (TS) also prepares the locking circuit for the (T) relays and the operate circuit of relay (TE). The operation of relay (TE) and locking of the (T) relay is delayed until relay (SS) operates to insure that any other (T) relay remaining operated due to the failure of the (D) relay back contacts to break will be released before the locking circuit is closed. The operation of relay (SS) following sender or coin supervisory circuit group selection causes the (TE) relay to operate and the lowest numbered (T) relay to lock in parallel with relay (TE). When the (TE) operates it opens the circuits for the operating windings of the (T-) relays.


"A" SWBD.
"A" SWBD. DIST. JUNCTOR
HOLD MAGNETS SERVING 10 DIST. JUNCTORS
GROUP OF SENDERS ON #1 SEC. SW.
GROUP OF SENDERS ON #0 SEC. SW.
"A" GROUP
"B" GROUP
MULTIPLE TO OTHER (GB) RELAYS SERVING SAME SENDER GROUP
(B0) (B1) (GB2) (GB3) (GB0) (GB1)
(TR) (LC1) (ST) (SL) (LC) (D) (GB) (CB)
500ω
48V.
COIN DIST. JUNCTOR
(CC) (CO)
(HA) (HB) (AG) (BG)
(G9) (G-) (G0) (GE)
(T9) (T0) (TE) (RT) (RL) (TS) (RS) (SS)
226ω
GROUP CIRCUIT
CONTROL CIRCUIT
COIN SUPERVISORY OR KEY PULSING SENDER LINK AND CONTROL CIRCUIT
JUNCTOR OR TRUNK SELECTION
XB-75
N.Y. TEL. CO.
G.P.S. L.I.

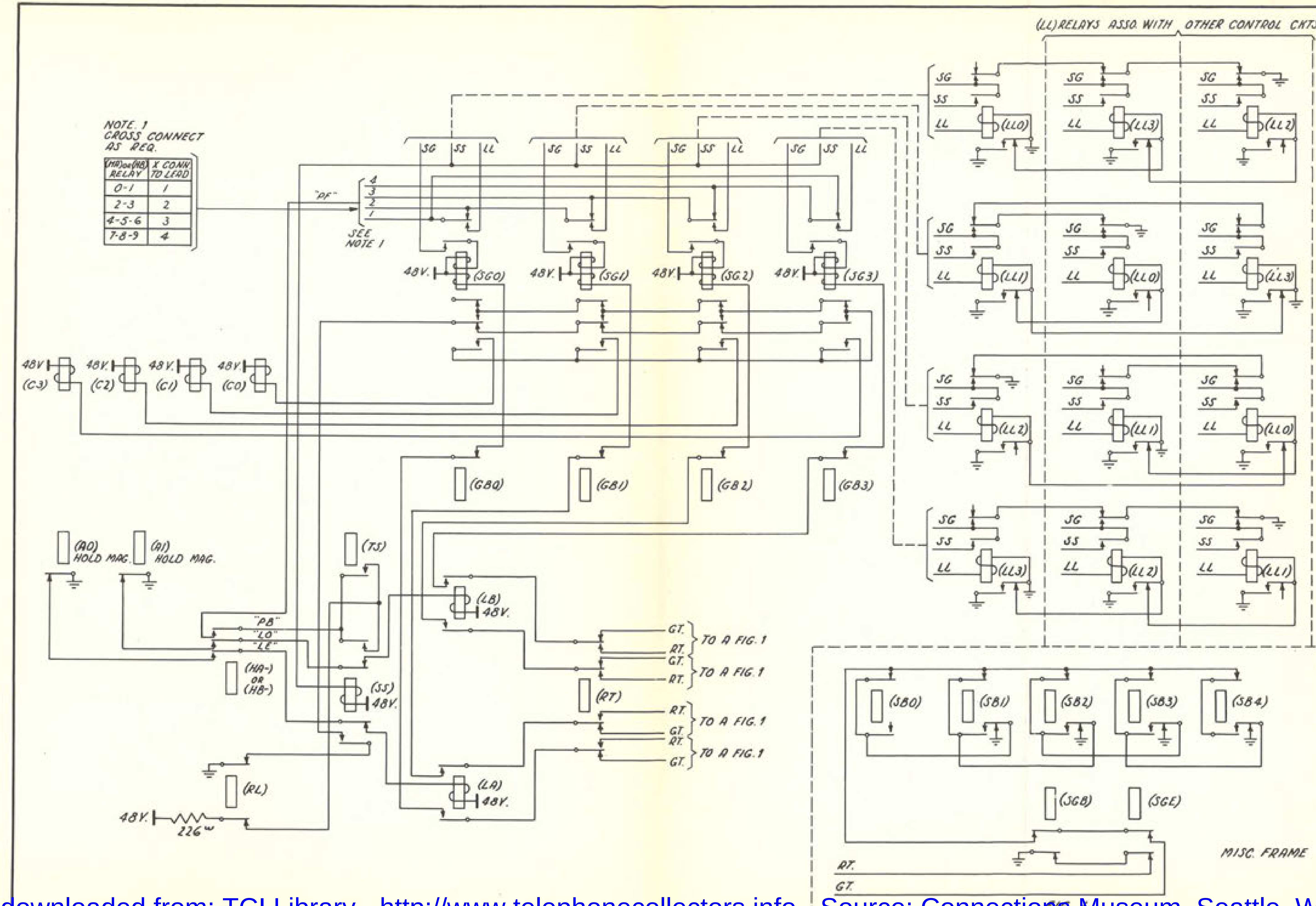
Regular and Reserve Test for Sender or Coin Supervisory Group,
Also Sender or Coin Supervisory Circuit Group Selection

The operation of relay (HA-) or (HB-) closed through leads "LE" and "LO" from ground on the back contacts of the primary hold magnets (A) to the windings of relay (LA) and (LB) through normal contacts of relay (SS) causing the (LA) and (LB) relays to operate if the corresponding link is idle. If relay (SGE) is normal indicating that the group of senders or coin supervisory circuits is not being held by another link and controller circuit and two or more circuits in the group are idle, ground will be connected to the "GT" lead under control of the chain contacts on the (SB-) relays to the windings of the (SG-) relay associated with that group, which will operate if its circuit is closed through the (GB-) relay normal and the associated (LA) or (LB) relay is operated.

As shown on XB-75 when relay (TS) operates indicating that the trunk has been selected, relay (RS) begins to release, relay (RT) operates when slow release relay (RS) is normal and transfers the group test from the "GT" to the "RT" leads. There will be ground on the "RT" lead of a sender or coin supervisory circuit group if the group is not being held busy by another link and controller circuit or if the (SGB) relay is not operated indicating the group is busy. The (SG-) relay associated with the group will operate through relay (GB-) normal if the associated (LA) or (LB) relay is operated indicating that the corresponding link is idle.

When one or more (SG-) relays have operated on either regular or reserve test, a circuit is closed to operate one of the four (LL) relays associated with this controller circuit. This circuit is closed from battery through resistance (A) make contacts of the (HA-) or (HB-) relay over one of the preference leads, depending on which group of district junctors are being served, make contact of the (SG-) relay to operate the (LL-) relay associated with (SG-) relay. The operation of the (LL-) relay locks other controller circuits out of the group, furnishes ground to lock to corresponding (SG-) relay and operates relay (SS).

Each controller circuit has one (LL-) relay associated with each (SG-) relay. Relay (SS) operated (1) releases the (LA) and (LB) relays, (2) locks the lowest numbered (T) relay operated (see XB-75), (3) operates relay (TE) through relay (TS) operated (see XB-75), (4) supplies a holding ground for relay (TS) through the (T) relay operated (see XB-75), (5) connects ground from relay (RL) normal, through relay (SG-) operated to operate the associated (C-) relay and (6) by-passes the operate circuit of relay (LL-) around the (TS) relay.



COIN SUPERVISORY OR KEY PULSING SENDER LINK AND CONTROL CIRCUIT
REGULAR & RESERVE TEST FOR SENDER OR COIN SUPERVISORY GROUP ALSO
SENDER OR COIN SUPERVISORY CIRCUIT GROUP SELECTION

XB-76

N.Y. TEL. CO
G.P.S. L.I.

Selection of Key Pulsing "A" Sender or Coin Supervisory Circuit and Release of Controller Circuit

When relay (TE) operated, ground was closed through to operate the primary select magnet associated with the district junctor serving the call, as indicated by the (T-) relay operated.

When a group of key pulsing senders or coin supervisory circuits has been selected as indicated by the operation of relay (C-), it closes through leads "PO" to "P4" one of which is grounded under control of an operated (T-) relay. This ground will operate one of the (S-) relays indicating which key pulsing sender or coin supervisory circuit will serve the call. Relay (S-) operated (1) locks to relay (C-), (2) opens the operating circuit to preceding (S-) relays, (3) connects ground to lead "SC" of the selected sender or coin supervisory circuit and (4) operates the secondary select magnet corresponding to the selected sender or coin supervisory circuit. Relay (S-) operated also operates relay (SA) and (SGE). Relay (SGE) operated causes the selected group of five senders or coin supervisory circuits to test busy to other controller circuits. The operating ground of relay (SA) is closed through its make contact through a normal contact of relay (SL), through a make contact of the operated (SG-) relay, over lead "HE" or "HO" to operate both the primary and secondary hold magnets.

Key Pulsing "A" Senders use Figure 1

When relay (S-) operated and grounded lead "SC," relays (SC) and (SC1) of the key pulsing sender operate. With relay (SC1) operated a circuit is closed to operate one of the (F-) relays in the sender from ground on the "F-" lead furnished by the controller to indicate which district junctor frame is being used. When relay (SC) in the sender operated leads "S" and "SL" are closed through to operate relay (SL) from the operating ground of the hold magnets. Relay (SL) operated removes the short circuit from the winding of relay (TST) allowing it to operate if the sleeve is not crossed with any other sleeve, if the sleeve were crossed there would be ground on both sides of the winding of relay (TST) keeping it from operating and causing a time alarm. With relay (TST) operated relay (DC) will operate from ground at relay (TA) normal, (SD) normal, (TST) operated to the winding of relay (DC). Relay (DC) operated (1) locks to ground on relay (SA) operated, (2) closes ground to lead "GS" to operate relay (ON) in the key pulsing sender. The (ON) relay operated (1) grounds the "S" lead to hold the primary and secondary hold magnets, (2) grounds lead "SB" to operate relay (SB-) in the controller circuit associated with that sender, the (SB-) relay operated grounds lead "BS" to operate relay (ON1) in the sender and grounds lead "RL" from the sender to the controller circuit, the grounded "RL" lead operates relay (SD) which in turn operates relay (RL) causing the controller circuit to release.

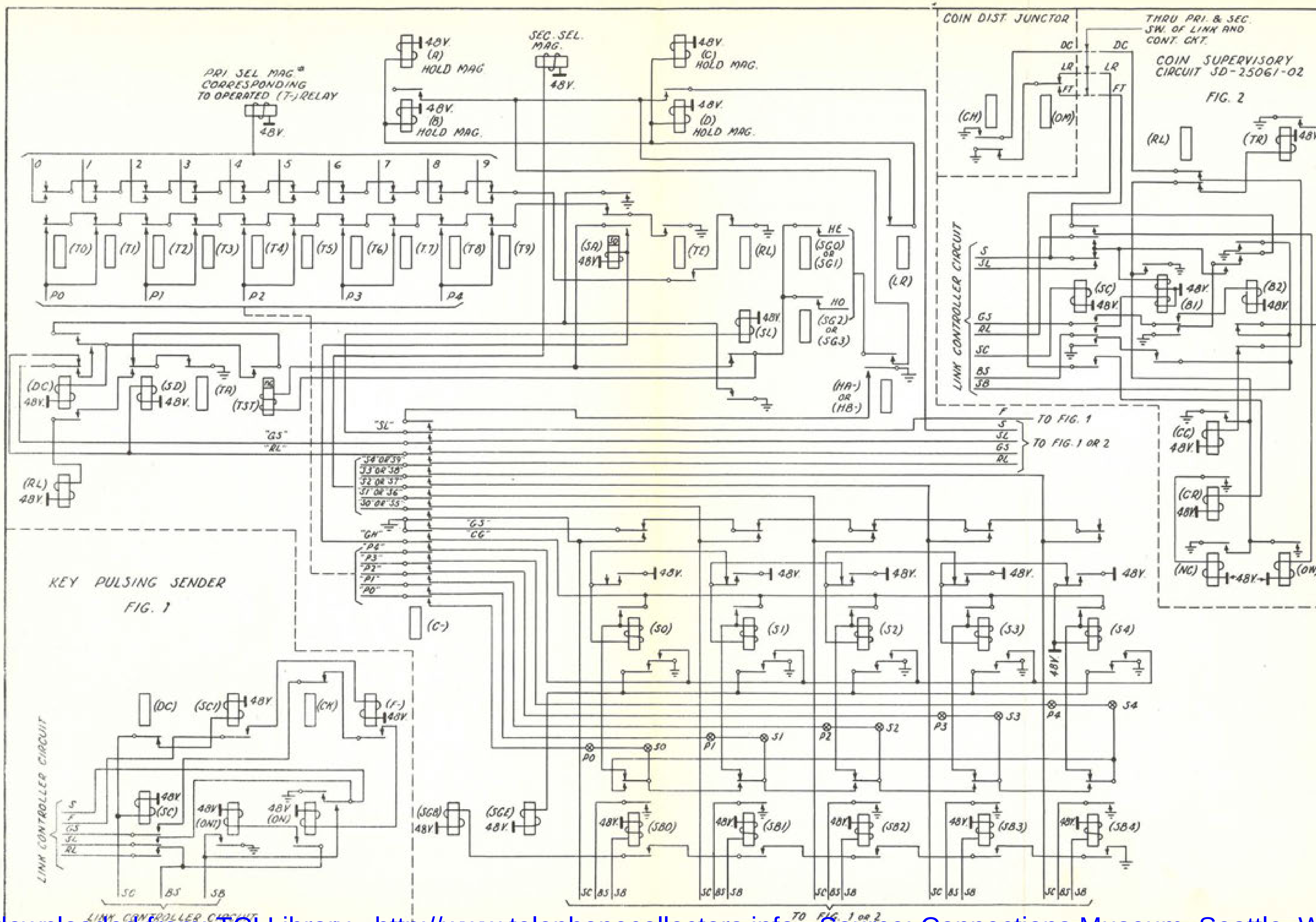
Coin Supervisory Circuit use Figure 2

When relay (S-) operated and grounded lead "SC" to the coin supervisory circuit, relay (SC) in that circuit operated to close through various leads.

Depending on what function the coin supervisory circuit is required to perform, that is collect, return or test for a coin will determine which of

Selection of Key Pulsing "A" Sender or Coin Supervisory Circuit and Release of Controller Circuit (Cont'd)

the relays (CC), (NC) or (OW) will be operated, but any one of the three operated will operate relay (TR) which in turn grounds lead "SB" to operate the (SB-) relay in the controller circuit associated with the selected coin supervisory circuit. The (SB-) relay operated in turn grounds the "BS" lead to operate the (B1) relay in the coin supervisory circuit. When relay (SC) in the coin supervisory circuit operates leads "S" and "SL" are closed through to operate relay (SL) from the operating ground of the hold magnets. Relay (SL) operated removes the short circuit from the winding of relay (TST) allowing it to operate if the sleeve is not crossed with any other sleeve. With relay (TST) operated relay (DC) will operate, in turn grounding lead "GS" to the coin supervisory circuit and operating relay (B2) in that circuit. Lead "RL" is now grounded from the coin supervisory circuit to the controller circuit and in turn operating relay (RL) of the controller, causing the release of that circuit.



COIN SUPERVISORY OR KEY PULSING SENDER LINK AND CONTROL CIRCUIT
SELECTION OF KEY PULSING "A" SENDER OR COIN SUPERVISORY CIRCUIT AND RELEASE OF CONTROLLER CIRCUIT

N.Y. TEL. CO.
G.P.S. L.I.

XB-77

ORIGINATING DECODER MARKER

PURPOSE OF CIRCUIT

This circuit is part of the originating equipment of a crossbar office and is used in connection with subscribers' senders, key set "A" switchboard senders, district link and connector circuits, district junctors and office link and connector circuits.

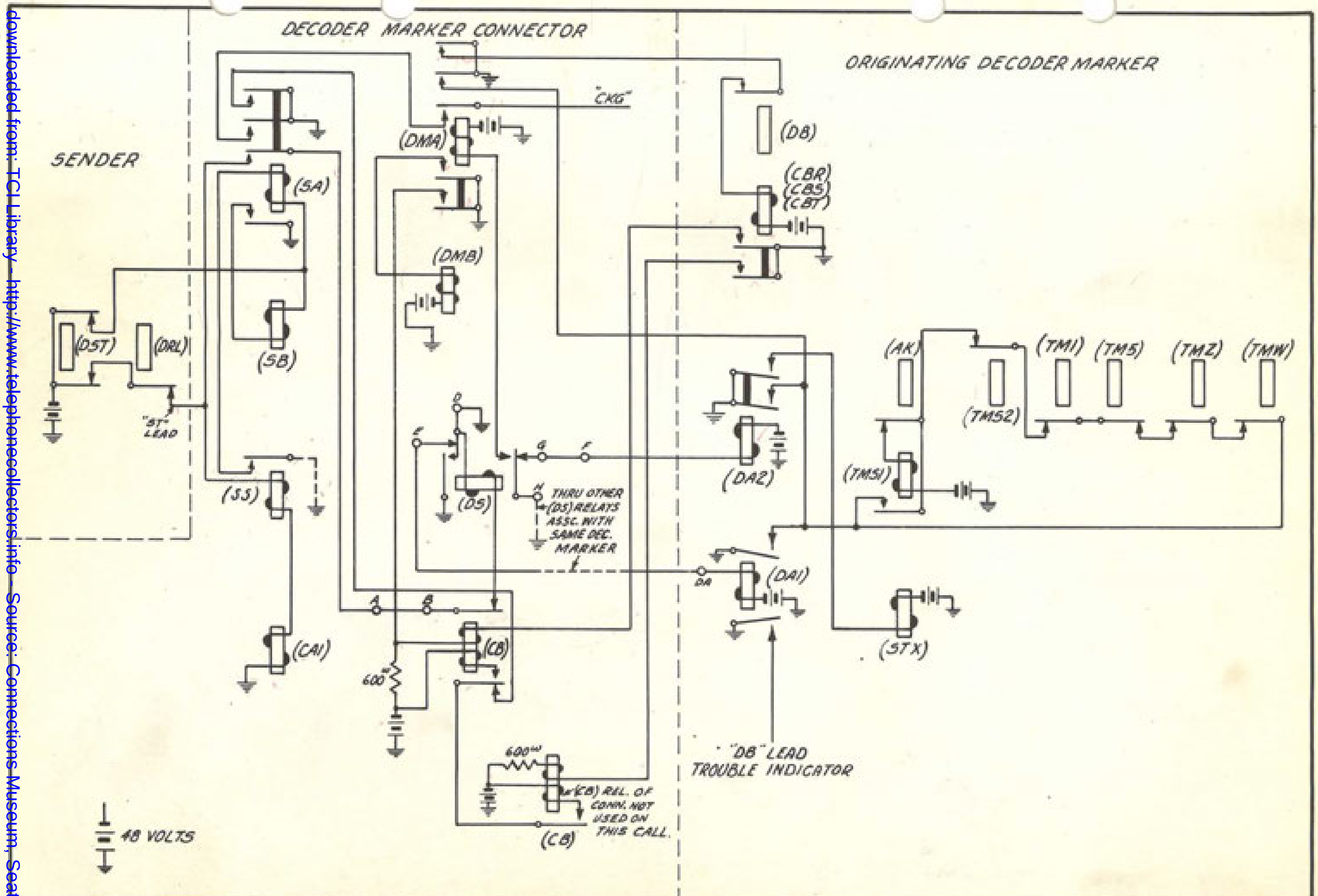
Its purpose is to decode the digits registered in the sender as an office code; to select and test the outgoing trunk group and paths thereto; to set up information in the sender for class of call, compensating resistance, office selections, if any; to operate the proper magnets in the district and office frames in order to connect the district junctor to the outgoing trunk and to transmit talking selections, zone, charge and party information to the district junctor circuit.

SEIZURE BY DECODER CONNECTOR

When a sender has registered the three digits of the office code or has registered zero for the first digit or as soon as the sender recognizes the existence of a permanent signal condition, it calls upon the decoder connector for a decoder. The decoders are furnished in a common group and as soon as any decoder and the decoder connector which that sender uses are idle, the connector and the decoder are seized for the temporary use of the sender which is connected to the decoder over a number of leads.

With sender (DST) relay operated, battery is placed on the start lead to operate the (STS) and (CA1) relays in series. If some other connector circuit is not using the decoder, operated (STS) causes relay (SA) to operate and in turn relay (SB) operates. Relay (SA) operated closes through the start lead battery to operate relay (DS) which releases relays (DA1) and (DA2) in the decoder marker. These relays released start the timing circuit by operating (TMS1) and also operates relay (STX). Relay (DMA) operates from the operated (DS) and in turn operates relay (DMB). This relay operates relays (CBR), (CBS) and (CBT) relays in the decoder which supplies ground to operate the (CB) relays of all decoder marker connector circuits associated with it, with the exception of the one in use. This is accomplished by ground at the operated (DMA) relay shunting the resistance battery of the (CB) relay in use.

With relays (SA), (SB), (STS), (DMA), (DMB) and (DS) operated, numerous leads are closed through from the sender to the decoder marker.



N. Y. TEL. CO. G.P.S. - L.I.	ORIGINATING DECODER MARKER SEIZURE BY DECODER CONNECTOR	1 2 3 4 5 SCW. XB-100

RECEIVING INFORMATION FROM SENDER AND CHECK OF REGISTRATION LEADS

With lead (CKG) grounded, a path is prepared for checking the receiving leads from the sender. These leads are connected to six sets of relays in the decoder. The (A), (B) and (C) register relays record the office code, the (D) register relays record the class of subscriber calling or whether an operator is making the call, the (F) register relays indicate the district frames being used, and three miscellaneous relays operate as follows: (OF) for overflow indication, (AR) for alternate route indication and (TP) for tip party indication.

These registration relays are grouped together in three groups. The (F) and (D) relays on the "CK3" and "CK4" leads; the (B) and (C) relays on the "CK2" lead; the (A), (OF), (AR) and (TP) on the "CK1" lead. Check relays (CK1), (CK2) and (CK3) are used to check the above groups.

Check leads CK1, CK3 and CK4 receive ground from relay (CK4) normal and check lead CK2 receives ground from relay (CK5) normal. These leads are connected through to the sender.

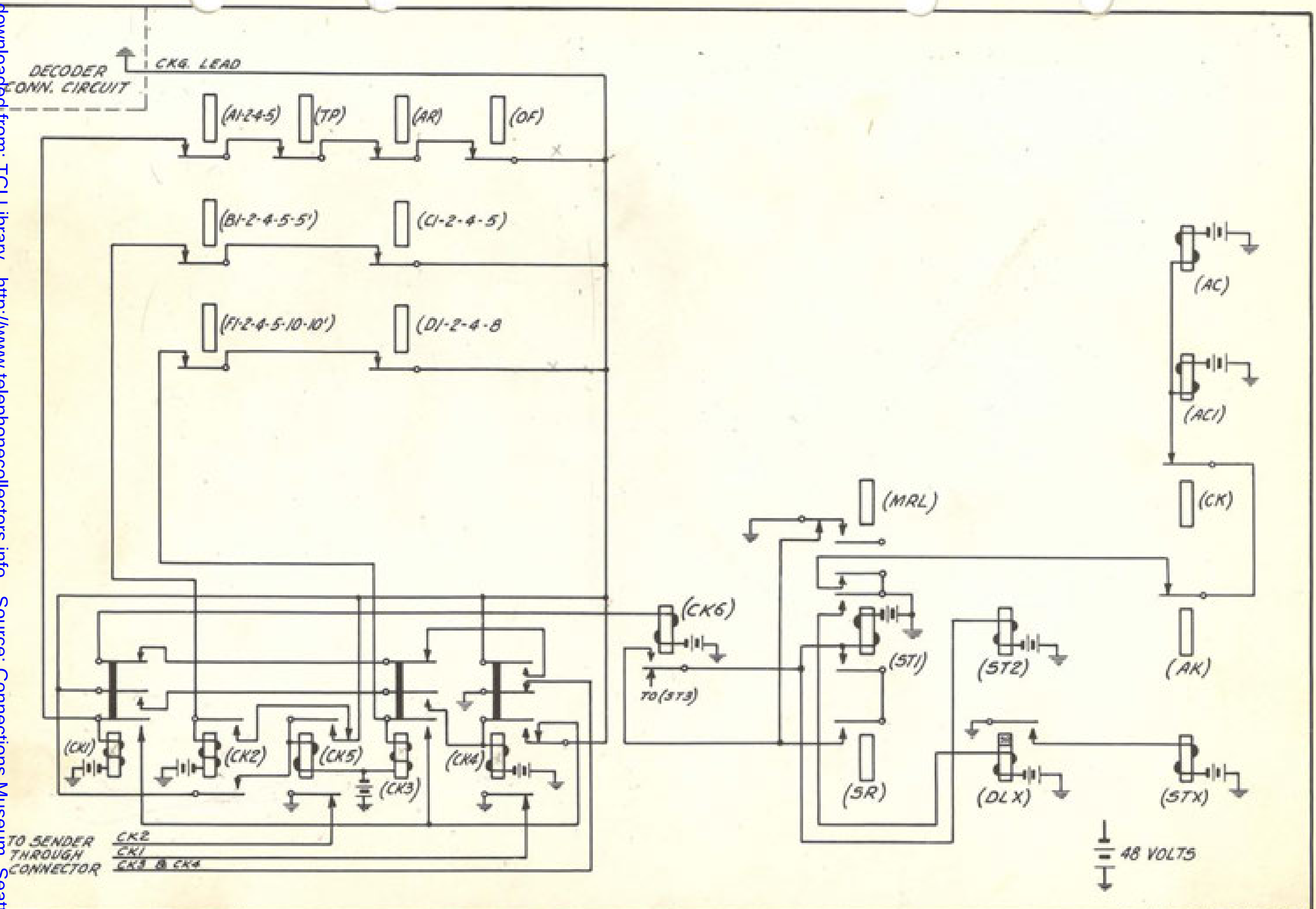
The sender causes the registration relays which are required for this particular call to operate and with the aid of the four check leads causes the remainder of the registration relays to operate. With all of the relays operated, three series paths are closed through the three groups of relays for operating the corresponding (CK1), (CK2) and (CK3) relays. These relays lock through back contacts on the (CK4) and (CK5) relays.

The (CK1) and (CK3) relays having operated indicate that the (F) and (D) registers and (A) and miscellaneous registers have properly functioned and in turn operate the (CK4) relay which locks to the "CKG" lead. Similarly the (CK2) relay operates when the (B) and (C) registers have properly functioned, which in turn operates the (CK5) relay which also locks to the "CKG" lead.

The operation of relays (CK4) and (CK5) breaks the locking path for (CK1), (CK2) and (CK3) relays, leaving them held only by the chain circuits through the contacts of the recording relays. They also break ground from leads "CK1", "CK2", "CK3" and "CK4" which releases all recording relays connected to these leads in the sender, leaving only those operated which were operated from ground in the sender. However, if any one of the leads connected to the "CK1", "CK2", "CK3" or "CK4" lead on the sender is falsely grounded, the ground will back up over the "CK1", "CK2", "CK3" or "CK4" lead and none of the relays in the decoder operated to that particular lead will release.

When at least one recording relay in each chain releases, the chains are broken and relays (CK1), (CK2) and (CK3) release, but a false ground preventing the release of any relay in one chain will prevent the release of (CK1) and (CK3) or (CK2).

With relays (CK1) and (CK3) released and (CK4) operated, relay (CK6) operates, causing relays (ST1) and (ST2) to operate. These relays cause relays (AC), (AC1), (DLX) and (STX) to operate; the function of these relays will be explained later.



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
RECEIVING INFORMATION FROM SENDER AND CHECK OF REGISTRATION LEADS

1	2	3				SCW

XB-101

TRANSLATING OFFICE CODE

Relays (A1), (A2), (A4) and (A5) are operated for the A register in the sender according to the first digit dialed, relays (B1), (B2), (B4), (B5) and (B5') from the B register according to the second digit, and (C1), (C2), (C4) and (C5) from the C register according to the third digit. In case the sender registers a permanent signal, relays (A1) and (A4) are operated.

The relays for each digit are operated in the following code. The numbers of the relays add up to the number dialed.

No. Dialed	Relay Operated (A) Digit	Relay Operated (B) and (C) Digit
0	1-4-5	None
1	1	1
2	2	2
3	1-2	1-2
4	4	4
5	5	5
6	1-5	1-5
7	2-5	2-5
8	1-2-5	1-2-5
9	4-5	4-5

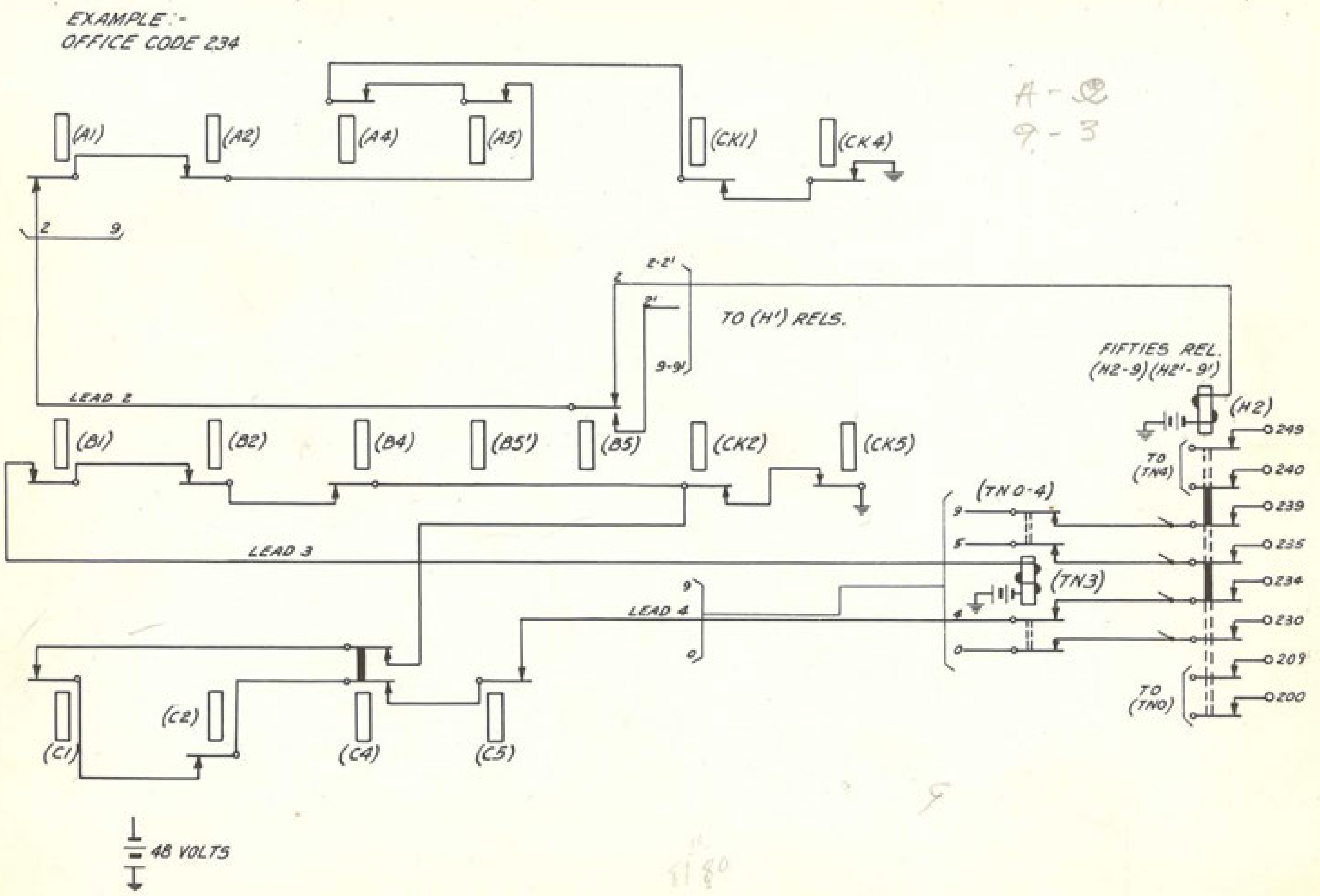
The first digit of a three digit code is some number from 2 to 9. As soon as relay (CK1) releases, one of the fifties relays, designated (H2 to H9) and (H2' to H9'), operates. When 0 is recorded as the A digit or when a permanent signal is recorded, no (H) relay operates, but one of the terminals "0" or "PS" is grounded.

The second digit of the three digit code which can be dialed by the subscriber is some number from 1 to 9. When the (CK2) relay releases, one of the tens relays (TN0) to (TN4) operates as controlled by (B1), (B2), (B4) and (B5).

The third digit of a three digit code which can be dialed is some number from 1 to 9. When the (CK2) relay releases, one of the ten make contacts of the tens relays is grounded as controlled by the (C1), (C2), (C4) and (C5) relays.

The result of operating one (H) relay and one (TN) relay and of grounding one contact of the (TN) relay, closes a circuit to ground one of the 800 terminals connected to the contacts of the (H) relays. These terminals represent all three digit codes and together with terminals "0" and "PS" represent 802 separate indications for any registration the decoder can receive from a sender.

Ground on one of these contacts causes the operation of the proper route relay.



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
TRANSLATING OFFICE CODE

1 2

XB-102

RECORDING CLASS OF SERVICE

The circuit is designed to accomodate a maximum of 14 classes of service, where calls for certain codes are routed differently or charged differently on account of zone service or because different classes of subscribers require different trunk groups to the special service or long distance operator. Number 8 of the 14 classes is used exclusively for an operator's class.

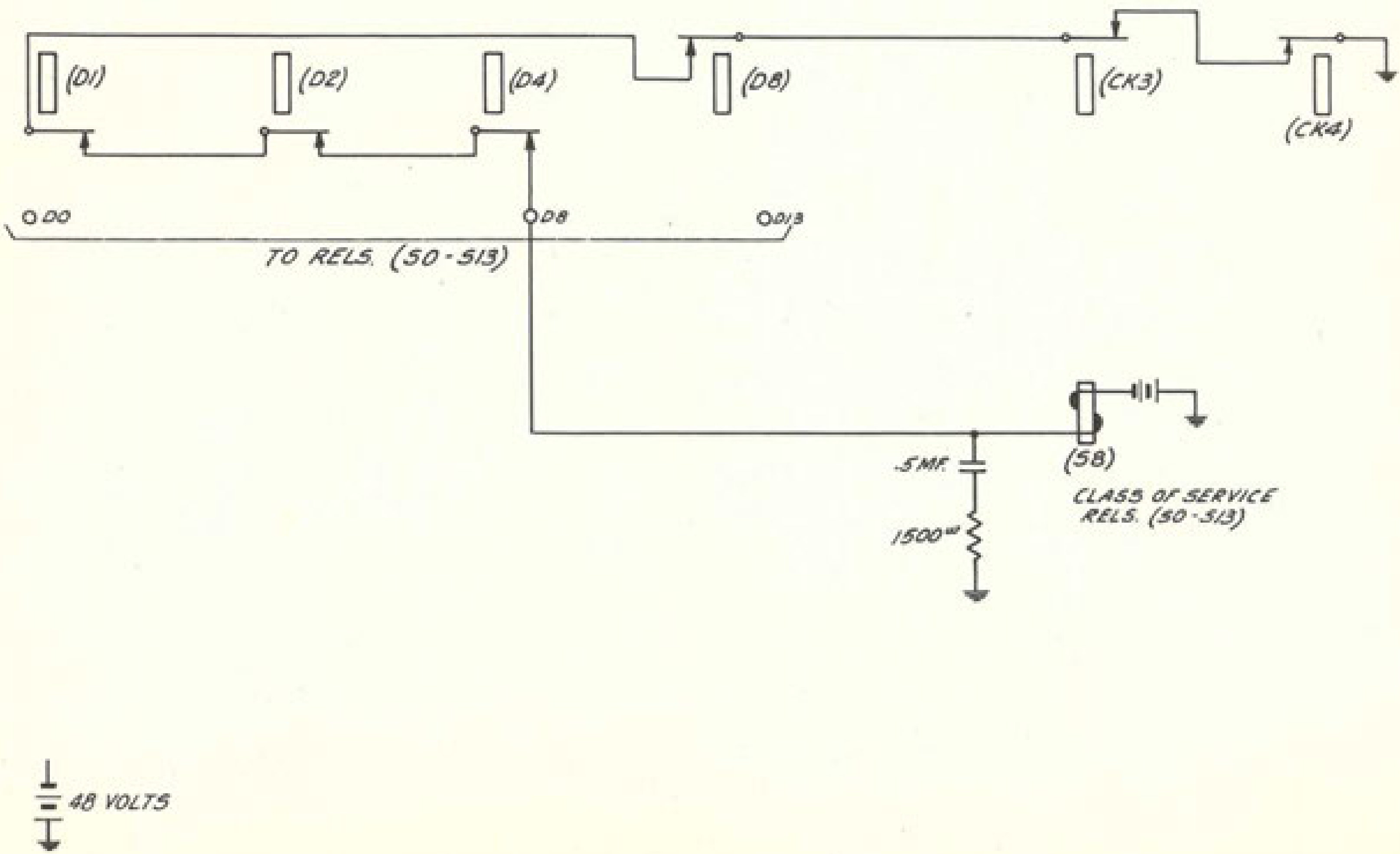
According to the class of service, the sender grounds any one of "D1", "D2", "D4" or "D8" leads. A total of 14 combinations is possible. Grounding lead "D1" operates relay (D1) and so on for relays (D2), (D4) and (D8).

When relay (CK3) releases, one of the relays (S0-S13) operates according to the setting of the (D) relays.

If less than 14 classes are required, only the (D) and (S) relays required need be furnished.

The several combinations of leads grounded by the senders, the (D) relays necessarily furnished and operated and the (S) relays operated, are shown in the following table:

Lead Grounded	Relay Operated	Relay Operated	Class
None	None	S0	0
D1	D1	S1	1
D2	D2	S2	2
D1-2	D1-2	S3	3
D4	D4	S4	4
D1-4	D1-4	S5	5
D2-4	D2-4	S6	6
D1-2-4	D1-2-4	S7	7
D8	D8	S8	8
D1-8	D1-8	S9	9
D2-8	D2-8	S10	10
D1-2-8	D1-2-8	S11	11
D4-8	D4-8	S12	12
D1-4-8	D1-4-8	S13	13



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
RECORDING CLASS OF SERVICE

XB-103

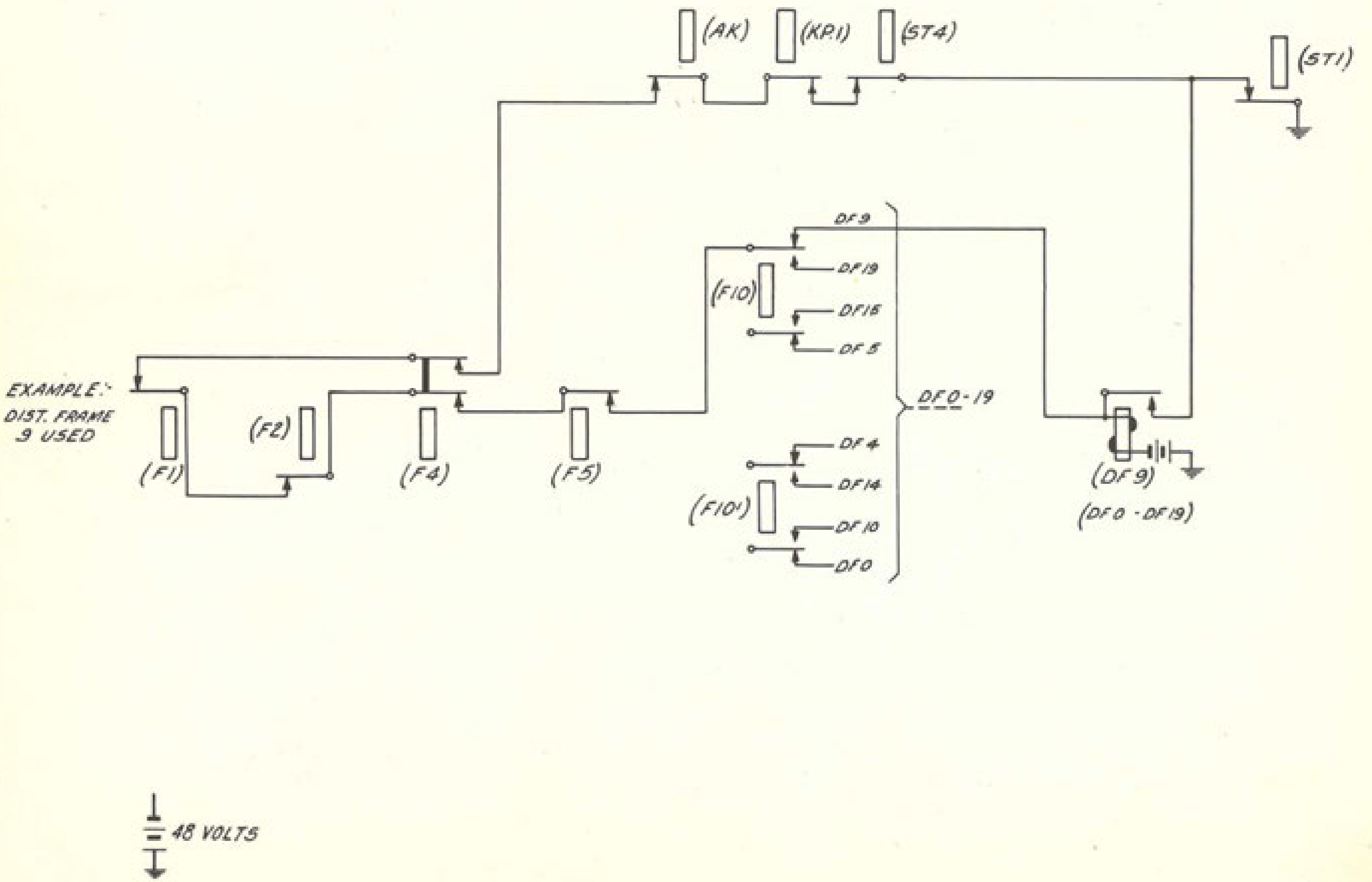
RECORDING DISTRICT FRAME INDICATION

Relays (F1), (F2), (F4), (F5) and (F10-F10') are operated from the frame register in the sender according to the number of the district frame through which the call is being originated.

The relays for each frame are operated in the following order, so as to record the district frame number in the decoder marker:

Frame Number	Relay Operated	Frame Number	Relay Operated
0	None	10	F10-10'
1	F1	11	F1-10-10'
2	F2	12	F2-10-10'
3	F1-2	13	F1-2-10-10'
4	F4	14	F4-10-10'
5	F5	15	F5-10-10'
6	F1-5	16	F1-5-10-10'
7	F2-5	17	F2-5-10-10'
8	F1-2-5	18	F1-2-5-10-10'
9	F4-5	19	F4-5-10-10'

With relay (ST1) operated, ground is closed through the contacts of the (F) relays to one of the leads (DF-0-19) and operates the correspondingly numbered relay (DFO) to (DF19) which corresponds to the number of the district frame.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER RECORDING DISTRICT FRAME INDICATION	1 2 XB-104

TRANSMITTING INFORMATION TO THE SENDER

When an (R) relay operates with its contacts grounded, it grounds seven terminals designated OB, OG, SB, SG, CR, CL and SP, individually to that relay. The decoder transmits six major and six minor items of information to the sender by means of six groups of transmitting relays, each controlled by one make contact of the operated (R) relay. If there is any charging information to be transmitted to the district, it is done by a group of transmitting relays operating in series with the (R) relay.

The six groups of transmitting relays control six groups of leads over which the information is transmitted. The following table gives the master designation of the group of relays, the items of information, and the leads used. In each case the major item is given first in the table and the minor item follows it.

Group	Item of Information	Leads Used
OB	Office Brush	OB1,OB2,OB4
OB	Stations Delay	SD,SD1
OG	Office Group	OG1,OG2,OG4,OG5
OG	Skip First Office	SO
SB	Second Office Brush	SB1,SB2,SB4
SB	Second Office Comp.Resis.	CR6,CR7
SG	Second Office Group	SG1,SG2,SG4,SG5
SG	Skip Second Office	SSO
CR	Compensating Resistance	CR1,CR2,CR3,CR4
CR	Trunk Test Relay (TG) or (MTG)	CR5
CL	Class of Call	CL1,CL2,CL3,CL4
CL	Two-wire Office	TW

TRANSMITTING COMPENSATING RESISTANCE INFORMATION TO SENDER

The group of (CR) relays for transmitting to the sender the first office compensating resistance information, consists of relays (CRO) to (CR9), (CRA) to (CRC), (CRP), (CRS) and (XCR). Relays (CRO) to (CR9) are double wound, one end of each winding being wired to a terminal for cross-connection to the CR terminals of the (R) relays; thus on each call the operation of an (R) relay causes the operation of one of relays (CRO) to (CR9). With the (CRO) relay operated, none of the leads "CR1" to "CR4" is connected to ground, but with any one of relays (CR1) to (CR9) operated, either one or two of these leads are connected to ground through the windings of either or both of the (CRB) and (CRC) relays. The secondary windings of the (CRO) to (CR9) relays are connected to battery through the windings of the (CRS) and (XCR) relays in series. The primary windings of these relays are connected to battery through the windings of the (CRP) and (XCR) relays in series. The (XCR) relay operates only when more than one of the numbered relay windings is grounded, in which case the operation of the (XCR) relay causes the operation of the decoder (XX1) relay, thus blocking the call.

The compensating resistance for use during and after trunk test is transmitted over the "CR3" and "CR4" leads. When there are no office selectors to be set up on the particular call, then the relays operated and leads to ground for the various compensating resistance conditions are as follows:

Comp. Resis. Trunk Test	Leads Grounded	Relay Operated	Check Relays Operated
0	None	CRO	None
300	CR3	CR4	CRB
600	CR4	CR7	CRB
900	CR3-CR4	CR9	CRB-CRC

The compensating resistance for use during a single distant office test and selections and during and after trunk test is transmitted over the "CR1", "CR2", "CR3" and "CR4" leads. The leads grounded and the relays operated for the various compensating resistance conditions are as follows:

Comp. Resis. Office Test	Trunk Test	Leads Grounded	Relay Operated	Check Relays Operated
900	0	None	CRO	None
600	0	CR1	CR1	CRB
300	0	CR2	CR2	CRB
0	0	CR1-CR2	CR3	CRB-CRC
900	300	CR3	CR4	CRB
600	300	CR1-CR3	CR5	CRB-CRC
300	300	CR2-CR3	CR6	CRB-CRC
900	600	CR4	CR7	CRB
600	600	CR1-CR4	CR8	CRB-CRC
900	900	CR3-CR4	CR9	CRB-CRC

When one of the (CRO) to (CR9) relays is operated through its primary winding, the operation of the (CRP) relay connects the winding of the (CRA) relay to lead "CR5" and causes the sender to substitute the (MTG) relay for the (TG) relay which is required when the incoming selector is of the type which has battery and ground connected to the trunk while returning to normal. When one of the (CRO) to (CR9) relays is operated through its secondary winding, the (CRS) relay operates instead of the (CRP) relay and does not ground lead "CR5".

The drawing XB-105 explained the operation of the CR group. Other groups function in a similar manner.

The following tables and explanations show the relays and leads used to transmit the information to the sender:

(OB) Group

Office Brush	Leads Grounded	Relay Operated	Check Relays Operated
0	None	OBO	None
1	OB1	OB1	OBB
2	OB2	OB2	OBB
3	OB1-OB2	OB3	OBB-OBC
4	OB4	OB4	OBB
0	SD	OB5	OBB
1	SD-OB1	OB6	OBB-OBC
2	SD-OB2	OB7	OBB-OBC
3	SD-OB1-OB2	OB8	OBB-OBC-OBD
4	SD-OB4	OB9	OBB-OBC

Station Delay

The "SD" and "SD1" leads are or are not grounded indicating to the sender whether or not the called office requires the sender to delay after the fourth numerical digit of the called number has been dialed for a possible fifth numerical digit or a station's digit. The "SD" lead is grounded on all calls, except those to manual offices having some party lines with station letters. The "SD1" lead is grounded on all calls, except those to manual offices having some lines with 5-digit numbers. The "SD1" lead is grounded through the winding of the (OBA) relay when any one of the (OBO) to (OB9) relays are energized on their primary windings.

(OG) Group

Office Group	Leads Grounded	Relay Operated	Check Relays Operated
0	None	OGO	None
1	OG1	OG1	OGB
2	OG2	OG2	OGB
3	OG1-OG2	OG3	OGB-OGC
4	OG4	OG4	OGB
5	OG5	OGO	OGA
6	OG1-OG5	OG1	OGA-OGB
7	OG2-OG5	OG2	OGA-OGB
8	OG1-OG2-OG5	OG3	OGA-OGB-OGC
9	OG4-OG5	OG4	OGA-OGB

Skip First Office

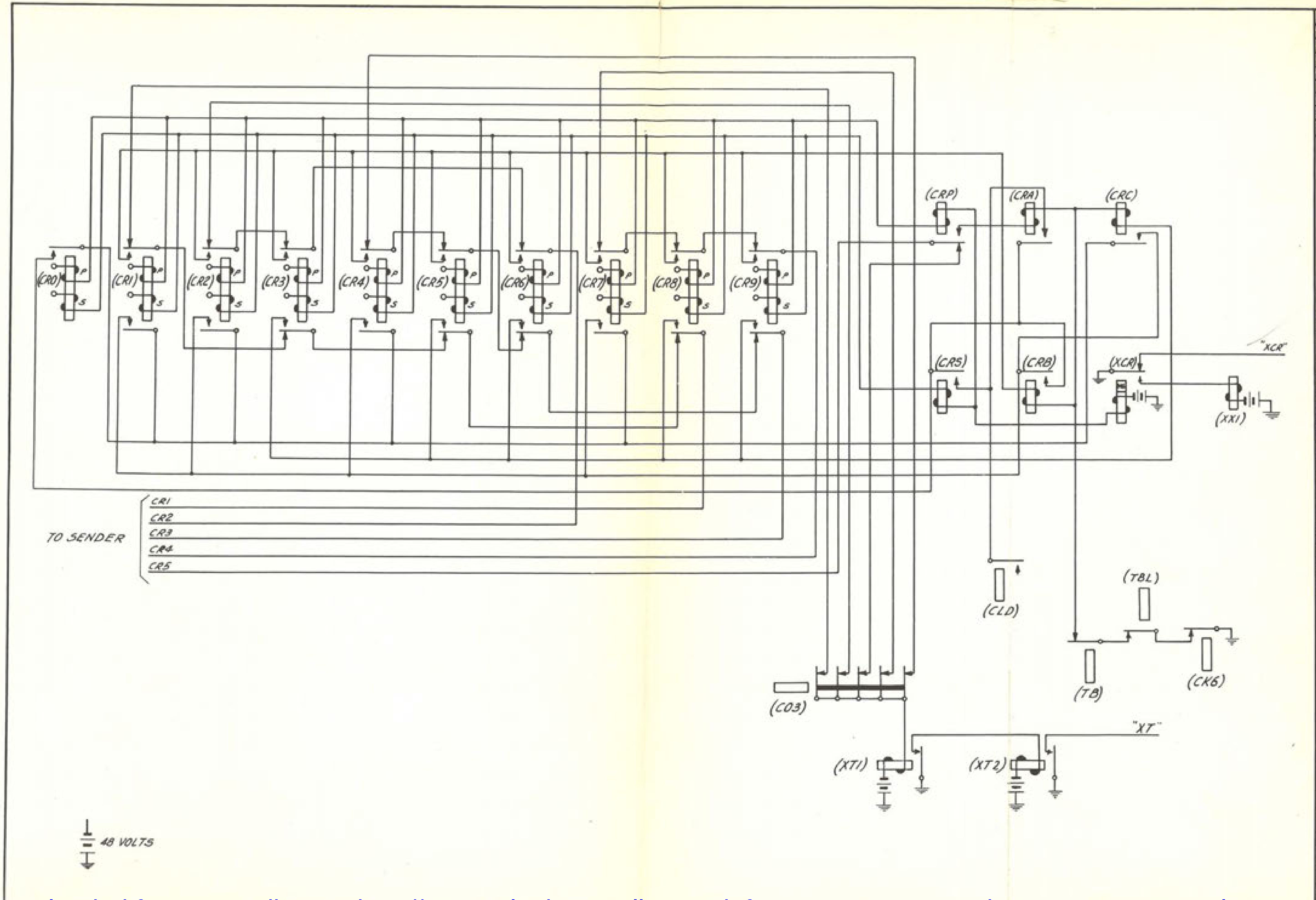
The "OG5" lead is grounded through the winding of (OGA) relay when any one of the (OGO) to (OG4) relays is energized on the primary winding. The (OG5) relay when operated grounds the "SO" lead to indicate to the sender [illegible]

CL Group

Class of Call	Leads Grounded	Relay Operated	Check Relays Operated
Full Sel.to Panel Off.	None	CLO	None
Full Sel.to Crossbar Off.	CL1	CL1	CLB
Restricted Code Rerouted Direct to Operator and Overflow on All but Zero and Three Digit Operator Calls	CL4	CL4	CLB
PC1 Tandem	CL2-CL4	CL3	CLB-CLD
PC1 Direct	CL1-CL2-CL4	CL2	CLB-CLC-CLD
Official Code, Dial Zero, or Permanent Signal Direct to Operator and Overflow on Call to These Trunk Groups	CL3-CL4	CL6	CLB-CLC
Official Code Through PC1 Tandem	CL2-CL3-CL4	CL5	CLB-CLC-CLD

Two-wire Office

The "TW" lead is grounded through the winding of the (CLA) relay when any of the (CLO) to (CL6) relays are energized on their primary windings. When this lead is grounded, information is transmitted to the sender that the call is to be routed through one or two office selectors or through full selector tandem equipment for the purpose of extending the time out period for stuck sender. It is also grounded on certain operator class calls for the purpose of short circuiting the winding of the sender (OF) relay on trunks that normally return reverse battery during trunk test. Also on calls from key pulsing "A" senders to certain types of operators' trunks reached directly from the distant office multiple, it causes a heavy positive pulse to be transmitted following (TG) tests.



XB-105

ORIGINATING DECODER MARKER

TRANSMITTING COMPENSATING RESISTANCE INFORMATION TO SENDER

N.Y. TEL. CO

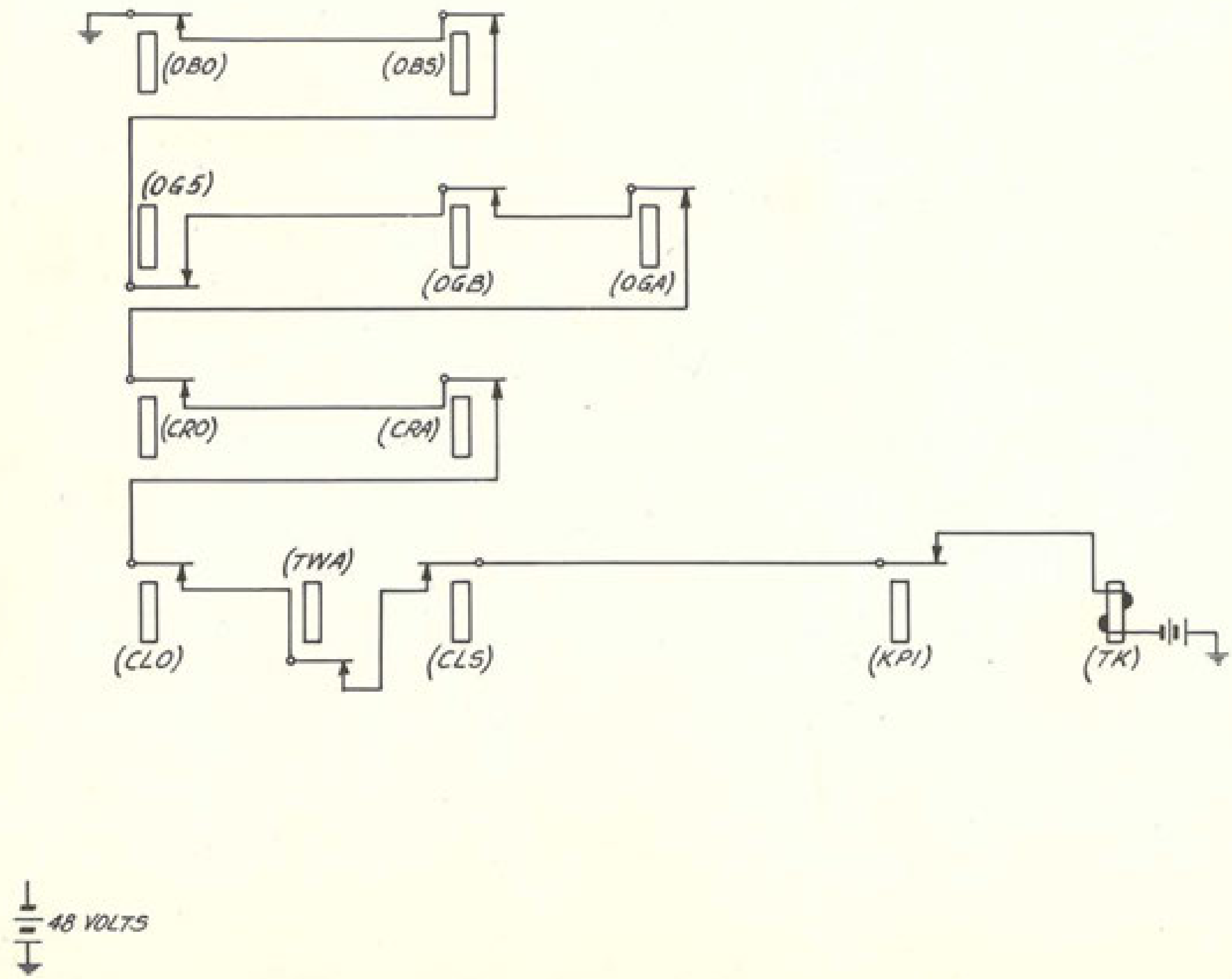
G.P.S. – L.I.

OPERATION OF THE (TK) RELAY INDICATING THAT THE TRANSMITTING RELAYS HAVE OPERATED

When a route relay is operated with ground supplied to its "OB", "OG", "CR" and "CL" terminals and also "SB" and "SG" terminals if a second office frame is used, the corresponding transmitting relays operate as has been described.

When and only when the proper combination of leads and windings of these relays are grounded, a path may be traced through the proper combination of these relays to operate the (TK) relay.

The attached drawing shows one of the combinations which may be set.



N. Y. TEL. CO. G.P.S. - L.I.	ORIGINATING DECODER MARKER OPERATION OF (TK) RELAY INDICATING THAT THE TRANSMITTING RELAYS HAVE OPERATED	1 52N XB-106

SELECTING A PAIR OF OFFICE FRAMES AND ASSOCIATING THEM WITH THE DISTRICT FRAME ORIGINATING THE CALL

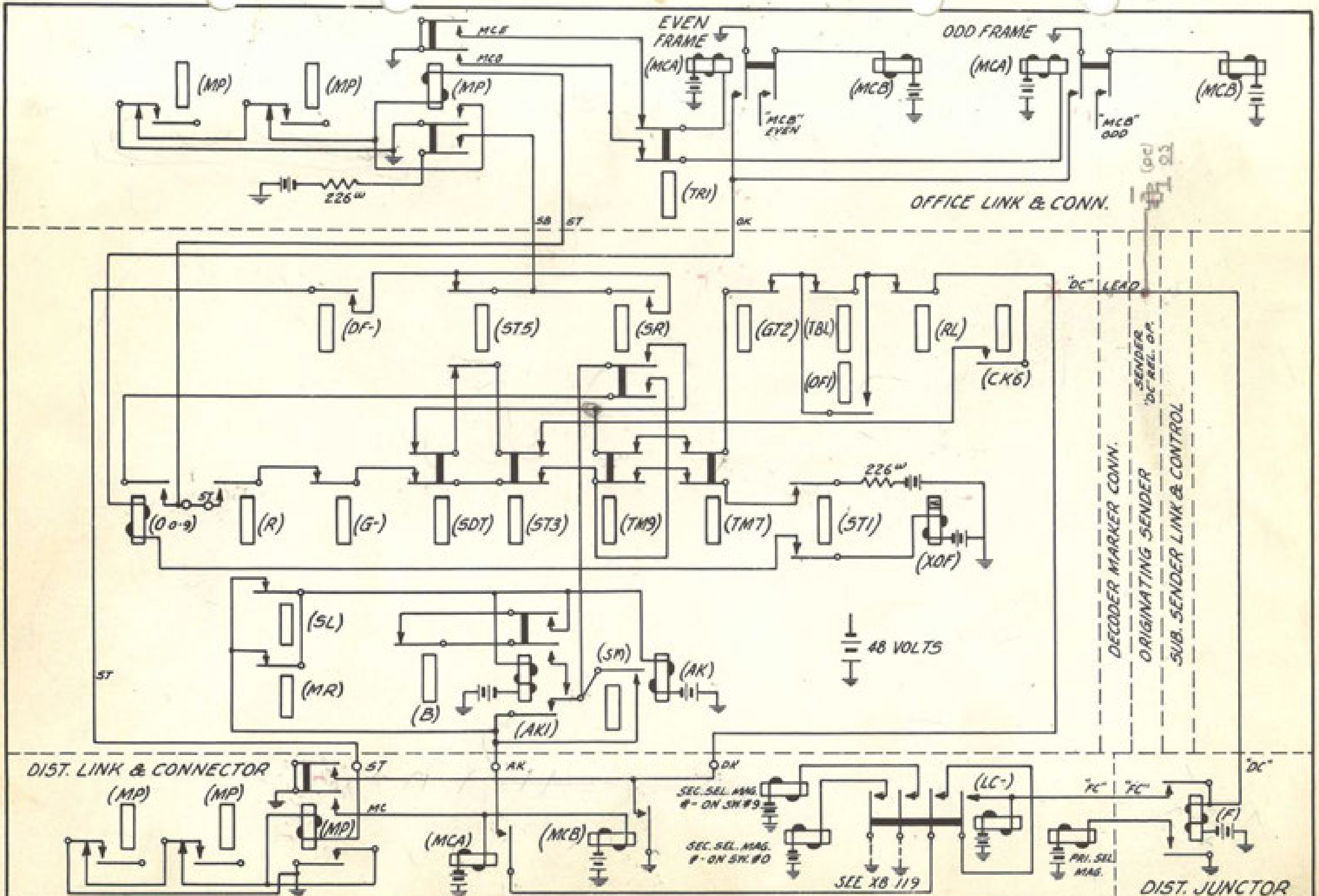
When the route relay operates and its associated ground supply relays (GS1-4) and (G1-4) are not operated and there is no call in the marker stage, the decoder marker proceeds to cause a pair of office frames to be connected in order to test for and find an idle trunk to the desired office.

The pair of office frames is picked by placing resistance battery on the office "ST" lead, causing the (MP) of the circuit associated with the marker to operate if not in use. Relay (MP) operated causes relays (MCA) of even office frame and (MCA) of odd office frame to operate. Relay (MCA) of the office operated grounds the "OK" lead. This operates the particular frame relay (O-O) to (O-9) corresponding to the office frame selected.

The office (MP) relay also places resistance battery on the "SB" lead through the operated (DF-) relay corresponding to the district frame used by the originating call, to operate the (MP) relay in the district link and connector circuit. With this relay operated, the (MCA) and (MCB) relays of the district are operated, also ground is placed on the "DK" lead to the marker which goes through the marker and leaves as the "DC" lead, passing through the decoder marker connector, originating sender, and subscribers' sender link and control circuit to the district junctor to operate relay (F) of that circuit.

With relay (F) operated, it operates its select magnet on a primary switch of the district link and connector circuit, also the (LC-) relay associated with that primary switch. The district junctor (F) relay also closes through the "DC" lead to the make contacts of the operated (LC-), which continues to a make contact of the (MCA) relay to return to the marker as the "AK" lead, operating relays (AK) and (AK1).

A circuit is now closed to hold the district junctor (F) relay operated until the marker has completed its functions.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER ASSOCIATING THE OFFICE LINK AND CONNECTOR WITH THE DISTRICT LINK AND CONNECTOR WHICH SERVES THE SELECTED DISTRICT JUNCTOR	1 2 3 XB-107

GROUND SUPPLY RELAYS

When all trunks of a group are busy, the (TB) relay operates as shown on (XB-112). With the (TB) relay operated, ground is closed over the "TB" terminal of the route relay to operate the (TB-) relay of the ground supply group which is serving the route relay. The operation of the (TB-) relay operates the (GS-) and (G-) relay associated with it. This opens the circuit to the transmitting trunk level, group start and group end relays, also the "ST" lead.

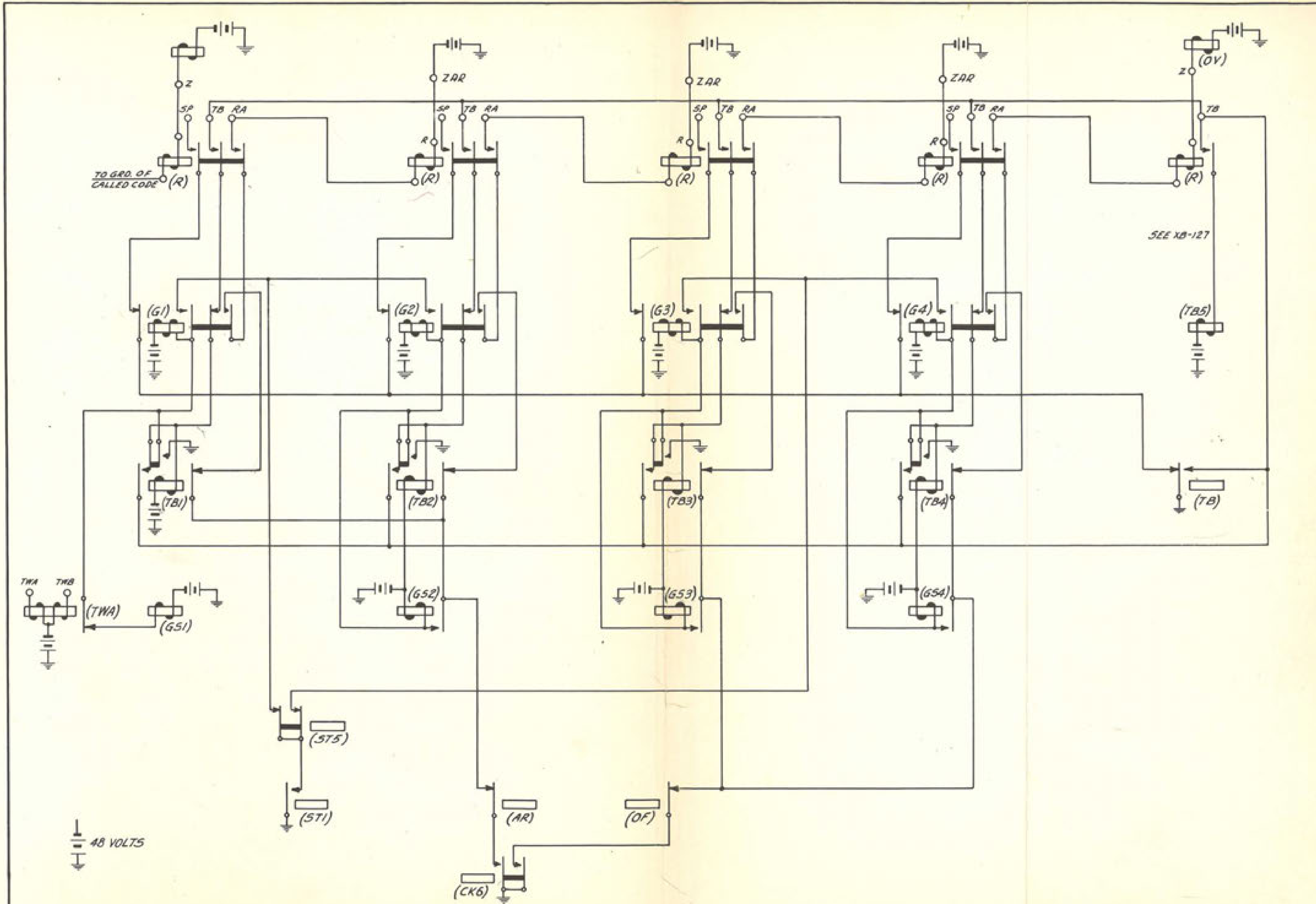
With the (G-) and (R) relays operated, the "RA" lead is closed to ground to operate the (R) relay of the next group of trunks which may be the second regular group, an alternate group or overflow group.

The operating circuit for the (GS1) relay is different than that for the (GS) 2-4 relays in order to reduce the number of route relays for the alternate routes through office frames. The decoder is arranged to use the original route relays in ground supply Group No. 1 that have alternate trunks through office selectors to transmit the required office brush and office group selections to the sender. This reduces the route relays for alternate routes through office selectors.

When the office selector alternate route relay is operated, either because the sender is asking for the alternate route on a second trial, or because of an all trunk busy condition in the original route relay trunks, provisions must be made for making the "OB", "OG" and "CL" terminals from the original route relay in the ground supply Group No. 1 effective, in order to transmit the required information to the sender for the alternate route through the office selector.

The "SP" terminals from the office selector alternate route relays are cross-connected so as to operate the (TWA) relay. The (GS1) relay was operated either from the (AR) relay or from the (TB1) relay. The operation of the (TWA) relay will release the (GS1) relay and, since the original route relay is still operated, the release of (GS1) relay will close ground again through the contacts of the original route relay to the required points for transmitting information to the sender for the office selector alternate route.

The "SP" terminal of the original route relay is cross-connected to the (OG5) relay to give a skip office indication. The "SP" lead is under control of the (G1) relay, so the skip office indication is not effective when the alternate route is used.



ORIGINATING DECODER MARKER
GROUND SUPPLY RELAYS

XB-108

N. Y. TEL. CO
G.P.S. - L

LEADS FROM GROUND SUPPLY RELAYS TO ROUTE RELAYS

The "OB" or office brush terminal of the route relays receives ground when relays (TB) and (GS-) are normal. The "OG" or office group terminal of the route relay receives ground when ground is connected to either the "SPA" or "SPB" or "TWA" or "TWB" terminal. This ground is supplied from the "SP" terminal of the route relay. The "CL" or class of call terminal receives ground when relays (GS-) and (TB) are normal. Terminals "CR", compensating resistance, and "SP", special, receive ground when relays (G-) and (TB) are normal. Terminals "TL", trunk level, "GS", group start, and "GE", group end, receive ground when relays (G-), (ST4), (SDT) and (MRL) are normal. Terminal "ST", start, receives 226 ohm resistance battery from the (ST1) relay operated through the timing relays and several other relays to the (G)1-4 relays. In the case of the (G1) relay, it continues through a normal contact of the (TWA) relay to the "ST" terminal and, in the case of the (G)2-4 relays, it goes directly to the "ST" terminal without going through the normal contact of the (TWA) relay.

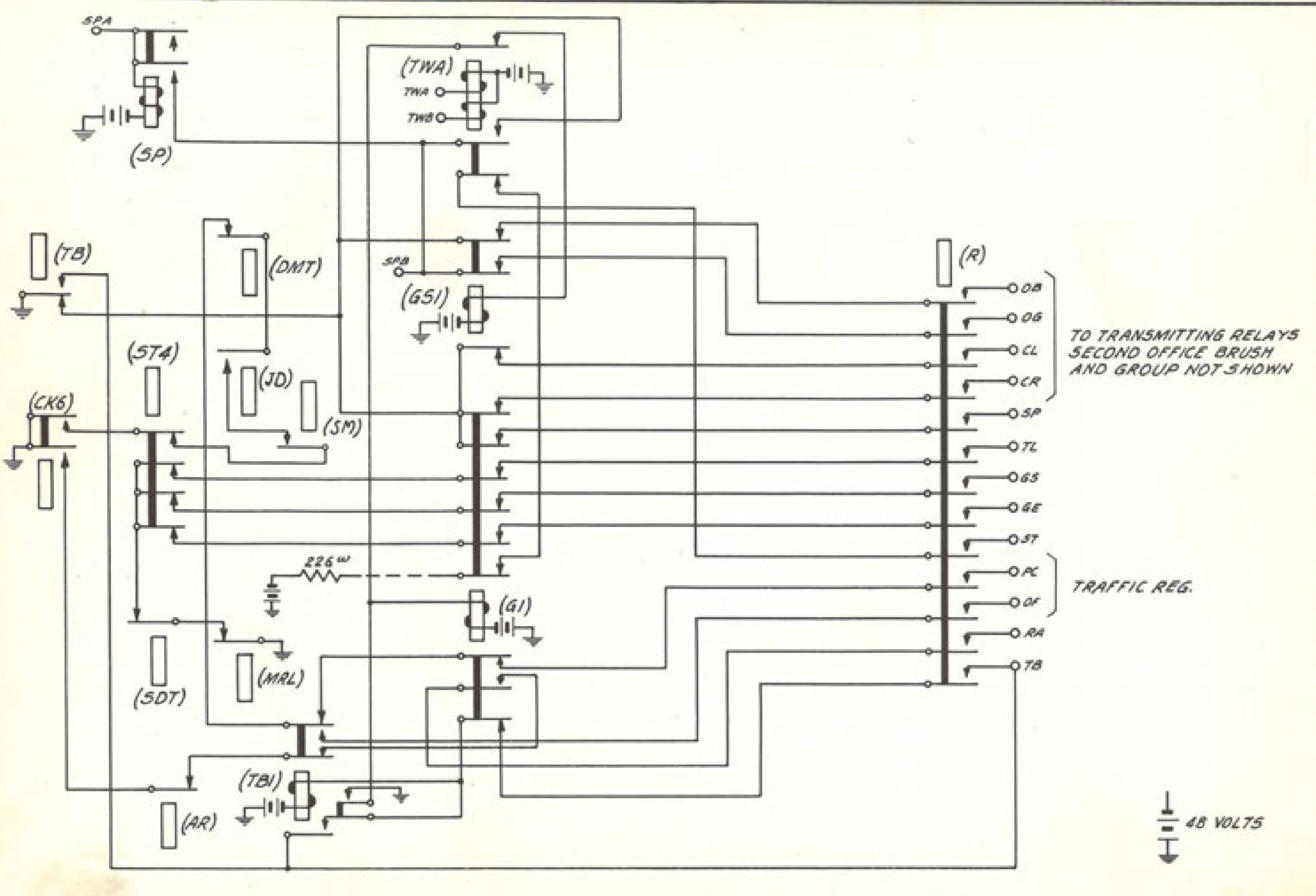
When the (G-) relay of a ground supply group is operated and its (TB-) relay has returned to normal, the "RA" terminal is grounded to operate another route relay in whatever group the next group of trunks are located. Terminal "TB" is used to operate the (TB-) relay of the ground supply group when all trunks of that group are busy, which causes the (TB) relay to operate, grounding the "TB" terminal.

The terminals for the second office brush and group are not shown on this drawing.

The "PC" terminal is provided from the route relay to furnish means for operating a register and thus record the number of calls routed to a particular trunk group. When a route relay operates and its associated ground supply relay (G1-4) is normal, a register cross-connected to the particular "PC" terminal will be operated. On trunk groups that have two route relays, the "PC" terminal of only the first choice route relay should be cross-connected. The "PC" terminals of the second choice route relays should not be cross-connected because if they were, the trunk group peg count register would be operated twice whenever the second choice route relay was operated on finding all trunks of one of the first choice trunk sub-groups busy.

The "OF" terminal is provided to furnish means for obtaining a record of the number of times that a call is originated for a trunk group and all trunks of the group are found busy. The (TB1-4) relay of the group found busy will be operated, grounding the "OF" terminal and operating the overflow register associated with the particular trunk group. On trunk groups that have two route relays, the "OF" terminal of the second choice route relay should be cross-connected to the required point while the "OF" terminal of the first choice route relay should not be cross-connected. This is to avoid falsely operating the overflow register on going to the second choice route relay when one of the first choice subgroups of trunks is found busy.

The ground lead to the "PC" and "OF" terminals is opened on the contacts of the (DMT) relay, so that these registers will not be operated on sender test circuit calls and decoder marker test calls.



N. Y. TEL. CO. P.S. - L.I.	ORIGINATING DECODER MARKER LEADS FROM GROUND SUPPLY RELAYS TO ROUTE RELAYS	1 2 XB-109

OPERATING THE TRUNK LEVEL RELAYS, INDICATING SPLIT OR NON-SPLIT TRUNKS AND INDICATING BOTH EVEN AND ODD OFFICE FRAMES ARE PREPARED TO HAVE TRUNKS TESTED

When the route (R) relay operates, ground is placed on the "TL" lead, operating one of the fourteen (TL) relays. If more than one should operate, the marginal relay (XTL) would operate, bringing in a trouble condition.

With relay (TL) 0 operated, ground is placed on leads "TLO" even and odd to the pair of office frames that were previously started and have their (MCA) relays operated. Leads "TLO" even and odd cause the (TLO) relay in both frames to operate. Relay (TL) of the office is cross-connected to a (TR) relay which would be another trunk level.

The trunk level is the level at which the trunks appear on the secondary switches. Relay (TL) indicates the level on the left half of the secondary switch and (TR) indicates the level on the right half of the secondary switch.

The trunk level relays in the office receive their battery from the (SS) relay corresponding to their level. The (SS) relay when operated, operates the proper secondary select magnets. This will be explained later.

The (TL) and (TR) relays also indicate to the decoder marker whether the trunk group is split or non-split. In the case of a split group the "SP" punchings on the (TL) and (TR) relays are cross-connected, shown as X wiring on the drawing, grounding lead "SP" to the decoder marker. If the trunk group is non-split, the "NS" punchings of these relays are cross-connected, shown as Y wiring, grounding lead "NS". If one office frame for a particular level is split, its mate frame must also be split and the same holds true for non-split levels.

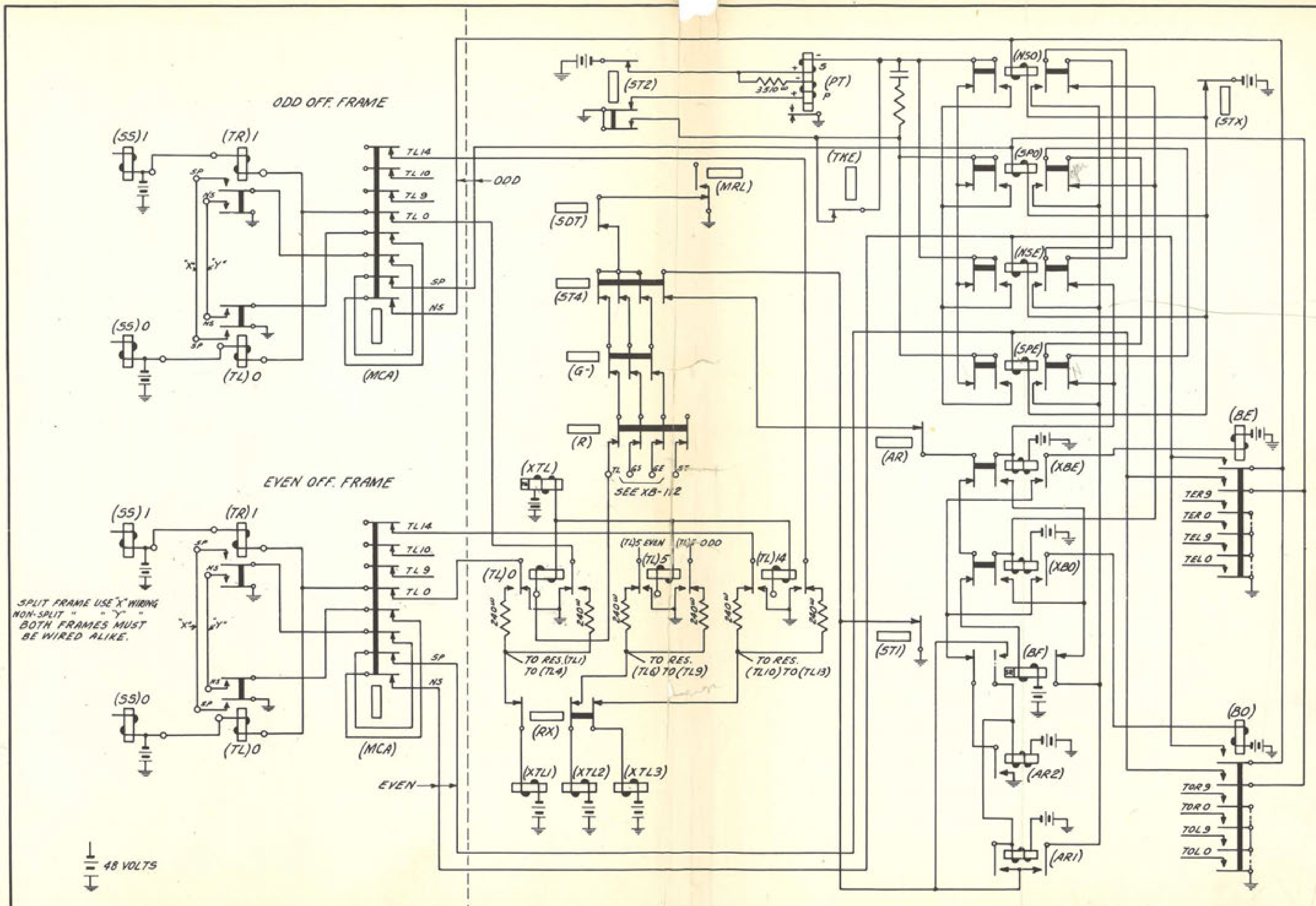
Assuming the trunk groups are non-split with the (TL) and (TR) relays of both office frames operated, the "NS" leads, even and odd, would be grounded, causing relays (NSE) and (NSO) of the marker to operate. With both of these relays operated, ground is removed from the negative side of the secondary winding of relay (PT). This has been holding the (PT) relay non-operated. It will now operate after the condenser has discharged and charged. The purpose of operating this relay and reason for the delay will be explained later.

In the event that only one of the (NS) relays should operate, relay (PT) could not operate and would cause the marker to time out, provided the (AR) relay had not been operated. The same condition applies to the (SP) relays.

When the (AR) relay is operated, indicating an alternate route, call relay (BF) is operated which in turn operates relays (AR1) and (AR2) which lock. Under this condition, if either of the pair (NSE) or (NSO) fails to operate, the (XBO) or (XBE) will operate, (XBO) operating for an odd office frame failure and (XBE) for an even office frame failure. The same is true for a split condition. With either (XBO) or (XBE) operated, the slow release (BF) relay releases, operating relay (BO) if (XBO) is operated, or operating (BE) if (XBE) is operated.

With relay (BO) operated, it grounds the "T" leads for the odd office frame trunks giving the indication that these trunks are busy; also it connects together the "NS" leads and the "SP" leads of the two office frames. Relay (BE) performs a similar function for the trunk of the even office frame and treats the "NS" and "SP" leads in a like manner.

With the "NS" or "SP" leads connected together, when one of the leads is grounded it places ground on the mate lead, thus operating both the (NSE and NSO) or (SPE and SPO) relays, allowing the (PT) relay to operate in the usual manner.



ORIGINATING DECODER MARKER

OPERATING THE TRUNK LEVEL RELS. INDICATING SPLIT OR NON-SPLIT TRUNKS AND INDICATING THAT BOTH EVEN AND ODD OFFICE FRAMES ARE PREPARED TO HAVE TRUNKS TESTED

N. Y. TEL. CO.
G.P.S. - L.I.

XB-110

CONNECTING FORTY "S1" LEADS FROM A PAIR OF OFFICE FRAMES TO THE DECODER MARKER, USED TO TEST FOR BUSY TRUNKS

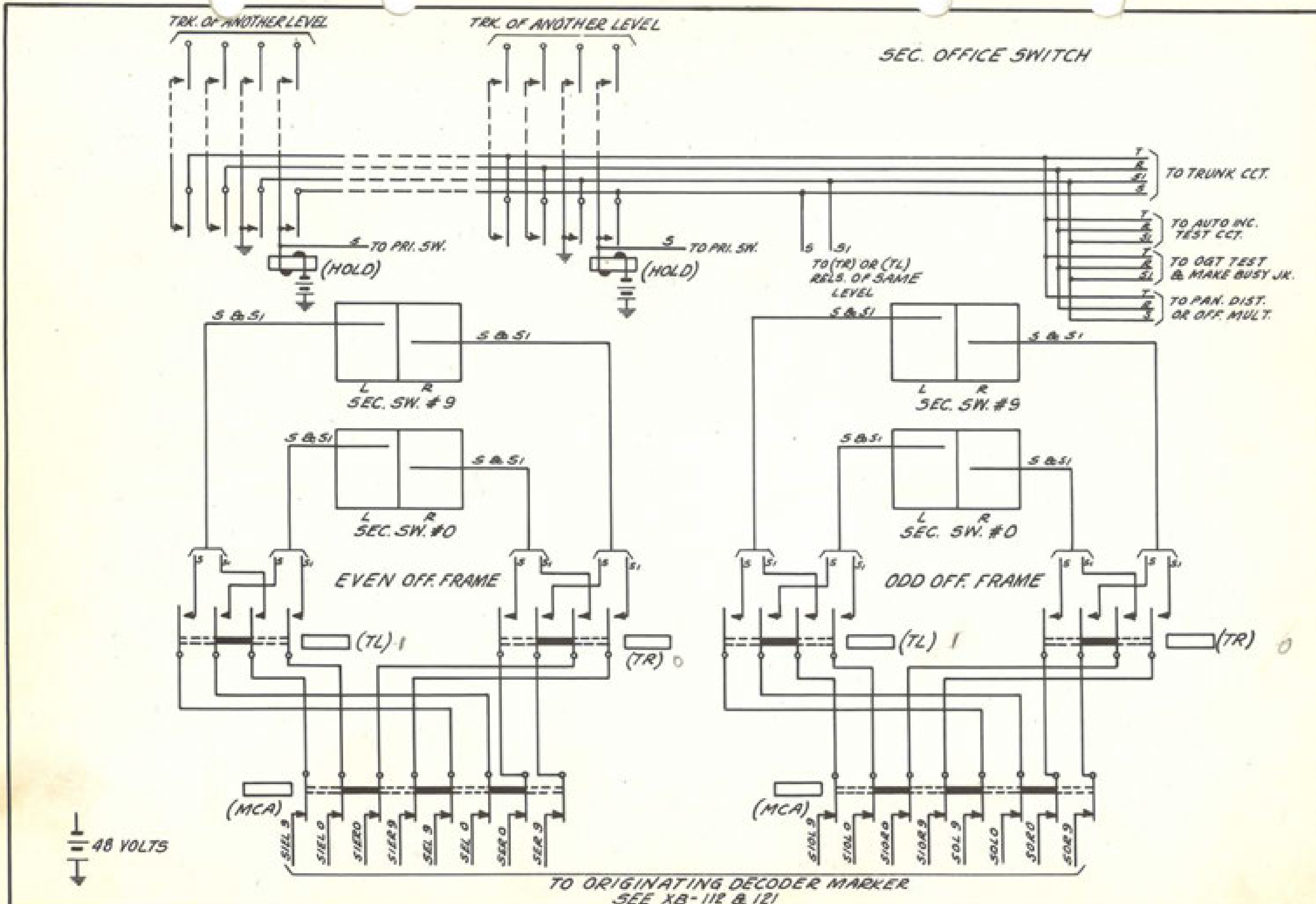
With the operation of the (MCA), (TL) and (TR) relays of the pair of office frames, forty "S1" leads were closed through to the decoder marker to test for busy trunks served by the (TL) and (TR) relays.

Although forty trunks are tested to determine whether they are busy or not, the decoder marker only deals with the trunks of the group being used. This group may range from 2 to 40 trunks and is controlled by the group start and group end relays of the marker, which will be explained later.

The trunk groups are shown on the attached drawing as split groups. In the case of non-split groups the trunk would extend through the left and right halves of the secondary office switch.

Twenty "S1" leads come from the even office frame designated "S1" ELO to "S1" EL9 and "S1" ERO to "S1" ER9, likewise twenty "S1" leads come from the odd office frame designated "S1" OLO to "S1" OL9 and "S1" ORO to "S1" OR9.

When outgoing trunks are used in common with a panel office, the "S1" punching of the outgoing trunk is connected to the "S" punching of the panel trunk, in order to give a busy indication if in use at the panel office. A busy condition will also be recognized if the trunk is made busy or in use at the OGT board or automatic incoming test frame.



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
CONNECTING 40 "S" & "S1" LEADS FROM A PAIR OF OFFICE FRAMES TO THE DECODER MARKER, USED TO TEST FOR BUSY TRUNKS

1 2 DCW
XB-111

TRUNK GROUP START AND END ALSO TRUNK SELECTION

Although the sleeve leads of forty trunks have been closed through to the decoder, the particular trunk group required may be of any number from 2 to 40. It is, therefore, necessary to determine the first and last trunk of the desired group, in order to choose an idle trunk within the desired group. This information is obtained from the route relay, terminals "GS" and "GE", which indicate the group start and group end points. These terminals are cross-connected to the (TG-) group start and (TG-) group end according to the size and location of the trunk group.

As stated above, a trunk group or sub-group may consist of any number of trunks from 2 to 40, except that the arrangement provided in the decoder marker cuts in an even number of trunks. That is, it cuts in 2,4, 6 and so on up to 40 trunks. If the particular trunk group or sub-group should consist of an odd number of trunks as 1,3,5,7,etc., up to 39 trunks, then the unused trunk on the office switch is made to appear busy by connecting ground to "S1" terminal corresponding to the unused trunk.

The arrangement in the decoder marker for cutting in a trunk group is a complete circle arrangement and, therefore, the start point may be at any of the 20 start points in the circle. For instance, assuming a trunk group of 40 trunks, the start point need not necessarily be at "ELO" with the end point at "OL9", but instead the start point may be at any other point from "ELO", as for instance, "ER1", "EL2", "ER3" and so on up to "EL9". The corresponding end point for a 40 trunk group would then be "OLO" for start point "ER1" and "OR1" for start point "EL2", and "OL2" for start point "ER3", and so on up to "OR8" for start point "EL9".

On the attached drawing the first and tenth group of (TG-), (T-), (P-) and (K-) relays are shown.

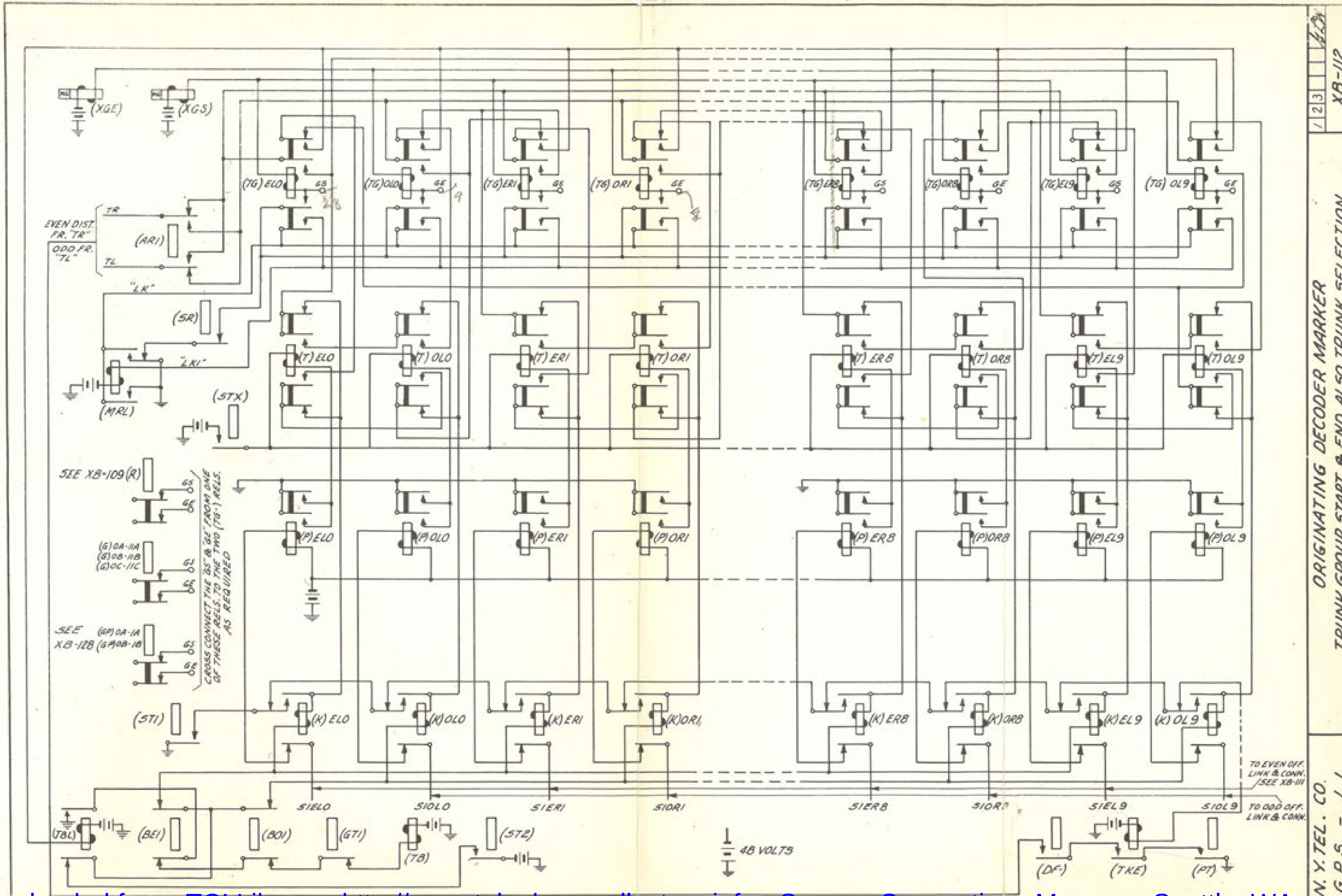
The following table shows the order of appearance of these relays in the ten groups:

Group	First Relay	Second Relay	Third Relay	Fourth Relay
1	ELO	OLO	ER1	OR1
2	EL2	OL2	ER3	OR3
3	EL4	OL4	ER5	OR5
4	EL6	OL6	ER7	OR7
5	EL8	OL8	ER9	OR9
6	ERO	ORO	EL1	OL1
7	ER2	OR2	EL3	OL3
8	ER4	OR4	EL5	OL5
9	ER6	OR6	EL7	OL7
10	ER8	OR8	EL9	OL9

The numeral 0 to 9 following the relay designation corresponds to the office secondary switch number and the same holds true for the "S1" leads. Assuming a group of six trunks were assigned, starting with "EL4" and ending with "OL6", the first trunk would be on even office frame #4 secondary switch left side, the second on odd office frame #4 secondary switch left side, the third on even office frame #5 secondary switch right side, the fourth on odd office frame #5 secondary switch right side, the fifth even office frame #6 secondary switch left side, and the sixth odd office frame #6 secondary switch left side. The trunk levels at which these trunks appear on the office secondary switches are controlled by the (TL) relays for the left side and (TR) relays for the right side.

Any "S1" lead which is grounded will operate its corresponding (P-) relay which in turn operates the (T-) relay associated with it. Only the (P) and (T) relays between the group start and group end points are used on this call, although others may operate. If all the (T) relays between the group start and group end points should operate, a circuit is closed to operate the (TB) relay, indicating the trunks of that sub-group are busy.

The (PT) relay was made slow operating in order to allow time for all of the (P) and (T) relays to operate that were going to be operated. When the (PT) relay finally operates, it closes ground through contacts of the (TKE) relay through the operated district frame (DF-) relay, through the normal or operated contacts of the (AR1) relay to the operated group start (TG-) relay to the (T-) relay, representing the first trunk of the group, thence through the chain contact until it finds the first unoperated (T-) relay. The path is then continued through the back contact of this unoperated (T-) relay to the winding of the associated (K-) relay which operates and locks. The (TKE) relay releases, opening the operating circuit to the (K) relays.


ORIGINATING DECODER MARKER
TRUNK GROUP START & END ALSO TRUNK SELECTION
XB-112
N.Y. TEL. CO.
G.P.S. - L.I.
(XGE)
(XGS)
(TG) ELO
(TG) OLO
(TG) ERI
(TG) ORI
(TG) ER8
(TG) OR8
(TG) EL9
(TG) OL9
EVEN DIST. FR. "TR"
ODD FR. "TL"
TR
TL
(ARI)
"LK"
(SR)
"LKI"
(MRL)
(STX)
(T) ELO
(T) OLO
(T) ERI
(T) ORI
(T) ER8
(T) OR8
(T) EL9
(T) OL9
SEE XB-109 (R)
(G) OA-11A
(G) OB-11B
(G) OC-11C
SEE XB-128
(GP) OA-1A
(GP) OB-1B
CROSS CONNECT THE "GS" & "GE" FROM ONE OF THESE RELS. TO THE TWO (TG-) RELS. AS REQUIRED
(P) ELO
(P) OLO
(P) ERI
(P) ORI
(P) ER8
(P) OR8
(P) EL9
(P) OL9
(STI)
(K) ELO
(K) OLO
(K) ERI
(K) ORI
(K) ER8
(K) OR8
(K) EL9
(K) OL9
SIELO
SIOLO
SIERI
SIORI
SIER8
SIOR8
SIEL9
SIOL9
TO EVEN OFF. LINK & CONN. /SEE XB-111
TO ODD OFF. LINK & CONN.
(TBL)
(BEI)
(BOI)
(GTI)
(TB)
(ST2)
48 VOLTS
(DF-)
(TKE)
(PT)

DOUBLE CONNECTION TEST - CHECK OF "S" LEAD - RELEASE OF (MCB) RELAY ON MATE OFFICE FRAME

TRUNK DOUBLE CONNECTION TEST OF TRUNKS USED IN COMMON WITH DECODER MARKERS AND PANEL OFFICES

When relay (ST1) operated, a path was closed which operates the (DT2) relay under control of the (EL), (OL), (ER) and (OR) relays. This operates the (DT1) relay. When the (K-) relay operates, the ground that is operating the (DT1) relay is connected to the "S1" lead of the selected trunk. This is to make that trunk test busy to another decoder and to panel selectors on trunk groups used in common with panel. The (K-) relay also operates the corresponding (EL), (OL), (ER) or (OR) relay. Assume the first idle trunk to be on the even office frame left side, the (EL) relay would operate. This relay in operating removes ground from the winding of the (DT2) relay, which releases. This in turn removes the operating ground from the (DT1) relay whose winding is now connected through the operated (K-) relay to the "S1" lead of the chosen trunk. If some hunting panel selector which may have chosen the same trunk at the same moment has not grounded the "S1" lead, the (DT1) relay will now release, again connecting busy ground to the "S1" lead from the (S) relay normal.

CHECK FOR FALSE GROUND ON OFFICE "S" LEAD

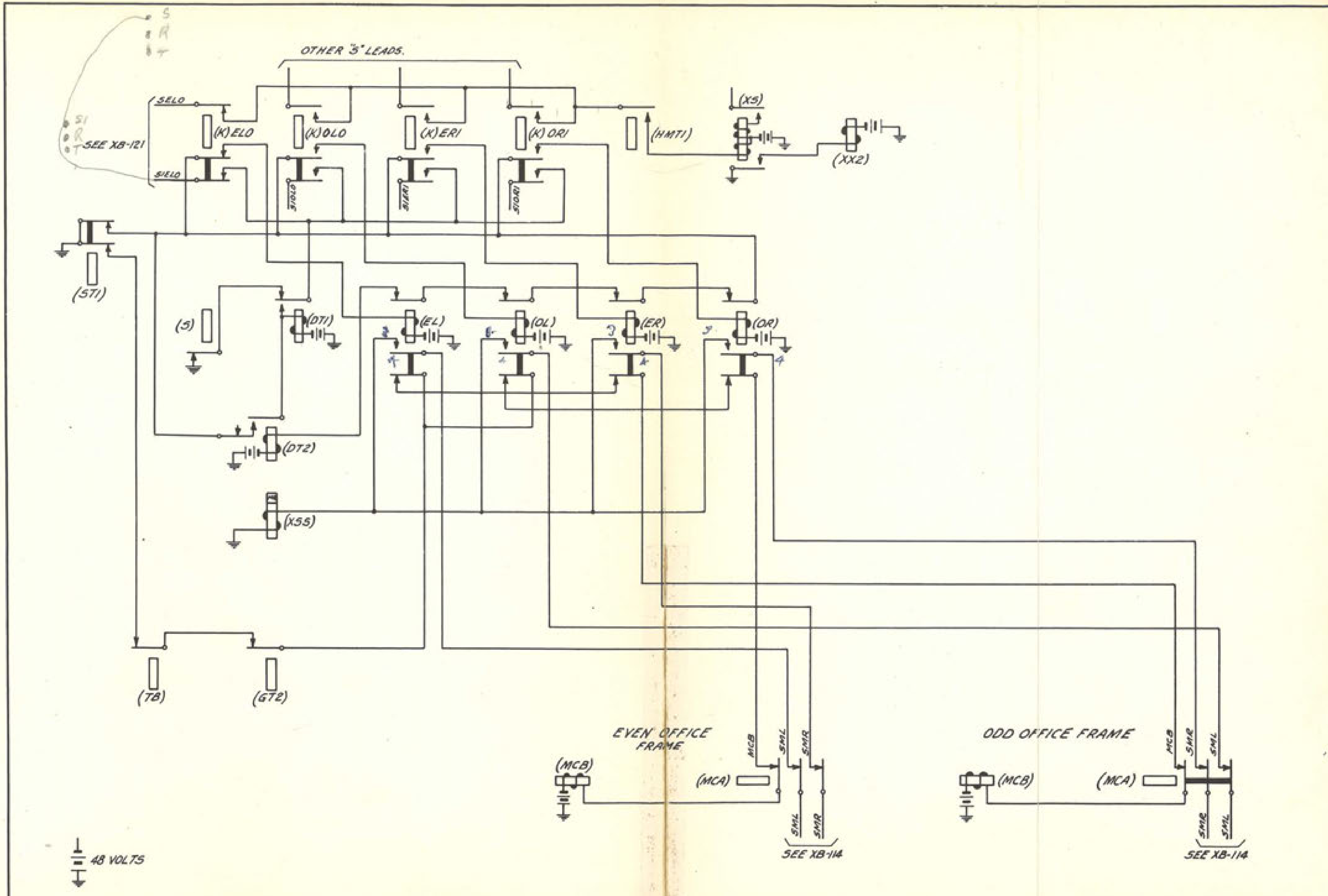
The (K-) relay also connects battery through the winding of the (XS) relay to the "S" lead if some trouble condition allows a trunk to be selected as idle and yet there was a ground on the "S" lead, or if this lead should become grounded after the trunk was selected, but before the hold magnet has been operated, then the (XS) relay will be operated and locked. The (XX2) relay will then be operated and the call blocked. The trouble indicator circuit will be called in to take a record of the condition, after which a trouble release signal will be given the sender through the district, except when the sender is asking for overflow. The (RL) relay will be operated and the decoder marker will release as described under "Trouble Release."

When the (HMT1) relay has released (which will be explained later), the path from the "S" lead to the winding of the (XS) relay is opened.

RELEASE OF (MCB) RELAY ON MATE OFFICE FRAME

The decoder marker is connected to a pair of office frames by the operation of two (MCA) and two (MCB) relays in the office link and connector circuit.

In order to prevent interference while testing for an idle channel from the office frame used, it is necessary that the (MCB) relay of the frame not in use be released. This is done by opening the circuit through which the (MCB) relay is operated on the contacts of the (EL), (OL), (ER) or (OR) relays. The (EL) or (ER) which operate when a trunk is selected on the even frame, releases the (MCB) of the mate or odd frame, while (OL) or (OR) releases the (MCB) of the mate or even frame.



ORIGINATING DECODER MARKER

DOUBLE CONNECTION TEST-CHECK OF "5" LEAD-RELEASE OF (MCB) REL. ON MATE OFFICE FR.

XB-113

N.Y. TEL. CO.
G.P.S. - L.I.

OPERATION OF SELECT MAGNETS ON OFFICE SECONDARY SWITCHES

When a split group of trunks is used, two trunks appear on the split level of each office secondary switch, if all levels were split, a secondary switch could serve 20 trunks, 10 from the left half and 10 from the right half. When none of the levels is split, a secondary switch can serve only 10 trunks, since the same trunk appears on the left half level as on the right half of the same level.

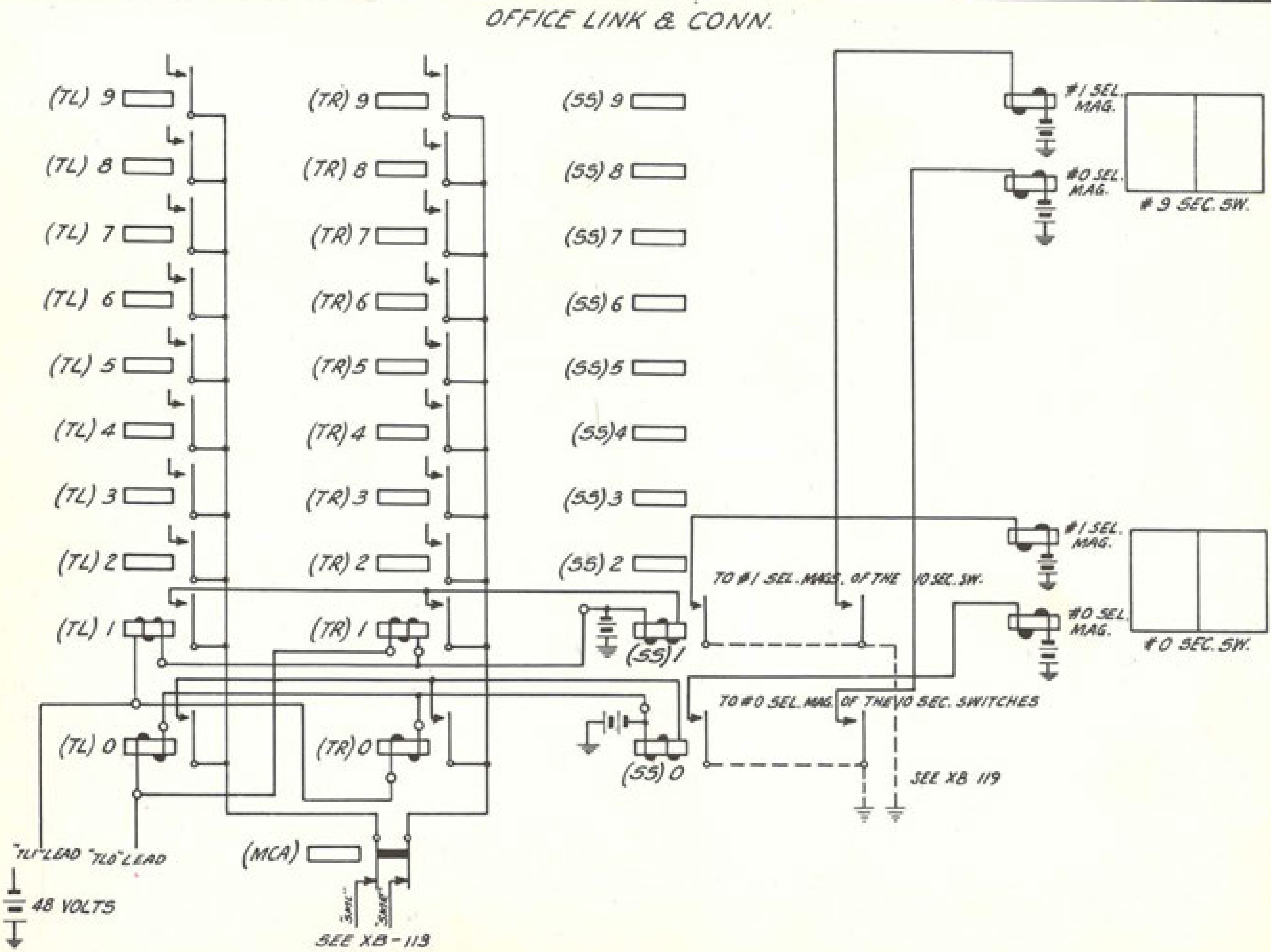
A switch may have some levels split and others non-split, but in this case the same levels must be split on all secondary office switches of the pair of frames, and an even number of levels must be split on each switch.

In the case of a non-split group, when it is desired to have more than ten trunks in a group on an office frame, it will be necessary to have trunks of that group appear on more than one level of a secondary switch.

In order to operate the select magnet on the level of the selected trunk, the proper (SS) relay must be operated.

When an even level (TL) relay is operated the next higher level (TR) relay is operated and when an odd (TL) relay is operated the next lower (TR) relay is operated. With this arrangement a failure of a particular (SS) relay would only affect half of a group of trunks, served by a particular trunk level indication.

Assume that the left half trunk appeared on "0" level and the right half trunk appeared on "1" level. If the right half trunk was selected, the "SMR" lead would be grounded, operating relay (SS) 1 which in turn would operate the #1 select magnet on each of the ten secondary switches. But if lead "SML" was grounded, relay (SS) 0 would operate, in turn operating the "0" select magnets of the ten secondary switches.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER OPERATION OF SELECT MAGNETS ON OFFICE SECONDARY SWITCHES	1 2 BTW XB-114

SENDER RELEASE

When the code information has been properly recorded in the decoder, the proper route relay operated, and the information for the proper setting up of the call transmitted to the sender, a path is closed for operating the slow operate (TK) relay. This relay is made slow-operate in order to allow sufficient time for the register relays in the sender to operate before the connection to the sender is broken down.

The path for operating the (TK) relay is opened on calls from an operator's sender where the operator keys a blank code or a code that should not be routed over the particular type of trunk that she has plugged into. In these cases, the (KP) relay is operated in series with the route relay and in turn operates the (KP1) relay. The (RO) lead to the "A" sender is also grounded. This causes the operation of a relay in the sender which in turn causes a lamp at the "A" operator's position to flash as a signal that something is wrong.

When the (TK) relay has operated in the case of a call from an "A" operator's sender that is routed over a direct trunk through a two-wire office selector and on sender test circuit calls, connection is not made to a district frame. In these cases ground is connected directly to the "RL" lead through the decoder connector to the sender.

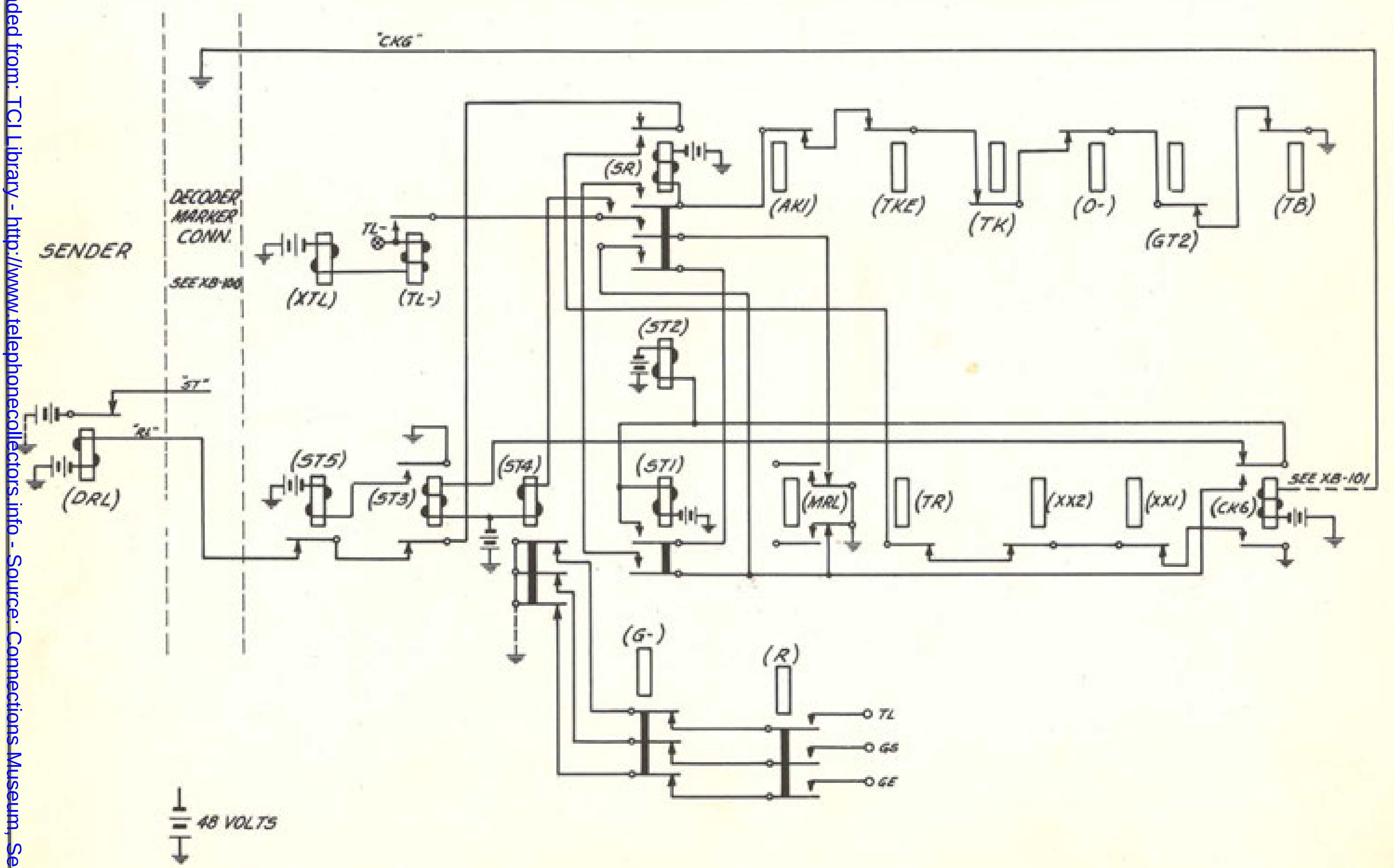
For all types of calls, except those just mentioned, when the (TK) relay has operated, and with the district frame connected and with the (AK) and (AK1) relays operated and when a trunk has been found and the (TKE) relay has been released, then a path is closed for operating the (SR) relay. The (SR) relay, in addition to furnishing locking ground for numerous relays that would otherwise release when the decoder connector releases, also grounds the "RL" lead to the sender.

When the "RL" lead to the sender is grounded, the (DRL) relay of the sender operates, which removes battery from the start lead to the decoder connector circuit which releases, breaking all connections between the sender and the decoder through the decoder connector. With relay (SR) operated, the district link and connector circuit is locked to the marker over leads "DK" and "AK" (see XB-100).

Opening the leads through the decoder connector releases all the (A), (B), (C), (D), (F), (AR), (OF), (TP), (TNO-4), (H), grouping, and (SO-13) relays that are operated. The route relay or relays and the transmission relays are also released.

Among the leads broken by the decoder connector is the "CKG" lead. This releases the (CK4), (CK5) and (CK6) relays. The (CK6) relays opens the ground that was connected to the "RL" lead, so that in case the decoder is immediately seized again, the "RL" lead will not be grounded and give that sender a premature release signal. With the (CK6) relay released, the ground that is holding the (ST1) and (ST2) relays is extended to the winding of the (ST3) relay which now operates. The (ST5) relay operates, opening the "DK", "RL" and "TRL" leads which were opened on the (ST3) relays. It is necessary, however, to open them also on the (ST5) relay to prevent the possible false closure of ground to these leads, should the (CK6) relay be again operated due to another call in the decoder stage, and should the (ST3) relay release before the (ST1) relay, on the release of the marker at the completion of a call.

The (ST5) opens the operating and holding ground to the zone and charge relays. These relays are held, however, over the "ZK" lead to the district link and connector circuit. The (CK6) relay also releases the ground supply relays (GS1-4) and (G1-4) that are operated. The decoder is now free to be seized for use by another sender and the decoder function may take place up to and including the operation of a route relay, even though the marker is still functioning in setting up the connection through the district and office junctors from the previous call. This arrangement is made to reduce the decoder marker holding time.



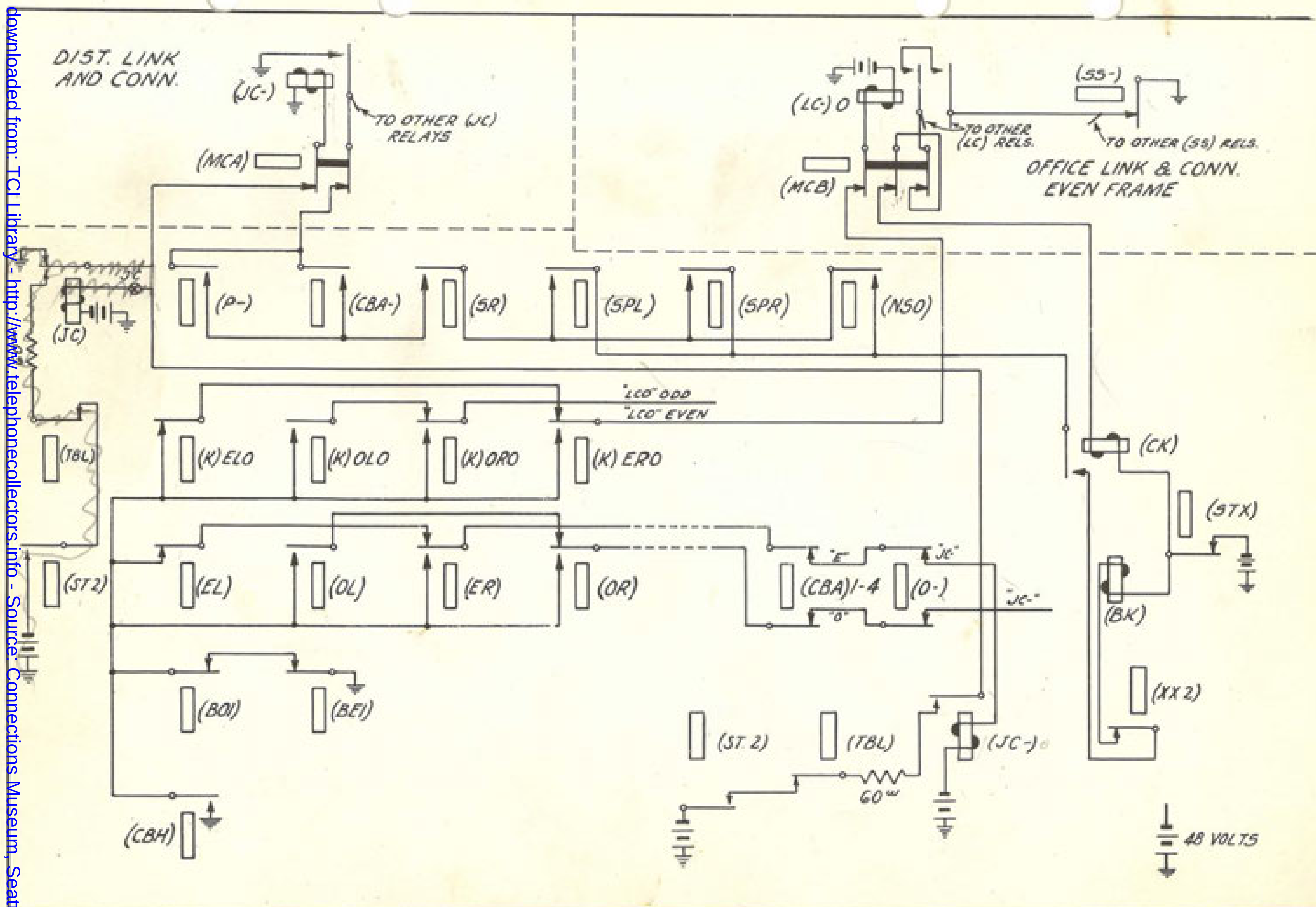
N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER SENDER RELEASE ON REGULAR CALLS	1 2 ... 8/7/34(?) XB-115

GAINING ACCESS TO THE PROPER SET OF
OFFICE LINKS AND OFFICE JUNCTORS

When relay (K) ELO operated, it indicated that a trunk on the even office frame, zero switch, and left half of the switch had been found idle. The operated (K) ELO relay also grounded lead "LCO" to the even office link and connector frame to operate the (LCO) relay of that circuit.

When relay (EL) operated, it grounded the "E" lead which is connected through the (CB-) relays to the operated office relay to the district frame, operating the proper (JC) relay on that frame.

Relay (LC-) of the office grounds the "CK" lead operating the (CK) relay. Relay (JC-) grounds the "BK" operating the (BK) relay.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER GAINING ACCESS TO PROPER SET OF OFFICE LINK & OFFICE JUNCTORS	1 2 3 4 GZW XB-116

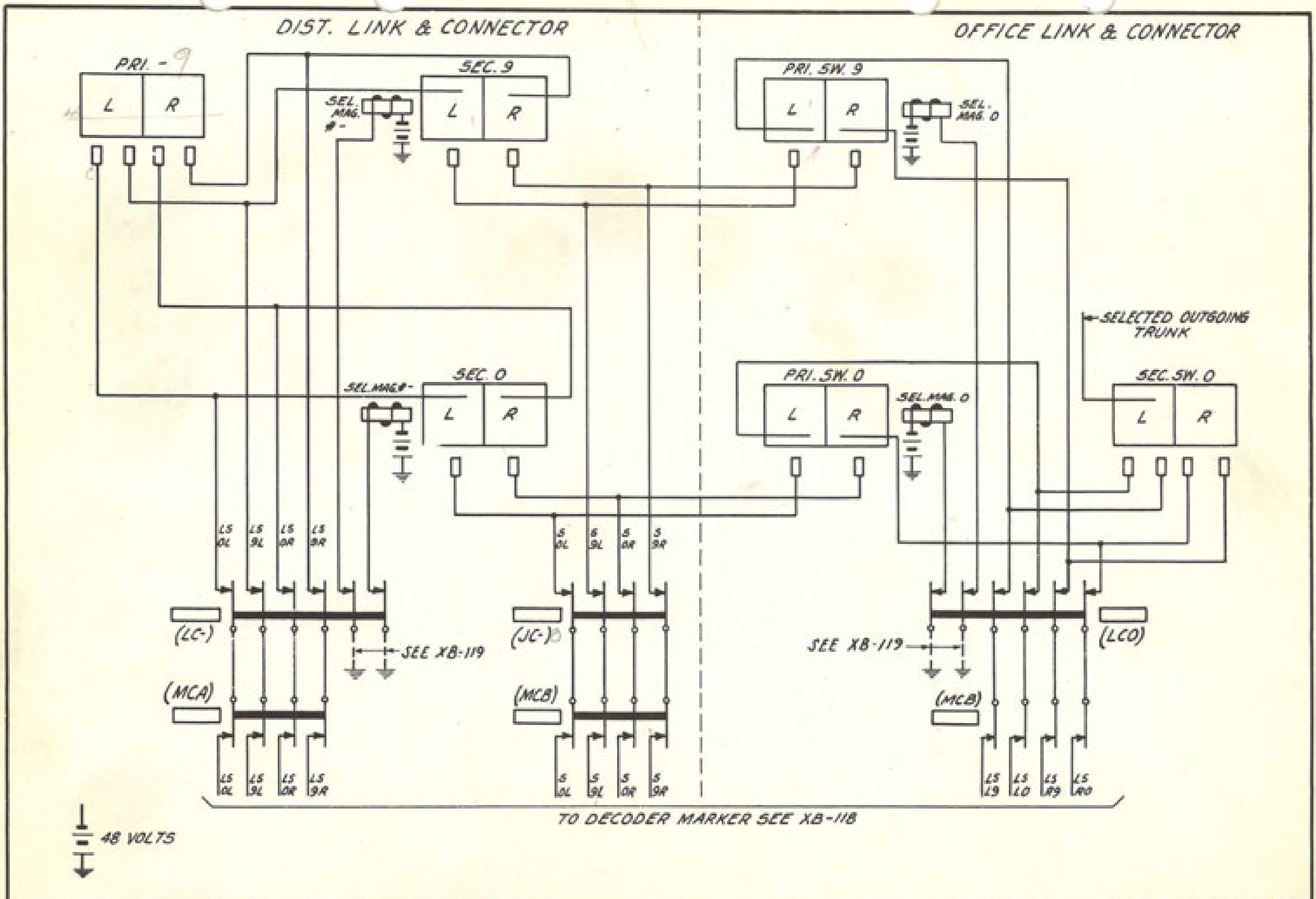
LEADS FOR TESTING CHANNELS AND
CHOOSING AN IDLE COMBINATION OF DISTRICT LINKS,
OFFICE JUNCTORS AND OFFICE LINKS

The twenty "LS" leads from the (LC) relay in the district frame circuit terminate in the secondary windings of the twenty (AB) relays. The twenty paths from the operated (JC) relay in the district frame circuit terminate in the primary windings of the twenty (AB) relays. The twenty "LS" leads from the (LC) relay in the office frame circuit terminate in the secondary windings of the twenty (C) relays.

It is over these paths that the decoder marker tests to find an idle channel. Channels that are busy have ground connected to one or more of these leads and the (AB-) or (C-) relay corresponding to these busy or non-available channels are operated.

There are less than twenty channels available when there are more than ten district or office frames. In these cases the (C-) relays corresponding to the non-available channel are operated from the pattern relays. There are also less than twenty channels available when the trunk selected is on a split level of the office secondary switch. In these cases the (C-) relays corresponding to the non-available channels are operated from the (SPL) or (SPR) relay. One of these relays is operated from the (EL), (OL), (ER), or (OR) relay if the (SPE) relay is operated indicating that the selected trunk is on a split level.

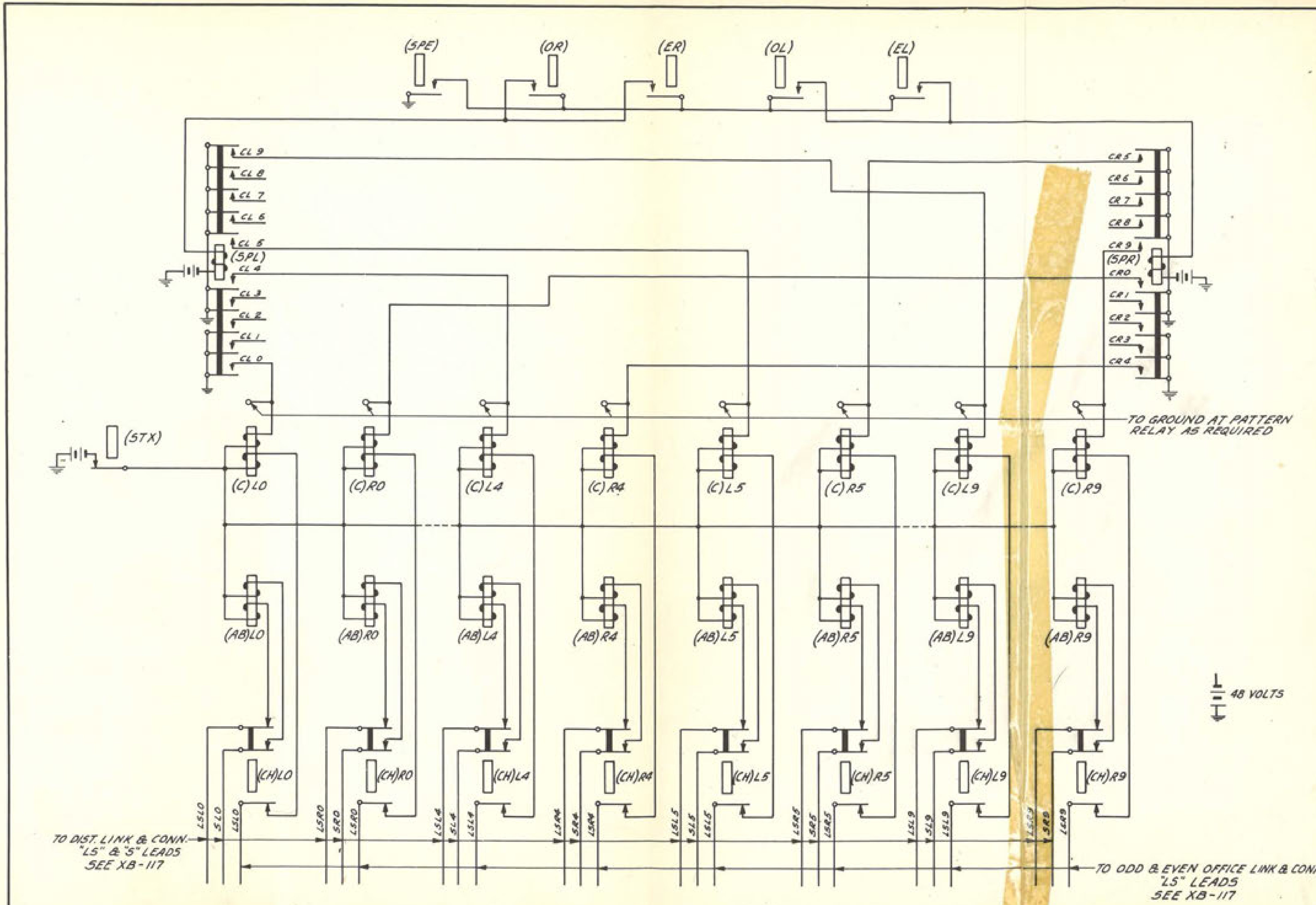
The operation of any (AB-) or (C-) relay causes the decoder marker to pass the corresponding channel by as busy.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER LEADS FOR TESTING CHANNELS

1 2 3

XB-117



ORIGINATING DECODER MARKER

CHOOSING AN IDLE COMBINATION OF DIST. LINKS, OFFICE JUNCTORS & OFFICE LINKS

XB-118

N.Y. TEL. CO.

G.P.S. - L.I.

SELECTION OF A CHANNEL AND TIMING FOR RELEASE OF HOLD MAGNETS

SELECTION OF A CHANNEL

The (BK) relay operated as an indication that the channel test paths were closed. With relay (BK) operated, it removes a shunt from around the condenser associated with the (CHT) relay. Removing this shunt will not allow the (CHT) relay to operate immediately, however, since current will continue to flow through the S winding as the associated condenser is charged. This current will decrease, however, as the condenser becomes charged and eventually it will be reduced to a point where the energy in the secondary winding is less than that in the primary winding and finally the (CHT) relay will operate. There will be a delay from the time (BK) relay operates until the (CHT) operates and this delay is provided to allow time for any (AB-) or (C-) relays to operate if they are going to operate.

With all (CH) relays normal, relay (CHE) operated as soon as relay (ST1) operated and in turn operated relay (HMT1).

When relays (CHE), (HMT1) and (CHT) operate, ground is closed through a chain path through the (AB-) and (C-) relays. The first set of these relays encountered which does not have either or both the (AB-) or (C-) relays operated closes a path to their associated (CH-) relay which will now operate and lock. The operated (CH-) relay in turn releases the (CHE) relay.

OPERATION OF DISTRICT SECONDARY, OFFICE PRIMARY AND SECONDARY SELECT MAGNETS

When the (CHE) relay operated, following the operation of the (ST1) relay, the (CHE1) and (CHE2) relays were operated. These relays operate the (SM) relay which locks under control of the (S) and (SL) relays.

When an idle channel has been found, as just described and the (CHE) relay is released, the (CHE1) and (CHE2) relays release. These relays in addition to starting the operation of the (HMT) relay also energizes the district secondary, office primary and secondary select magnets over the "SSA" and "SSB" leads to the district and the "PSA", "PSB", "SSA" and "SSB" leads to the office. Five select magnets in parallel are energized over each of these leads.

When the (S) and (SL) relays have been operated, the (SM) relays releases and the select magnets release.

TIMING FOR RELEASE OF HOLD MAGNETS

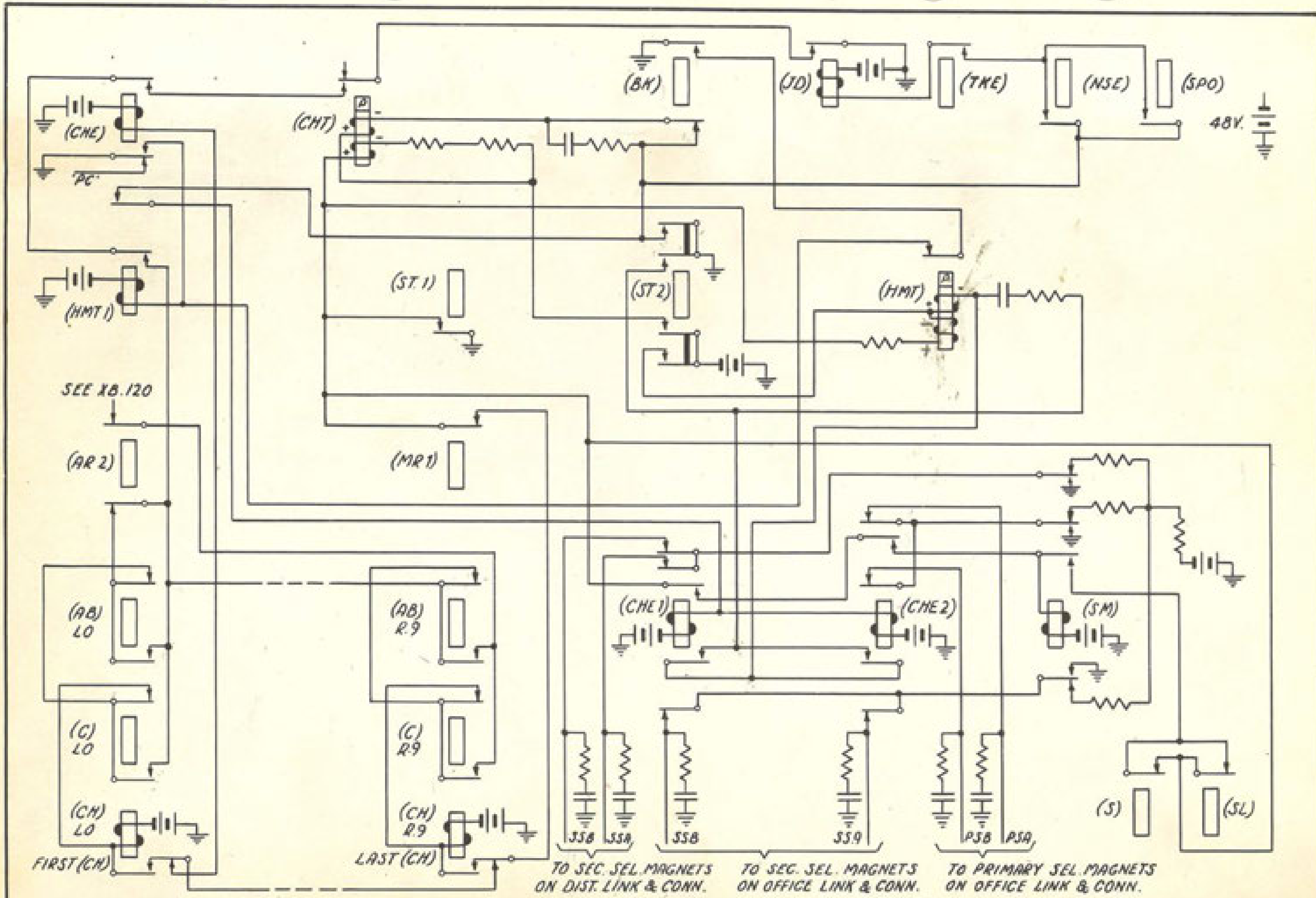
The (CHE) relay was operated following the operation of the (ST1) relay, as has been described. The (HMT1) relay then operates. When the (BK) relay operates following the operation of the district junctor (JC) relay, a path for holding the (HMT1) relay is established through the back

TIMING FOR RELEASE OF HOLD MAGNETS (CONT'D)

contact of the (HMT) relay. When the (ST2) relay is operated, the (HMT) relay is energized on its primary winding and may operate. It will release, however, when its secondary winding is energized following the operation of the (CHE) relay.

The (CHE) relay releases following the operation of any (CH-) relay. The (CHE) relay is made fast release, so that the path from the front contacts of the (CHT) relay over which the (CH-) relay was operated will be opened quickly and prevent the possible false operation of another (CH-) relay, should some (AB-) or (C-) relay, through whose front contact the particular (CH-) relay was operated, release due to that channel becoming idle. If this should occur, it would close the operating circuit to another (CH-) relay. The (CHE) relay then opens the operating ground to the (CH-) relays and opens the operating path to the (HMT1) relay. This relay does not release at this time, however, since it is held through the back contact of the (HMT) relay. The (CHE) relay releasing also removes a shunt ground from the (HMT) condenser and associated resistance. This ground was energizing the polarized (HMT) relay on its secondary winding in the operated down direction and this winding is strong enough to hold the relay in its non-operated position, even though it is energized in the operated direction through its primary winding. Removing direct ground from the secondary winding of the (HMT) relay will not allow it to operate immediately, however, since current will continue to flow through the secondary winding as the (HMT) condenser is charged. This current will decrease as the condenser becomes charged and eventually it is reduced to a point where the energy in the secondary winding is less than that in the primary winding and finally the (HMT) relay will operate. There will be a delay then from the release of the (CHE) relay, following the choosing of an idle channel, until the (HMT) relay operates. This relay is provided to permit the release of any district or office hold magnet that may have started to release just in time to permit the decoder to select the corresponding channel as idle. Should a hold magnet be energized before it has had time to release and restore the trip finger, two cross points would be closed.

When the (HMT) relay has operated, the (HMT1) relay will release starting the operation of the district primary and office secondary hold magnets in series with the (A) and (C) relays, which will be described later.



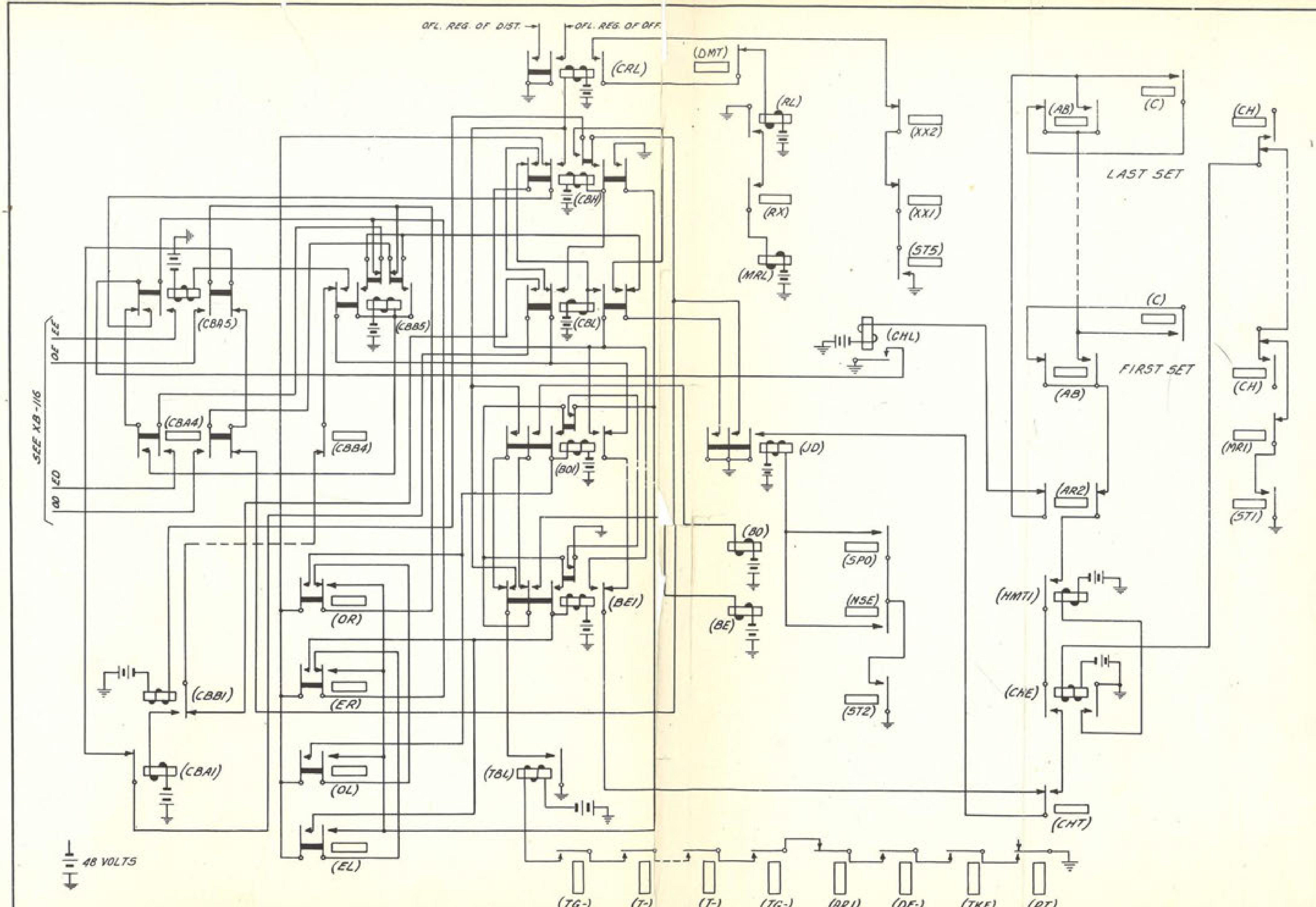
N. Y. TEL. CO. G.P.S. L.I.	ORIGINATING DECODER MARKER SELECTION OF A CHANNEL AND TIMING FOR RELEASE OF HOLDING MAGNETS	3 XB. 119

CHANNEL BUSY AND USING OVERFLOW CHANNEL

When all channels of a test choice are found busy, all of the (AB) or (C) relays will be operated. When the (CHT) relay has finally operated under this condition, ground is extended to operate the (CBB2) to (CBB5) relay, whichever one is next in turn. The (JC) relay in the district link and connector circuit then releases, releasing the (BK) relay. This shunts the (CHT) relay (see XB-119) which releases, closing ground to operate the (CBA2) to (CBA5) relay, whichever one is the next in turn, and the preceding relay releases. The (JC) relay of the next test choice of junctors now operates, operating the (BK) relay which removes the shunt from the winding of the (CHT) relay which starts to operate to test for an idle channel in the next test choice. If they too are found busy, the cycle of operation is continued until an idle channel is found, or until the (CBA5) relay is operated. With the (CBA5) relay operated, a test of the "E" or overflow choice is made. If they too are busy, when the (CHT) relay operates, it causes the operation of either (BE1) or (BO1) relay, depending upon whether the selected trunk was on the even or odd office frame.

Assuming that the selected trunk was on the even office frame with the (BE1) relay operated, it operates the (BE) and disconnects battery to the windings of all (K) E- relays and whichever relay was operated now releases, disconnecting the selected trunk. The (BE) relay operates all of the 20 (T) E- relays which causes all the trunks on the even numbered office frame to appear busy, so that an idle trunk on this frame will not be selected because all channels to this frame have been found busy. The (K) E- relay releases the (EL) or (ER) relay and the (LC) relay in the office link and connector circuit is released, in turn releasing the (CK) and the (BK) relays. The (BE1) relay also releases the (JC) relay which in turn releases the (BK). The (BK) relay shunts the (CHT) relay and it releases, operating the (CBL) relay. The (CBA5) and (CBB5) relays now release and when they are both released, a path is closed, operating the (CBH) relay through the front contact of the (CBL) relay. When the (CBH) relay has operated, the (CBB1) operates and the ground that is locking the (CBH) relay operates the (CBA1) relay.

When the (K) relay released, the (TKE) relay again operated and removed the shunt from the (PT) relay preparatory to selecting an idle trunk on the mate office frame. Since the (BE) relay is operated, all of the trunks on the even office frame are made to appear busy, so that the marker is forced to select an idle trunk on the odd office frame. If an idle trunk on this frame cannot be found, then the (CRL) relay is operated from the (PT) relay for releasing the decoder. If an idle trunk is found, one of the (KO-) relays operates, in turn operating the (OL) or (OR) relay. This closes ground over the "O" lead through the contacts of the (CBA1) relay and a (JC) relay on the district link and connector circuit is operated, connecting the "A" test choice of the junctors to the odd office frame. The (LC) relay on the office link and connector circuit is operated, in turn operating the (CK) relay and the (BK) relay now operates, removing the shunt from the winding of the (CHT) relay; this relay starts to operate for selecting an idle channel as has been described. If an idle channel is found in this test choice of junctors, the circuit proceeds to set the connection up in the normal manner, but if all these channels are found busy, then when the (CHT) relay operates, the (CBL) relay is released and the (CBB2) relay operates. The other choices are tested in a like manner until the "E" or overflow choice is selected. If they too tested and the marker must now give the sender a trouble release, unless this is a third trial call, in order that the decoder can be released and the sender can try to set the connection up with another decoder over the alternate route, if there is one, or to an overflow trunk. The reason the marker must give a trouble release instead of immediately releasing the office frame and trying to find a trunk over the alternate route or overflow is that the decoder connector has been released and there is no way of giving the sender a new translation that will be required for the alternate route or for overflow. The sender is given a trouble release by operating the (CRL) relay. The (TBL) relay is operated from the (PT) relay if all trunks on one of the office frames have been found busy and in turn operates the (CRL) relay. In any event, the (CRL) relay closes ground to operate the district and office frame overflow registers and connects ground to the "TRL" lead through the district link and connector circuit, except on overflow calls. The (RL) relay being slow to operate, also operates. With relay (RL) operated, the "DK" lead to the district is opened (see XB-107) and the (F) relay of that circuit and the (AK), (AK1) and (LC) start to release. The (MRL) relay is operated, in turn releasing the (ST1), (ST2), (ST4) and (SR) relays. (See XB-115)



ORIGINATING DECODER MARKER
CHANNEL BUSY AND USING OVERFLOW CHANNEL

XB-120

1 2 3

N. Y. TEL. CO.
G. P. S. - L. I.

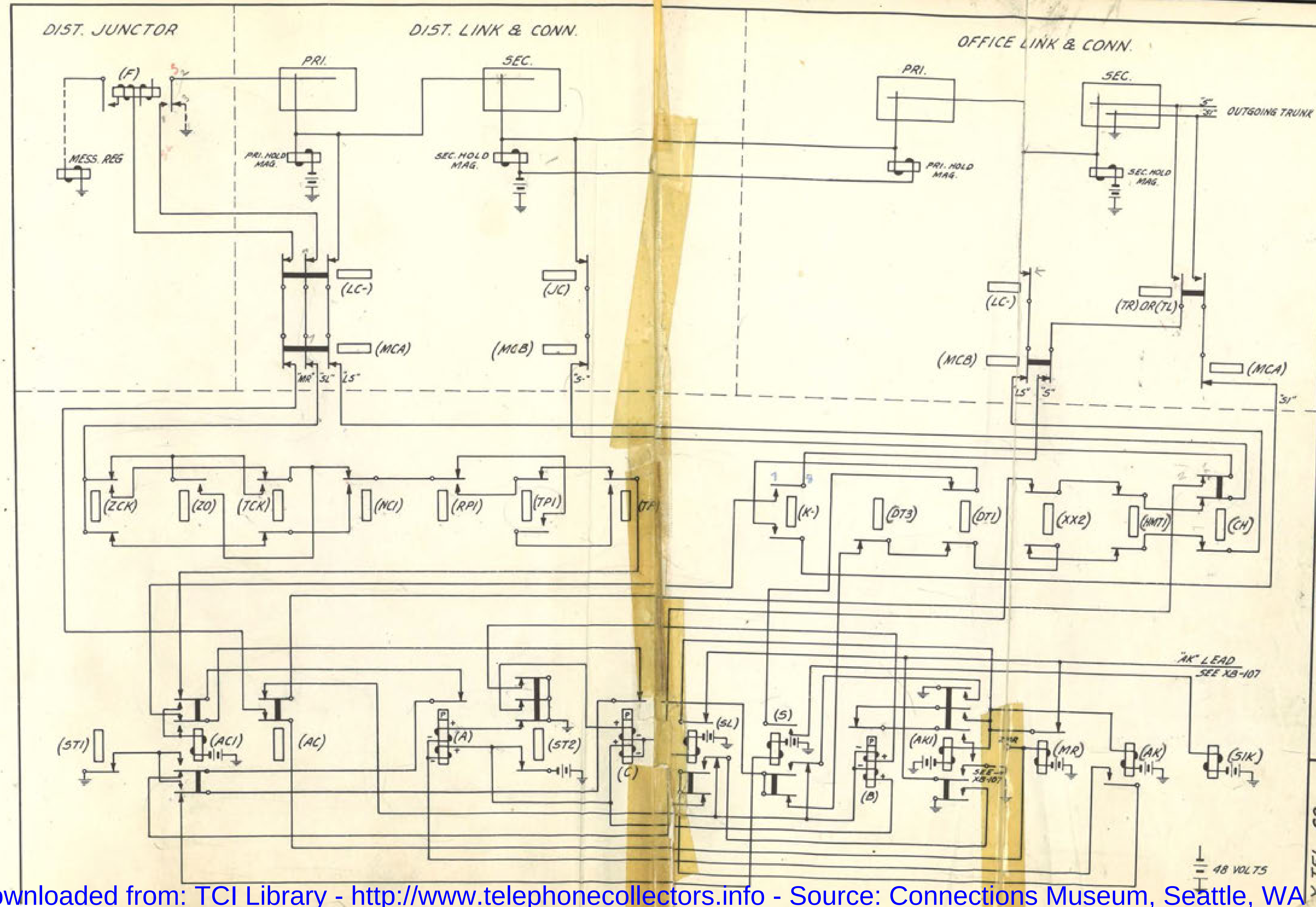
CHECKING FOR CROSSES AND DOUBLES ON THE DISTRICT AND OFFICE HOLD MAGNETS AND OPERATION OF THE HOLD MAGNETS

With a (CH-) relay operated and relay (HMT1) released, the (A) and (C) relays will operate if they encounter the battery through the associated hold magnets. They will not operate if ground is encountered at the hold magnets. The district primary magnet will operate in series with the (A) relay and the office secondary hold magnet will operate in series with the (C) relay. The (A) and (C) relays having operated, release the (AC) and (AC1) relays which were previously operated from off-normal ground. Relay (AC) having released, closes the district "S" lead to ground from the front contacts of the (AK1) relay through the back contacts of the (S) and (SL) relays. This ground causes the operation of the district secondary and office primary hold magnets, each of which in turn extend the ground to the district link and office link, respectively. The district primary and office secondary hold magnets should also operate if not already operated in series with the (A) and (C) relays. These in turn close the cross-points extending the ground through to the district "SL" lead and trunk "S" lead. When the district secondary and office primary holding magnets have operated, the ground that operated these magnets shunts the (A) and (C) relays, which release. With these relays and the (AC1) relay released and all holding magnets operated, a circuit is closed for operating the (S) and (SL) relays. These relays connect ground to the winding of the (A) and (C) relays to hold them in the non-operated position and remove the direct ground to the holding magnets. However, ground through the winding of the (B) relay will hold the magnets as well as the (S) and (SL) relays. The (B) relay will now operate in series with the holding magnets and (S) and (SL) relays, provided there is not a false ground on the holding magnet circuit caused by a double connection.

When the (AC) relay released, a circuit was closed from battery through the winding of the (MR) relay over the "MR" lead, through the district junctor to ground, through the subscriber's line message register. On coin and flat rate lines which are not equipped with message registers, the (MR) relay is operated from ground through the contacts of the class of service relay (SO-13) depending on the ones used for this class of service. The (MR) should open one of the paths through which the (AK) and (AK1) relays are held, the (SL) relay having opened another while the (B) relay opens the third and last. The operation of the (B) relay releases the (AK) and (AK1) relays.

With the office secondary holding magnet operated, ground is first connected to the sleeve of the out trunk as a busy condition. When relay (S) has operated, this ground is extended to the winding of the (S1K) relay, which operates.

The release of the (AK1) relay removes the ground that was holding the district junctor (LC) relay, the district (F) relay and the sender (DC) relay (see XB-107) which then release. The (F) relay connects ground to the holding magnets. This ground is extended to the winding of the (B) and this relay should now release.



ORIGINATING DECODER MARKER

CHECK FOR CROSSES AND DOUBLES ON THE DISTRICT AND OFFICE HOLD MAGNETS AND OPERATION OF THE HOLD MAGNETS

XB-121

1 2

N.Y. TEL. CO

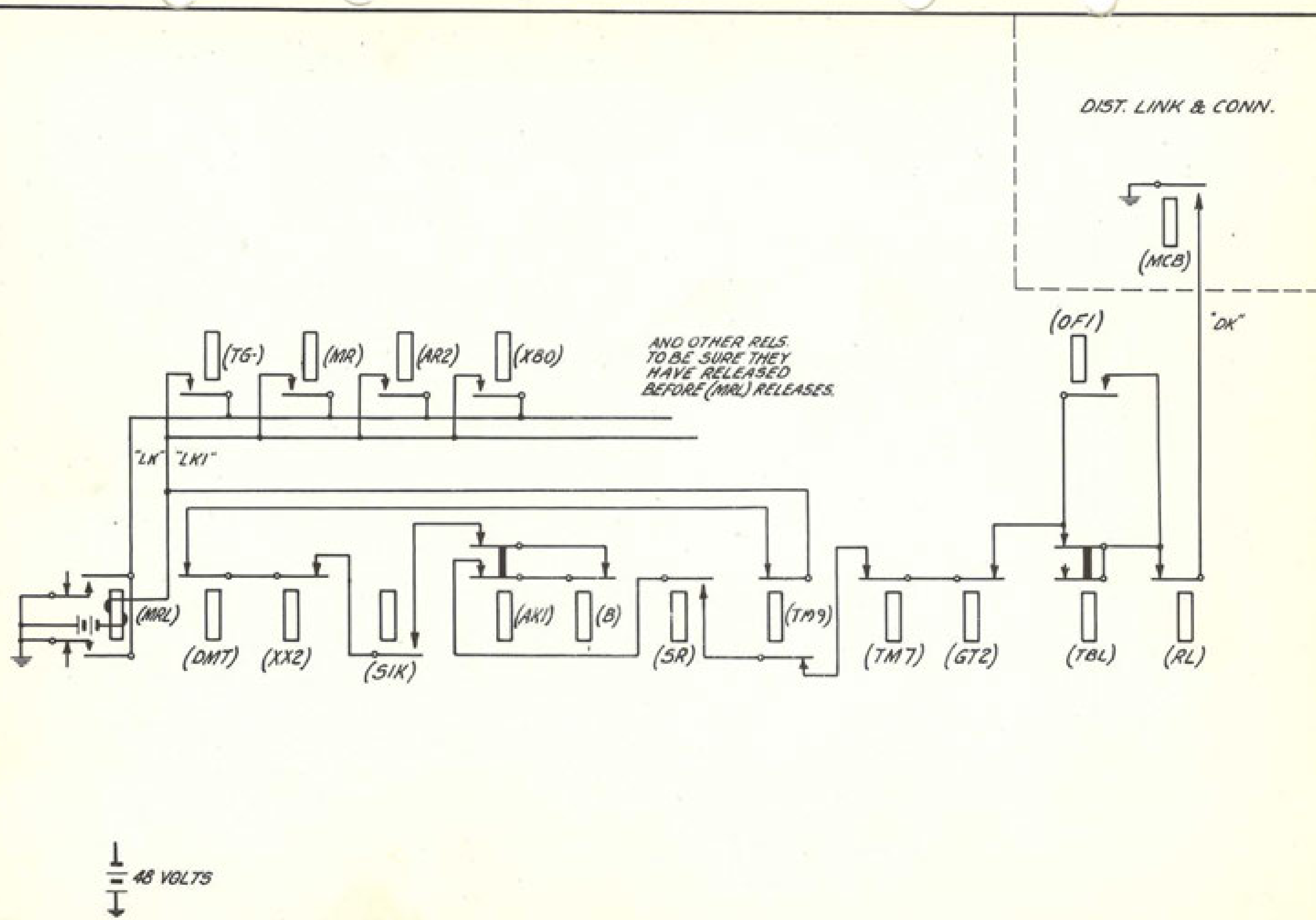
F.S. - L

MARKER RELEASE

With the (B) and (AK1) relays released and the (S1K) relay operated, ground is closed to the winding of the (MRL) relay which now operates. The (MRL) relay locks under control of numerous operated relays which must release before the (MRL) can release. The (MRL) also releases the (ST1), (ST2), (ST3), (ST4) and (SR) relays. (See XB-115) These relays open the office and district start leads. (See XB-107) The release of these circuits removes the off-normal battery and ground from the numerous relays that were operated and locked during the marker stage causing these relays to release. The last one to release opens the locking circuit for the (MRL) relay which then releases. With the (MRL) released and the (CK6) again operated, due to another call having started in the decoder stage, the (ST1) and (ST2) relays will again operate and the next call will advance into the marker stage.

The (ST5) relay is held to the zone and charge relays which are in turn held over the "ZK" lead to the district link and connector circuit and the common control multiple registration circuit. Thus, the (ST5) relay does not release until these circuits have released, following the release of the (SR) relay. This is to prevent the possible false closure of ground on the "DK" lead. (See XB-107) The zone and charge relays are held to the district, as just outlined, so that these relays cannot release before the district link and zone charge circuits and cause the false operation of the (XZP) or (XZS) relay.

The release of the (ST1) relay also removes ground from the winding of the (DLX) relay which starts to release. This relay is made slow release, however, so that the (STX) relay, which is held operated from its contacts, will not release before the office link and connector circuit has released. Should the (STX) relay release first, the (XTK) and (XCH) relays would be falsely operated. The (STX) relay will not release on calls where the (CK6) relay is again operated before the (DLX) relay has had time to release. On overlapping calls the (ST1) relay may be released for such a short time that the (DLX) relay will not have time to release. This relay is not in the locking circuit for the (MRL) relay and this condition will not hinder the next call.



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
MARKER RELEASE

1 2 3

XB-122

RECORDING PARTY INDICATION AND TIP PARTY CHARGE

RECORDING PARTY INDICATION

Senders that serve two-party message rate subscribers must give the decoder an indication of which party is calling, in order that the decoder marker may set the district junctor for charging the party making the call.

The sender passes this information to the decoder marker by grounding the "TP" lead if the tip party of a two-party message rate line is calling and does not ground this lead if any other class of subscriber or an operator is calling.

When relay (ST1) operates and with the (TP) relay held operated from the sender, the (TP1) relay operates and locks under control of the (ST1) relay until the district has been connected when it holds to the "ZK" lead. The (TP1) relay causes ground to be connected over the "TP" lead to the district link and connector circuit, when that circuit is finally connected, for the purpose of operating the (TP) relay in the district junctor so that the tip party will be charged for the call.

If the (TP) relay is not operated in the decoder marker, then relay (RP1) operates and locks in place of (TP1). This does not operate the (TP) relay in the district junctor.

TIP PARTY CHARGE

The district junctor circuits through which calls from two-party message rate subscribers are completed are equipped with means for charging the tip or ring party, whichever one is making the call.

With the (TP1) relay operated, indicating a tip party call, and when the district has been connected and while an idle trunk and channel are being selected, the (AC) relay remains operated. The "TP" lead from the district is then connected through the front contacts of the (TP1) and (AC) relays to ground. This operates the (TP) relay in the district junctor which locks when the sender has been given the release signal. The (AC) relay releases after an idle channel has been found and the ground that is locking the district relay is returned over the "TP" lead operating the (TPK) relay. This completes a path from the "SL" lead over which the (SL) relay must later operate (see XB-121).

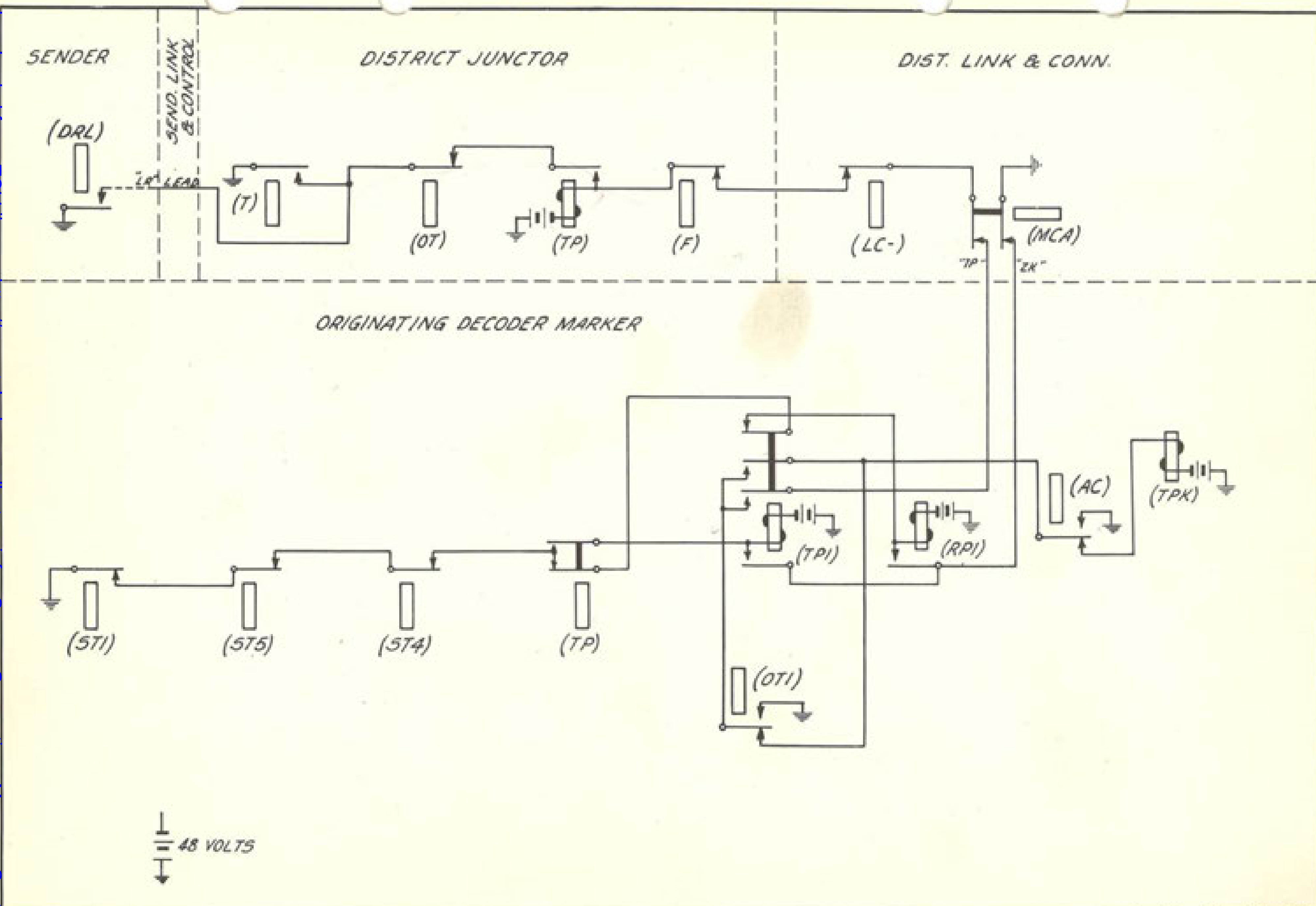
The check path from the "SL" lead is taken through the contacts of the (TP1), (RP1) and (TPK) relays in such a way that the (TP1) or (RP1), one or the other, must be operated but not both, and when the (TP1) is operated the (TPK) must also be operated. This arrangement is to prevent charging the wrong party on two-party message rate lines.

When the district is to be set in the cut-through position, as described under "Operator Talking," the (OT) relay in the district junctor is operated so the locking ground for the (TP) relay in the district that operated over the "TP" lead is not closed. Therefore, under this condition, it is necessary that the decoder cancel the check for the locking of

RECORDING PARTY INDICATION AND TIP PARTY CHARGE (CONT'D)

TIP PARTY CHARGE (CONT'D)

the district (TC) relay. On an operator's call, the (OT1) relay would be operated. When the (AC) relay releases and the (TP1) operated, ground is connected to the winding of the (TPK) relay which operates with a purpose of closing the "SL" lead over which the (SL) relay must finally operate.

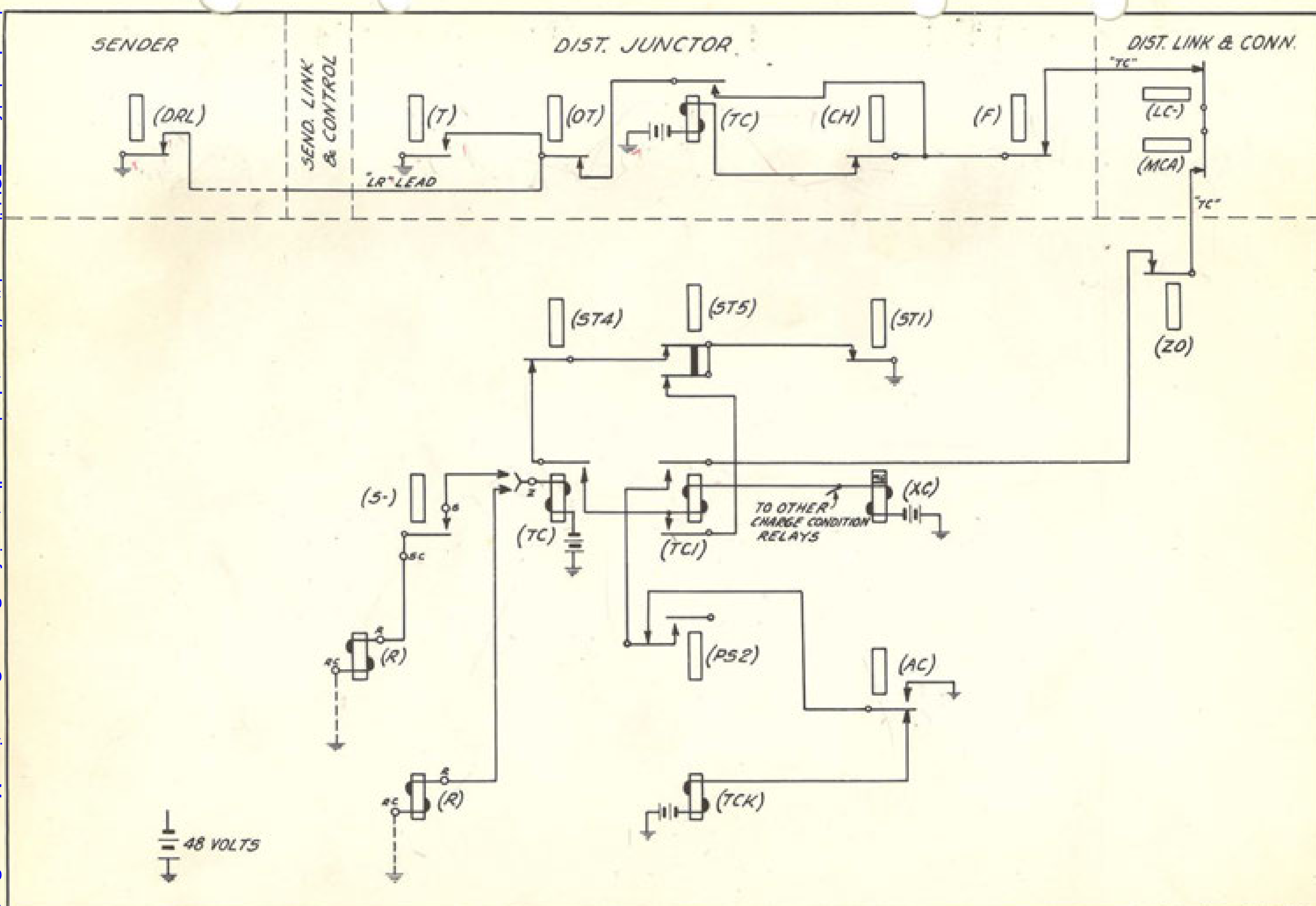


N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER RECORDING PARTY INDICATION AND TIP PARTY CHARGE	1 ... STW XB-123

TALKING CHARGE

The cross-connections from the route relay winding terminals are provided either direct or through class of service relays. The route relays are cross-connected to the (TC) relay for all codes not in the flat rate zone reached by flat rate subscribers who are to be charged one message unit. Also, all codes in the first message rate zone reached by the message rate subscribers.

The (TC) relay is operated in series with the route relay for the purpose of setting the district junctor in the proper charge position. Relay (TC) operated operates relay (TC1). When the district junctor has been connected and while an idle trunk and channel are being found, the (AC) relay remains operated. The "TC" lead from the district is then connected through front contacts of the (TC1) and (AC) relays to ground. This operates the (TC) relay in the district junctor which sets the district for a single charge, when the call is completed. The (TC) relay in the district junctor is not locked until a trunk has been found to the desired destination. When a trunk has been found and the sender given a normal release signal through the operation of the (SR) relay, (See XB-115) the district talking charge relay is locked as are the sender register relays. The (AC) relay releases when an idle channel has been found and then the ground that is locking the district relay is extended over the "TC" lead through a back contact of the (AC) relay and operates the (TCK) relay. The "SL" lead from the district, (See XB-121) over which the (SL) relay must finally operate, is brought through the contacts of the (TCK) and (ZCK) relays in such a way that one of these relays must be operated, but not both of them. When neither is operated, then the (NC1) relay must be operated. This arrangement checks that the talking charge relay in the district has been properly operated and locked.

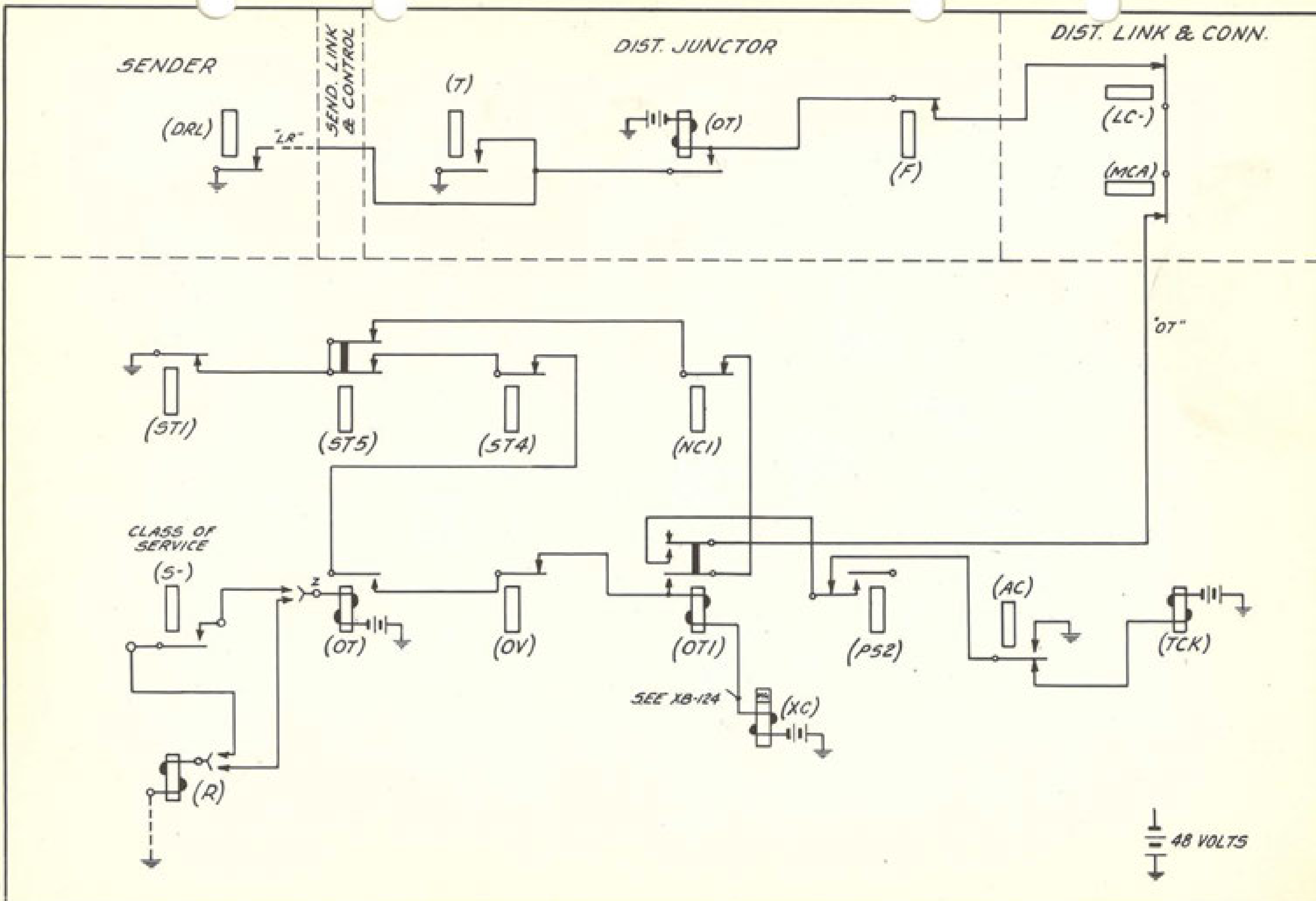


N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER TALKING CHARGE	1 2 XB-124

OPERATOR TALKING

On all codes requiring operator talking condition in the district junctor circuit, the route relay receives its battery through the (OT) relay.

On certain type of operator calls it is necessary that the district be set for operator talking transmission, that is, with the tip and ring leads in the district cut straight through. This requires a ground closure over the "OT" lead from the decoder marker. On such calls, the (OT) relay is operated in series with the route relay. This operates the (OT1) relay and when the district junctor is connected and, with the (AC) relay operated, ground is connected to the "OT" lead, operating the (OT) relay in the district junctor. When an idle trunk has been found and the sender given a normal release signal, the relay in the district junctor is locked. When an idle channel has been found, the (AC) relay releases and then the locking ground from the district relay is extended over the "OT" lead, and the (TCK) relay is operated. The (TCK) relay is used in the operation of the (SL) relay as has been described under talking charge.



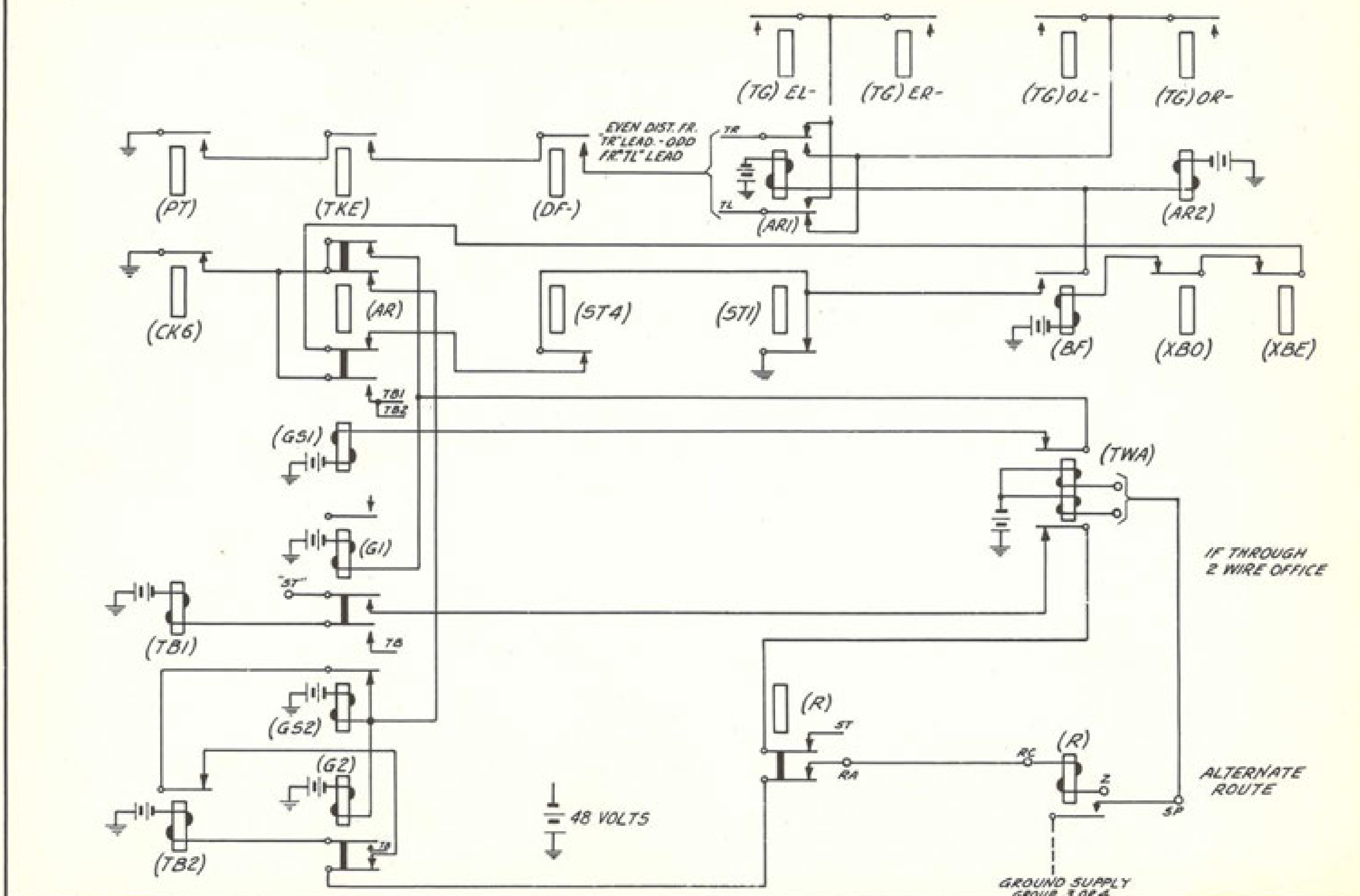
N. Y. TEL. CO. G.P.S. - L.I.	ORIGINATING DECODER MARKER OPERATOR TALKING	1 2 XB-125

RECORDING ALTERNATE ROUTE INDICATION

When a sender is making a second trial with a decoder the "AR" lead is grounded in the sender and, therefore, when the (CK4) relay operates the (AR) relay does not release. When the (CK6) and (ST1) relays have operated with the (AR) relay operated, a path is closed operating the (AR1) and (AR2) relays. These relays lock, reverse the direction of testing for an idle trunk and shifts the start and end points for channel tests. When the (CK6) relay operates with the (AR) relay operated, the (G1), (GS1), (G2) and (GS2) relays are also operated. This opens the contacts of the route relays in ground supply groups numbers 1 and 2. If the destination called has an alternate route the first choice original route relay is cross-connected to ground supply number 1 and if there is a second choice original route relay it is cross-connected to ground supply group number 2. Since the contacts of ground supply groups 1 and 2 are opened the original route relays are made ineffective with the exception of the "RA" terminal which is cross-connected to operate the first choice route relay of the alternate route for the particular original route relay operated. Thus, with the (AR) relay operated the decoder attempts to set the call up over the alternate route if there is one.

If there is no alternate route for the particular group of trunks the route relays are in the third and fourth ground supply groups so that on second trial where the (AR) relay is operated the decoder attempts to set the call up over the original route just as though it were a first call and the only difference is that the direction of testing for an idle trunk is reversed and the group start and group end points for channel testing are shifted.

If the alternate route is through a two-wire office selector, when the alternate route relay has been operated the (TWA) relay operates from the "SP" cross-connecting terminal. This relay opens the circuit through the winding of the (GS1) relay which will then release so that the original route relay can transmit to the sender first and second office brush and group selections information as well as the class of call information corresponding to the particular two-wire alternate route destination and thus saves alternate route relays since otherwise a different route relay would be required for each destination reached over the alternate route through the two-wire office center.



N. Y. TEL. CO.
G. P. S. - L. I.

ORIGINATING DECODER MARKER
RECORDING ALTERNATE ROUTE INDICATION

1 2

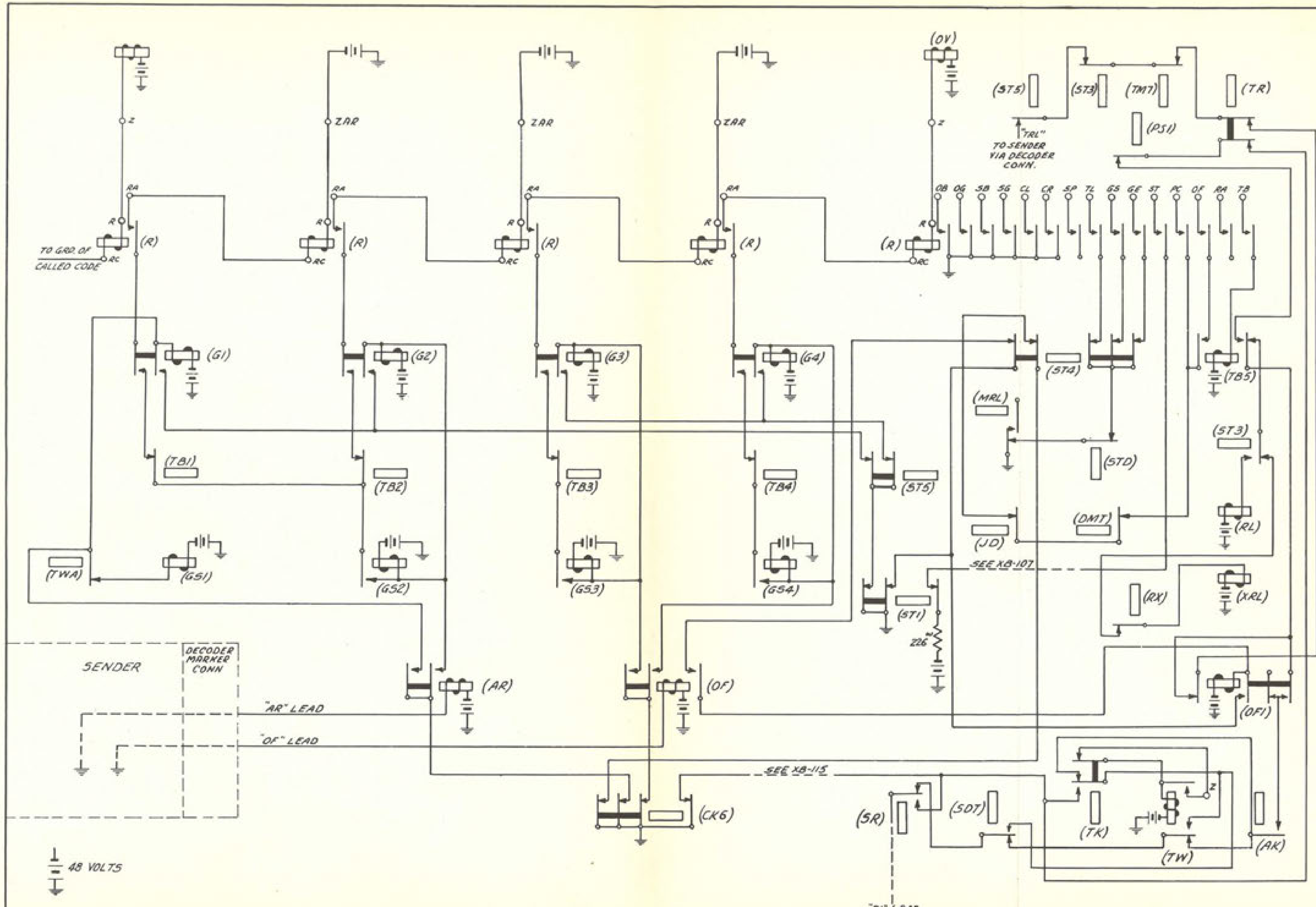
XB-126

RECORDING OVERFLOW INDICATION

When the sender is making a third trial with the decoder, the "OF" lead is grounded as well as the "AR" lead. This causes both the (OF) and (AR) relays to remain operated after the (CK4) relay operates. The (AR) relay causes the operation of the (GS1), (G1), (GS2) and (G2) relays. The (OF) relay operated after the (CK6) has operated causes the (GS3), (G3), (GS4) and (G4) relays to be operated and thus makes ineffective the contacts of ground supply groups Nos. 1,2,3, and 4. Assuming that the destination called was such as to have a first and second choice original route relay and a first and second choice alternate route relay, then when the first choice original route relay operates with the (G1) relay operated, ground from the back contact of the (TB1) relay is closed to the "RA" terminal and operates the second choice original route relay. Ground from the back contact of the (TB2) relay will now be connected through the front contacts of the (G2) relay to the "RA" terminal of the second choice original route relay and the first choice alternate route relay will be operated. Ground from the back contact of the (TB3) relay will be connected through the front contacts of the (G3) relay to the "RA" terminal of this first choice alternate route relay and the second choice alternate route relay will then be operated. Ground from the (TB4) relay is then connected through the front contacts of the (G4) relay to the "RA" terminal of this route relay operating the overflow route relay. Now, since the ground supply relays are operated for the original as well as the alternate route relays, the decoder will attempt to find an idle trunk in the overflow group of trunks only and whether or not a trunk is found, the sender will be given a normal release signal.

If an idle trunk and channel are found, the decoder marker will function in a normal manner and the connection will be set up to an overflow trunk, after which the decoder will release in a normal manner.

If an idle trunk cannot be found, the (TB5) relay operates as described under "All trunks busy," and the "RL" lead to the sender is grounded. This causes the sender to function and remove battery from the start lead of the decoder connector and the decoder marker. All relays in the decoder marker will then release, since the (SR) relay has not been operated.



ORIGINATING DECODER MARKER
RECORDING OVERFLOW INDICATION

XB-127

1 2 3

N.Y. TEL. CO
G.P.S. - L.I.

ROTATION OF CALLS TO DIFFERENT TRUNK
SUB-GROUPS AND ALL TRUNKS BUSY

In order to distribute as evenly as possible the traffic through the various units of the office frames as well as to distribute calls to the different trunk sub-groups of large trunk groups, the decoder marker is arranged to route the calls successively to different sub-groups of trunks. When the (CK6) relay has operated, the (GWO) relay operates. The (CK4) relay grounds leads through the break contacts of the (GZO) relay to operate relays (GPOA) and (GPOB). When the (CK6) relay releases, the (GZO) relay operates, releasing relays (GPOA) and (GPOB). On the next call when relay (CK6) operates, the (GWO) relay winding is shunted and it releases. With relays (CK4) and (GZO) operated, relays (GP1A) and (GP1B) operate. Then when (CK6) releases, the (GZO) relay releases. On the next call then, the (GPOA) and (GPOB) relays will operate as in the beginning.

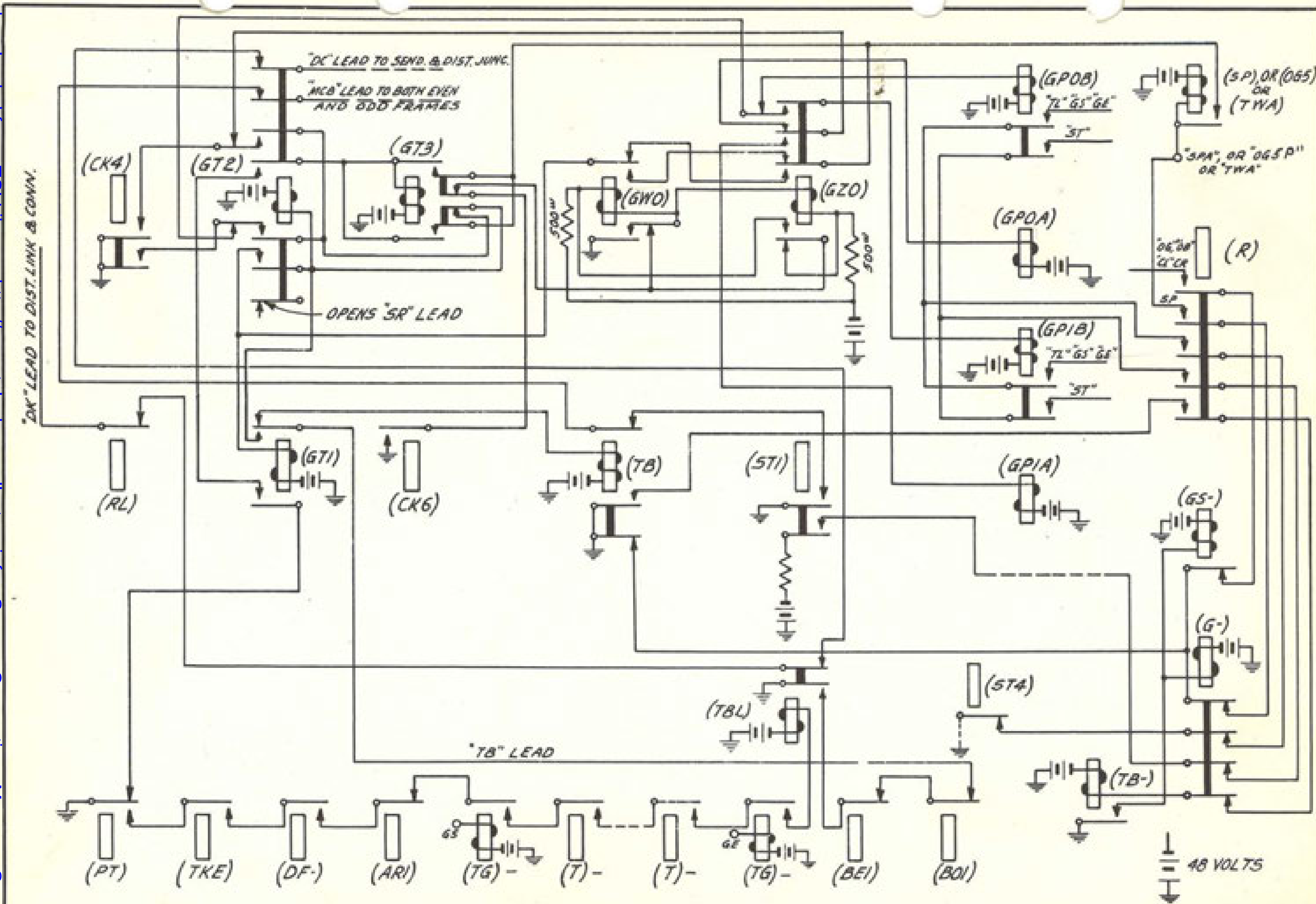
With the above arrangement, on successive calls the (GPOA-B) and (GP1A-B) relays are alternately operated. The "ST", "TL", "GE" and "GS" terminals from the contacts of the route relay of routes having trunk groups divided into two sub-groups are cross-connected to the contacts of the grouping relays, so that the successive operation of the (GPOA-B) and (GP1A-B) relays distributes the calls to the two sub-groups. The decoder may also have an arrangement to distribute calls over as many as twelve sub-groups, but it is doubtful that this arrangement will be used in our area for some time.

When all trunks of a sub-group are busy, all the (T-) relays of that group are operated when the "S1" leads are closed to the office frame. With these relays operated and when the (PT) relay has operated, ground is connected to the "TB" lead to operate the (TB) relay if the (GT1) relay is normal, or operate the (GT2) relay if the (GT1) relay is operated.

Trunk groups that are divided into two sub-groups have only one route relay. However, the decoder will test both of these sub-groups of trunks, before going to the alternate route, if there is one, or to the overflow trunk group. In order to provide this arrangement for trunk groups divided into two sub-groups, the (GT1) relay is operated by cross-connecting the "SP" terminal of these route relays to operate either the (SP) relay or the (TWA) or (OG5) relay on their primary winding. The (GT1) relay will not be operated on trunk groups that are not sub-divided or trunk groups sub-divided into three or more sub-groups.

With the (GT1) relay operated and when the "TB" lead is grounded, due to all trunks of a sub-group being busy, instead of operating the (TB) relay for the purpose of going to another route relay, the (GT2) relay will be operated. This relay locks under control of the (GT3) and (GZO) relays. It also opens the operating circuit for the grouping relays and they release. This opens the "ST", "TL", "GE" and "GS" leads from the route relay in use. The operated (GT2) relay also opened the "DK", "DC" and "MCB" leads, causing the district and office frames to release. The trunk level, group start and group end relays, whichever ones are operated release as well as the (PT) relay. When the (PT) relay closes its back contact, the (GT3) relay operates, locks and opens the control path to the (GZO) and (GWO) relays and the (GZO) relay operates if not already operated, or releases if it is already operated. The operation of the (GT3) relay and functioning of the (GZO) relay as just described open the holding ground to the (GT2) relay which now releases closing ground, operating the other pair of grouping relays, that is, either relays (GPOA) and (GPOB) or (GP1A) and (GP1B), whichever ones that were not operated in the beginning, are now operated. These relays close the "ST", "TL", "GE" and "GS" leads from the route relays to whatever points are required for the other or mate sub-groups of trunks. The office and district frames will be connected in a normal manner as has been described and the trunk level, group start and group end relays corresponding to the other or mate sub-group of trunks will operate and the circuit will continue in a normal manner in setting up the connection to an idle trunk on the other sub-group.

If an idle trunk is not found in the mate sub-group, then when the (PT) relay again operates, the (TB) relay will be operated for going to the alternate route, if there is one, and if not, then to the overflow group of trunks, instead of operating the (GT2) relay. This is due to the fact that the operation or release of the (GZO) relay, whichever took place, opens the circuit through which the (GT1) relay operated and the (GT3) relay remains locked up to the ground from the "SP" terminal of the route relay and holds the control lead to the (GZO) and (GWO) relays open and thus prevents the (GWO) relay from being either operated or released, whichever would again close the operating circuit for the (GT1) relay. Therefore, the (GT1) relay remains released while testing for an idle trunk in the other or mate sub-group and when the (PT) relay operates and all trunks are found busy the (TB) relay operates, removing ground from the "SP" terminal, causing the (GT3) relay to release. This closes the control lead to the (GZO) and (GWO) relays and the (GWO) relay either operates or releases, depending upon its condition. This closes the path over which the (GT1) relay may again operate when the alternate route relay operates, grounding its "SP" terminal. This is assuming that there is an alternate route and that its trunk group is also divided into two sub-groups.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER ROTATION OF CALLS TO DIFFERENT TRUNK SUB-GROUPS & ALL TRUNKS BUSY	1 2 3 BZW XB-128

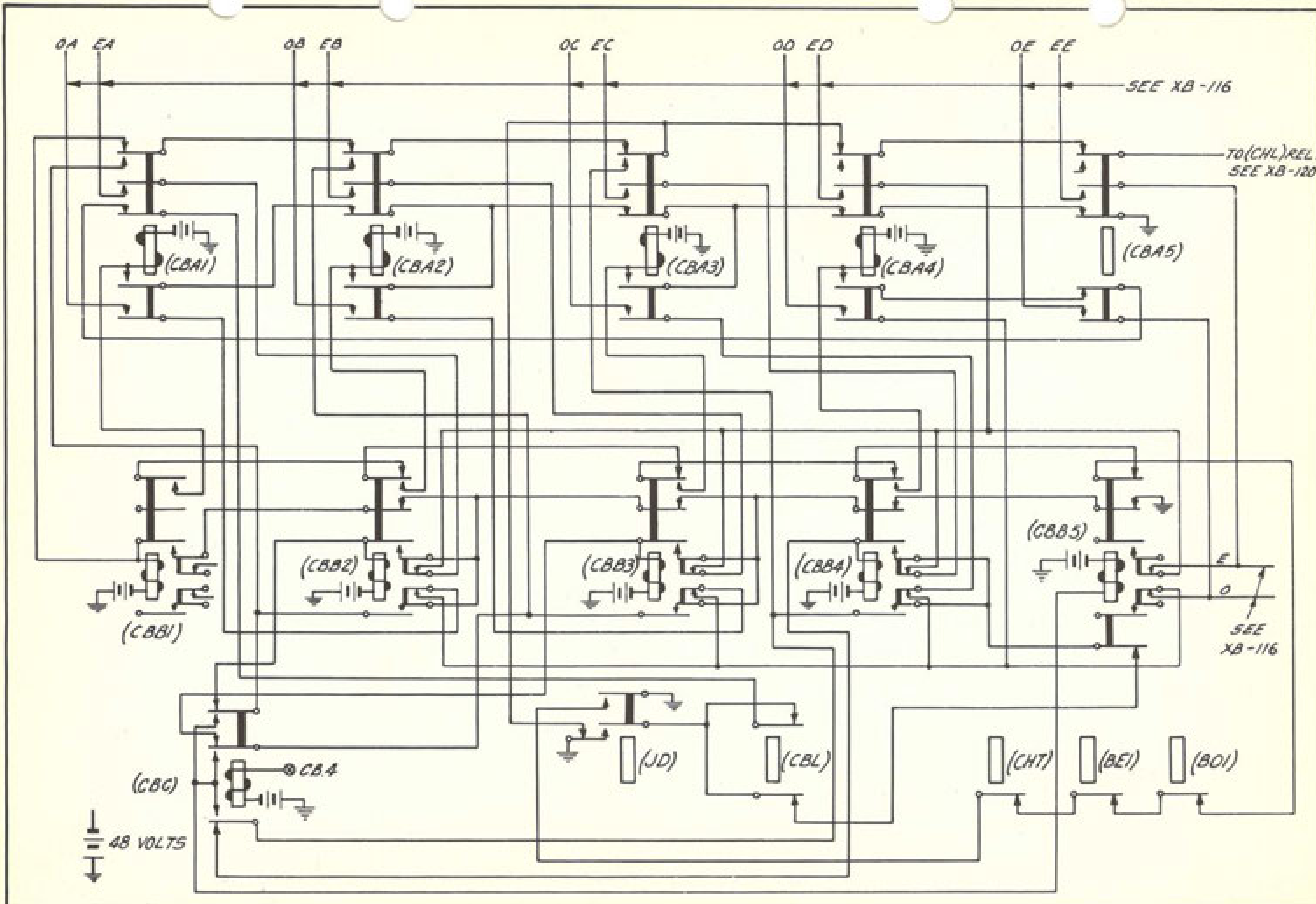
DISTRIBUTING SUCCESSIVE CALLS OVER DIFFERENT LINKS AND JUNCTORS

The decoder is arranged to test only 20 channels at one time and where more than this number are available, the circuit is arranged to rotate the successive calls to different sub-groups or test choices of junctors.

Assume an installation that has two district frames and two office frames. There will be 100 junctors from any district to either office frame; the first call handled by the decoder will use the "A" test choice of junctors, the second call, the "B" test choice and the third call, the "C" choice while the fourth will go to the "D" choice. The fifth call will go back to the "A" test choice as in the beginning, because the "E" or fifth test choice is used only as an overflow sub-group, that is, only when the other sub-groups are found busy. This condition will be explained under channel busy.

With the (JD) relay normal, relay (CBB) operates and locks through the normal contacts of the other (CBB) relays. When the call progresses far enough to operate relay (JD) and with relay (CBB1) operated, a circuit is closed to operate relay (CBA1) which closes the "A" choice leads to operate the (JC) relay in the district (see XB-116).

The release and operation of the (JD) relay on each successive call causes the next set of relays to operate until relay (CBB4) operates. This relay locks under control of relay (JD) operated. So with the release of the (JD) relay, the next call would appear on the "A" choice.



N. Y. TEL. CO. G. P. S. - L. I.	ORIGINATING DECODER MARKER DISTRIBUTING SUCCESSIVE CALLS OVER DIFFERENT LINK & JUNCTORS	1 2 XB-129

Seizure of Originating Trouble Indicator

There are numerous (X) relays provided to furnish means for detecting false grounds or crosses on many of the leads over which connection is made to associated circuits. These relays are connected when the circuit is normal as well as when busy in service except, of course, on leads that are actually in use.

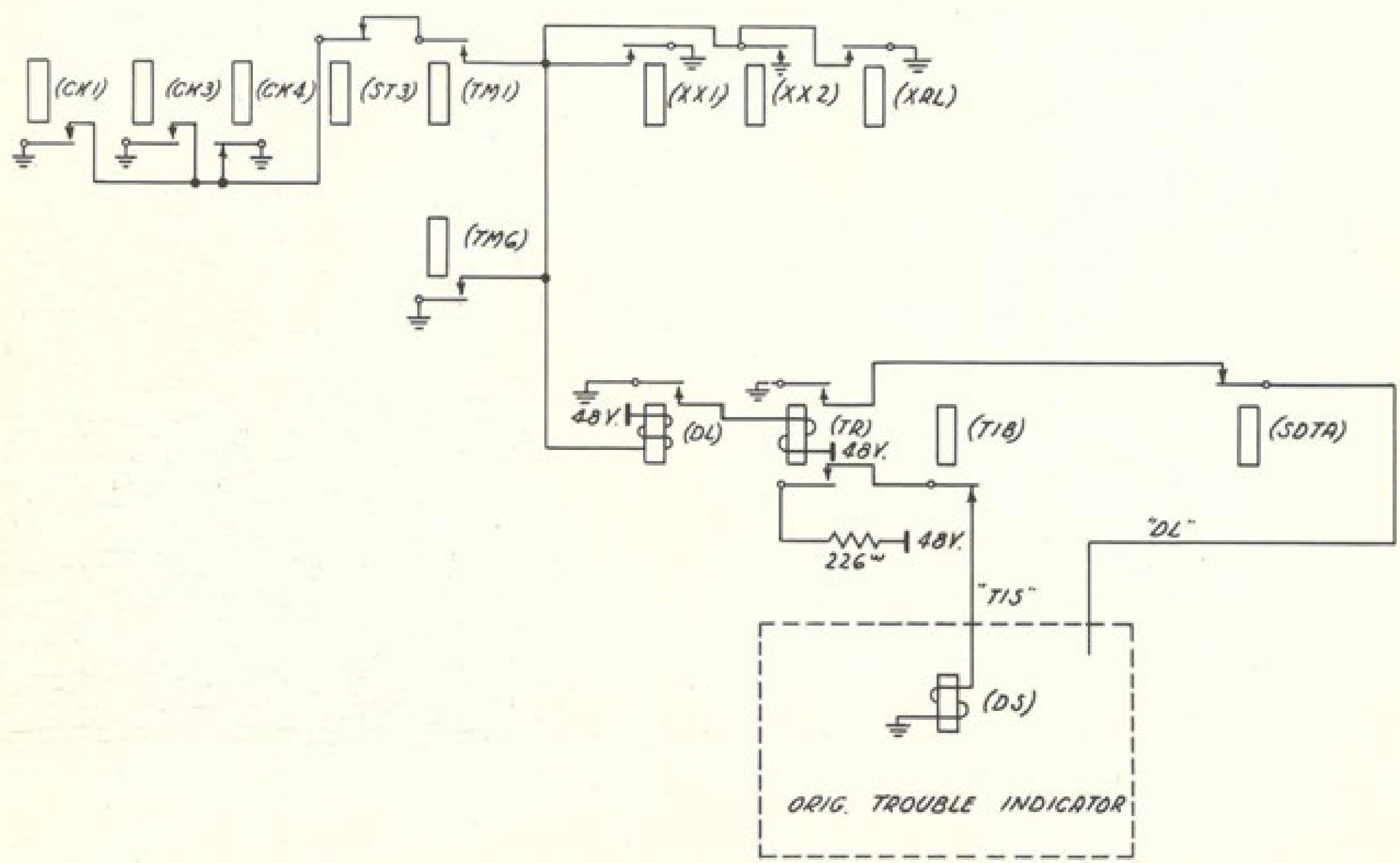
The operation of any of these (X) relays will cause the (XX1), (XX2), or (XRL) relays to operate which in turn operates the (DL) relay to call in the trouble indicator which will attempt to record the progress of the call as completely as possible so that the cause of the failure may be determined.

The marker is arranged to time out at different intervals depending on the progress of the call and call in the trouble indicator should any delay occur that might interfere with normal traffic.

The code and other information will normally be received and checked in much less time than the 1.15 seconds allowed but if there is a delay after the marker has been seized, the timing relays function and cause the (TM1) relay to operate. The (TM1) relay operated closes a path from the winding of (DL) relay through back contact of (CK4) or through front contacts of (CK1) and (CK3) relays. Therefore, unless the (CK4) has been operated and the (CK1) and (CK3) relays have been released within the allowable 1.15 seconds the (DL) relay will operate to call in the trouble indicator.

Another time out interval is provided to check the completion of the marker functions within 2.45 seconds and should any abnormal condition cause a delay the timing relays function and cause the (TM6) relay to operate and call in the trouble indicator.

The (DL) relay operated causes the (TR) relay to operate and connect resistance battery to the "TIS" lead which operates the (DS) relay in trouble indicator. The (TR) relay also connects ground to the "DL" lead to the trouble indicator.



N.Y. TEL. CO.
G.P.S. L.I.

ORIGINATING TROUBLE INDICATOR

ORIGINATING MARKER ATTEMPT TO SEIZE
THE ORIGINATING TROUBLE INDICATOR

2 LZW

XB-150

Connection of Trouble Indicator to Originating Marker

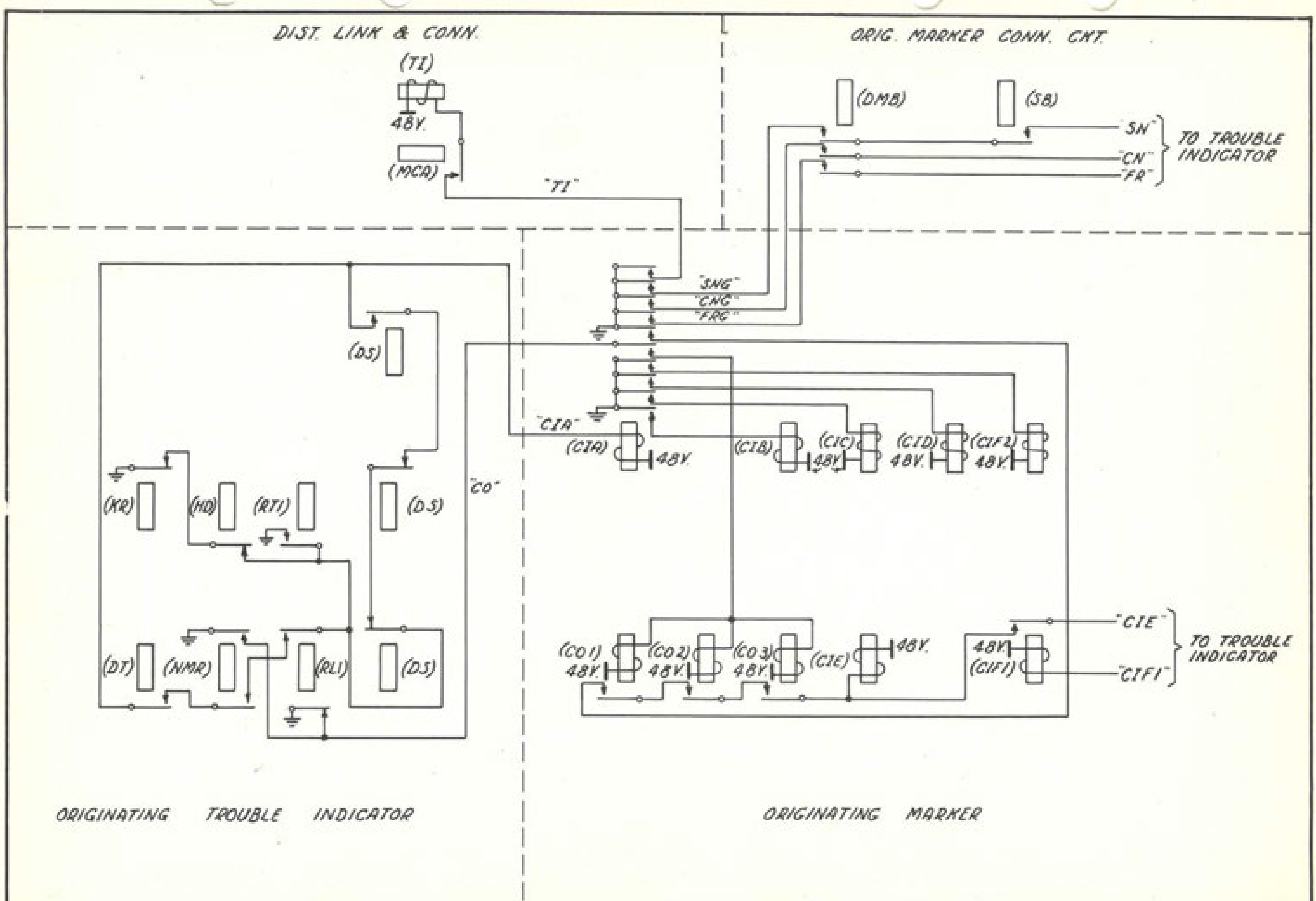
There is one (DS) relay for each marker and these are connected in a preference chain so that if two or more markers call in the trouble indicator only one will be connected to record the failure.

The (DS) relay operated closes ground to the "CIA" lead to operate relay (CIA) in the marker.

The (CIA) operated (1) operates relays (CIB) (CIC) (CID) and (CIF2), (2) closes through the "CO" lead from trouble indicator to operate the (CO1) (CO2) and (CO3) relays, (3) connects ground to the "TI" lead of the district link and connector circuit to operate the (TI) relay in that circuit, (4) connects ground to the "FRG", "SNG" and "CNG" leads of the marker connector circuit associated with the marker calling in the trouble indicator.

The operation of the (CO1) (CO2) and (CO3) relays operates the (CIE) relay which closes the transmitting and receiving leads to the trouble indicator recording relays.

The (CIA) (CIB) (CIC) (CID) (CIE) and (CIF1) relays together connect all of the trouble indicator recording leads to the marker.



N.Y. TEL. CO.
G.P.S. L.I.

ORIGINATING TROUBLE INDICATOR
CONNECTION OF TROUBLE INDICATOR TO ORIGINATING MARKER

2

XB-151

Taking the Record and Disconnection from the Originating Marker

The operation of (CID) relay in the marker connects ground to the "DR" lead to operate relay (DR) in the trouble indicator (1) which lights the DR lamp to indicate the particular marker that is recording the failure (2) opens the ground from the DL lamp to prevent it from lighting, (3) starts the trouble indicator alarm and (4) operates the (RT) relay.

The (DL) relay associated with the marker from which the record is being taken will operate and lock but is prevented from lighting its DL lamp by the operation of the associated (DR) relay. However, any other marker that may call in the trouble indicator while it is busy will operate their respective (DL) relays which in turn lights their associated lamps to indicate the markers that failed without a record having been taken.

The operation of relay (RT) operates (RT1) and it in turn operates the (HD) relay. The (HD) locks under control of the (DR) relay and operates the (GD) and (GD1) relays which lock all of the operated recording relays and releases the (RT) and (RT1) relays.

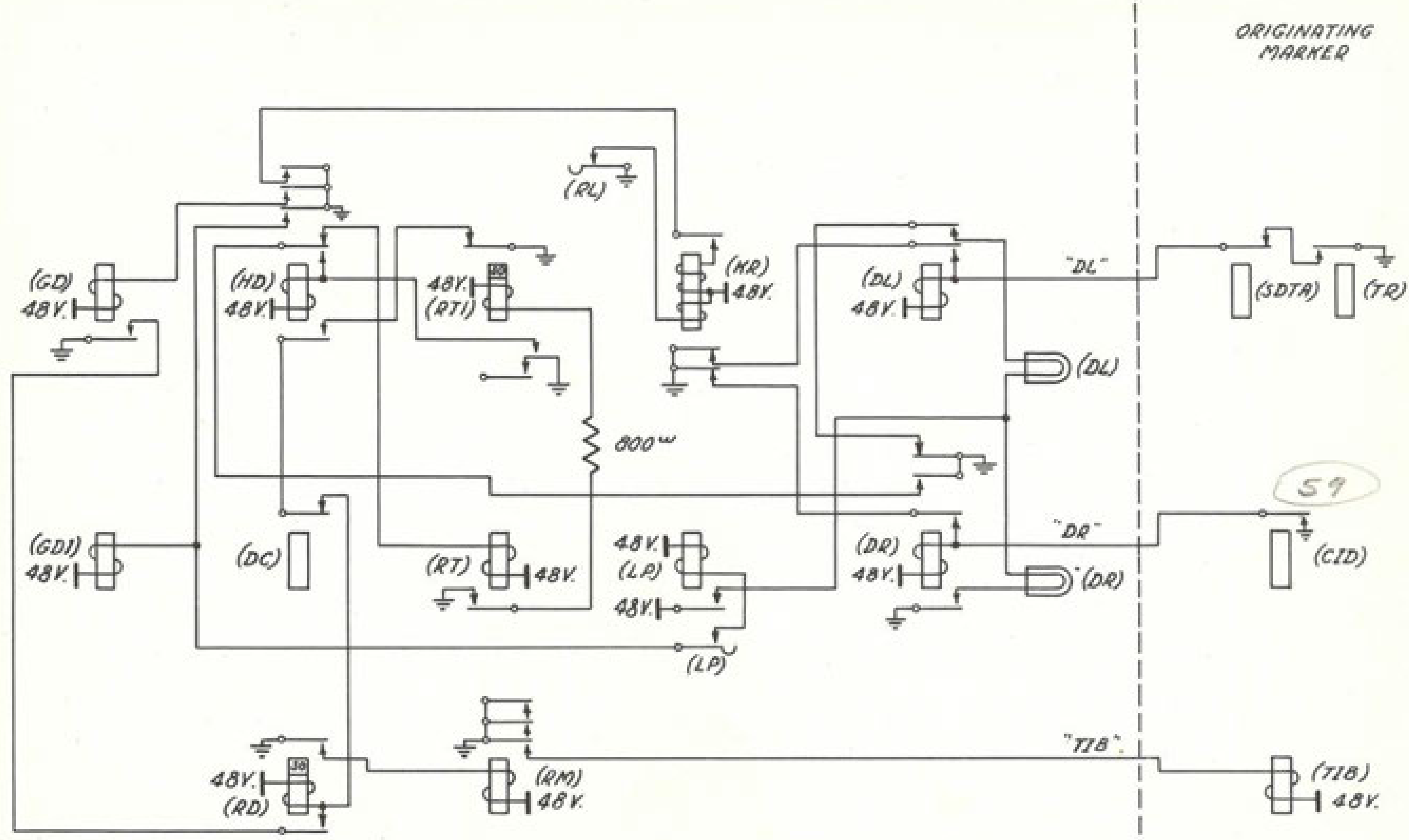
The release of the (RT1) relay (1) connects ground through operated contacts of (HD) relay operating the (RD) relay which locks and in turn operates the (RM) relay, (2) disconnects ground from "CIA" lead releasing the (CIA) relay in the marker (see XB-151). The (CIA) relay releases the (CIB) (CIC) (CID) (CIE) and (CIF1) relays in the marker disconnecting all of the recording leads.

The operation of relay (RM) connects ground to the (TIB) leads of all originating markers operating the (TIB) relay in each circuit.

The operation of the (TIB) relays causes the marker from which the record of failure was taken, as well as any other markers that are calling for the trouble indicator, to transmit a trouble release signal to their associated senders and restore to normal. In addition, the (TIB) relay in each marker opens the "TIS" leads and releases all the operated (DS) relays in the trouble indicator preference chain.

The (RM) relay remains locked up until the RL key is operated, thus causing all markers that call in the trouble indicator while it is holding a record of failure to give an immediate trouble release signal.

To wipe out the record and return the trouble indicator to normal, the RL key is momentarily operated, operating the (KR) relay which locks under control of the operated (HD) relay. The operation of relay (KR) opens the locking circuit for relays (DR) and (DL) and they release. The DR relay normal causes the (HD) relay to release which in turn releases the (GD) (GD1) (RD) (RM) relays and the (LP) relay if the LP key is locked in the operated position.



N.Y. TEL. CO
G.P.S. L.I.

ORIGINATING TROUBLE INDICATOR
TAKING THE RECORD AND DISCONNECTION FROM THE ORIGINATING MARKER

2

XB-152

Testing Originating Marker Circuits

The trouble indicator circuit, in addition to taking records of service failures, is provided with means for originating test calls and recording the progress of such calls through the marker.

A set of keys is provided for setting up the code, class of service and district frame information for all classes of calls that may be handled by the marker circuits in regular service.

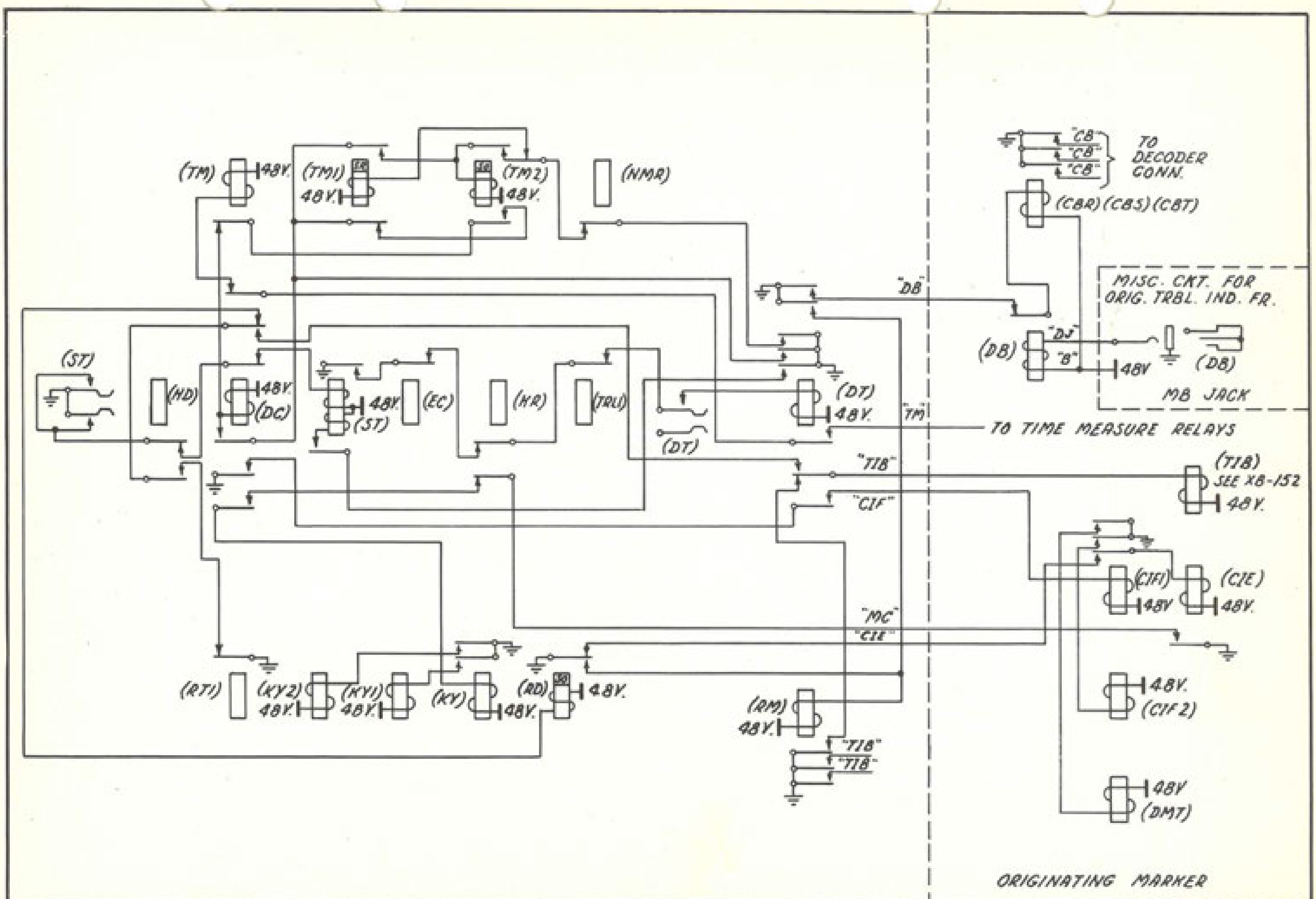
The marker to be tested is selected by operating the DT key on the trouble indicator frame, associated with the marker to be tested. The ST key is used for starting the test.

With DT and ST keys operated the ST relay operates in turn operating the DT relay associated with the marker to be tested. Only one DT key can be effective due to a preferential chain circuit.

The operation of relay (DT) grounds the "DB" lead and starts a test to determine if the marker is busy. If it is busy the trouble indicator will wait until it becomes idle but will prevent another marker connector circuit from seizing it in the meantime. When the marker becomes idle the trouble indicator prepares for the test call and connects all of the test leads between the two circuits by grounding the "CIF1" lead. At the same time that the (DT) relay grounds the "DB" lead it also grounds the "TIB" leads to all other markers making the trouble indicator test busy to all circuits except the one to be tested. The marker signals the trouble indicator when it has connected the leads required for the test call by grounding the "MC" lead operating the (KY) (KY1) and (KY2) relays which connect the transmitting leads to the marker.

The closure of the transmitting leads sets up the marker receiving relays similar to the connection of a sender by a marker connector circuit. The marker upon receiving the code information proceeds to perform its regular functions for handling a call and upon completion, assuming no failure occurs, it calls for the trouble indicator to take a record of the call instead of releasing as in the case of a service call. The marker is arranged to do this by the operation of its (DMT) relay which switches the release circuit so that instead of operating the marker release relay (MRL) at the completion of a call, it operates the (TR) relay in the trouble indicator circuit. The operation of this relay operates the (TR) relay in the marker which calls in the trouble indicator to take a record of the call.

When the marker completes its decoding functions, it operates its sender release relay (SR) grounding the "RL" lead which in the case of a test call operates a relay in the trouble indicator circuit which causes the recording relays that have been operated to lock and then releases the (CIE) relay in the marker. The release of (CIE) relay disconnects the transmitting and receiving leads and removes ground from the "CKG" lead. It also causes the (KY) (KY1) and (KY2) relays to release.



N.Y. TEL. CO. G.R.S. L.I.	ORIGINATING TROUBLE INDICATOR TESTING ORIGINATING MARKER CIRCUITS	2 XB-153

RECORDING FRAME INDICATION

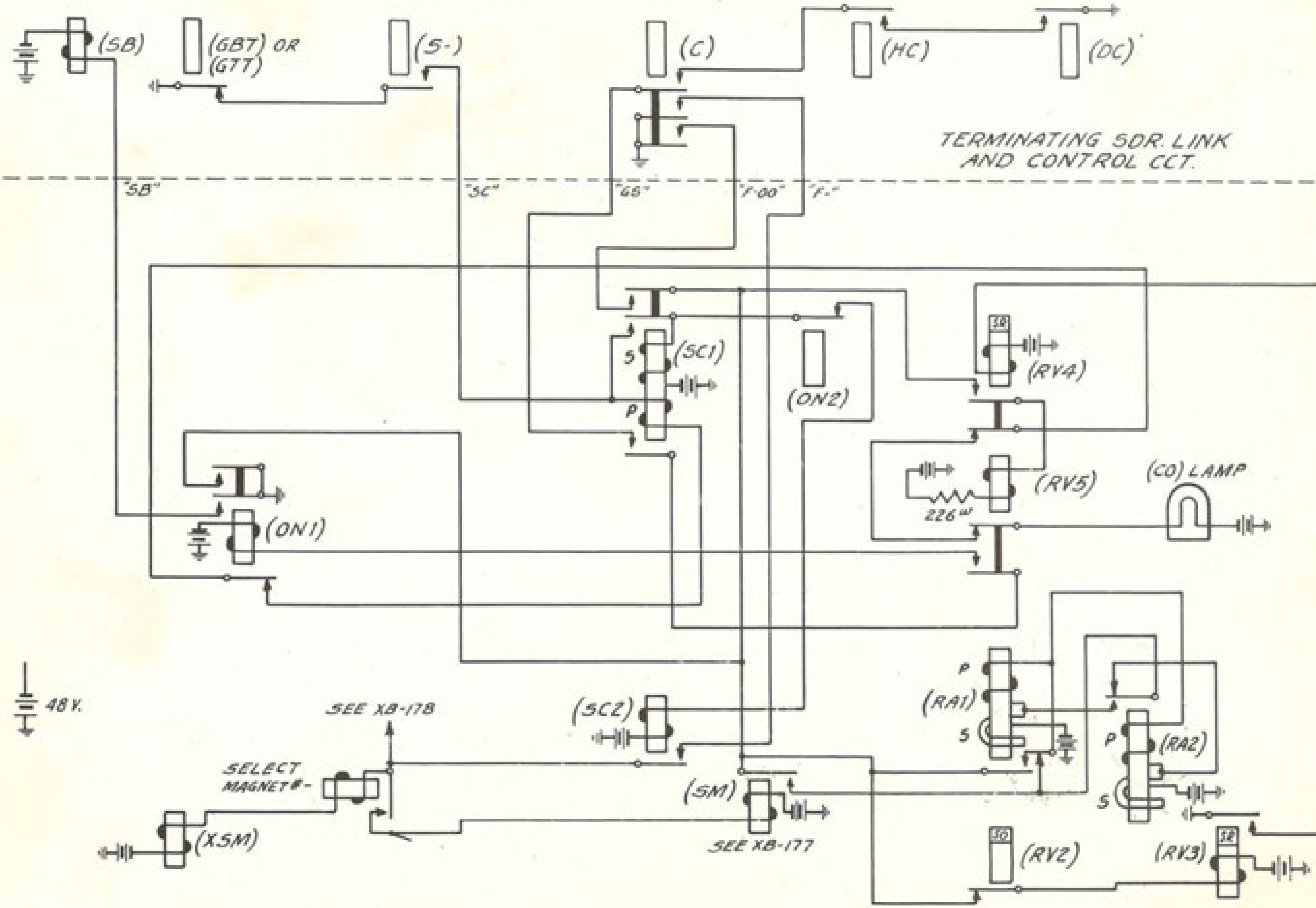
When an incoming trunk calls for a sender, the sender link and control circuit grounds the "SC" lead. Relay (SC1) operates to the "SC" lead on its primary winding and then holds to it by its secondary winding. The primary winding is used for the purpose of checking the battery circuit through the resistance lamp, this being of great importance at a later stage in the connection.

(RV3) operates over the "FOO" lead from the sender link and control circuit after (SC1) operates, and is held by an off normal ground after (ON1) operates. The operation of (RV3) causes the operation of (RV4) and (RV5) in turn.

After (RV5) and (SC1) relays operate, ground on the "GS" lead operates (ON1) relay.

When relay (SC1) has operated, (SC2) also operates to the "SC" lead, and it connects the common lead "FO" to "F9" to the Crossbar register select magnets. One of the select magnets operates from ground in the sender link and control circuit, according to the units digit of the incoming frame number, and it passes the operating ground on to operate relay (SM).

(SM) closes a circuit to operate (RA1) and to shunt down (RA2) so that it cannot operate.



N. Y. TEL. CO.
G. P. S. - L. I.

TERMINATING SENDER
RECORDING FRAME INDICATION

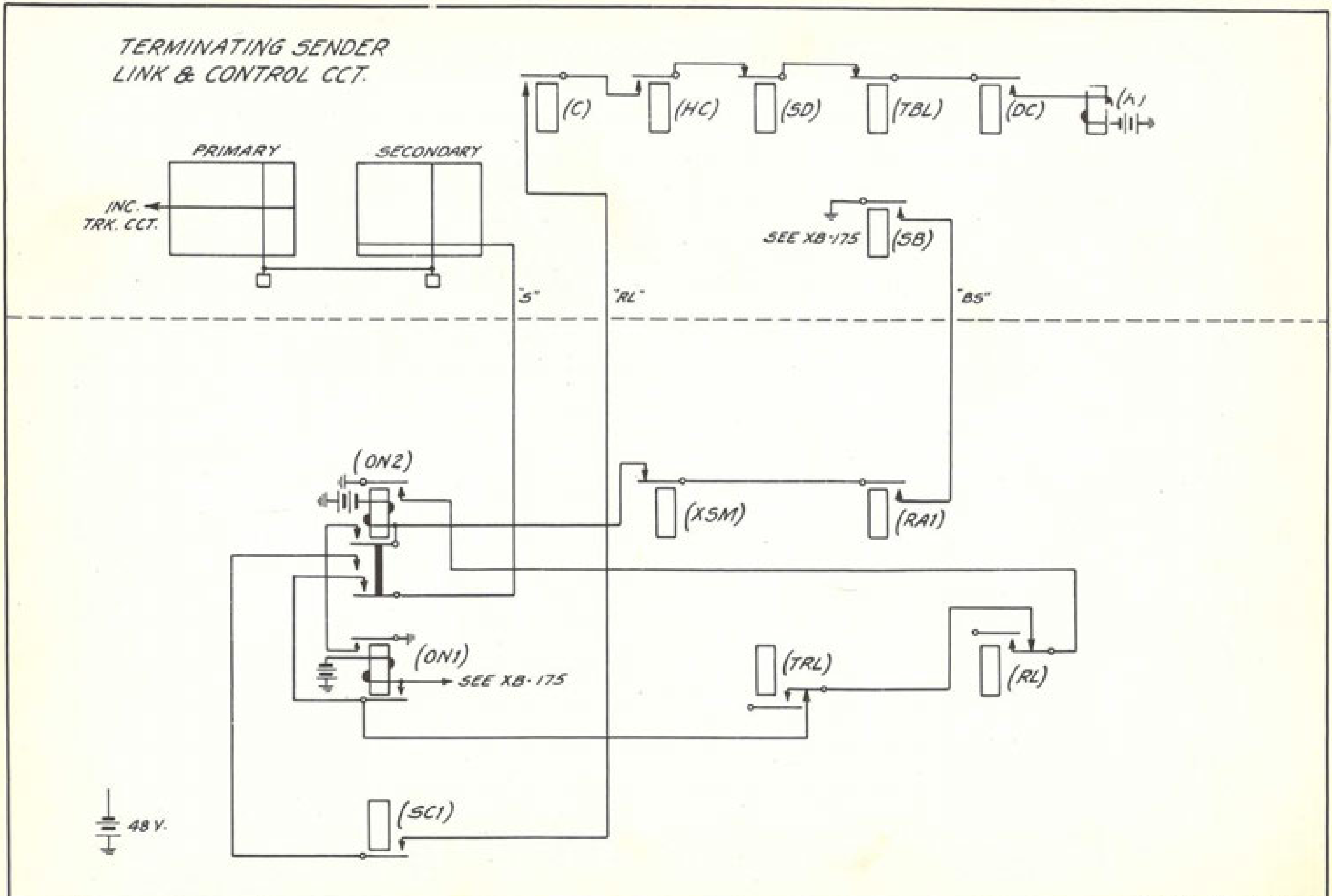
1	2					AYW

XB-175

OPERATION OF RELAY (ON2) AND RELEASE OF SENDER LINK AND CONTROL CIRCUIT

With relay (SB) of the sender link and control circuit operated, ground is placed on lead "BS" to operate relay (ON2). This grounds the "S" lead to hold the sender link hold magnet after its control circuit is released.

The operation of relay (ON2) also places ground on lead "RL" to the sender link and control circuit to operate relay (R), which in turn releases that control circuit.



N. Y. TEL. CO. G.P.S. - L.I.	TERMINATING SENDER RELEASE OF SENDER LINK & CONTROL CIRCUIT	1 XB-176

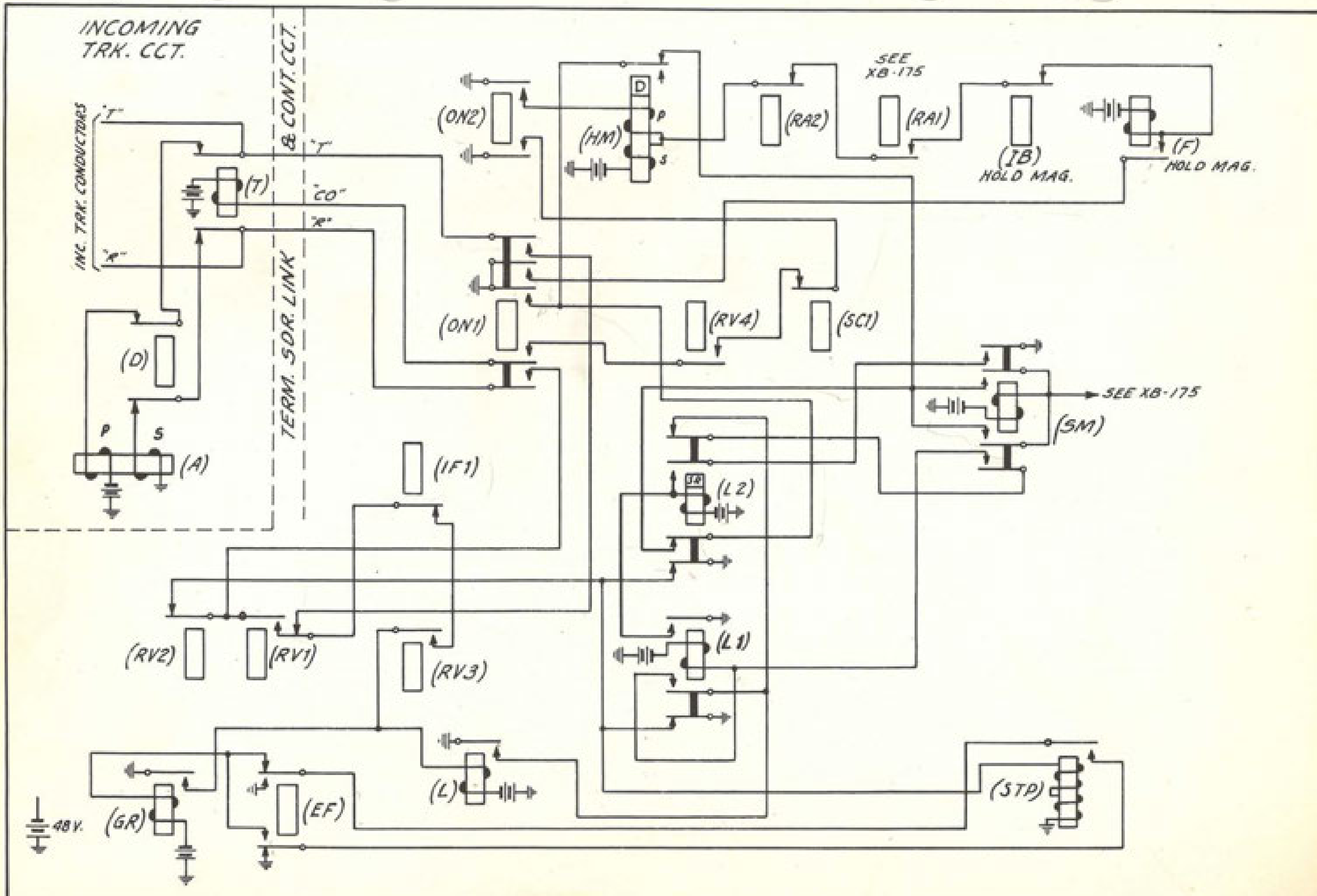
OPERATION OF (STP) AND (L) RELAYS

When the (ON1) operated, the tip lead was closed from the incoming trunk through the (L) relay to battery and the ring lead to ground. The (L) relay did not operate at this time due to the battery and ground from the (A) relay in the incoming trunk keeping it shunted, but this battery and ground holds the (STP) in the originating sender which had operated when the incoming trunk was picked. When relay (SC1) released indicating that the selected sender has been made busy in the terminating sender link, the "CO" lead was grounded operating the (T) relay in the incoming trunk which removes the (A) relay from the trunk. The opening of the (A) relay battery and ground removes the shunt condition from the (L) relay which now operates in series with the (STP) relay of the originating sender.

As has been shown relay (SM) operated when a select magnet operated for frame indication, then closed a circuit to operate relay (L1) which in turn operated relay (L2). With these relays operated, the short is removed from the (STP) relay in the terminating sender allowing it to also operate in series with the (L) relay and (STP) relay in the originating sender.

With the (STP) relay of the terminating sender operated, relay (GR) operates which grounds the "T" lead, causing the release of the (STP) relays in both the originating and terminating senders, but holding relay (L) operated which in turn holds (L1) and (L2) relays operated. This pulsing or alternate operation and release of the two (STP) relays, continues until the counting relays are satisfied in the originating sender. The operating circuit for relay (L) is then opened indicating the completion of that series of pulses.

In order to extend the life of the contacts of the (STP) relay, the direction of current flow through the contacts is reversed when relay (EF) operates. Relay (EF) operates on all calls from even numbered incoming frames.



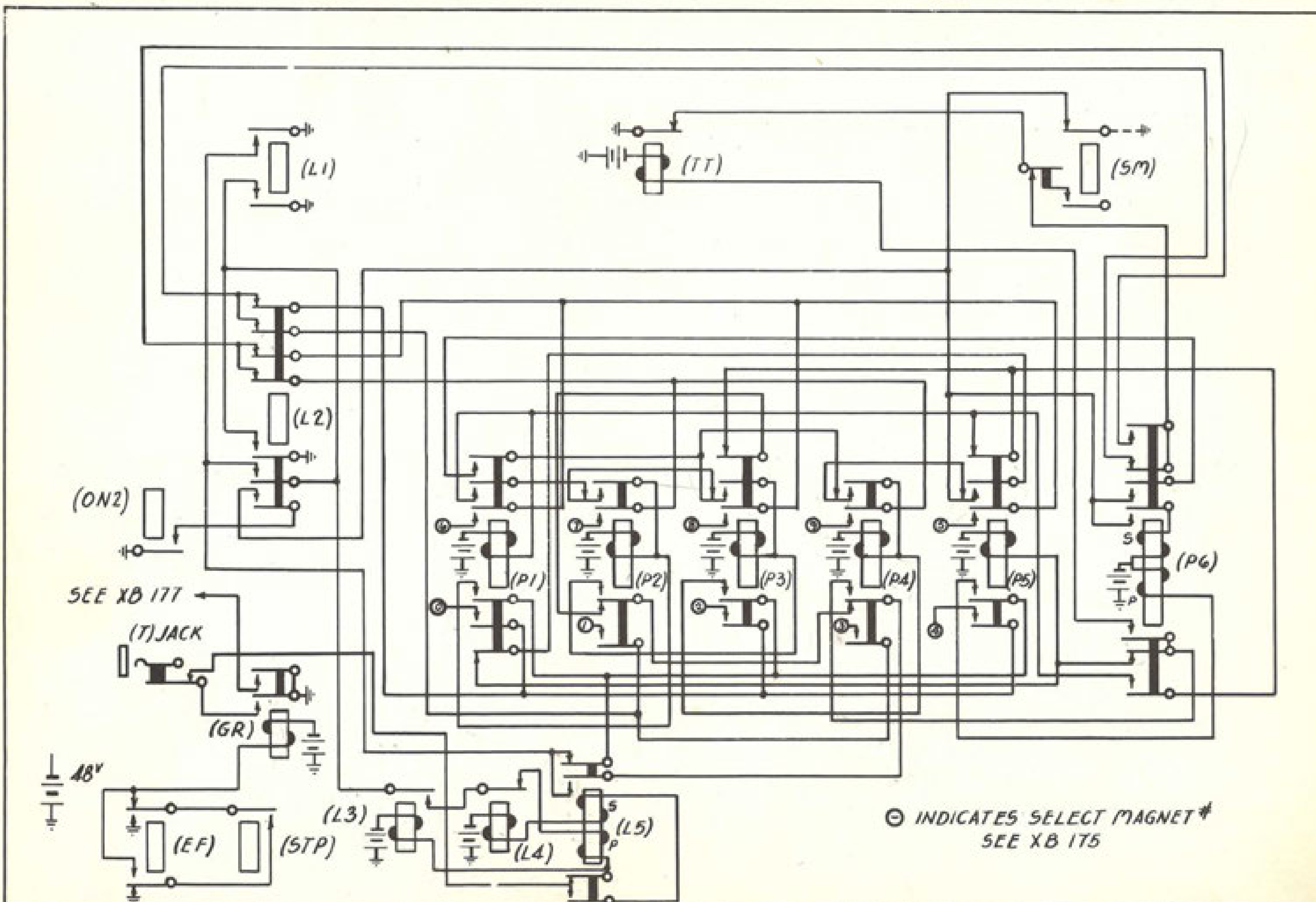
N. Y. TEL. CO. G. P. S. - L. I.	TERMINATING SENDER OPERATION OF THE (STP) & (L) RELAYS & "F" HOLD MAGNET	1 2 XB-177

TERMINATING SENDER PULSING RELAY OPERATION

The terminating sender counts the pulses on relays (P1) to (P6) actuating them by relays (L3), (L4) and (L5). The periodical operation and release of relay (GR) causes relays (L3), (L4) and (L5) to operate and release in a recurrent cycle of half the frequency, as follows: The operation of relay (GR) on the first or any odd-numbered pulse operates relay (L3); its release permits relay (L5) to operate in series with relay (L3), the operation of relay (GR) on the second or any even-numbered pulse operates relay (L4) in series with the secondary winding of relay (L5), whereupon relay (L3) releases but relay (L5) holds. The release of relay (GR) causes relays (L4) and (L5) to release. Thus relay (L5) operates at the end of each odd pulse and releases at the end of each even pulse. The ground connection for holding relays (L3) and (L5) in series is furnished by the parallel front contacts of relays (L1) and (L2) so that they will release after the last pulse of each selection.

The operation of relay (L5) on the first pulse causes relay (P1) to operate and lock. The release of relay (L5) on the second pulse causes relay (P2) to operate, lock and unlock relay (P1), which releases. Similarly, the operation or release of relay (L5) on subsequent pulses operates other (P-) relays. The relays left locked up after each pulse, any one of which may be the last pulse of a selection, are as follows:

Pulse	Relays	Pulse	Relays	Pulse	Relays
1	P1	5	P5	9	P3-P6
2	P2	6	P5-P6	10	P4-P6
3	P3	7	P1-P6	11	P4-P6-TT
4	P4	8	P2-P6		



N.Y. TEL. CO.

GRS L.I.

TERMINATING SENDER

OPERATION OF SELECT MAGNETS

XB 179

OPERATION OF HOLD MAGNETS AND INCOMING ADVANCE

Each time relay (SM) operates, it either operates relay (RA1) and leaves relay (RA2) normal, or it releases relay (RA1) and leaves relay (RA2) operated. In either case, the effect is to connect the windings of relay (HM) to the winding of the first non-operated hold magnet, causing the same to operate. The hold magnet closes the contacts of the cross-points at the level of the operated select magnet, locks up to a front contact of relay (ON1) or (ON2) and by connecting the locking ground to the windings of relay (HM), causes that to operate. When relay (HM) has operated on one selection and relay (L2) on the next selection, relay (SM) and the operated select magnet release.

Each time relay (SM) releases it either operates relay (RA2) and leaves relay (RA1) operated, or it releases relay (RA2) and leaves relay (RA1) normal. In either case the effect is to disconnect the windings of relay (HM) from any hold magnet, and relay (HM) releases.

When the last selection (final units) has been transmitted from the originating sender to the terminating sender, the former closes the circuit again through its stepping and overflow relays and awaits a reverse battery pulse to operate both of those relays and then release the stepping relay.

Relays (L), (L1) and (L2) operate when the originating sender closes the circuit to receive a reverse battery pulse. (RV1) relay then operates and locks through front contacts of the (FU) hold magnet and (L2) relay.

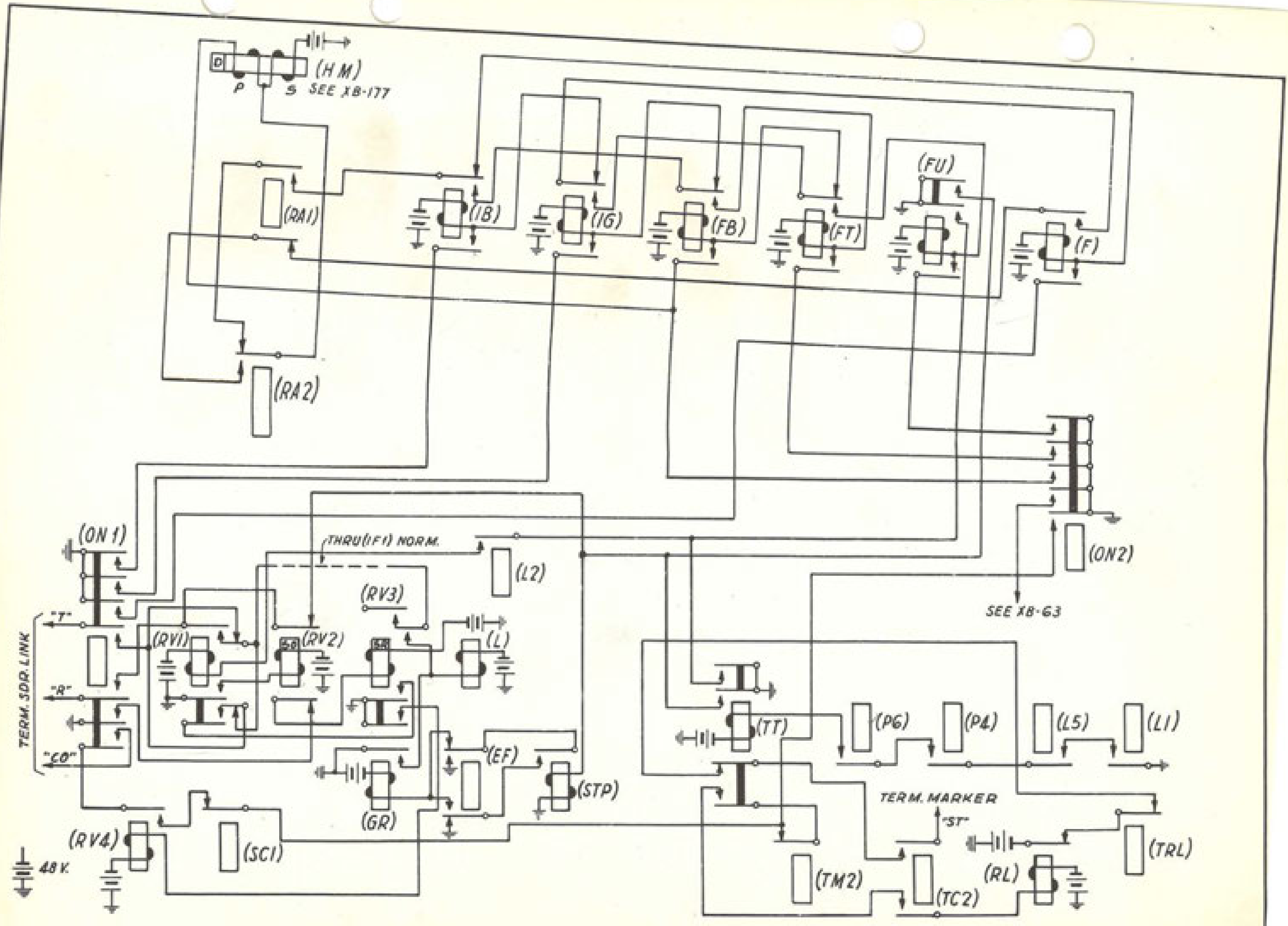
Slow operate relay (RV2) operates from a front contact of (RV1) relay and removes ground from the "R" lead which is connected to the winding of the (L) relay and reverse current goes out to operate the originating sender stepper and overflow relays, the current starts suddenly on account of the heavily soaked condition of the (L) relay.

Slow release relay (RV3) releases when the (RV2) relay operates. This breaks the connection to the "T" and "R" leads, terminating the reverse battery pulse and allowing the originating sender stepper to release.

Telltale call abandoned. The eleventh pulse will operate relay (TT). (TT) relay locks up and grounds that transfer spring of the (L2) relay and that back contact of the (RV2) relay which in a completed call are grounded by the operation of the (FU) hold magnet. (RV1) relay operates and the succeeding operations are the same as in incoming advance and trunk closure or a completed call, except that the sender is released without calling in a terminating marker.

(RV4) relay releasing removes ground from the "CO" lead, restoring the incoming trunk line relay to its normal connection with the trunk.

The operation of the (TC2) relay cannot call in a marker because a back contact of (TT) relay opens the ST lead, but the (TC2) relay closes a circuit through (TT) relay to operate relay (RL) and that causes the sender to release.



N. Y. TEL. CO.

OPERATION OF HOLD MAGNETS

1 2

SEIZURE OF MARKER CONNECTOR

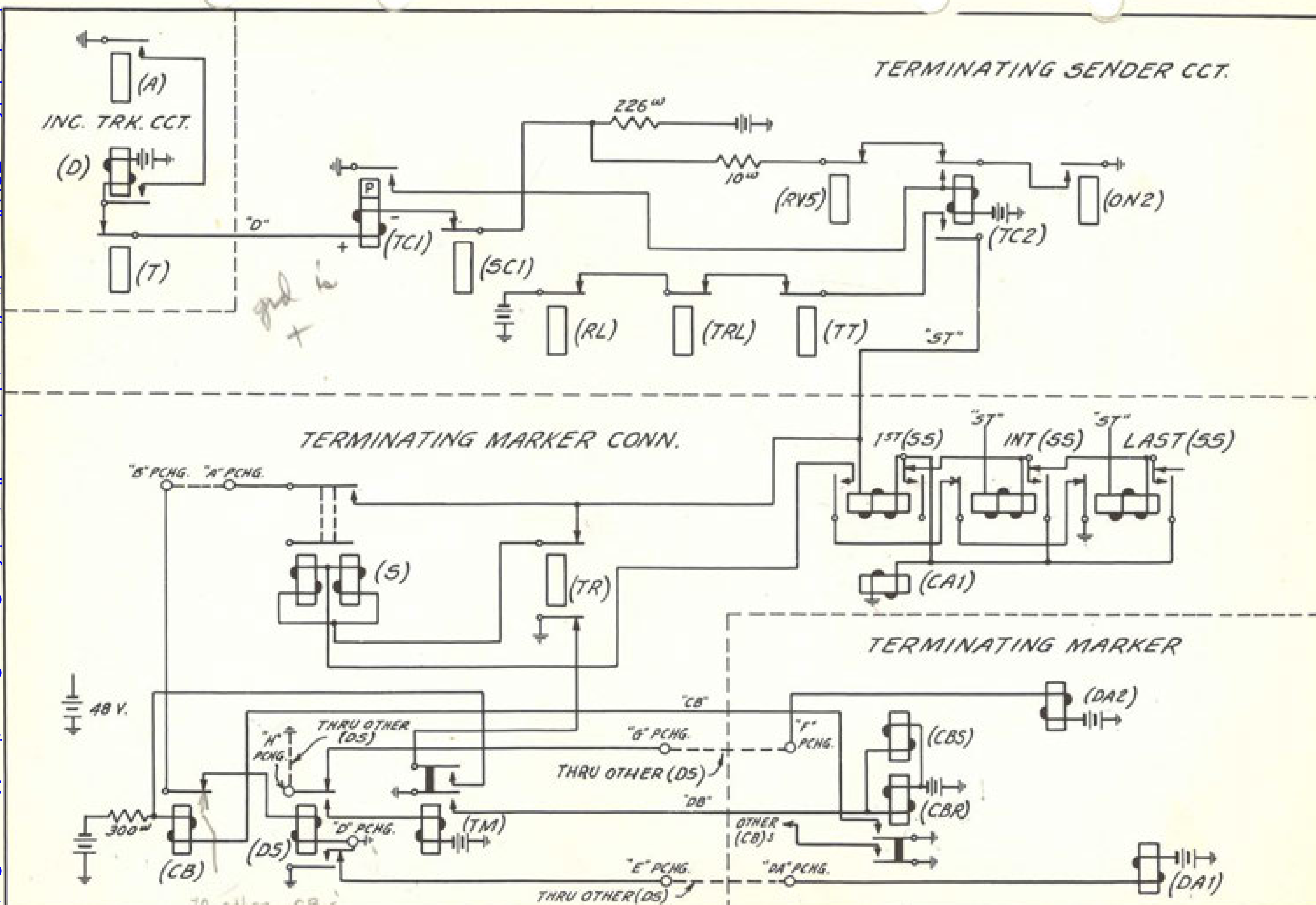
When relay RV5 released, low resistance ground was connected to the winding of relay (TC1) which causes relay (D) in the trunk circuit to operate in series with the winding of relay (TC1). Relay (TC1) does not operate at this time since it is polarized.

The (D) relay operating grounds lead "D" allowing relay (TC1) to operate. With relay (TC1) operated it causes relay (TC2) to operate, which locks and connects battery to the "ST" lead to the marker connector.

Relay (SS) and (CA1) operated in series from battery on the "ST" lead. The multi-contact relay (S) associated with the sender is operated by relay (SS) and connects the sender to the receiving leads of the connector.

The operation of relay (S) connects the "ST" lead to relay (DS) of the first idle marker. When relay (DS) operated it caused relays (DA1) and (DA2) to release, closing ground to the alarm lead "TM". Relay (TM) operated from the operated (DS) relay and in turn operated relays (CBR) and (CBS) in the terminating marker, which in turn operated the (CB) relays in all connectors associated with that marker. The (CB) relay in the connector used does not operate since it is short-circuited through the made contacts of relay (TM).

With relays (S) and (TM) operated, numerous leads are closed through from the sender to the marker.



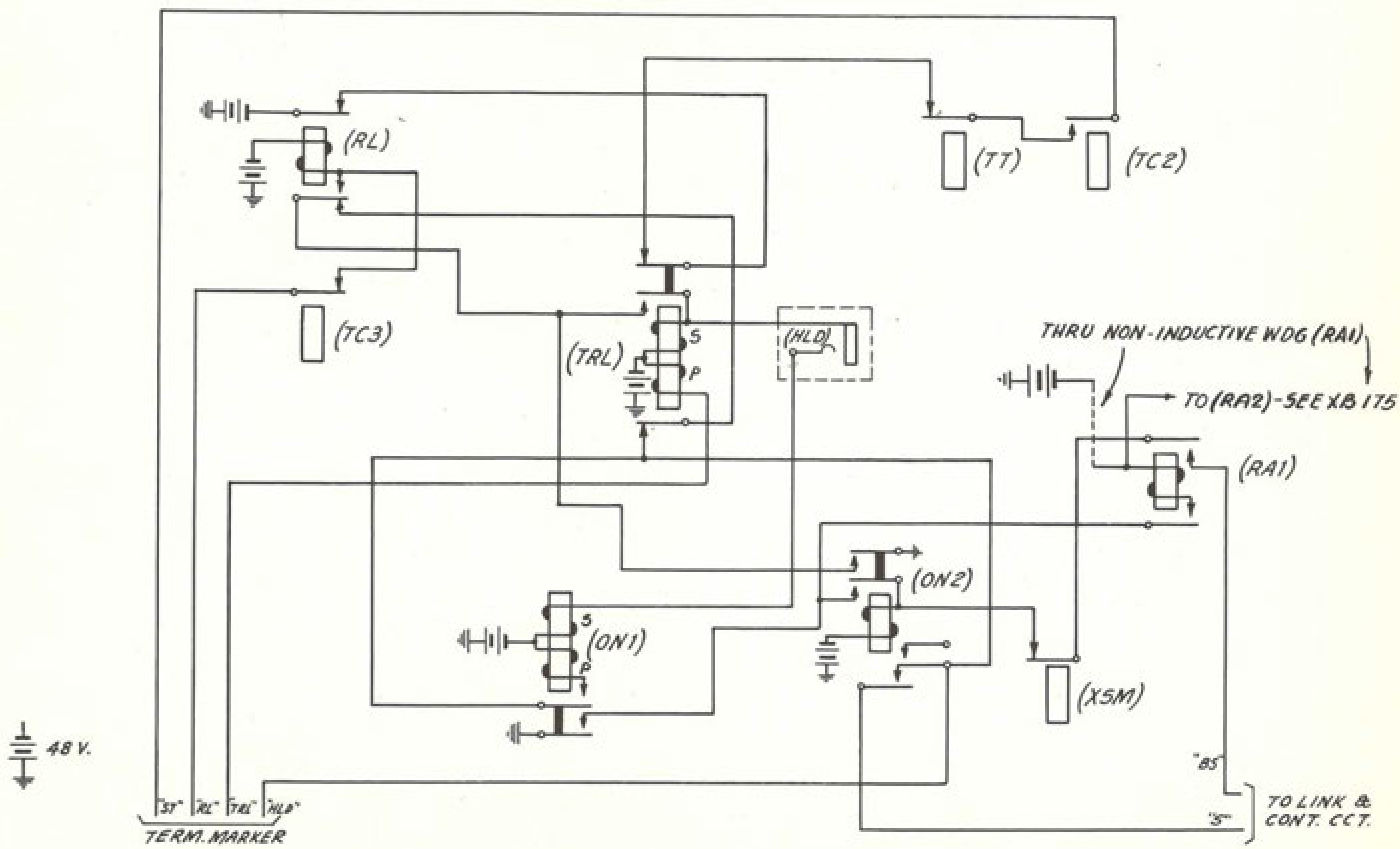
N. Y. TEL. CO. G. P. S. - L. I.	TERMINATING SENDER SEIZURE OF MARKER CONNECTOR	1 XB-180

SENDER RELEASE

When a connection has been established, or when the attempt has definitely failed, either relay (RL) or (TRL) is operated and locked to an off-normal ground.

(RL) operating breaks battery from the "ST" lead to release the marker connector. (RL) also breaks the local ground connection which locks (ON1) and holds the link switches over lead "S", but these do not release at once because they are also held over lead "HLD" from the marker connector. When that releases (ON1) and the link switches also release and the sender is freed from its external connections. The reason for holding over the "HLD" lead is to prevent the breaking of current on the cross-points of the register. When (ON1) releases, it is followed by (RA1) if that is operated, and then by (ON2). The register and all locked up relays release, and the sender is normal and ready for reuse.

(TRL) operating breaks battery from the "ST" lead and breaks the local ground connection which locks (ON1) and holds the link switches over lead "S", just as (RL) would do. The marker connector is released, and in doing so breaks its ground from the "HLD" lead, so there is no longer any ground on the "S" lead or the primary winding of (ON1). The link switches release and the sender is freed from its external connections. If there is no plug in the (HLD) Jack (ON1) also releases and the sender restores to normal, but if there is a make busy plug in the (HLD) jack, (ON1) will hold on its secondary winding, the register and all locked up relays will hold and the sender will remain busy on the "SB" lead ground, until the plug is removed.

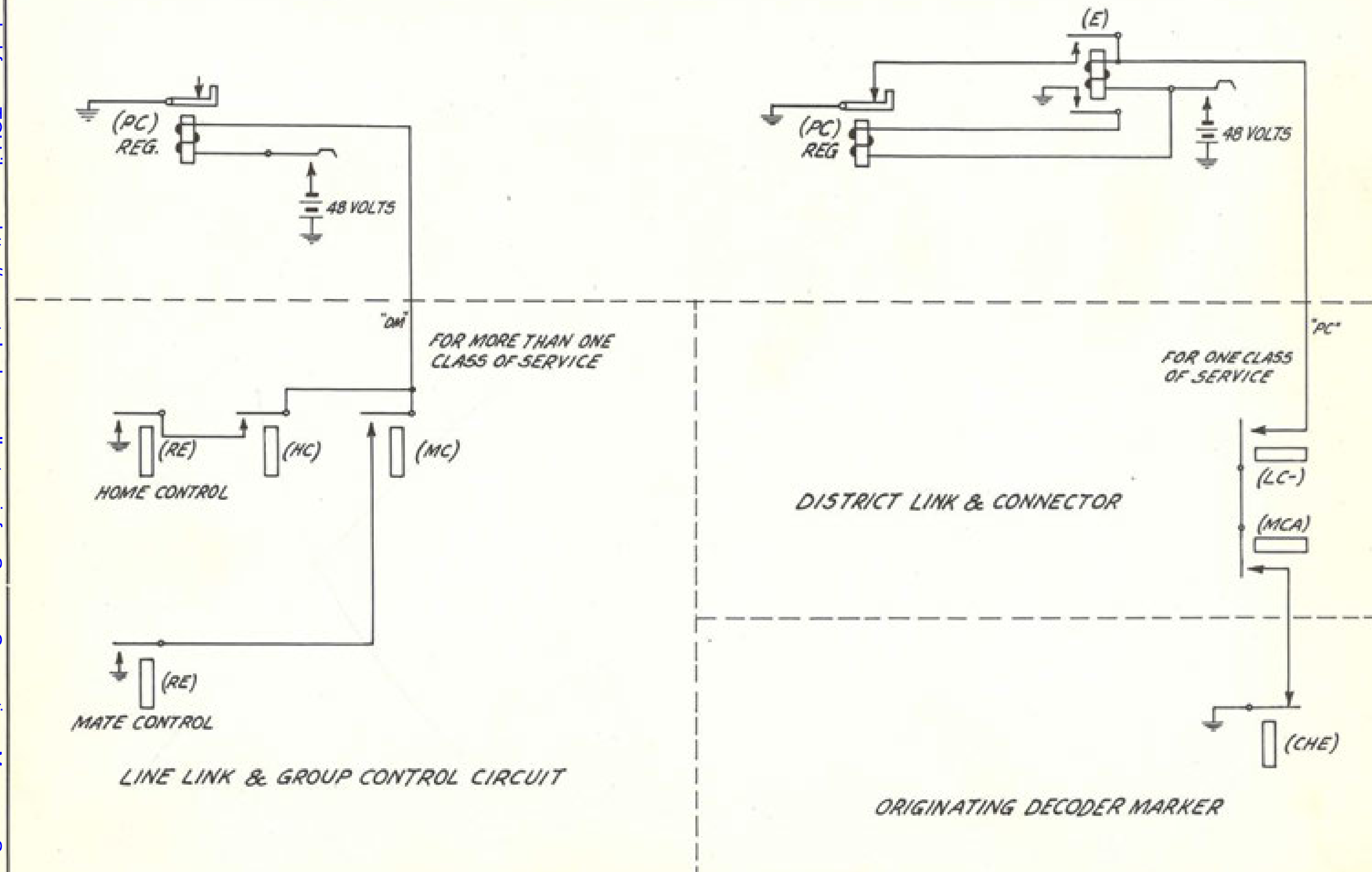


N. Y. TEL. CO. G. P. S. – L. I.	TERMINATING SENDER RELEASE	1 XB-181

DISTRICT JUNCTOR PEG COUNT

Whenever a district junctor of a group which serves only one class of service is seized, ground is connected from the originating decoder marker to the district link and connector, through the (LC-) relay associated with that group of district junctors, causing the peg count register to score.

Whenever a district junctor is seized for an originating call to a line link frame on which the available district junctors serve more than one class of service, the peg count registration per class of service is made at the line link frame. The "DM" lead of the line group originating the call will be grounded whether it is served by the home or the mate control circuit.



N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS DISTRICT JUNCTOR PEG COUNT, ONE CLASS & MORE THAN ONE CLASS	1 GEW XB-250

LINE LINK GROUP AND LINE LINK SUB-GROUP TERMINATING TRAFFIC PEG COUNT

AND GROUP BUSY REGISTER

When peg count and group busy readings are to be recorded for a line link group, the (LK) key is operated to the line link side, supplying battery to its traffic register circuits. On each terminating call to that line group, its "PC" lead is grounded in the line choice connector by operation of (CR) and (CE) relay and transmitted to the line link register circuit.

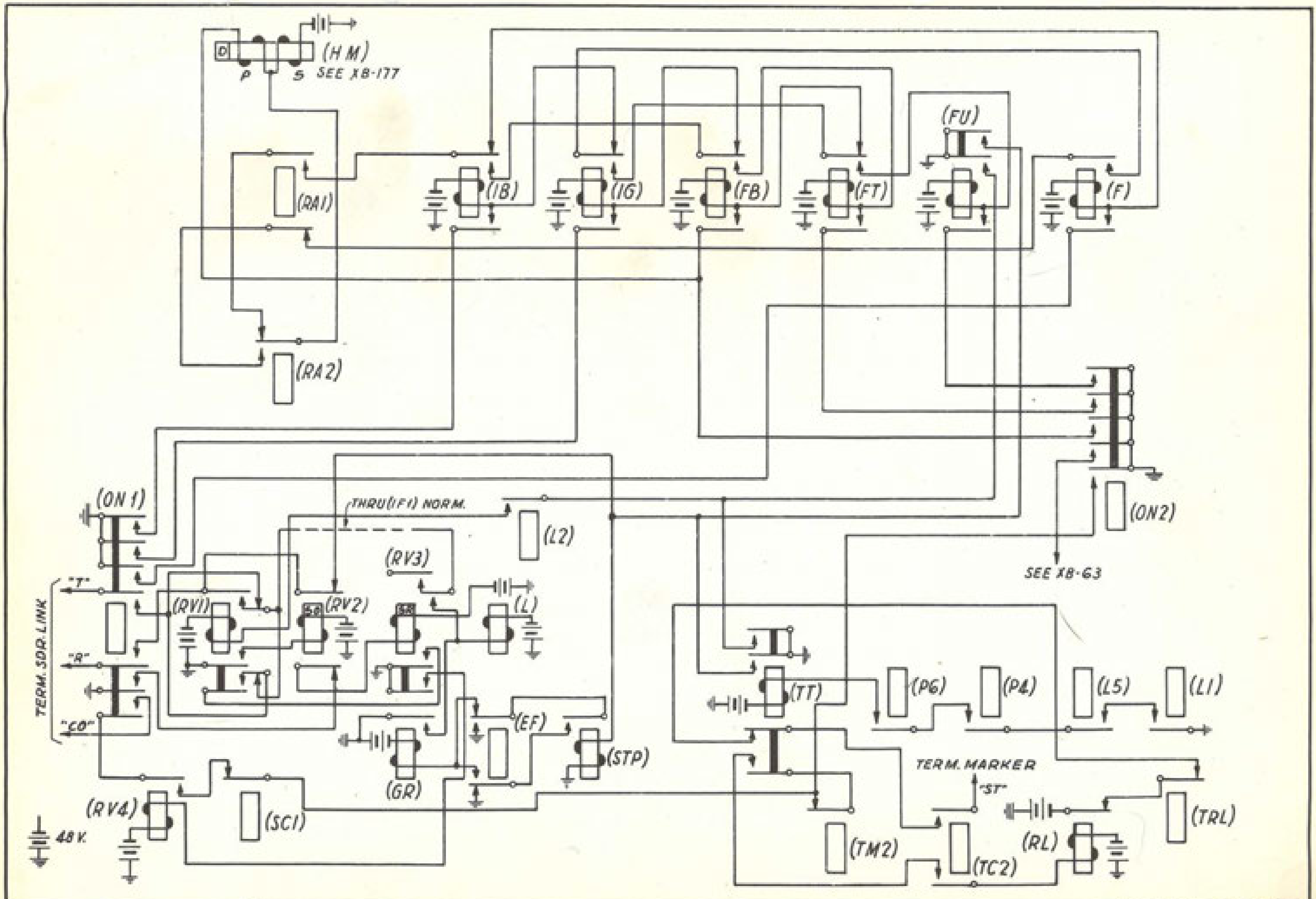
In order to record the number of times a predetermined number of links of a called sub-group are in use, the terminating marker operates its (REG) relay, if that number or more of the links are in use. Relay (REG) operating, grounds the "PL" lead to the line link group under control of the (CR) and (CE) relays in the line choice connector serving the line group.

If records are desired for the line link sub-groups, the (LK) key is operated to the line link sub-group side which operates its (H) and (J) relays. The peg count and group busy readings are now recorded for each sub-group of the line link group.

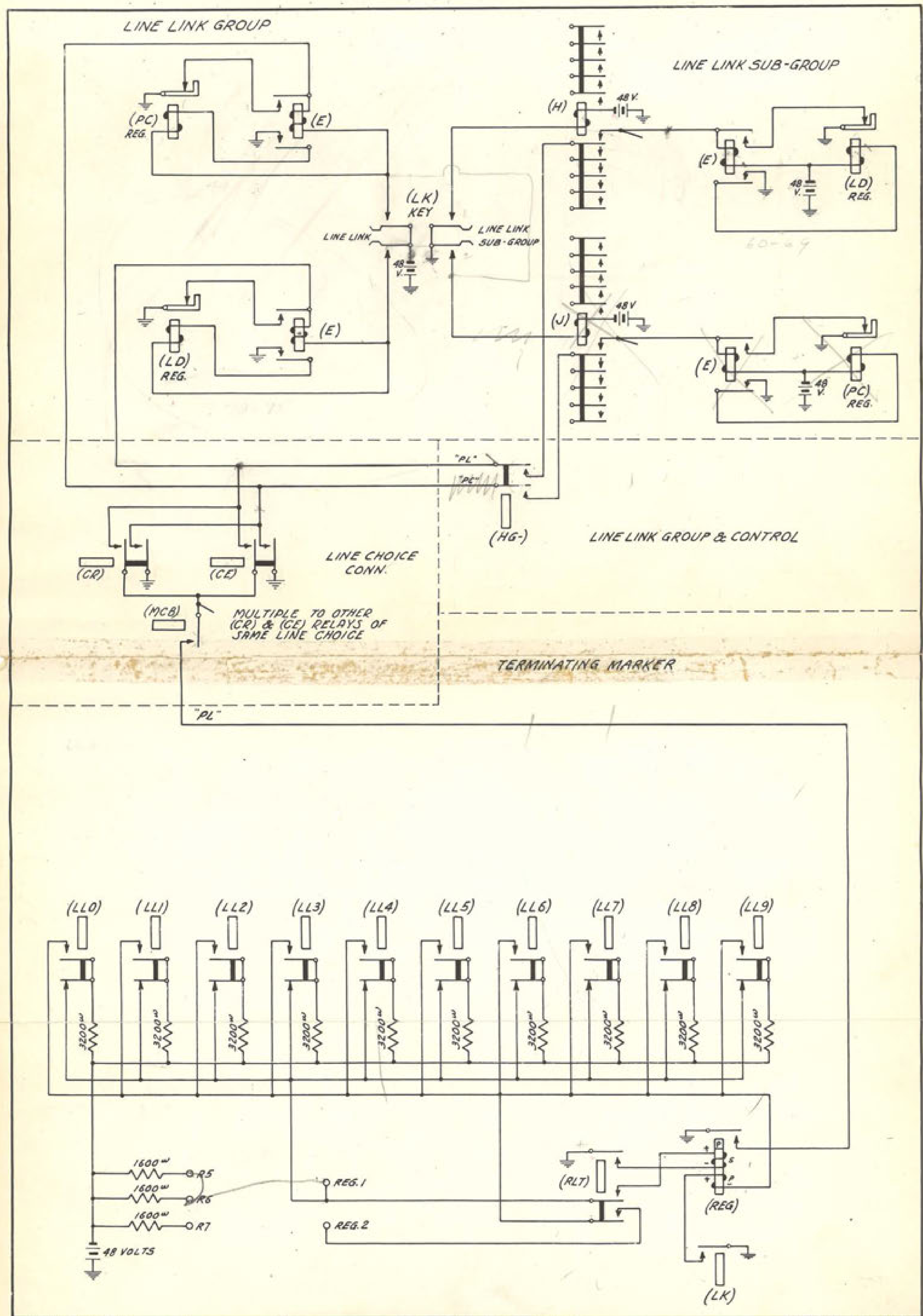
The sub-group busy registers and sub-group peg count registers are common to all line link groups in the office and by operating an (LK) key of a particular frame it is possible to associate these registers with any line link group desired.

The group busy register for line links will register for the number of busy links indicated by making the cross connection shown in the following table:

No. of Busy Links	Connect
3 or more	R5, R6 and R7 to REG 2
4 or more	R5 and R6 to REG 2
5 or more	R5 to REG 2
6 or more	None
7 or more	R5 to REG 1
8 or more	R5 and R6 to REG 1
9 or more	R5, R6 and R7 to REG 1



N. Y. TEL. CO.	OPERATION OF HOLD MAGNETS	1 2



N. Y. TEL. CO.
G.P.S. L.I.

TRAFFIC REGISTERS
LINE LINK GROUP, LINE LINK SUB-GROUP, TERMINATING TRAFFIC REG COUNT AND GROUP BUSY REGISTERS

XB-251

ORIGINATING DECODER MARKER AND TERMINATING MARKER PEG COUNT

When an originating decoder marker is seized and progresses to the marker stage, its (ST4) relay is operated. Relay (ST4) operated, grounds the "MPC" lead for that decoder marker, causing the traffic register to score.

When a terminating marker is seized and has recorded the necessary information from the terminating sender, its (CK4) relay is operated. Relay (CK4) operated, grounds the "PC" for that terminating marker, causing the traffic register to score.

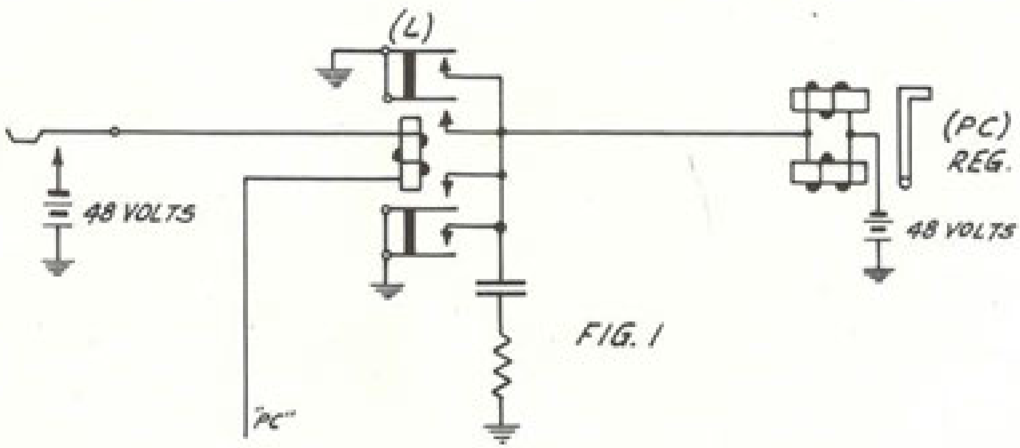
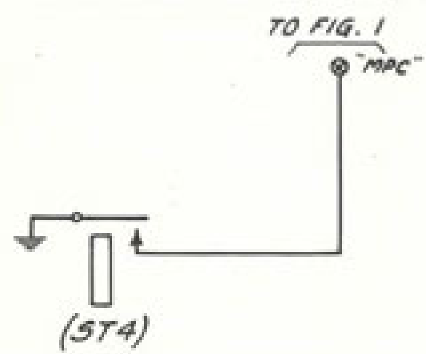
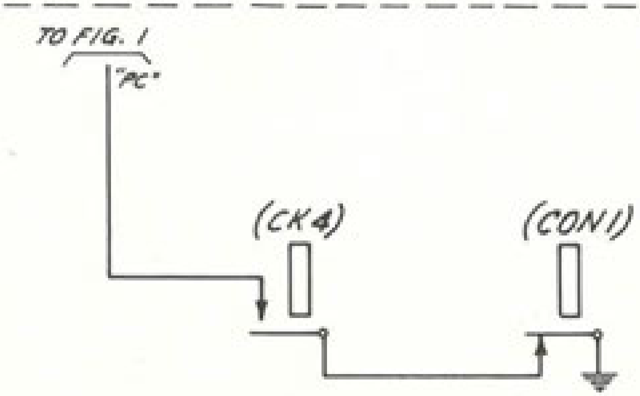


FIG. 1



ORIGINATING DECODER MARKER



TERMINATING MARKER

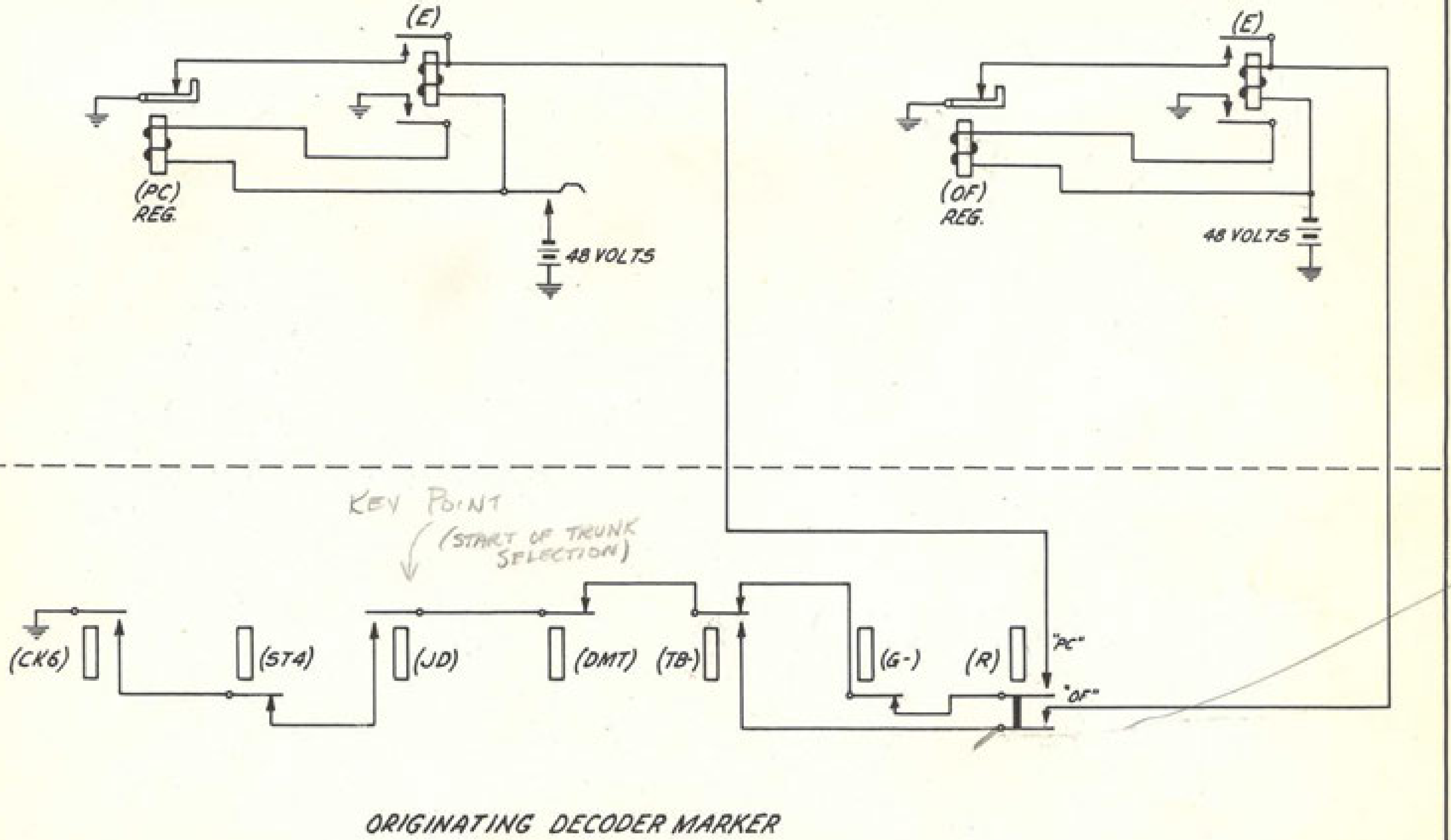
N. Y. TEL. CO. G. P. S. L. I.	TRAFFIC REGISTERS ORIGINATING DECODER MARKER & TERMINATING MARKER PEG COUNT	1 2 XB-252

OUTGOING TRUNK GROUP PEG COUNT AND OVERFLOW

The "PC" terminal connected to the route relay is provided to furnish means for operating a register and thus record the number of calls routed to a particular trunk group. When a route relay operates and its associated ground supply relay (GL-3) is normal, a register cross-connected to the particular "PC" terminal will be operated. On trunk groups that have two route relays, the "PC" terminal of only the first choice route relay should be cross-connected. The "PC" terminals of the second choice route relays should not be cross-connected because if they were, the trunk group peg count register would be operated twice when the second choice route relay was operated on finding all trunks of one of the first choice trunk sub-groups busy.

The "OF" terminal is provided to furnish means for obtaining a record of the number of times that a call is originated for a trunk group and all trunks of the group are found busy. The (TBI-4) relay of the group found busy will be operated, grounding the "OF" terminal and operating the overflow register associated with that particular trunk group. On trunk groups that have two route relays, the "OF" terminal of the second choice route relay should be cross-connected while the "OF" terminal of the first choice route relay should not be cross-connected. This is to avoid falsely operating the overflow register on the second choice route relay when one of the first choice sub-groups of trunks is found busy.

The ground lead to the "PC" and "OF" terminals is opened on the contacts of the (DMT) relay, so that these registers will not be operated on sender test circuits and decoder marker test calls.

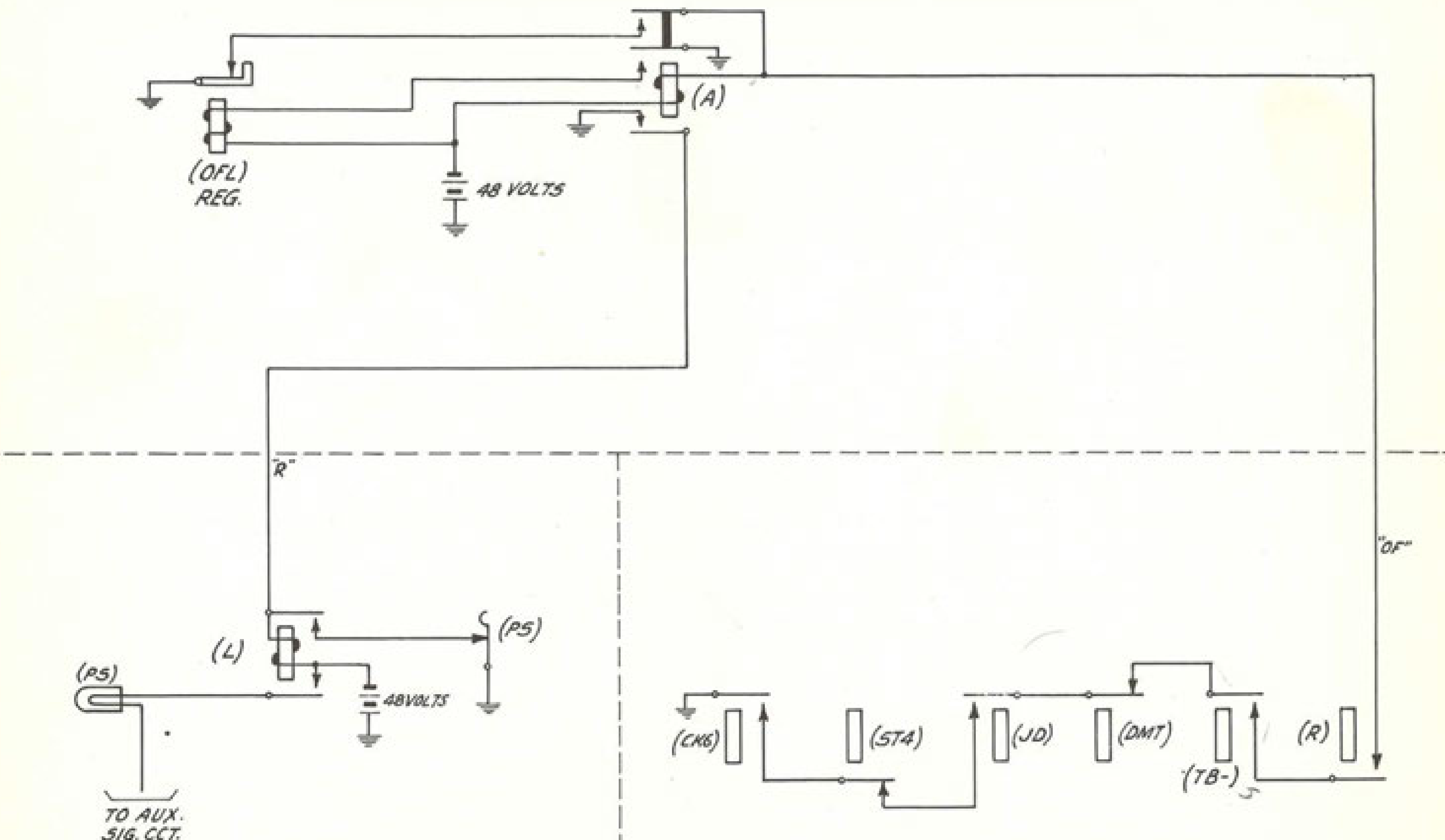


N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS OUTGOING TRUNK GROUP PEG COUNT AND OVERFLOW	1 2 5179 XB-253

PERMANENT SIGNAL OVERFLOW

When a sender is connected to a subscriber's line on which a permanent signal condition is recognized, and the decoder encounters an all-trunk busy condition on the permanent signal holding trunk group, ground is connected by the decoder marker circuit to its overflow register. This operates the (A) relay of the register circuit which in turn causes the register to score. The operated (A) relay also causes the (L) relay of the "A" switchboard overflow signal circuit for permanent signal holding trunks to operate. The (L) relay locks under control of the (PS) key and lights the (PS) lamp.

An overflow on outgoing trunks to the "A" switchboard operator functions in a similar manner, except that the ground from the operated (A) relay connects to the "A" switchboard make busy key and alarm circuit instead of to the permanent signal overflow circuit.



"A" SWITCHBOARD OVERFLOW SIGNAL CIRCUIT
FOR PERMANENT SIGNAL HOLDING TRUNK GROUP

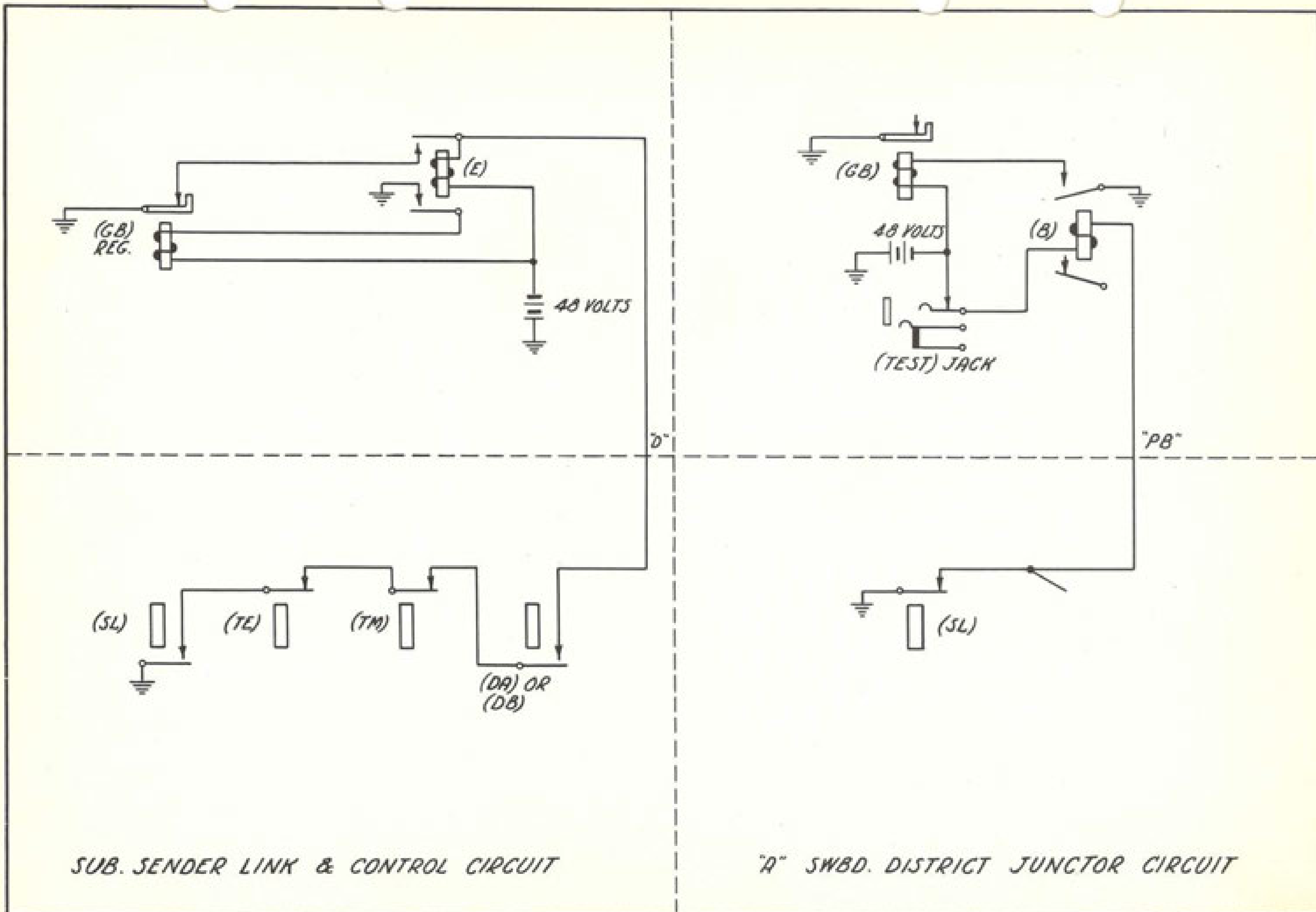
ORIGINATING DECODER MARKER

N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS PERMANENT SIGNAL OVERFLOW	1 2 XB-254

DISTRICT JUNCTOR GROUP BUSY

When the sender link and control circuit tests for idle district junctors and only one idle district junctor is found, relay (TM) will not operate, indicating that the last idle district junctor of that group of 10 is being used on this call. When the sender link and control circuit progresses far enough to operate relay (SL), ground is extended to the "D" lead for the group busy register associated with that group of 10 district junctors.

When all "A" switchboard district junctors in a group are busy their (SL) relays will be operated removing ground from the PB lead associated with this group causing to (B) relay in traffic register circuit to release in turn scoring the GB register.



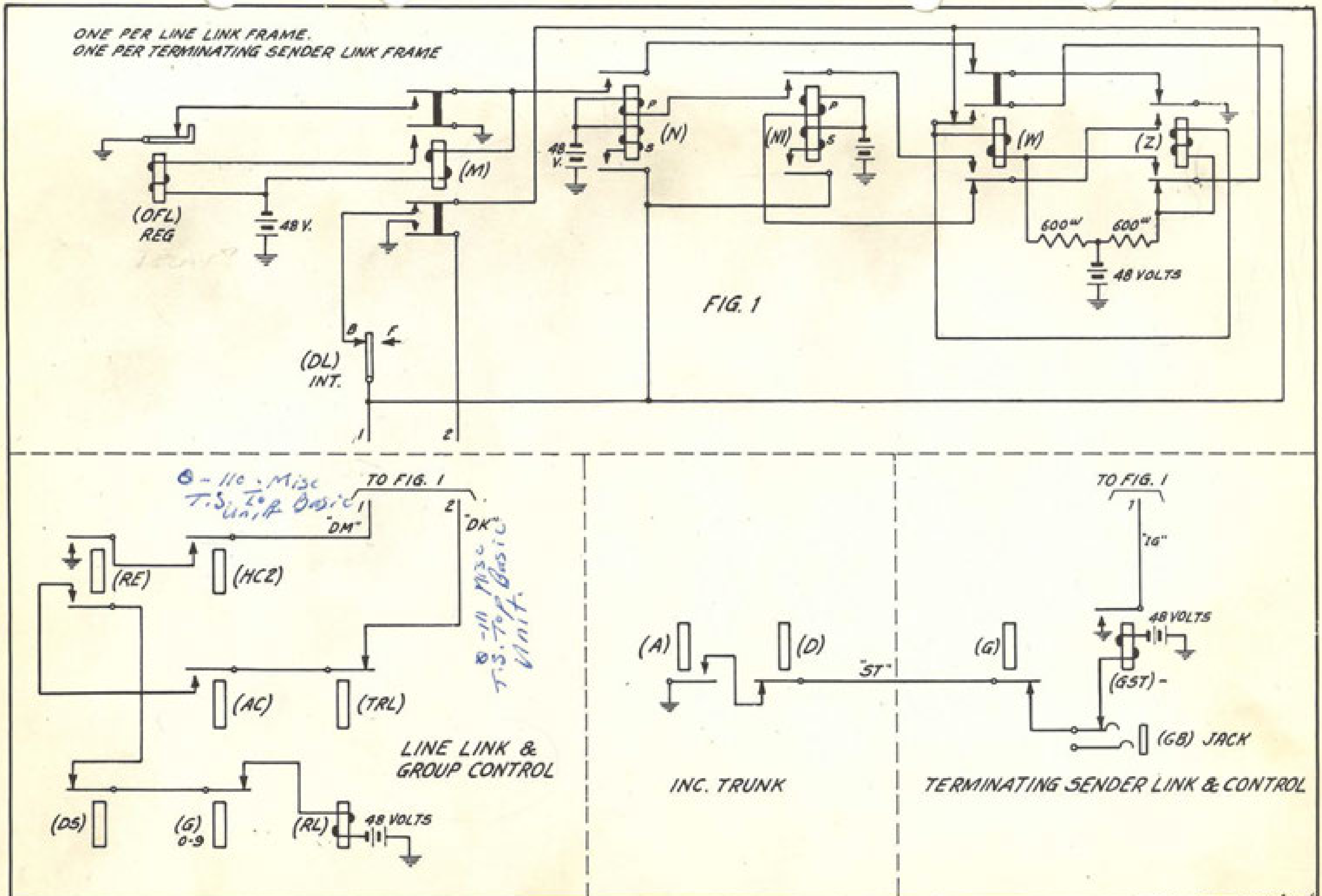
N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTER DISTRICT JUNCTOR GROUP BUSY	2 XB-255

DIAL TONE DELAY

When an originating call seizes a line link and group control circuit and has indicated which line is originating the call by relay (RE) operating, ground is placed on lead "DM" to start a register timing circuit. If this ground remains from 1-1/2 to 2 seconds, relay (M) will operate and lock under control of a normal contact of its traffic register, causing the register to score. If at this time the line link and group control circuit has not found an idle group of district junctors, ground on "DK" lead will operate relay (RL), releasing the line link and group control circuit.

TERMINATING SENDER LINK DELAY

When an incoming trunk is selected, it connects ground on its start lead to a (GST) relay which is associated with ten incoming trunks. The operation of any of the ten (GST) relays of the terminating sender link and control circuit places a ground on the "IG" lead to a (DL) interrupter, starting a traffic register timing circuit. If this ground remains from 1-1/2 to 2 seconds, relay (M) will operate and lock under control of a normal contact of its traffic register, causing the register to score. The operation of the (M) relay does not connect ground to the terminating link and control circuit to release the link.



N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS DIAL TONE DELAY & TERMINATING SENDER LINK DELAY	1 2 X8-256

DISTRICT, OFFICE, INCOMING AND LINE LINK OVERFLOW

District and Office Overflow

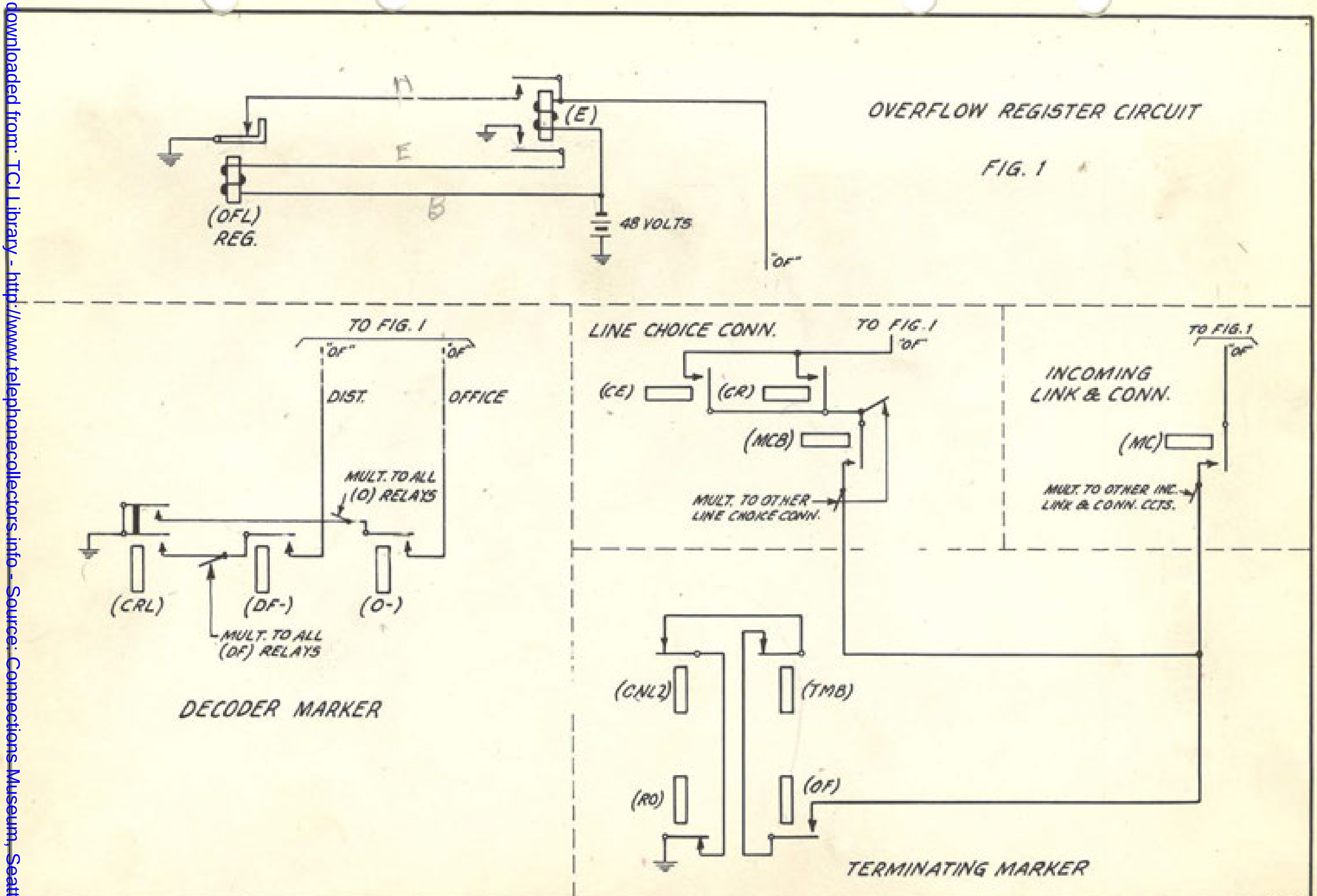
When a district junctor has been selected and the district frame on which it is located has been indicated to the originating decoder marker by the operation of a (DF-) relay, and a trunk has been selected on an office frame, which is indicated by the operation of an (O-) relay, all available channels between these two frames are tested until an idle one is found or, if they are all busy, relay (CRL) is operated.

Relay (CRL) operated, grounds the "OF" leads under control of the particular (DF-) and (O-) relays operated, to operate the overflow registers associated with those frames.

Incoming and Line Link Overflow

On a terminating call, the terminating marker tests all available channels between the incoming frame on which the incoming trunk is located and the line group which is serving the called line. If all of these channels are busy, relay (OF) of the terminating marker is operated.

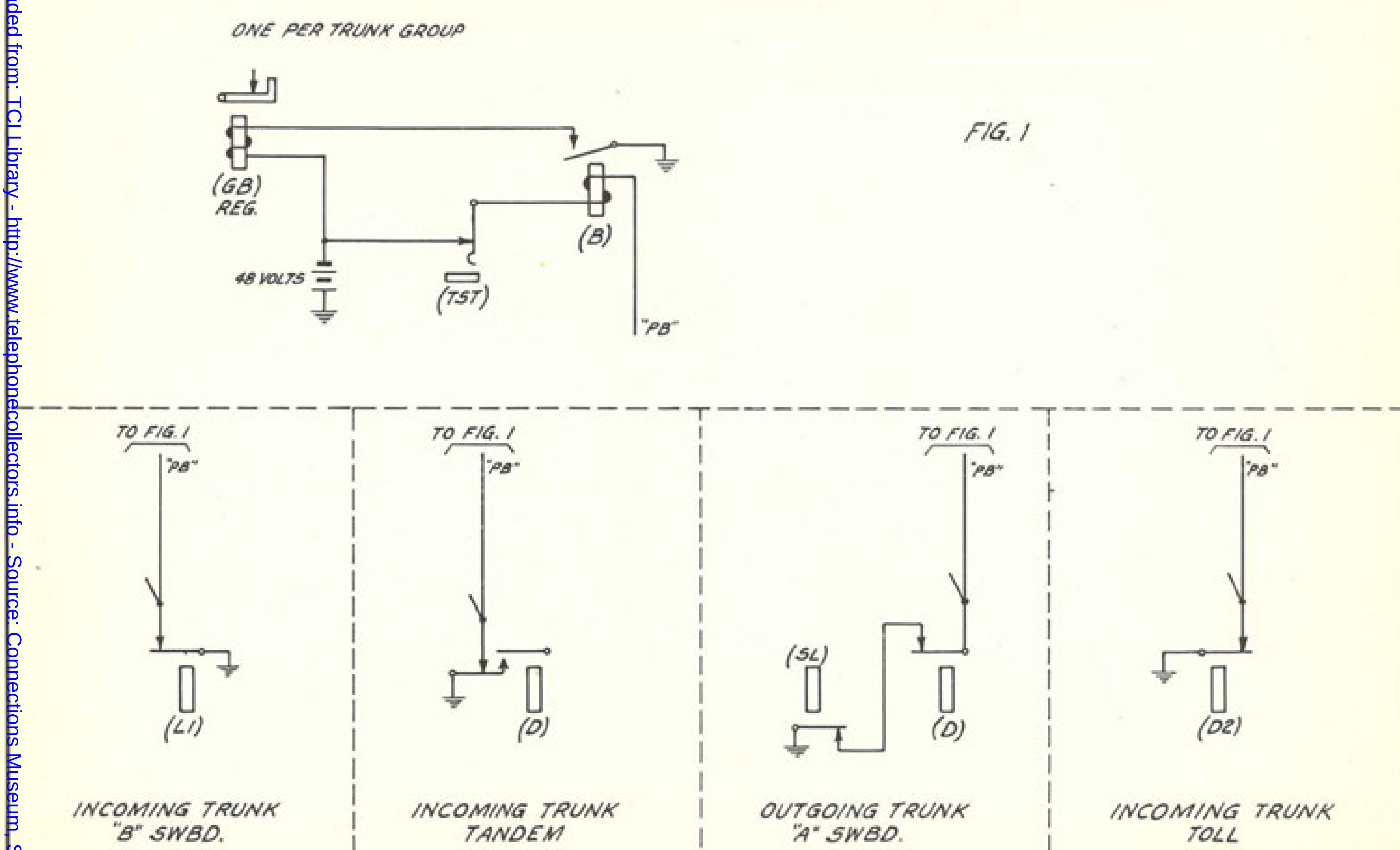
Relay (OF) operated, grounds the "OF" lead through the operated (MCB) relay of the incoming link and connector circuit to operate the overflow register of that incoming frame. The (OF) relay also supplies ground through the (MCB), (CR) and CE relays in the line choice connector to operate the overflow register associated with the called line group.



N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS DISTRICT & OFFICE OVERFLOW ALSO INCOMING & LINE LINK OVERFLOW	1 2 XB-257

TRUNK GROUP BUSY

When all trunks of a group are busy, the ground is removed from the "FB" lead associated with that group of trunks, releasing the (B) relay of the traffic register circuit. The release of the (B) relay closes ground to operate the group busy traffic register of that trunk group.

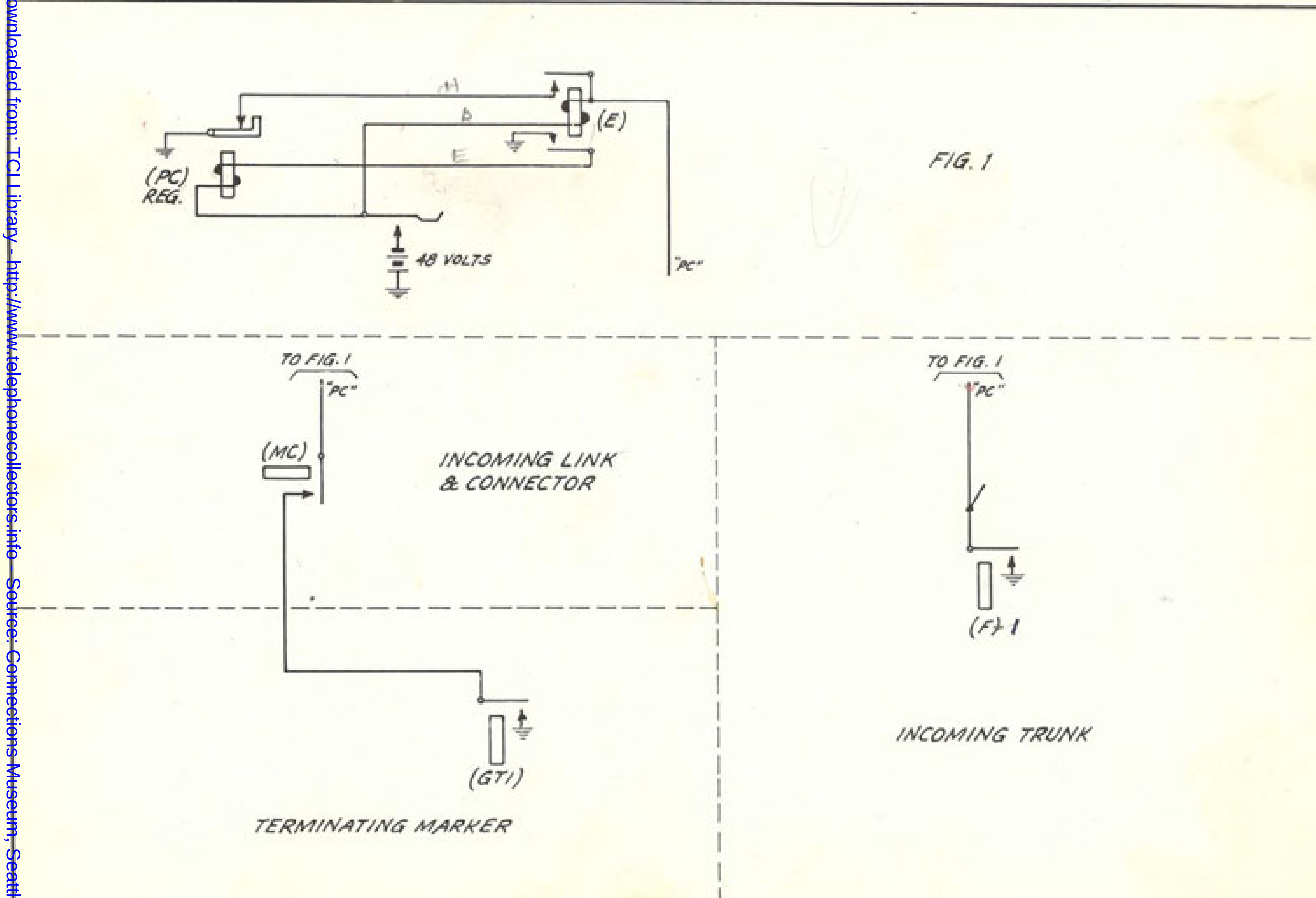


N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS TRUNK GROUP BUSY	1 2 XB-258

INCOMING LINK AND TOLL OR TANDEM INCOMING TRUNK PEG COUNT

There is one peg count register for each incoming link frame. When the terminating marker advances far enough to operate relay (GTI), ground is placed on the "PC" lead to the incoming link and connector frame, causing the peg count register to score for that frame.

The peg count register associated with toll or tandem incoming trunks is common to a group of trunks of 20 or less. The operation of the (F) relay of any trunk in that group causes its peg count register to score.



N. Y. TEL. CO.
G.P.S. L.I.

TRAFFIC REGISTERS
INCOMING LINK AND TOLL OR TANDEM INCOMING TRUNK PEG COUNT

1 2 ISS. W

XB-259

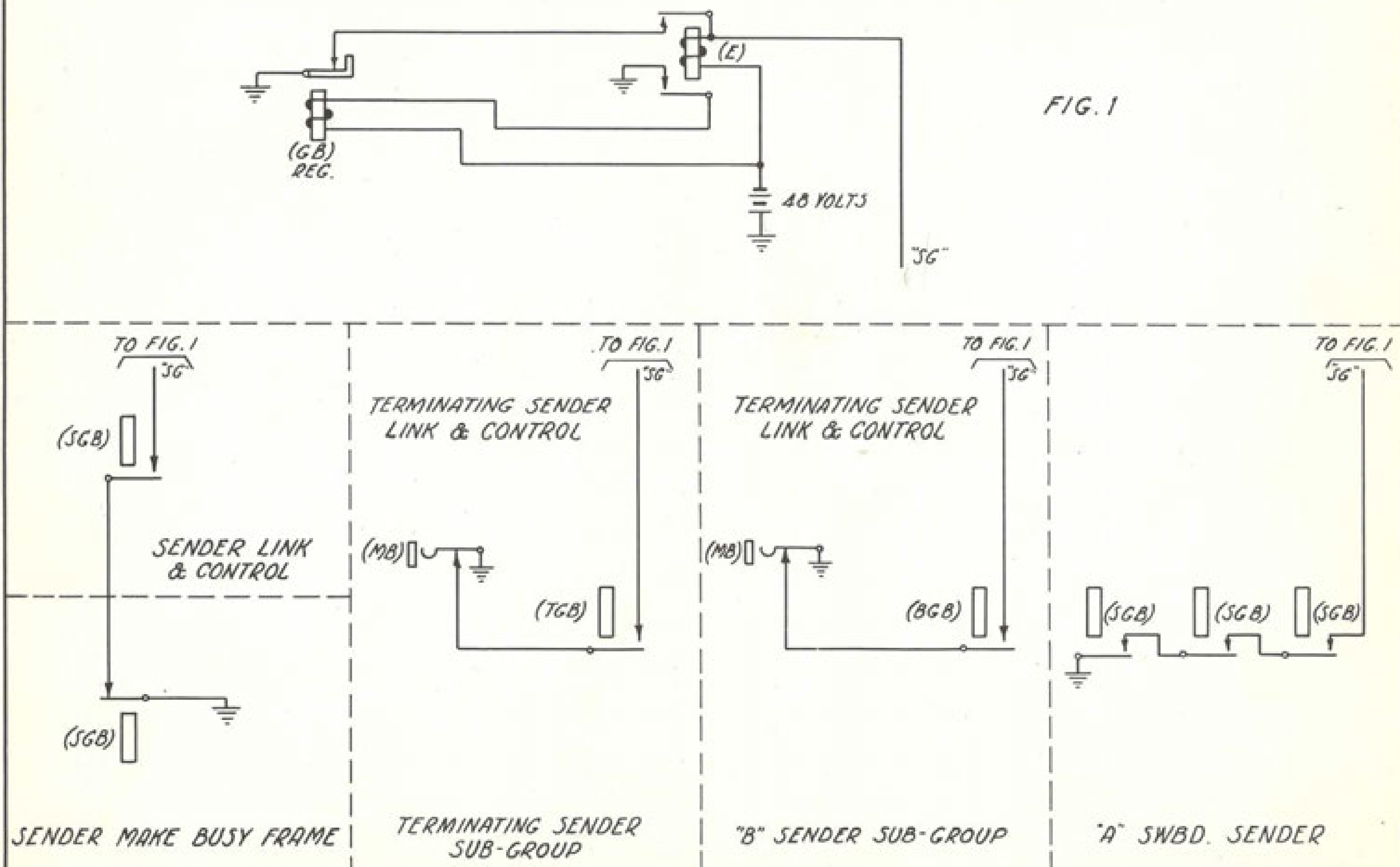
SENDER SUB-GROUP BUSY

When a sub-group of subscriber senders is busy, other than being made busy at a sender make busy frame, the operation of relay (SGB) grounds lead "SG" and operates the sub-group busy register associated with that sub-group of sender.

When a sub-group of terminating senders becomes busy and no plug has been placed in the (MB) jacks, the operation of relay (TGB) grounds lead "SG" and operates the sub-group busy register associated with that sub-group of terminating senders.

A sub-group of "B" senders scores a sub-group busy condition in a manner similar to the terminating senders, when its (BGB) relay operates and ground its "SG" lead.

When a sub-group of "A" switchboard senders are busy the operation of relay (SGB) grounds lead SG and operates the sub-group busy register.



N. Y. TEL. CO.
G. P. S. L. I.

TRAFFIC REGISTERS
SENDER SUB-GROUP BUSY

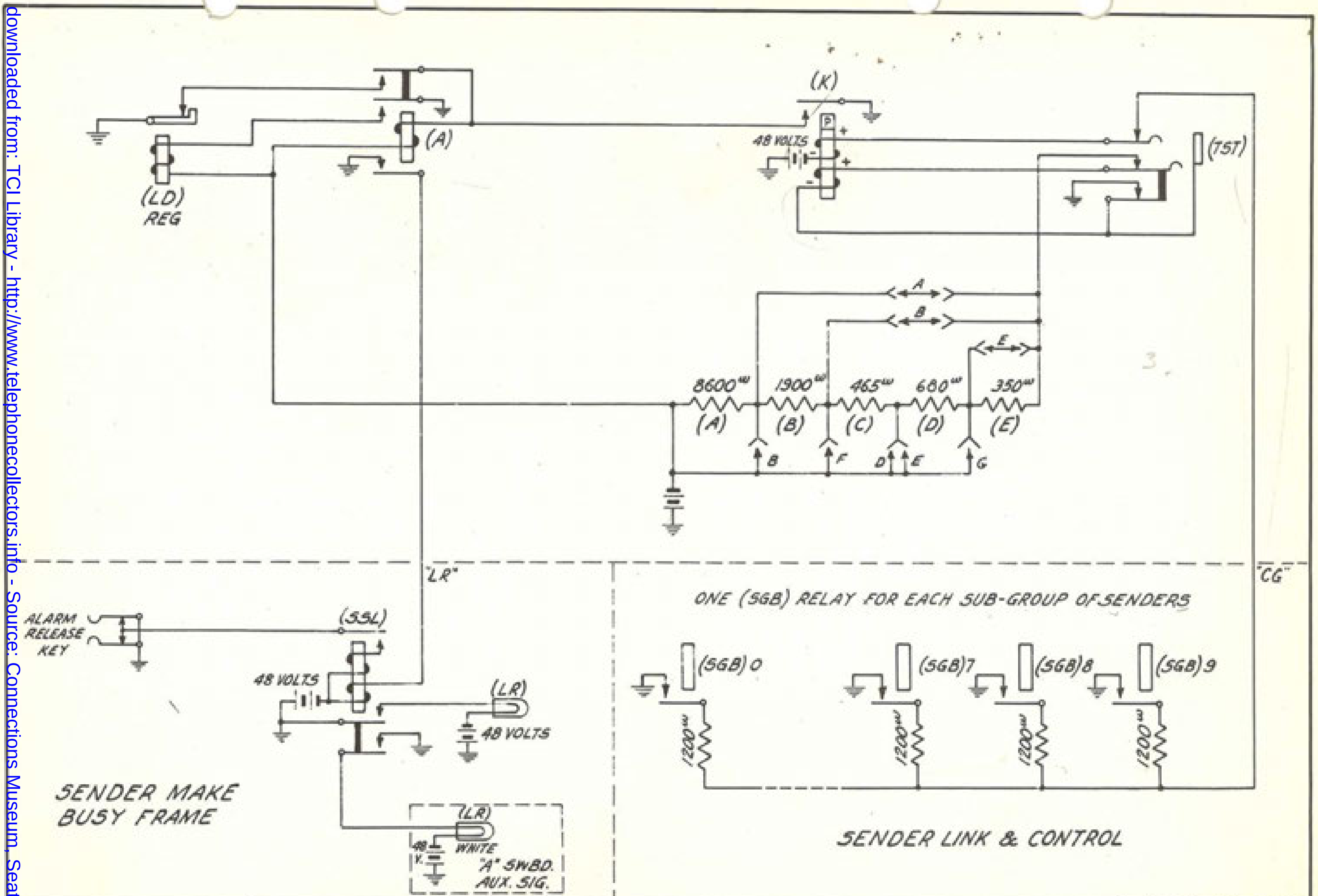
2

XB-260

SUBSCRIBER SENDER LOAD REGISTER

This provides a means for recording the number of times a set number of sender sub-groups are busy. The optional wiring "A", "B", "D", "E", "F" and "G" provides for registering when one to six sender sub-groups, respectively, in the office are busy and serves to vary the current through the secondary or biasing winding of relay (K). When a sender sub-group is busy its (SGB)- relay operates, connecting resistance ground to the "CG" lead. The number of sender sub-groups busy at one time determines the current flow through the primary winding of the (K) relay. When the primary winding overcomes the secondary winding, the (K) relay operates, which operates relay (A). The operated (A) relay causes the load register to score and also operates the (SSL) relay at the sender make busy frame to bring in an alarm and light a lamp at both the sender make busy frame and the "A" switchboard.

When a sender becomes idle in a sub-group, the subscriber sender link and control circuit disconnects the associated resistance ground from the "CG" lead and, depending upon the resistance in series with the secondary winding of the (K) relay, the (K) relay will release and release the (A) relay, in turn releasing the register.

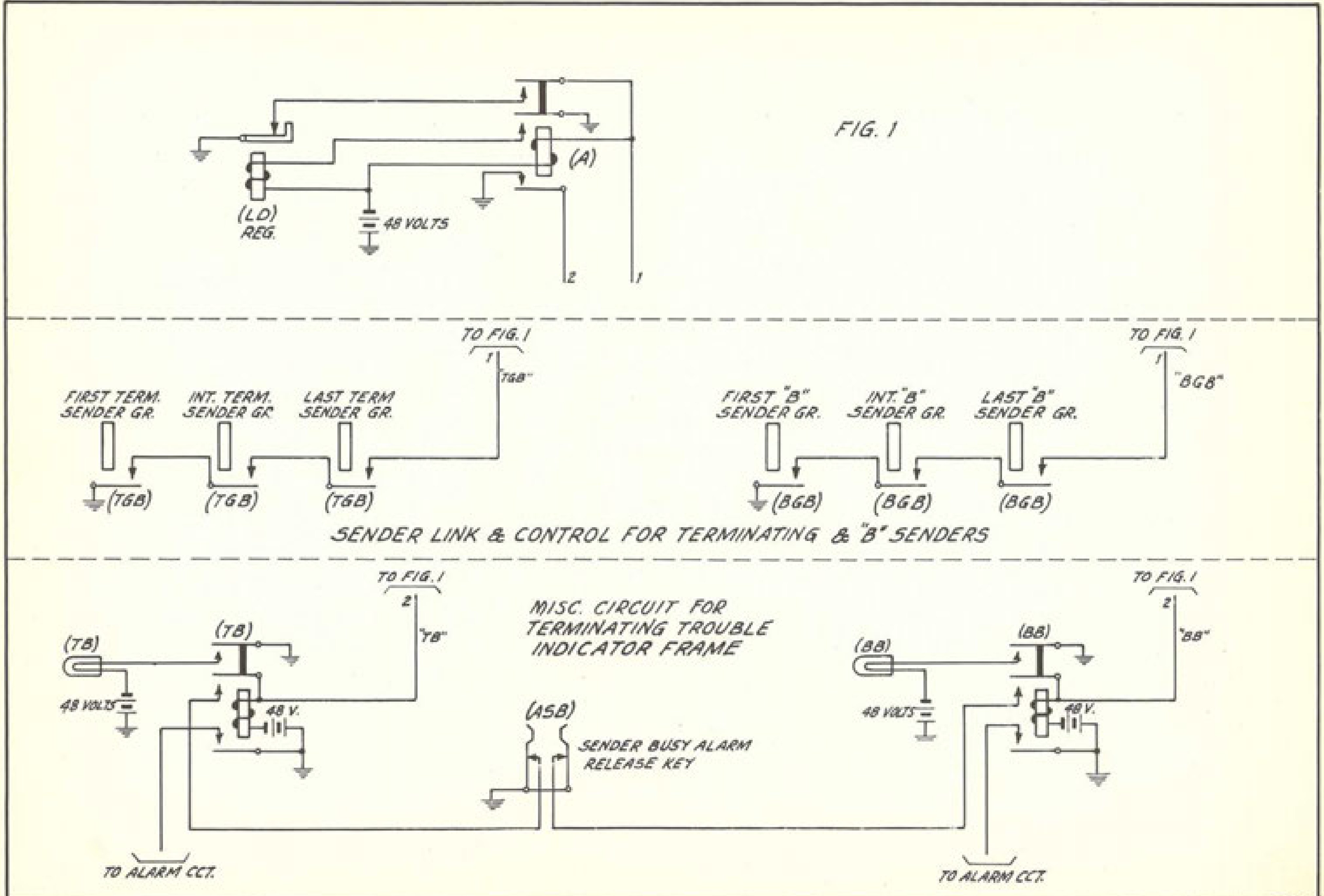


N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS SUBSCRIBER SENDER LOAD REGISTER	1 2 XB-261

TERMINATING AND "B" SENDER LOAD REGISTER

When all sub-groups of terminating senders are busy, all (TGB) relays are operated, closing ground through a chain circuit to the "TGB" lead which causes the (A) relay of the register circuit to operate, which in turn causes the load register to score. The operated (A) relay also operates relay (TB) of the terminating trouble indicating frame. This lights the (TB) lamp and brings in an alarm.

When all sub-groups of "B" senders are busy their (BGB) relays operate and the circuit functions as described above for the terminating senders.



N. Y. TEL. CO.
G.R.S. L.L.

TRAFFIC REGISTERS
TERMINATING & "B" SENDER LOAD REGISTER

1 2

XB-262

"A" SWITCHBOARD SENDER

OR

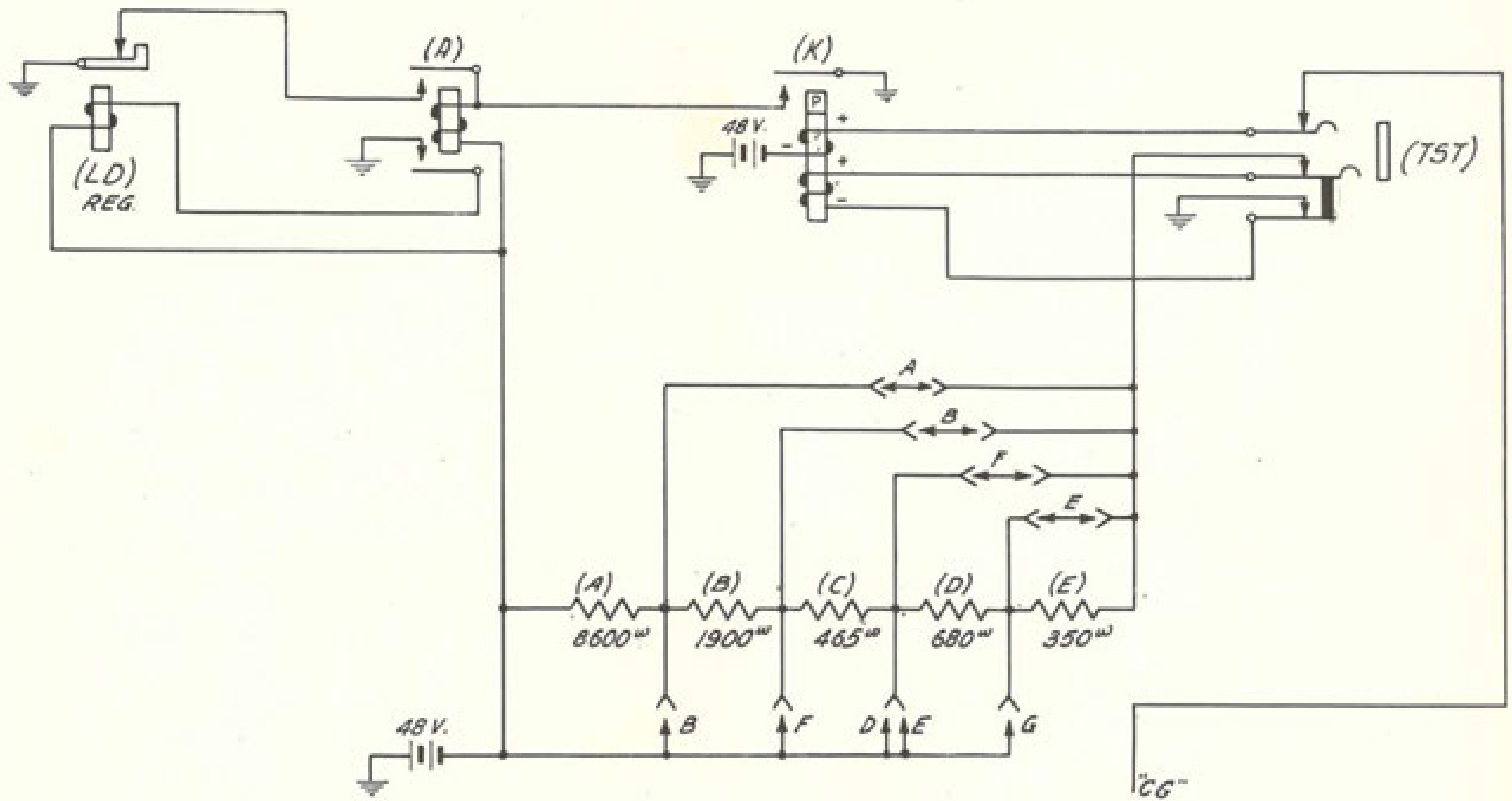
COIN CONTROL LOAD REGISTER

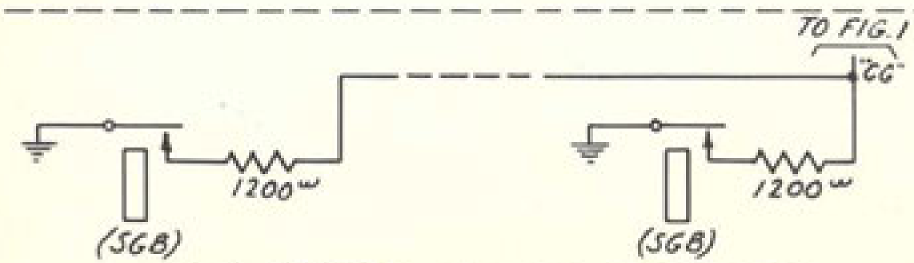
When all coin control circuits or "A" switchboard senders of a group are busy, relay (SGB) of that group operates. This grounds the "CG" lead through a 1200 ohm resistance. As other groups become busy their (SGB) relays also operate. As the number of operated (SGB) relays increase the resistance ground decreases due to the 1200 ohm resistances being placed in parallel.

When a predetermined number of (SGB) relays operate, which is controlled by the optional wiring in the register circuit, relay (K) operates, causing relay (E) to operate, which in turn causes the register to score.

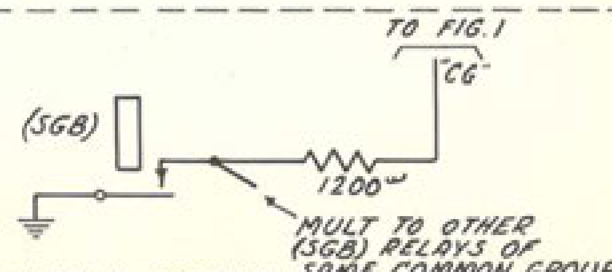
The optional wiring "A", "B", "D", "E", "F" and "G" provides for registering when one to six coin control sub-groups, respectively, in the office are busy and serves to vary the current through the secondary or biasing winding of relay (K).

FIG. 1





COIN CONTROL LINK & CONNECTOR



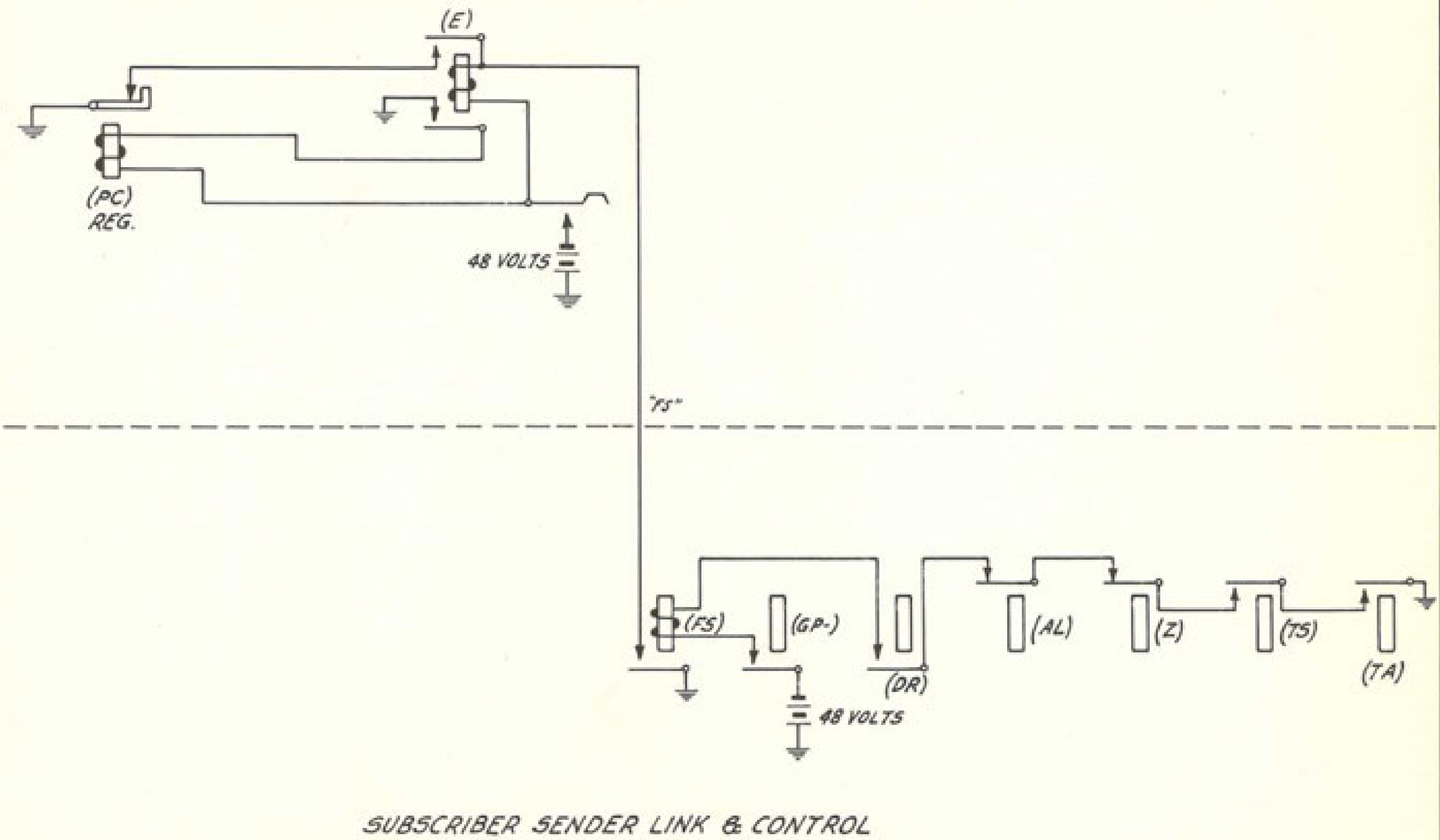
"A" SWBD. LINK & CONTROL

N. Y. TEL. CO. G.DS. L.I.	TRAFFIC REGISTERS "A" SWBD. SENDER OR COIN CONTROL LOAD REGISTER	1 2 YB-263

SUBSCRIBER SENDER LINK FALSE START

If the calling subscriber disconnects after relay (GH) of the sender link and control circuit has operated, the abandoned call can not be recognized until the sender circuit has progressed to the point of testing the dialing tip and ring leads for the line closure. This circuit is not capable of detecting the difference between a trouble condition wherein the tip and ring conductors through the switches of the established connection are actually open, and a normal "false start" call wherein the tip and ring conductors are closed momentarily to start a call and then immediately opened by the calling subscriber. However, a register is provided for recording all such conditions since it is expected that the vast majority of legitimate false starts will consist of closures longer than one second in duration, so that the register reading will furnish a fair indication of the existence of actual trouble conditions.

Sender link and control circuits which record a predominance of false starts will indicate the presence of actual trouble in the tip and ring conductors of the associated sender link and control circuit.



N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS SUBSCRIBER SENDER LINK FALSE START	1 XB-264

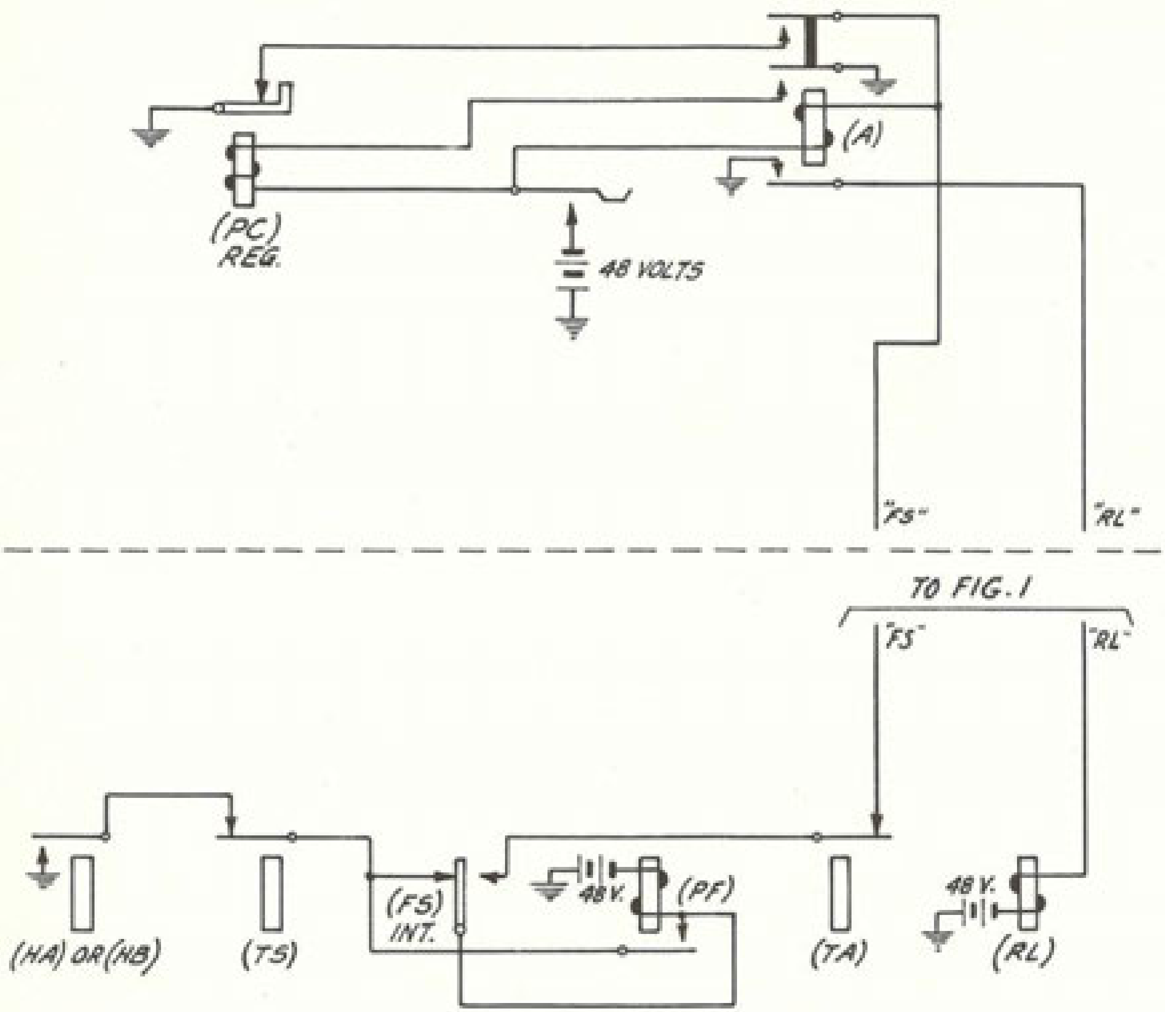
"A" SWITCHBOARD LINK AND CONTROL

OR

COIN CONTROL LINK FALSE START

When relay (HA) or (HB) operates, ground is closed through the back contacts of relay (TS) and interrupter (FS) to operate relay (PF). If the start ground disappears or the path available lead opens and causes the circuit to block before relay (TS) is operated, the closure of the front contact of interrupter (FS) will ground the "FS" lead to the traffic register circuit, causing it to score, indicating a false start. Ground is returned from the traffic register circuit on lead "RL" to operate relay (RL), which causes the control circuit to release.

FIG. 1

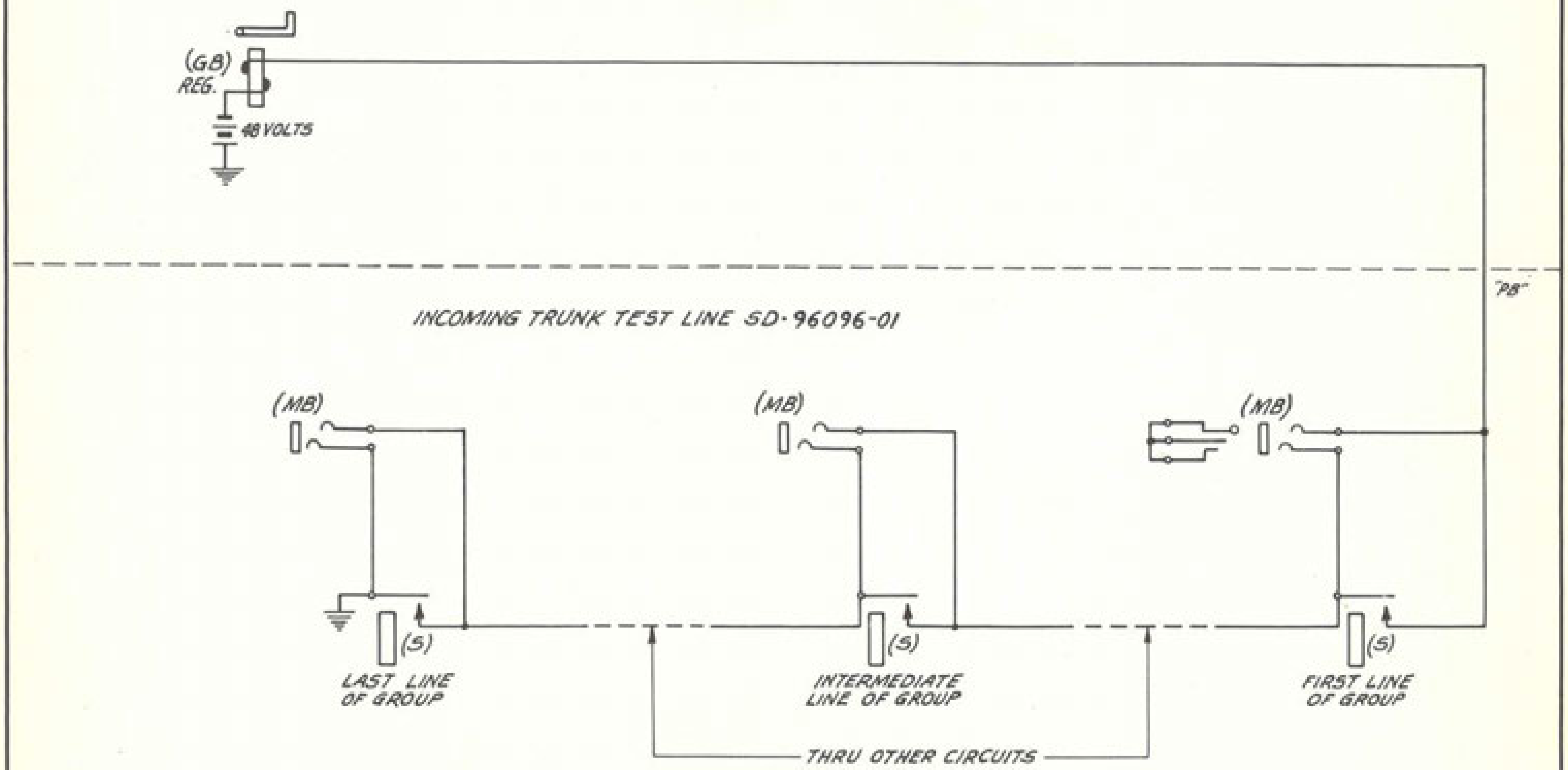


COIN CONTROL LINK & CONTROL CIRCUIT OR
"A" SWBD LINK & CONTROL CIRCUIT

N. Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS "A" SWBD. OR COIN CONTROL LINK FALSE START	1 2 XB-265

INCOMING TRUNK TEST LINE GROUP BUSY

When all Incoming trunk test line circuits are busy, either by their (S) relay being operated or by a plug in the make busy jack, a circuit is closed to place ground on the "PB" lead which causes the group busy register to score.



N. Y. TEL. CO.
G. P. S. L. I.

TRAFFIC REGISTERS
INCOMING TRUNK TEST LINE

1 2

XB-266

SUBSCRIBER LINE OVERFLOW

GENERAL

When it is desired to register the number of times a particular line, or the last line of a P.B.X. group has been found busy, a subscriber line overflow register circuit is connected between the "ANS" and "ALS" and the "NS" and "LS" terminals in the number group connector circuit.

The "CT" lead provides means for by-passing the subscriber's line overflow circuit, on number checking, no test and no hunt calls.

LINE IDLE, REGULAR CALL

When the terminating marker tests the "ANS" terminal of the line, it finds the lead open, indicating the line is idle. The marker proceeds to ground the "ANF" lead to operate the "S" relay. (Relay (S)) operated connects ground from the (SL) relay contact to the "ALF" lead which provides for horizontal group identification and line link lockout, and closes the "ANS" to the "ALS" lead to provide an operating path from the terminating marker for the line hold magnet and disconnects the (SL) relay from the "ALS" lead. When the terminating marker disconnects from the number group connector, the (S) relay releases and reconnects the (SL) relay to the "ALS" lead. Ground that is holding the line hold magnet, operates the (SL) relay which remains operated as long as the line is busy.

LINE BUSY, REGULAR CALL

When the called line is busy, ground from the "S" lead in line link group and control circuit will operate and lock (SL) relay. When the marker tests for a busy line, this line appears idle, since the (S) relay is unoperated and the "ANS" lead is not connected to the "ALS" lead. When ground is connected to the "ANF" lead (see XB-305) the (S) relay operates and closes through the "ANS" to the "ALS" lead. The "ALF" will not be grounded since the (SL) relay is operated on a busy line and holds through its locking contact to the busy ground on the "ALS" lead. When the marker makes the sleeve guard test (see XB-306) it finds ground on the "ANS" lead. This ground is traced from "S" lead in line link to "LS", "ALS" leads, make contact (S) relay to "ANS" lead and over the "NS" lead to the marker to operate its (SG) relay in turn operating the (SGA) relay (see XB-306). The operation of the (SGA) relay causes the (L-) relay to release in turn removing the ground from "ANF" lead. The (OF) relay then operates in series with the (S) relay to ground on "SOF" lead from the marker. Relay (OF) operated connected ground from "MR" lead in the marker to operate the (E) relay to score on the register. The marker recognizes the busy line on the second test due to the (S) relay in register circuit operating and grounding the "NS" lead to operate the (S-) relay in terminating marker. The marker then proceeds to return a busy back signal over the trunk to the calling subscriber. The marker then disconnects from the number group connector circuit and removes ground from the "SOF" and "MR" leads which permits the (S) and (OF) relays to release. The (SL) relay remains operated and locked to the busy ground on the "ALS" lead until the called subscriber's line is released.

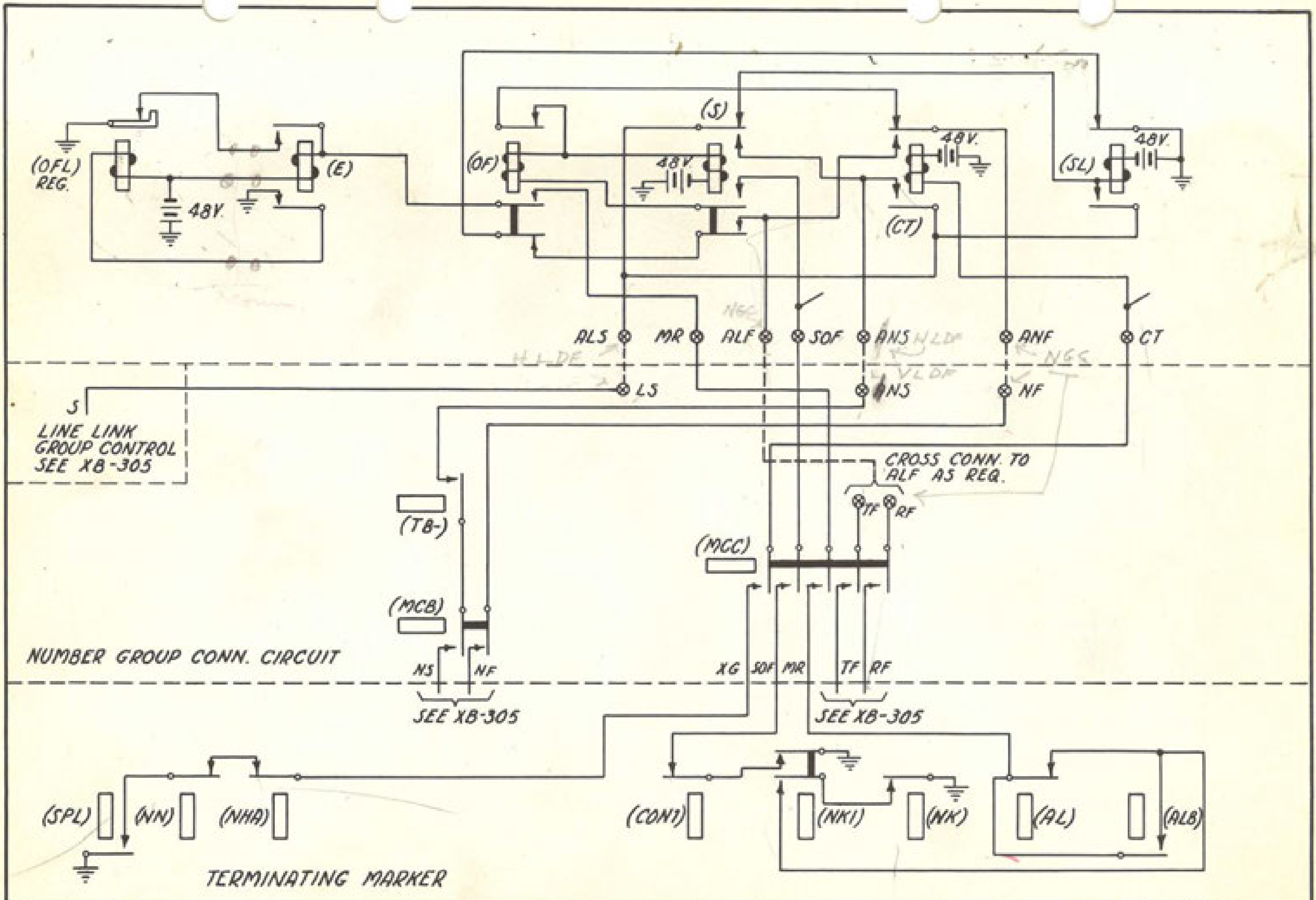
NUMBER CHECKING, NO TEST AND NO HUNT CALLS

When the terminating marker is set to make a number checking, no test or

SUBSCRIBER LINE OVERFLOW

NUMBER CHECKING, NO TEST AND NO HUNT CALLS

no hunt call, ground is connected through from the marker to the number group connector on the "CT" lead to operate the (CT) relay in subscriber line overflow circuit. The (CT) relay operated, disconnects the (S) relay from the "ANF" lead and connects the "ANF" to the "ALF" lead and also connects the "ANS" to the "ALS" lead, thus by-passing the relays which control the traffic register.

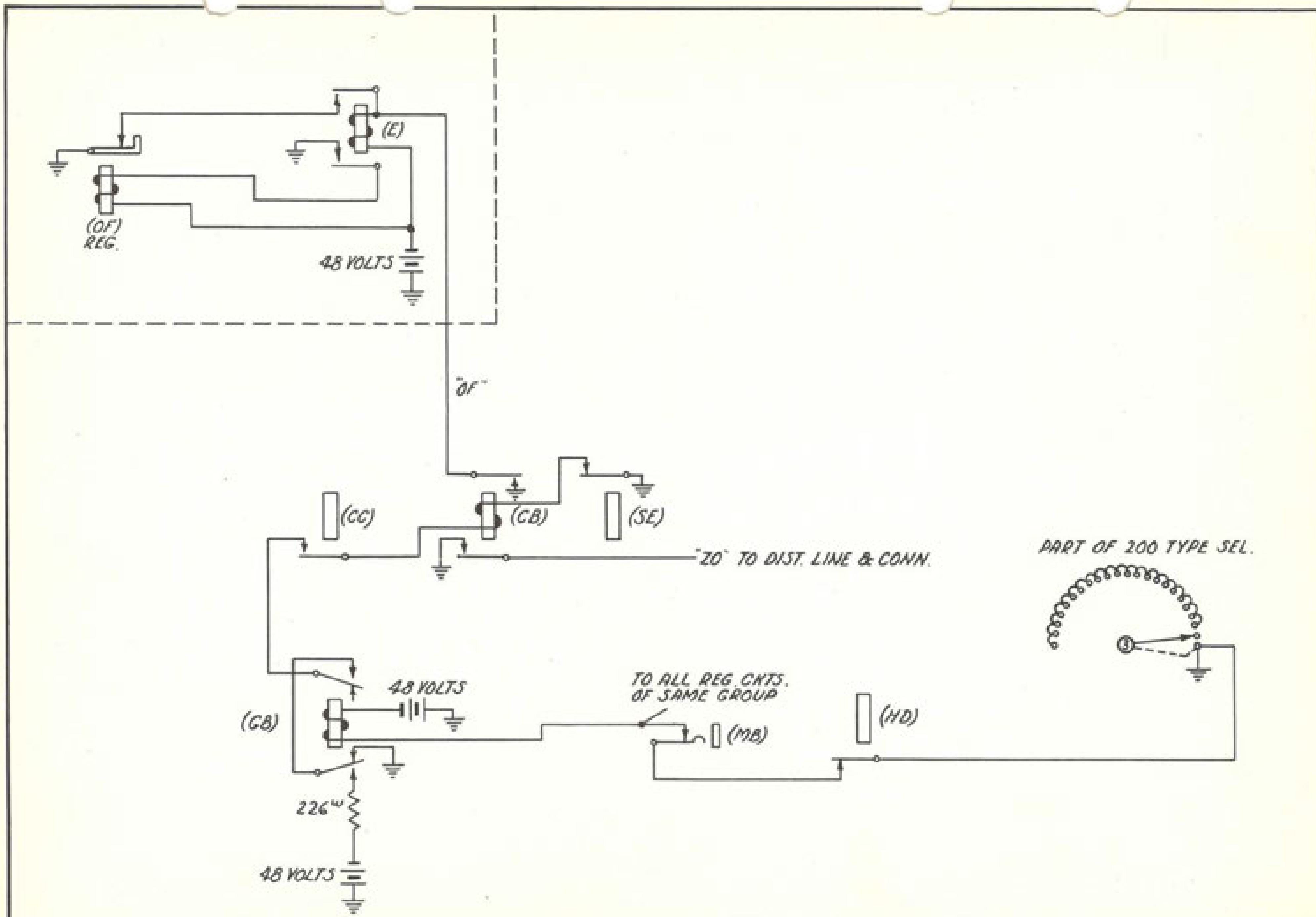


N.Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS SUBSCRIBER LINE OVERFLOW REGISTER	2 XB-267

ZONE REGISTRATION OVERFLOW

When all zone registration circuits of a group are busy, ground is removed from the winding of relay (GB) allowing it to release. With relay (GB) normal and relay (SE) normal, relay (CB) will operate. With relay (CB) operated, lead "OF" is grounded causing relay (E) of the register circuit to operate, which in turn causes the (OF) register to operate, recording the overflow condition, and opens the holding circuit for relay (E).

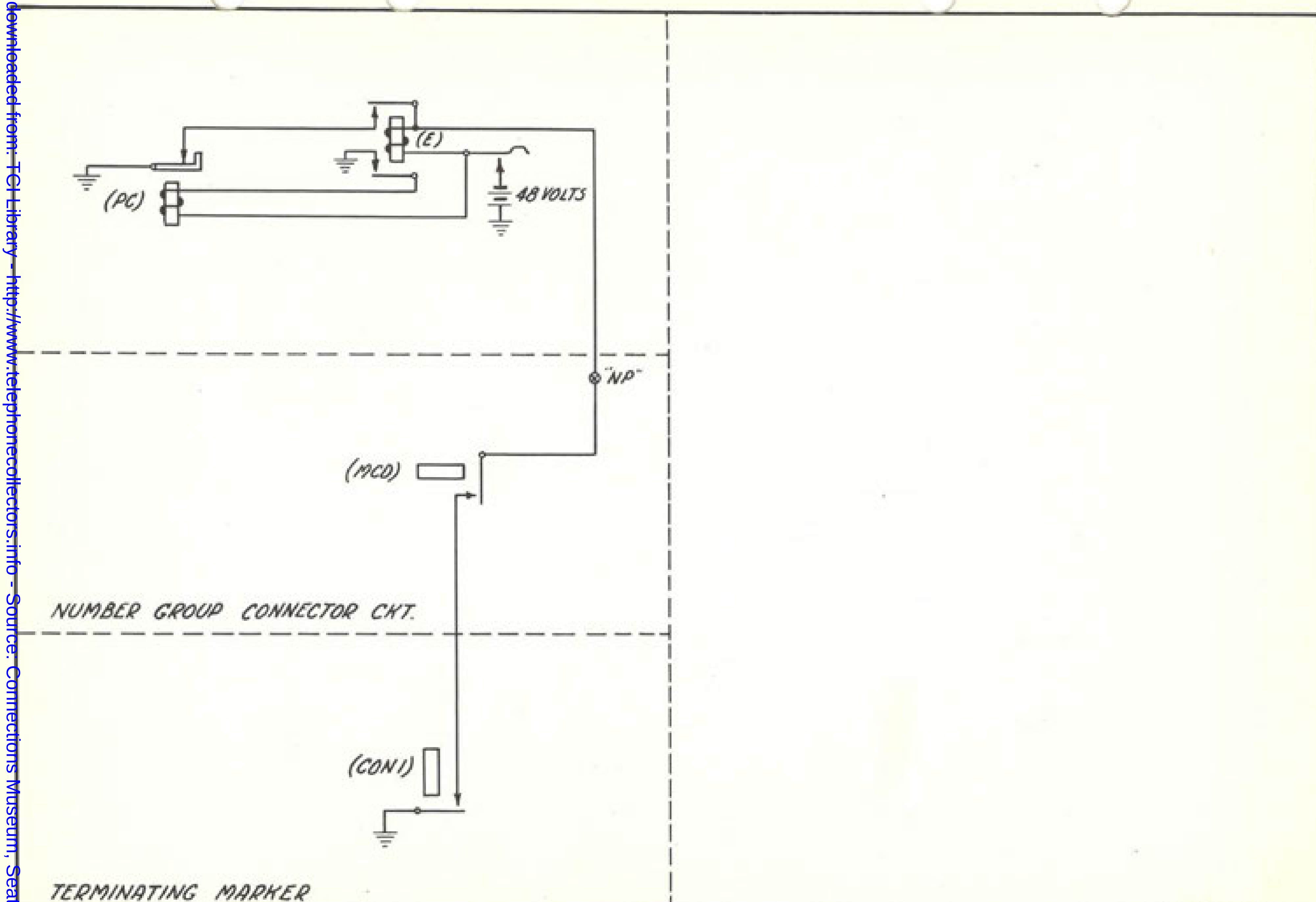
Relay (CB) operated also connects ground to lead "ZO" to the district link and connector which cause the originating marker to serve the connection as a local call.



N.Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS ZONE REGISTRATION OVERFLOW CIRCUIT
2	XB-268

NUMBER GROUP CONNECTOR PEG COUNT

When a call has progressed to a point where the (CON1) relay in terminating marker has operated, a ground is closed through the (MCD) relay, in the number group connector circuit to the NP lead to operate the register circuit.

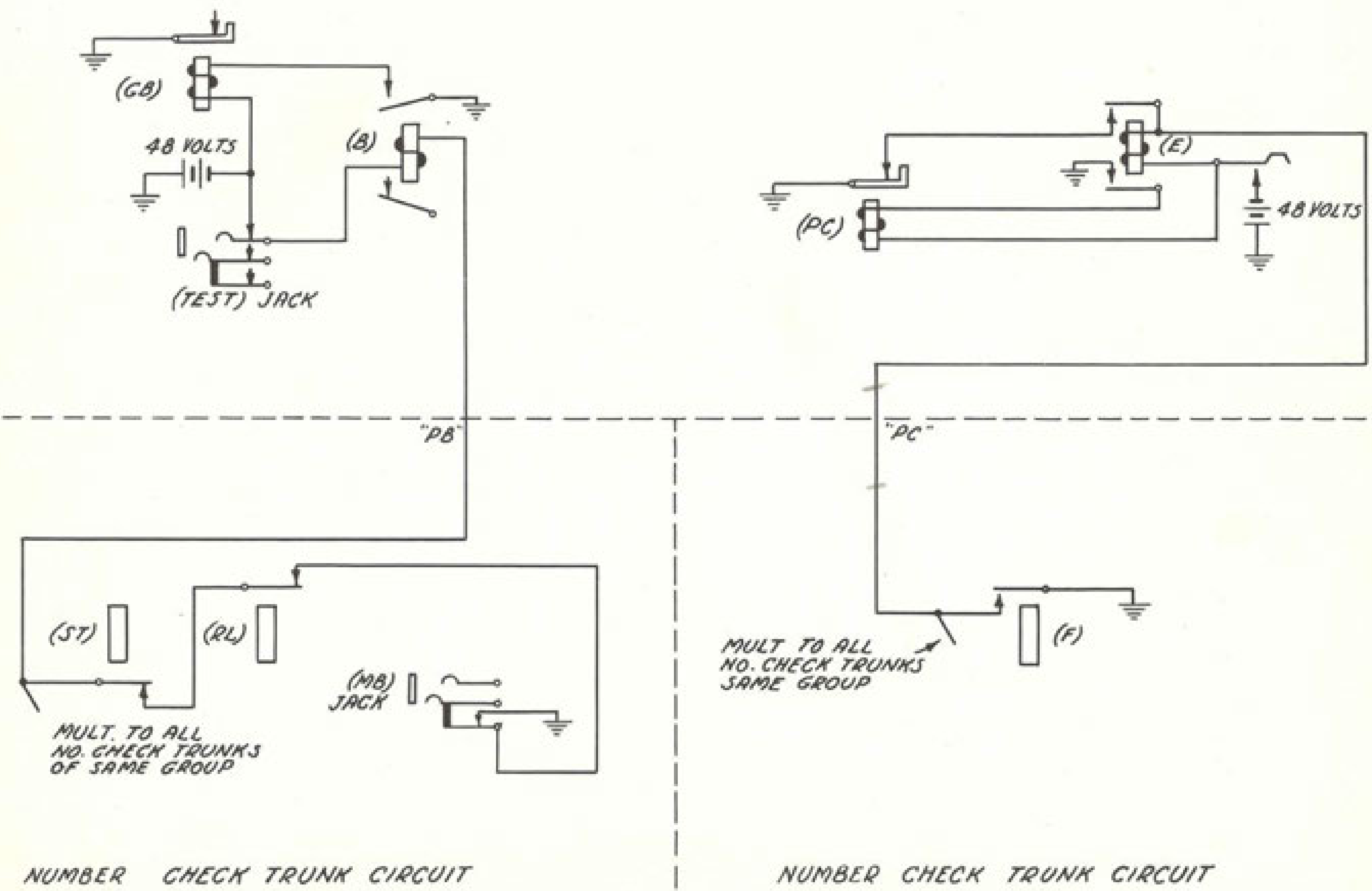


N.Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS NUMBER GROUP CONNECTOR PEG COUNT	1 XB-269

A SWITCHBOARD NUMBER CHECKING TRUNK PEG COUNT AND GROUP BUSY

When the (F) relay in the number check trunk circuit operates, it closes a ground to the PC lead to operate the register associated with the no check trunks.

When all trunks are busy in service or a make busy plug is inserted in the MB jack, ground is removed from the "PB" lead releasing the (B) relay in traffic register circuit to operate register associated with this group of trunks.



N.Y. TEL. CO. G.P.S. L.I.	TRAFFIC REGISTERS "A" SWBD. NUMBER CHECKING TRUNK PEG COUNT & GROUP BUSY	XB-270

TERMINATING MARKER

PURPOSE OF CIRCUIT

This circuit is part of the terminating equipment of a cross bar office and is used in connection with terminating senders, "B" switchboard senders, number checking senders, number group connectors, line choice connectors, incoming link and connector and number checking trunk circuits. Its purpose is to translate the digits registered in the terminating or "B" sender into numerical blocks of 100's, to connect to a number group connector, line choice connector and to an incoming link and connector circuit, to test the called line and select an idle individual line, or to select a line of a terminal hunting group if available. Also to test the paths necessary to set up the connection, to operate the selecting and holding magnets in the incoming link and connector circuits and the line link circuit, selecting the line link and group control circuit required to set up the call, and locking out originating traffic; also to transmit ringing, busy back, overflow and free line information to the incoming trunk, to test for trouble conditions which might affect the call and to reroute to one of several intercept groups when such routing is wanted. Two of the terminating marker circuits are also used to complete number checking calls, no test calls and no hunt calls.

OPERATION AND LOCKING OF RELAYS (CK4) AND (CK5)

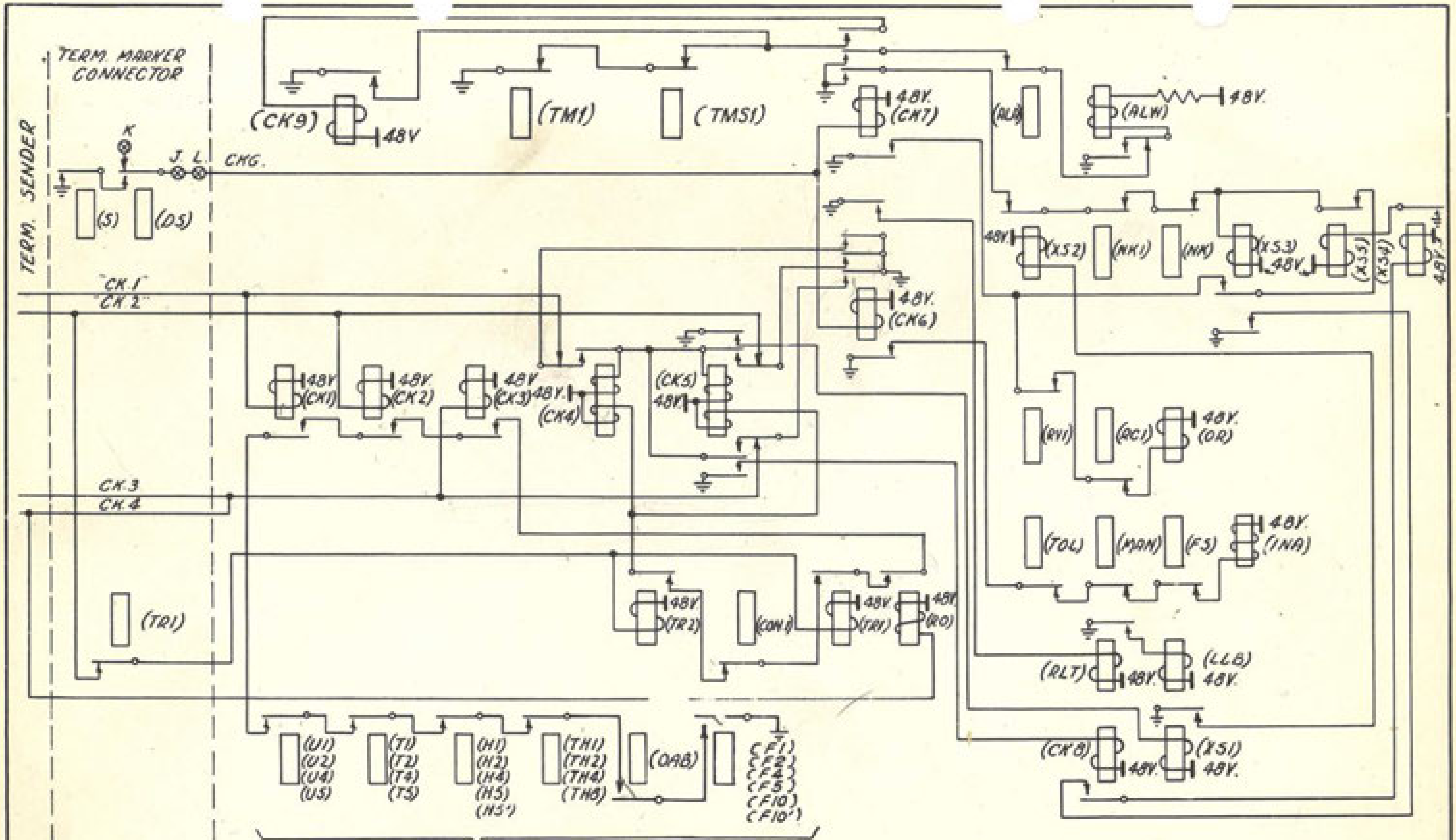
When a sender has registered the four numerical digits or has received a reorder signal, it connects to the terminating marker connector circuit for the purpose of seizing a terminating marker (see XB-180). The operation of the preference relay in the terminating marker connector grounds the "CKG" lead which operates the ground supply relays (CK6) and (CK7). Relay (CK6) operates relays (CK1), (CK2) and (CK3) and grounds leads "CK1", "CK2", "CK3" and "CK4". It also operates relay (RLT) and (INA) while relay (CK7) operates relays (XS3), (OR) and (ALW) the functions of these relays will be described later.

When the terminating marker connector cuts its leads through from the sender, the marker receives a record of the four numerical digits and the number of the incoming frame on which the call was received. This information is recorded on the numerical and incoming register relays, all other recording relays not used for this call are operated from ground supplied over the check leads.

When all the marker check leads are operated, they close a chain circuit started from ground at relay (F1) and through relays (CK1), (CK2) and (CK3) to operate relays (CK4) and (CK5). This chain circuit is not closed unless the (CON1) relay is normal to insure the marker has restored to normal from the previous call.

The operation of relay (CK4) grounds the marker peg count lead (see XB-252), also breaks the normal operating path for relay (CK1). The operation of relay (CK5) breaks the normal operating paths for relays (CK2) and (CK3). Relays (CK4) and (CK5) also open the grounding circuit for leads "CK1", "CK2", "CK3" and "CK4". This should release all recording relays except those operated from solid ground in the sender. If any one of these unused receiving leads is falsely grounded, the false ground will back up on leads "CK1", "CK2", "CK3" and "CK4" preventing the (CK1), (CK2) or (CK3) relay from releasing, which would block translation. Relay (CK5) operates relay (XS1) and (CK8). When (XS1) operated it in turn operates relay (XS2) which opened the operating circuit of relay (XS3) but this relay is still held through a normal contact of (XS5) relay. With relays (CK8) and (XS3) operated, relay (XS4) operates in turn operating relay (XS5) which releases relay (XS3) in turn the (XS4) releases, which in turn releases relay (XS5). When relays (XS3) and (XS5) release they close a circuit in part for operating a (TB-) relay in a number group connector circuit (see XB-302).

When relay (RLT) operated it in turn operates relay (LLB). This relay will be used in later functions of the circuit.



ALL OF ABOVE RELAYS ARE OPERATED WHEN (CK4) & (CK5) OR THE GROUND ON LEADS (CK1), (CK2),(CK3) & (CK4) IS OPENED RELEASING (CK1), (CK2),(CK3),(RO),(TR1) & (TR2) RELAYS ALSO (U-), (T-),(H-),(TH-) & (F) RELAYS WHICH ARE NOT USED

N. Y. TEL. CO.
GPS L.I.

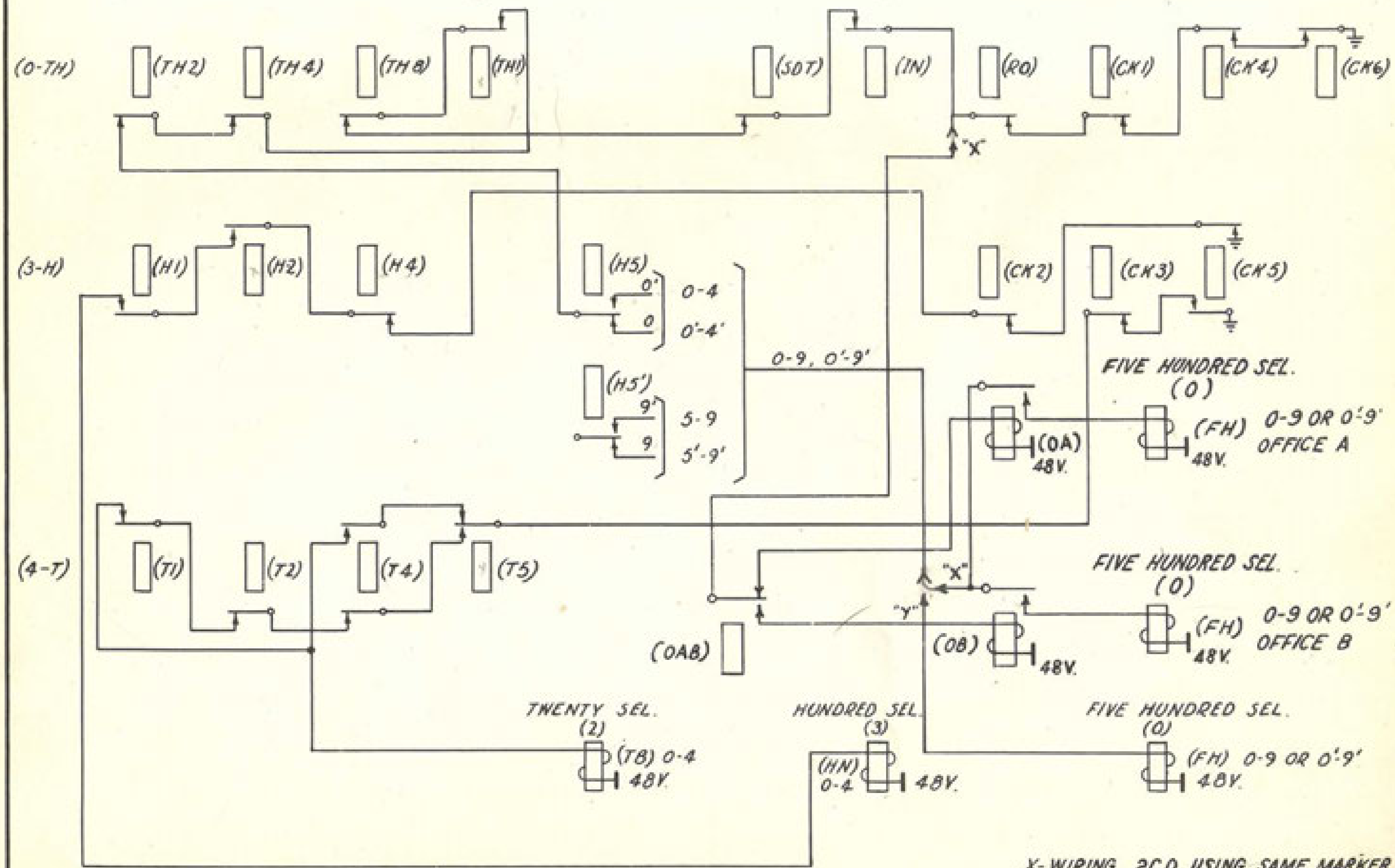
TERMINATING MARKER
OPERATION AND LOCKING OF RELAYS (CK4) AND (CK5)

1 2

XB-300

TRANSLATION

The translator consists of from one to twenty (FH) relays and relays (HNO) to (HN4). One (FH) relay is used for each group of 500 consecutive numbers. The setting of the (TH) or thousands register relays and the (H5) and (H5') or hundred five relays, controls which 500 block is to be selected. This is comparable to selecting a final frame in a panel dial office. The thousands designation corresponds to the (FH) relay number. For example with zero thousands (FHO) serves 0000 to 0499 and (FHO') serves 0500 to 0999. The hundred selection within the selected 500 block is controlled by the (H1), (H2) and (H4) relays, which operates one of the five (HNO) to (HN4) relays. Relays (TBO) to (TB4) are used to indicate the 20 block in the selected 100 block.



X-WIRING 2C.O. USING SAME MARKER
Y-WIRING 1C.O " " "

N.Y. TEL. CO. CPS L.I.	TERMINATING MARKER TRANSLATION	1 2 4 XB-301

SEIZURE OF NUMBER GROUP CONNECTOR

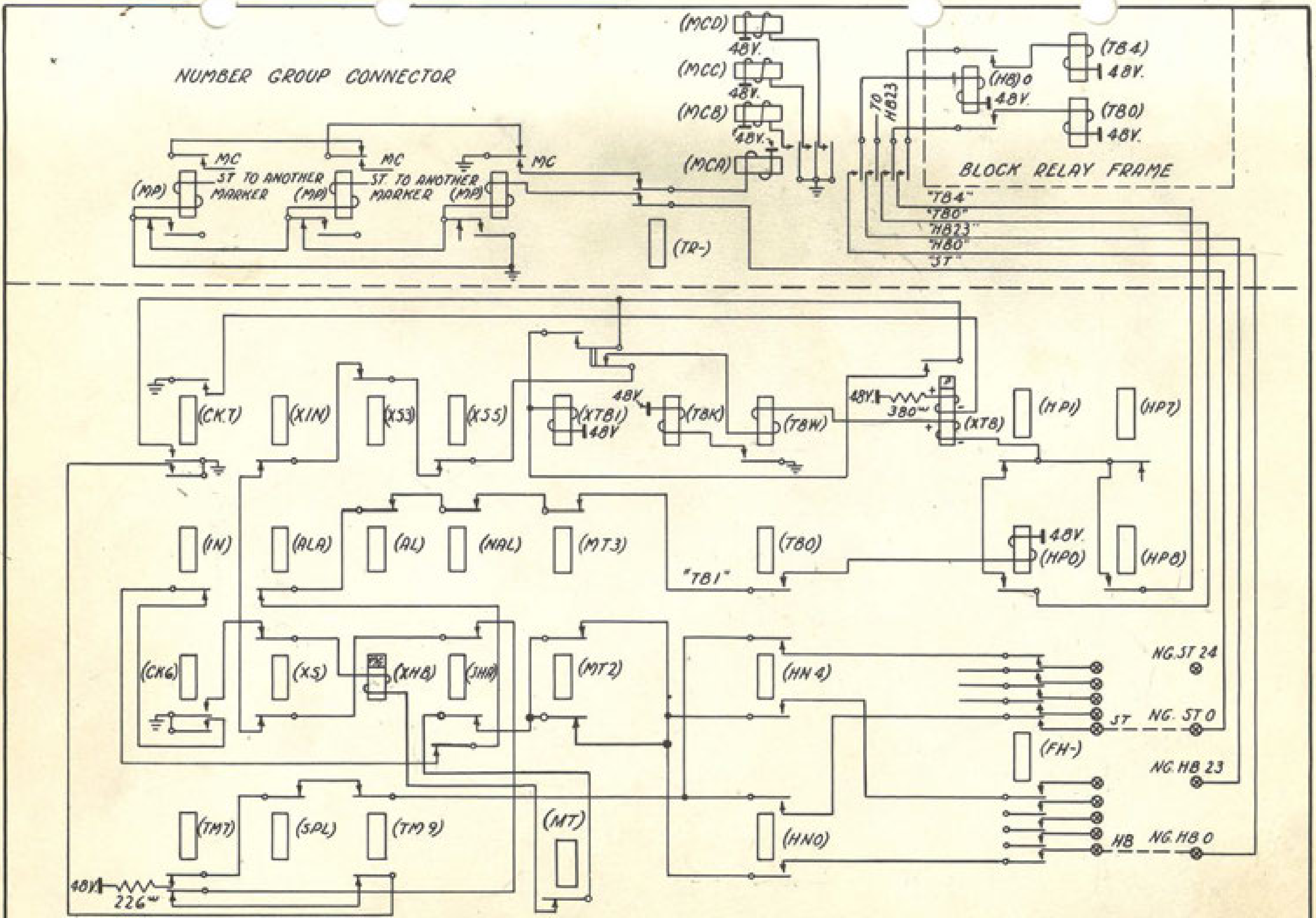
There is one start lead per number group connector circuit per marker. The associated number group connector start leads are brought into each marker to punchings designated NG-STO, to NG-ST24 and arranged so that the "ST" points of the translator may be connected to them.

Each group of 20 consecutive numbers is a unit and will be referred to as a 20-block. Five consecutive 20-blocks constitute a 100-block and each 100-block has its own "ST" lead for the selection and seizure of the number group connector. Therefore, any 100-block may be located in any number group connector.

The number group connector start lead is closed from 226 ohm battery through back contacts of relays (TM7), (SPL) and (TM9). If the number group connector is idle all its (MP) relays will be normal which will allow the (MP) relay associated with this terminating marker to operate and lock. The operated (MP) relay operates the number group marker cut-in relay (MCA) which in turn operates relays (MCB), (MCC) and (MCD), these relays close 240 contacts to establish testing and control paths between the marker and the number group.

The marker grounds one of the "HB" leads to operate a hundred block relay in the block relay frame. If any of the hundred block leads were crossed resulting in two or more (HB) relays operating, relay (XHB) would operate, this would stop the call and call in the trouble indicator.

When one of the (TB-) relays of the marker operated as shown on XB-301 a circuit is closed to operate one of the even numbered (HP) relays. With a hundred block relay operated in the number group connector a path is closed to operate the desired twenty block relay in the number group connector. Relay (XTB) is a marginal cross-detecting relay which indicates when two or more 20-block relays are operated simultaneously. If relay (XTB) operates relay (XTB1) would operate, to open the "TB" lead, block the marker and call in the trouble indicator.



N.Y. TEL. CO.
G.P.S. L.I.

TERMINATING MARKER
SEIZURE OF NUMBER GROUP CONNECTOR

1 2 3 479V

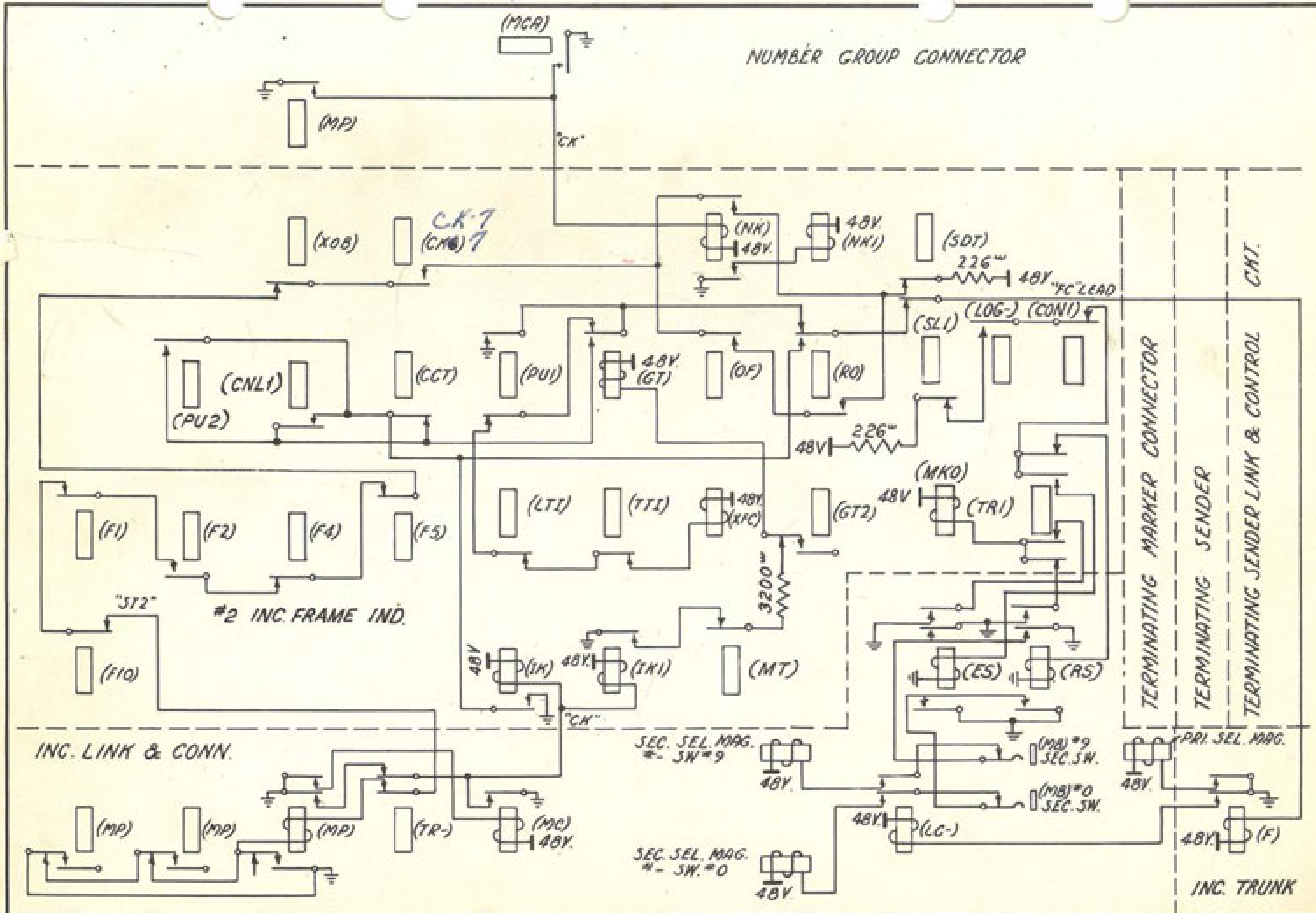
XB-302

ASSOCIATING NUMBER GROUP CONNECTOR WITH INCOMING LINK AND CONNECTOR CIRCUIT WHICH SERVES THE INCOMING TRUNK

When the (MP) relay in the number group connector operates, it operates the marker cut-in relays in the number group connector circuit and grounds the "CK" lead to the marker to operated relays (NK) and (NK1), to indicate to the marker that it has been connected to a number group. The (NK) relay closes 226 ohm battery through the frame indicating relays to the "ST" lead of the incoming link and connector circuit serving the incoming trunk which is making the call, this operated the (MP) relay in the incoming link and connector circuit associated with the marker. The operated (MP) relay in the incoming link and connector circuit operates its marker cut-in relay and grounds the "CK" lead to the marker to operate the (IK) and (IK1) relays in the marker to indicate that the Inc. Link and Conn. Ckt. has been seized. With relay (IK1) operated, relay (GT) operates and a circuit is now closed from ground at the operated (IK) relay to ground the "FC" lead to operate the (F) relay in the incoming trunk circuit. The operated (F) relay operates a primary select magnet on the horizontal level on which the incoming trunk appears and also operates an (LC) relay, the number of which corresponds to the primary switch serving the incoming trunk. When the marker operates one of the (LOG-) relays (see XB 307) a circuit is closed to operate either relay (ES) or (RS). Either of these relays operated closes ground to the armatures of the operated (LC-) relay, in turn operating a select magnet on each of the ten secondary switches, the number of the select magnet corresponds to the operated (LC-) relay. Relay (MKO) operated when either relay (ES) or (RS) operated.

When relay (RO) remains operated on reorder calls the number group connector is not seized but contacts on relay (RO) in series with contacts on relay (OF) close battery to the start lead of the incoming link and connector.

Should lead "FC" be falsely grounded, relay (XFC) will operate and lock causing the trouble indicator to be called in.



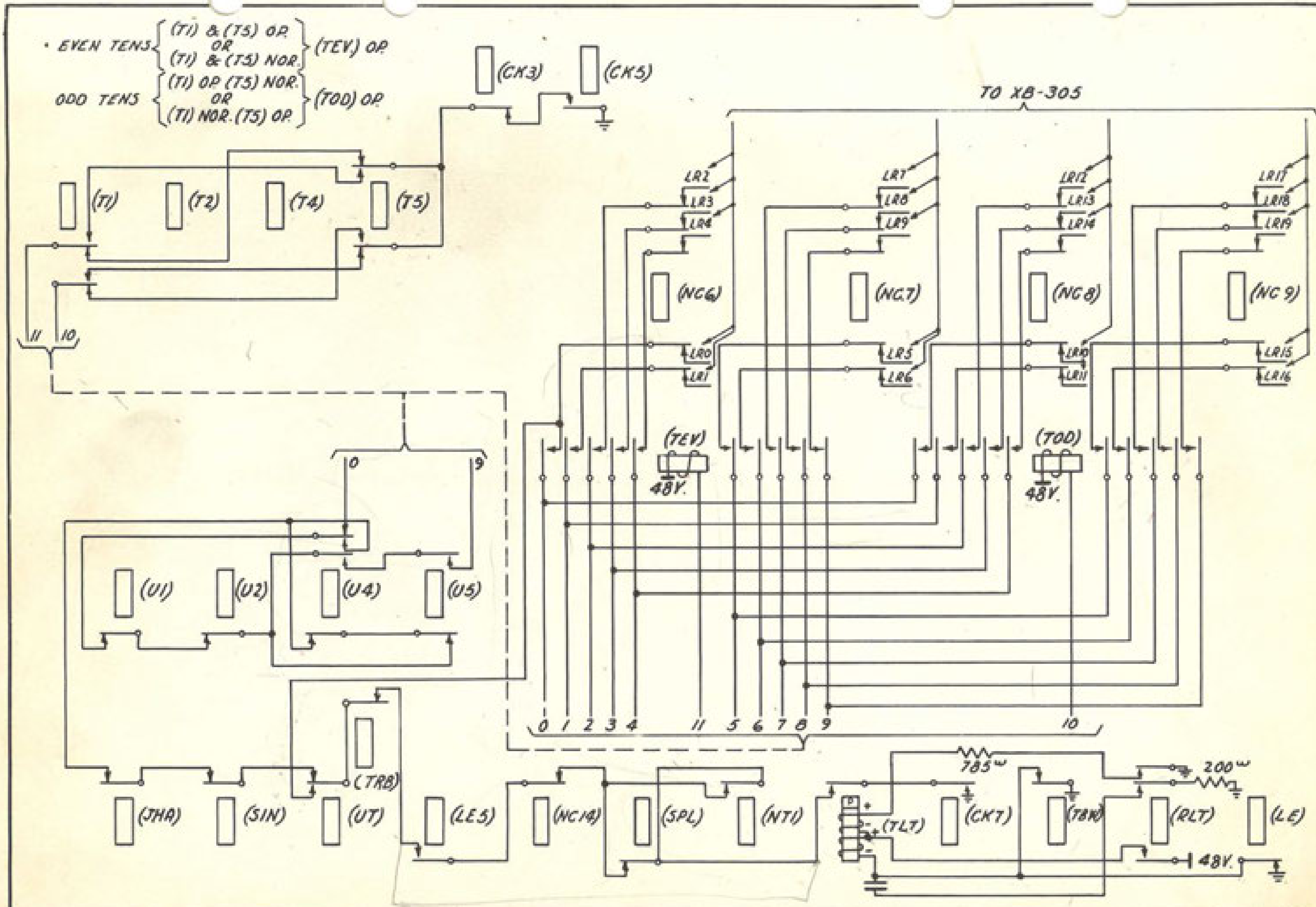
N. Y. TEL. CO. G.P.S. L.I.	TERMINATING MARKER ASSOCIATING NUMBER GROUP CONNECTOR WITH INCOMING LINK AND CONNECTOR CIRCUIT WHICH SERVES THE INCOMING TRUNK	1 2 XB-303

TENS EVEN OR TENS ODD INDICATION

Since the tens registration relays were used to operate the (TB) relay (20 block), it is necessary to also use them to indicate whether tens even or tens odd is being called.

This is determined by operating relay (TEV) for even tens and (TOD) for odd tens. Relay (TEV) operates when relays (T1) and (T5) are operated or both normal. Relay (TOD) operates when relays (T1) is operated and (T5) is normal or when (T1) is normal and (T5) operated. With relay (TOD) operated it adds ten to the unit indication of the (U) relays.

Relay (TLT) is a condenser timed relay whose time interval starts when relays (TBW) see XB-302 and (LE) see XB-305 have operated and removed the ground that has been holding it non-operated. The condenser now charges in series with the (TLT) relay secondary winding, the tendency of the (TLT) relay to operate through the primary winding is retarded until the charging current to the secondary winding has decreased sufficiently. By this means a definite time interval is introduced before relay (TLT) closes its make contact. This time interval is sufficient to allow the slowest (TB) plus (S) or (HT) to operate if an operating condition exists see XB-305.



N.Y. TEL. CO.
G.P.S. L.I.

TERMINATING MARKER
TENS EVEN OR TENS ODD INDICATION

1 2

XB-304

TESTING AN INDIVIDUAL LINE AND TERMINAL HUNTING

For each directory number there are four cross-connections made in addition to the M.D.F. cross-connections. The "S" and "M" cross-connections are made at the L.D.F. (line distributing frame). The "M" cross-connection is shown on XB-9 and is run as a pair with the "S" cross-connection, the directory number appears on the vertical side of the L.D.F. and the column, switch and vertical of the line link frame appears on the horizontal side.

The "F" field is used to select the line choice frame which serves the line link frame having the called line. This is done by a cross-connection from the "NF" punching of a twenty block relay to one of the punchings "RFO" to RF19 or "TFO" to "TF19" or "HFO" to"HF19". The "RF" punchings are used for an individual line, ring party or last line of a P.B.X. The "TF" punchings are used for tip parties and the "HF" punchings are used for first or intermediate lines of a P.B.X. group.

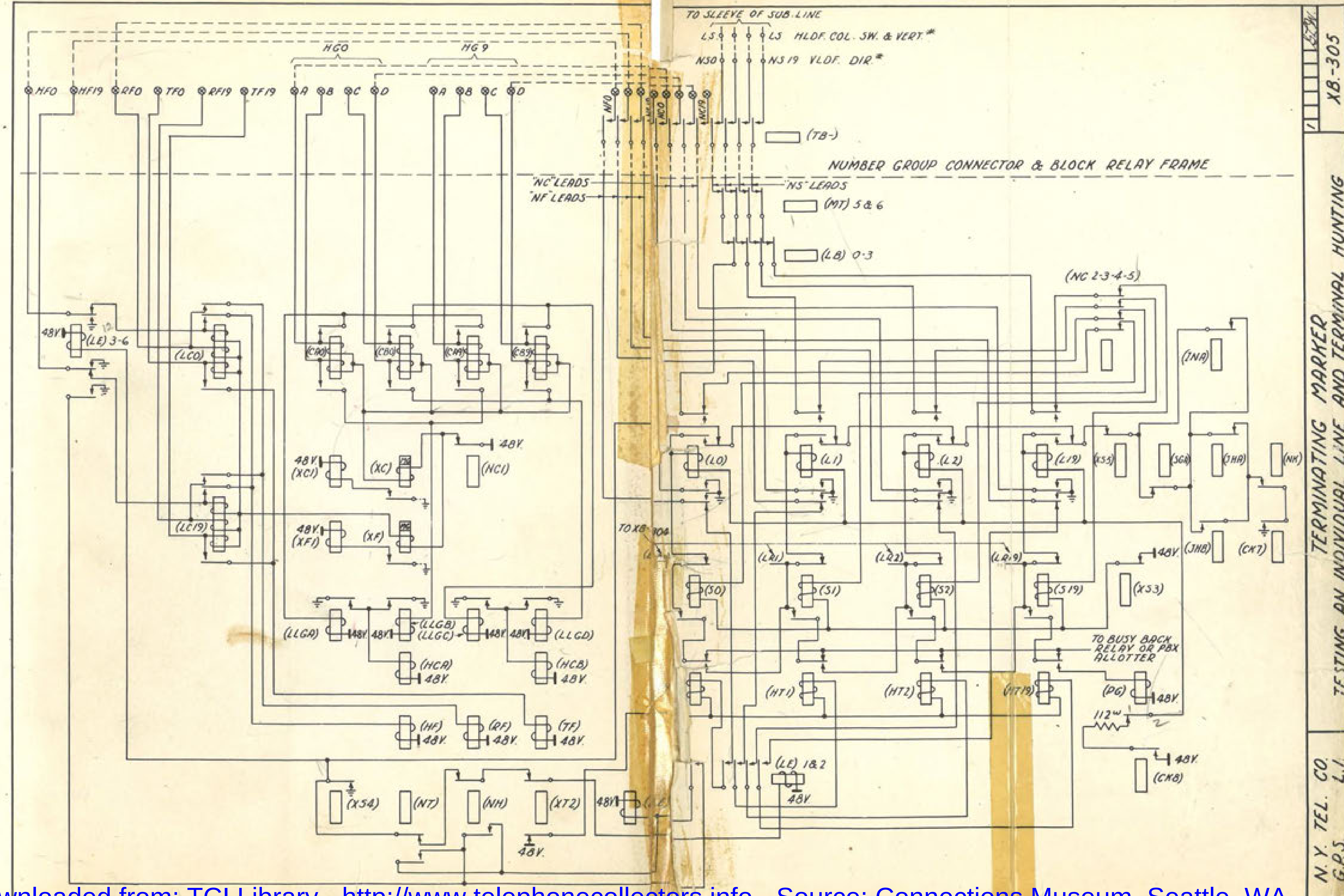
The "C" field is used to indicate which line link frame of a line choice, and which horizontal group of the line link frame is to be used.

Assume a call was made to an individual line, the "F" cross-connection at the (TB-) relay would be made as shown for relay (L2) to a "RF" punching, if the line were busy relay (S2) would operate and when ground was placed on lead "LR2" from XB-304 the busy back relay would operate, but if the line were idle relay (S2) would be normal and relay (L2) would operate and lock grounding leads "NF2" and "NC2". The ground from the "NF" lead being cross-connected to punching "RFO" would operate relay (LCO) indicating the called line was served by one of the four line link frames in line choice zero, also relay "RF" would operate which controls the type of ringing to be used. The ground from the "NC" lead being cross-connected to punching "HG9D" would operate relay (CB9) indicating the line was in horizontal group 9. When relay (CB9) operated and since it operated over a "D" punching relay (LLGD) would operate, indicating which one of the four line link frames of the line choice was to be used.

In the case of a 3 line P.B.X. group as shown for (LO), (L1) and (L2), when a call is made for a line associated with (LO) and assume the first two lines were busy, operating relays (SO) and (S1), relays (HTO) and (HT1) would now operate since relays (LE) 1, 2, 3, 4, 5 and 6 are operated due to relays (LO) to (L19) being normal. So when ground is placed on lead "LRO" it would operate relay (L2) and then the call would progress in the regular manner to line equipment associated with it. Of course, if either of the first two lines were idle, the call would have been completed to one of them.

In cases where a P.B.X. group extends to another twenty block relay and the last line of this twenty block is busy then with (HT19) operated, relay (PG) would operate to pick another twenty block, which will be explained later.

Relay (XC) is a marginal relay and operates only when two (CA) or (CB) relays operate. Likewise relay (XF) is marginal and it operates only when two (LC-) relays operate. If either (XC) or (XF) operate the call is blocked and the trouble indicator is called in to take a record of the equipment used.

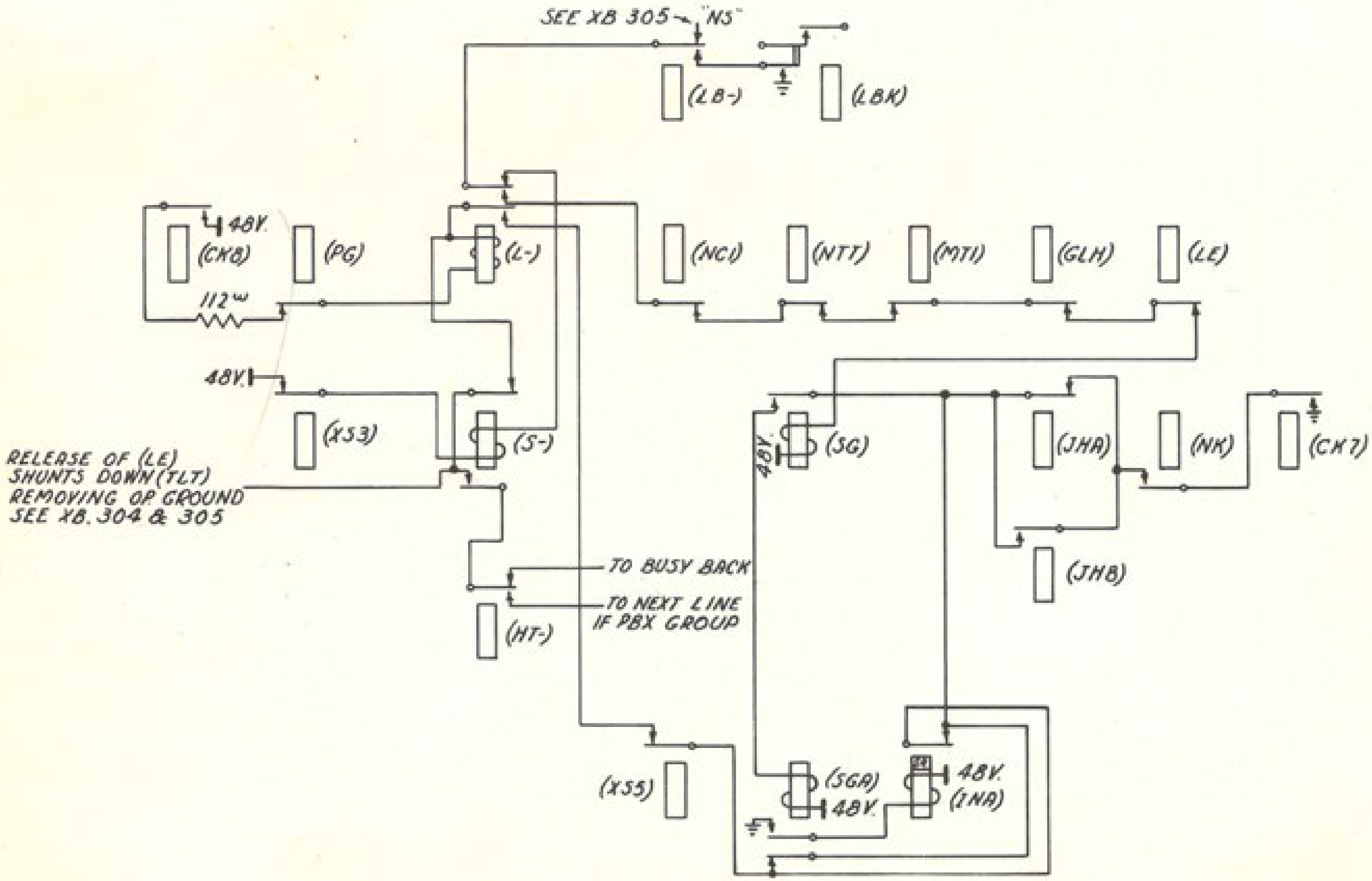

TO SLEEVE OF SUB. LINE
LS HLDF. COL. SW. & VERT.*
NS0 NS19 VLDF. DIR.*
HG0
HG9
HF0 HF19 RF0 TF0 RF19 TF19 A B C D A B C D
(TB-)
NUMBER GROUP CONNECTOR & BLOCK RELAY FRAME
"NC" LEADS
"NF" LEADS
"NS" LEADS
(MT) 5 & 6
(LB) 0-3
(NC 2-3-4-5)
48V. (LE) 3-6
(LC0)
(CA0) (CB0) (CA9) (CB9)
(JNA)
48V.
48V. (XC1)
(XC)
(NC1)
(L0) (L1) (L2) (L19) (XS5) (SGA) (JHA) (NK)
48V. (XF1)
(XF)
(LC19)
TO XB-304
(LR1) (LR2) (LR19)
48V. (JHB) (CK7)
(S0) (S1) (S2) (S19) (XS3)
(LLGA) 48V. 48V. (LLGB) (LLGC) 48V. 48V. (LLGD)
TO BUSY BACK RELAY OR PBX ALLOTTER
(HCA) 48V. (HCB) 48V.
(HT1) (HT2) (HT19) (PG) 48V.
112w
(HF) 48V. (RF) 48V. (TF) 48V.
48V.
(LE) 1&2
48V.
(CK8)
(XS4) (NT) (NH) (XT2) 48V. (LE)
48V.
TERMINATING MARKER
TESTING AN INDIVIDUAL LINE AND TERMINAL HUNTING
XB-305
N.Y. TEL. CO. L.I.
G.P.S.

SLEEVE GUARD

An originating call does not ground the sleeve of the calling line until after the subscriber sender has been seized. A terminating call does not lock out originating calls in a line link group until after the line test has been completed. It is evident, therefore, that there is an unguarded interval in which the terminating marker may select a line which appears to be idle because a subscriber sender has not yet been seized for that line but which is actually busy and will ultimately appear so at the time the marker is able to lock out the line link group.

To detect this condition, the sleeve guard relay (SG) has been furnished. The operation of one of the (L) relays released relay (LE), a circuit is now closed to operate relay (SG) if the line is now busy. If relay (SG) operates it in turn operates relay (SGA), which operates relay (INA), with these two relays operated the locking ground for the operated (L) relay is removed causing it to release, since the ground used to operate the (L) relay is also removed by the release of relay (LE) which caused relay (TLT) to release see XB-304 and 305.

With relay (L) released and ground on the sleeve its associated (S) relay operates, causing a busy indication on the next test or the selection of another line in a P.B.X. group if one is idle.



N.Y. TEL. CO. G.P.S. L.I.	TERMINATING MARKER SLEEVE GUARD	XB.-306

SEIZURE LINE CHOICE CONNECTOR AND LINE LINK GROUP AND CONTROL ALSO CHANNEL TEST

When an idle line is selected, the corresponding (L) relay is operated causing an (LC-) relay, associated with the line choice in which the called subscriber is located, to operate see XB-305. If relays (XF1) and (XC1) are normal indicating that no cross existed in the "F" or "C" field and relay (IK1) was operated indicating that incoming link and connector frame was connected to the marker, resistance battery is connected to the line choice connector frame to operate the (MP) relay associated with this marker. The (MP) relay operates relay (MCA) and grounds the "CK" lead to operate relay (LK). The operated (MCA) relay also operates the (MCB) and (MCC).

If the line link group and control circuit is in use and has advanced far enough to operate relay (EE) without selecting a group of district junctors, ground on lead "LR" will operate its (RL) relay to release the circuit, so that this call may be completed.

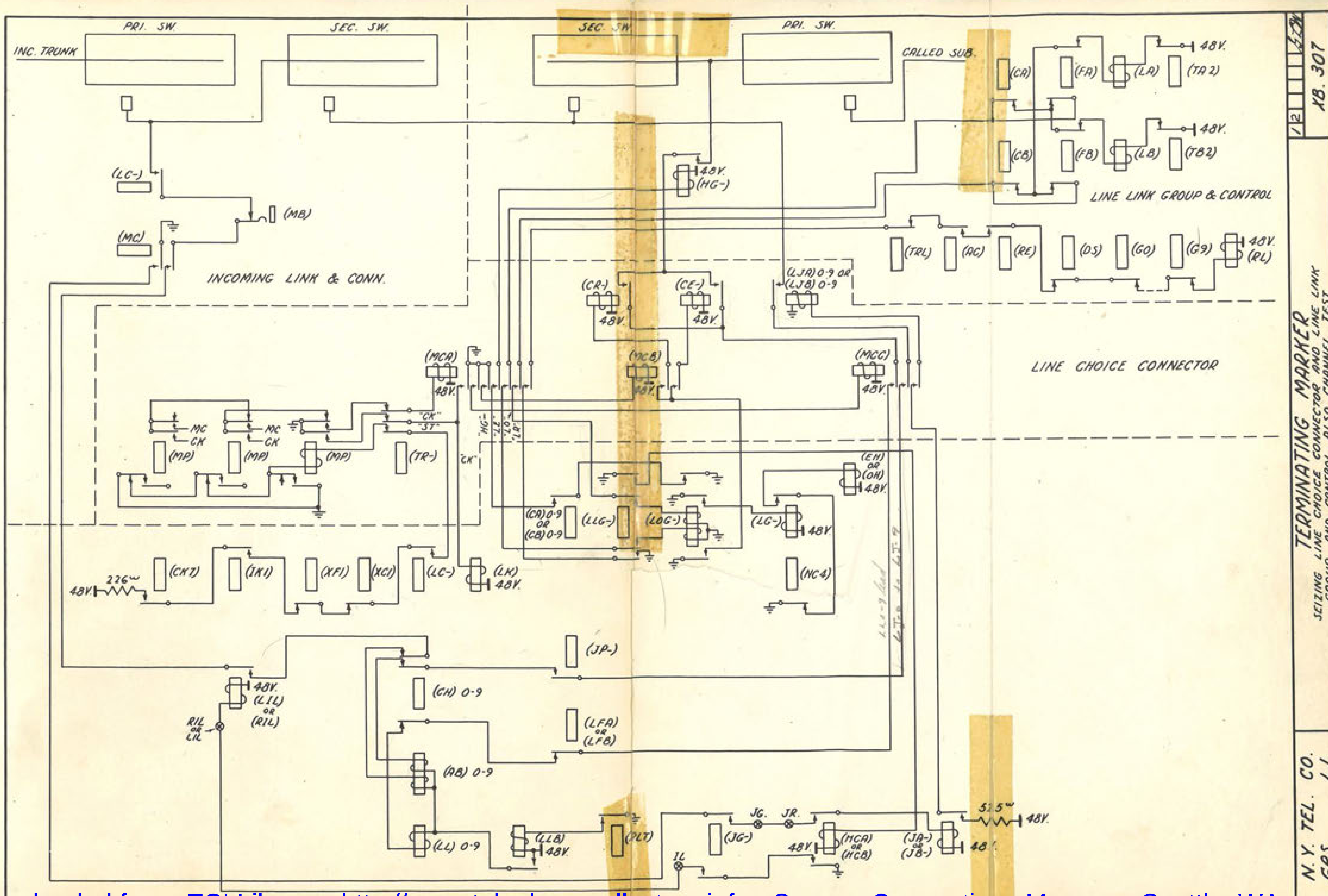
The operation of relay (LLG-) indicates in which half choice the line link frame is located by operating (HCA) or (HCB) relay and also which of the four line link frames are to be used, ground through the windings of relay (LOG-), under control of the (LLG-) relay, is closed over leads "LE" and "LO" to that line link frame, if the start circuit is normal, to operate relays (LA) and (LB) in series with relay (LOG-). The operation of the (LA) and (LB) locks out the start circuit to originating calls. Relay (LOG-) operated causes relays (CR-) and (CE-) associated with the line link frame to operate in the line choice connector circuit, it also operates the (HG-) relay in the line link frame under control of the (CA-) or (CB-) relay operated. These relays close through leads to test for idle line links.

The operation of relay (HCA) or (HCB) see XB-305, grounds one of the "IL" punchings to operate either relay (RIL) or (LIL) to select right or left incoming link.

The (LJA) and (LJB) relays are used in selecting a group of line junctors between the incoming secondary switches and the line link secondary switches. The (LJA) is associated with half choice "A" and (LJB) with half choice "B", their numerical designation corresponding to the vertical row of hold magnets on the line group secondary switches. Ground from the operated (MC) relay in the incoming link and connector circuit, and an operated (JG-) relay operates one of the (LJA) or (LJB) relays.

The three legs of each of the ten channels between the incoming trunk and the called line are tested to locate one channel that has the three legs idle, if either the incoming link or line junctor of a channel is busy the associated (AB-) relay will operate and if the line link of this channel is busy the (LL-) relay will operate, but if the channel is idle both the (AB-) and (LL-) relays will be normal and may be picked to serve the call.

When relay (LOG-) operated it operates the (LG-) relay for the associated line link frame. Relay (LG-) in turn operates either the (EH) or (OH) relay to indicate whether the line link frame was the even or odd frame of the half choice being used.


PRI. SW.
SEC. SW.
SEC. SW.
PRI. SW.
INC. TRUNK
CALLED SUB.
(LC-)
(MB)
(MC)
INCOMING LINK & CONN.
(CA)
(FA)
(LA)
(TA 2)
48V.
(CB)
(FB)
(LB)
(TB2)
48V.
48V.
(HG-)
LINE LINK GROUP & CONTROL
(TRL)
(AC)
(RE)
(DS)
(GO)
(G9)
48V.
(RL)
(CR-)
48V.
(CE-)
48V.
(LJA) 0-9 OR
(LJB) 0-9
LINE CHOICE CONNECTOR
(MCA)
48V.
(MCB)
48V.
(MCC)
48V.
MC
CK
MC
CK
(MP)
(MP)
(MP)
(TR-)
"CK"
"ST"
"HG"
"LL"
"LO"
"LR"
"CK"
(EH)
OR
(OH)
48V.
(CA) 0-9
OR
(CB) 0-9
(LLG-)
(LOG-)
(LG-)
48V.
48V.
226~
(CKT)
(IKI)
(XFI)
(XCI)
(LC-)
(LK)
48V.
(NC4)
(JP-)
48V.
(LIL)
OR
(RIL)
RIL
OR
LIL
(CH) 0-9
(LFA)
OR
(LFB)
(AB) 0-9
(LL) 0-9
(LLB)
48V.
(PLT)
JG.
JR.
(JG-)
IL
48V.
(MCA)
OR
(MCB)
(JA-)
OR
(JB-)
48V.
525~
48V.
TERMINATING MARKER
SEIZING LINE CHOICE CONNECTOR AND LINE LINK GROUP AND CONTROL, ALSO CHANNEL TEST
N.Y. TEL. CO. L.I.
G.P.S.
XB. 307
1
2

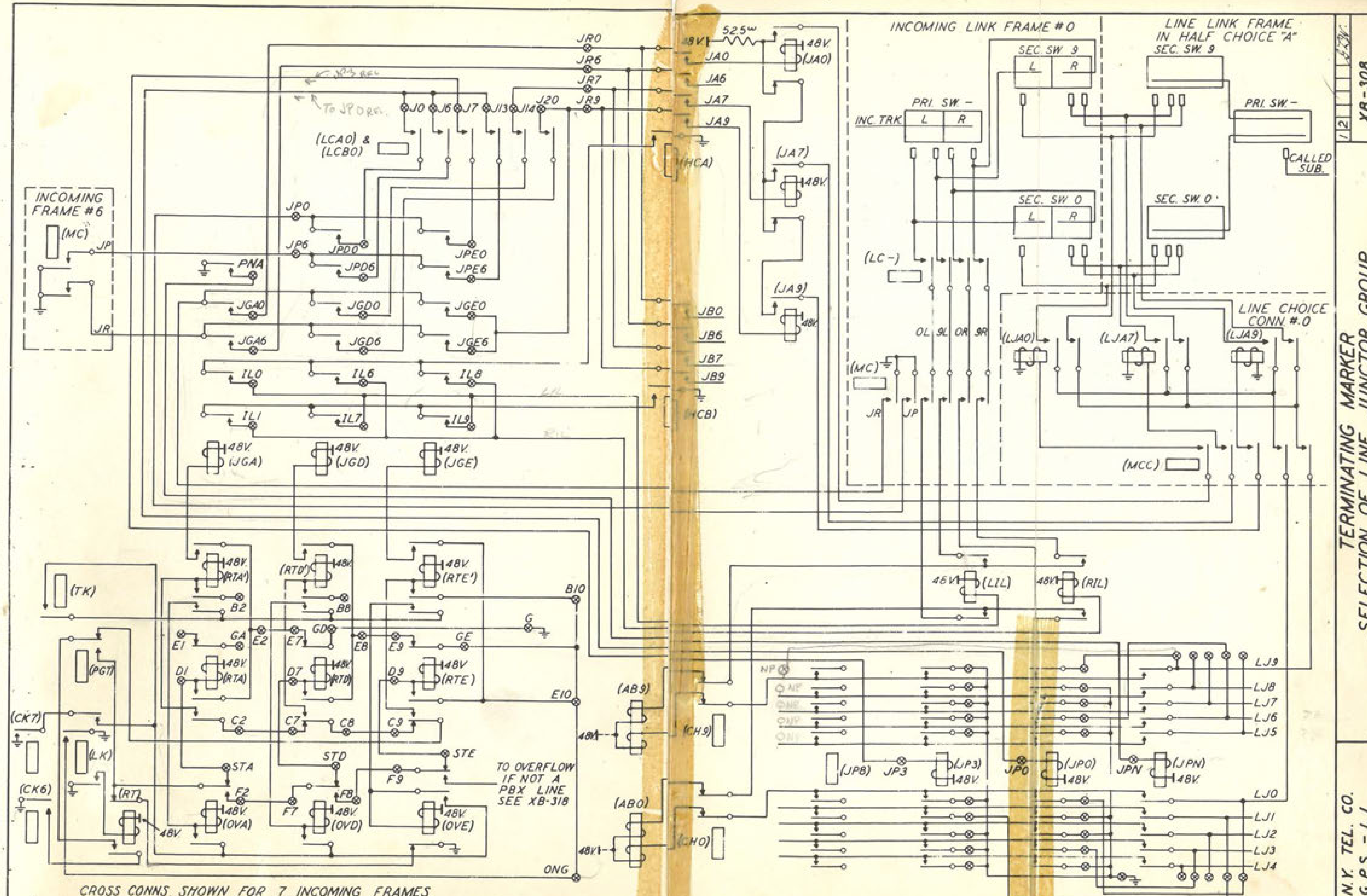
SELECTION OF LINE JUNCTOR GROUP

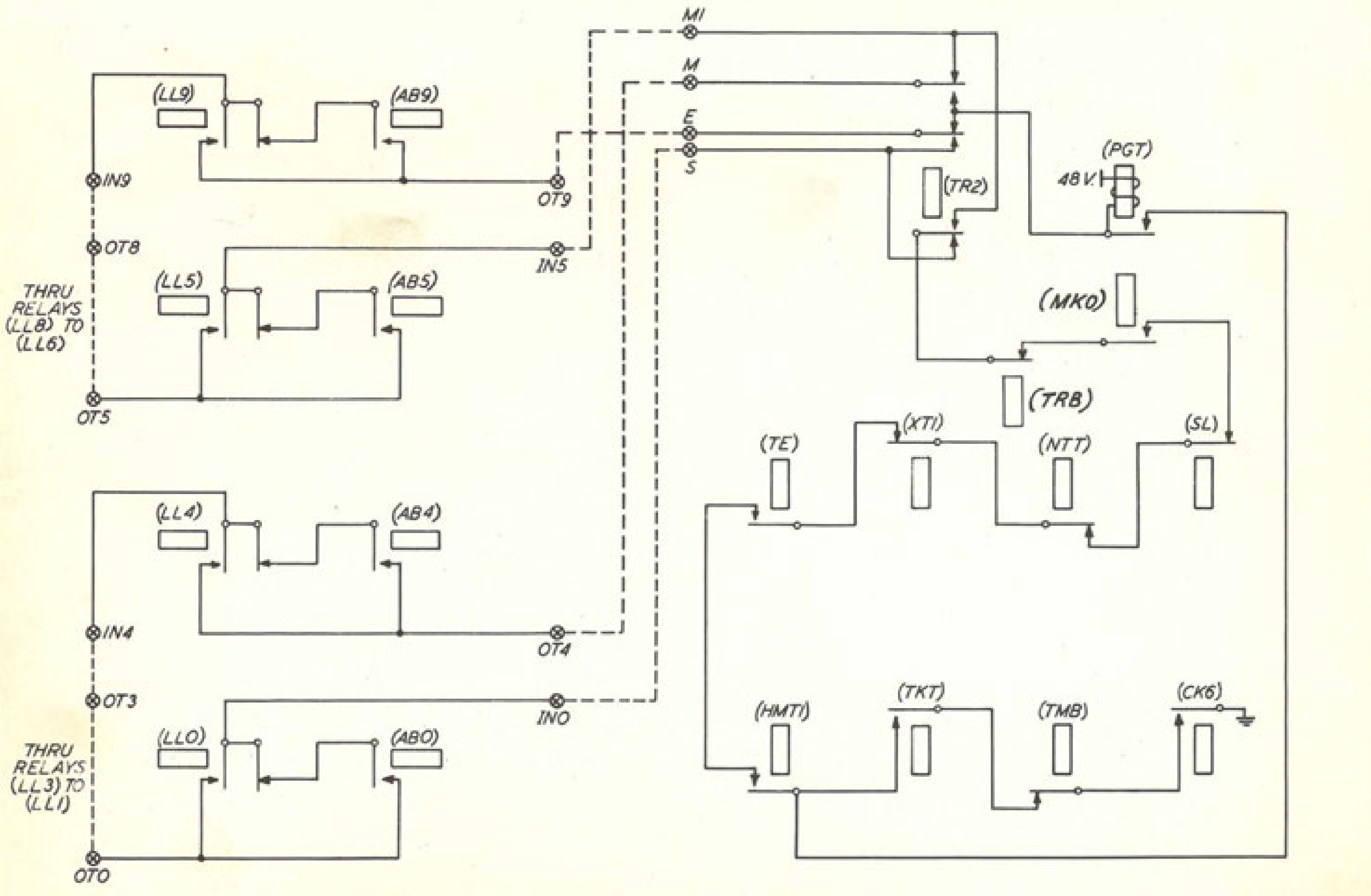
The cross-connections used here are for an office having seven incoming frames. For this particular call, we will assume the incoming trunk is located on incoming frame #0 and the called subscriber is in line choice #0, half choice "A".

When the marker returned to normal from the last call, relay (RTA) operated to ground through the back contact of relay (RT) and locked under control of relay (RTD), when the line choice connector was seized, relay (LK) operated (see XB-307) operating relay (RT) which operated relay (RTA') from ground on relay (CK6), relay (JGA) now operates. Since we assumed the call was in line choice #0 relay (LCA) 0 and (LCB) 0 operated and being in half choice "A" (HCA) will be operated and relay (LIL) will operate indicating the left incoming links are to be used, ground over lead "JR" from the incoming link and connector through relay (JGA), operated relay (JAO) which in turn operates relay (LJAO) in the line choice connector to close through ten line junctors for test under control of relay (JPN) which was also operated by relay (JGA). The circuit for testing the line link leg of the channel was shown on XB-307.

If an idle channel is found, the marker proceeds with the call, but if all channels test busy, relay (PGT) will operate and since relay (OVA) operated when relay (TK) operated, relay (RTD) now operates releasing relays (RTA), (RTA') and (JGA). Relay (JGA) in turn releases relay (LIL), (JAO), (LJAO) and (JPN). As soon as relay (PGT) returns to normal, relay (RTD') operates in turn operating relay (JGD). This time relays (RIL), (JA7), (LJA7) and (JPO) will operate, relay (JPO) being a junctor pattern relay will close through the channels which may be used and ground the leads on channels not available. If all channels again appear busy, relay (PGT) will operate releasing the "D" set of junctors and set up the "E" set of junctors. If all channels again appear busy, ground from the operated (PGT) relay will operate the (OF) relay if the call is not from a P.B.X. group, causing the marker to set the incoming trunk to give an overflow signal, this will be explained later.

The (LJA) or (LJB) relay number corresponds to the line link secondary switch hold magnet number.


TERMINATING MARKER
SELECTION OF LINE JUNCTOR GROUP
XB-308
N.Y. TEL. CO.
G.P.S. - L.I.
INCOMING LINK FRAME # 0
LINE LINK FRAME IN HALF CHOICE "A"
SEC. SW. 9
SEC. SW. 0
PRI. SW. -
INC. TRK.
CALLED SUB.
LINE CHOICE CONN. # 0
INCOMING FRAME # 6
(MC)
(LCA0) & (LCB0)
(HCA)
(HCB)
(JGA)
(JGD)
(JGE)
(RTA')
(RTD')
(RTE')
(RTA)
(RTD)
(RTE)
(OVA)
(OVD)
(OVE)
(TK)
(PGT)
(CK7)
(CK6)
(LK)
(RT)
(AB9)
(AB0)
(CH9)
(CH0)
(LIL)
(RIL)
(MCC)
(LC-)
(LJA0)
(LJA7)
(LJA9)
(JA0)
(JA7)
(JA9)
(JP8)
(JP3)
(JP0)
(JPN)
TO OVERFLOW IF NOT A PBX LINE SEE XB-318
CROSS CONNS. SHOWN FOR 7 INCOMING FRAMES



N.Y. TEL. CO.
G.P.S. – L.I.

TERMINATING MARKER
OPERATION OF (PGT) RELAY

1	2					

XB-308A

CHECK LEAD FOR OPERATING (TK) RELAY, ALSO OPERATION OF (CH-) RELAY

Since it is necessary to allow time for the (AB) and (LL) relays of a channel to operate if any part of that channel is busy, and thus open the operating circuit of their (CH) relay, so that this channel will not be selected, a check is made to insure that all the relays required to close through the test leads to the (AB) and (LL) relays were operated.

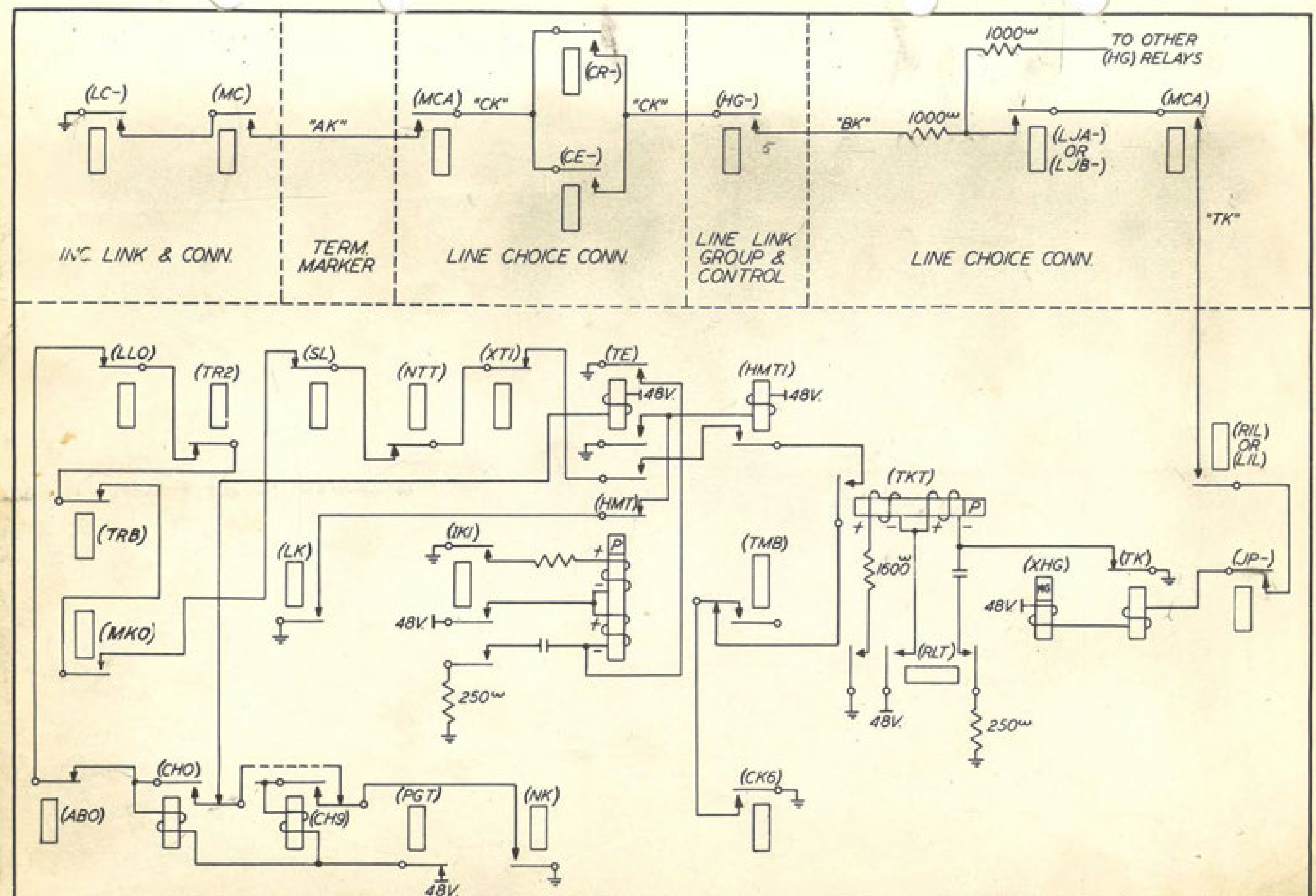
This is determined by the operation of the (TK) relay, which is operated from ground at the particular (LC) relay operated in the incoming link and connector circuit through all other relays involved to battery of the marginal (XHG) relay. The marginal (XHG) relay does not operate normally, but if a second (HG) relay should be connected with this circuit, it would operate and indicate a trouble condition.

When relay (TK) operates, it removes the ground which has been holding relay (TKT) normal; with this ground removed there is still a delay in relay (TKT) operating, due to the condenser which must charge. Then relay (TKT) operates, closing a ground to operate a (CH) relay.

The reason for the delay in operating relay (TKT) is to give the (AB) and (LL) relays ample time to operate if required.

Although more than one (CH) relay may operate, a locking circuit is available for only one (CH) relay. When any one of the (CH) relays operates relay (TE) releases, opening the operating circuit for the (CH) relays.

The (HMT1) relay is operated while relay (TE) is operated and the (HMT) relay is normal, under control of relay (LK). When the (TE) relay is operated the (HMT) a polarized relay is operated to its back contact. The condenser in series with the secondary winding of the (HMT) relay is short-circuited by the (TE) relay operated. When the (TE) relay releases following the operation of one of the (CH) relays the release of the (TE) relay removes the short-circuit from the condenser and allows the condenser to charge in series with the (HMT) relay secondary winding. The (HMT) relay operates through the primary winding but the operation is retarded until the condenser charging current through the secondary winding is reduced. When the (HMT) relay breaks its normal contact the (HMT1) relay releases. The time interval allows time for a holding magnet to release from the preceding call. Without this interval a holding magnet which had not had time to release would be falsely re-energized when the marker applies the channel lead tests.



N.Y. TEL. CO.
G.P.S. – L.I.

TERMINATING MARKER

CHECK LEAD FOR OPERATING (TK) RELAY ALSO OPERATION OF (CH-) RELAY

1 2

XB-309

CHECK OF HOLD MAGNET LEADS AND THE OPERATION OF INCOMING LINKS PRIMARY AND SECONDARY HOLD MAGNETS ALSO OPERATION OF LINE LINK SECONDARY HOLD MAGNETS

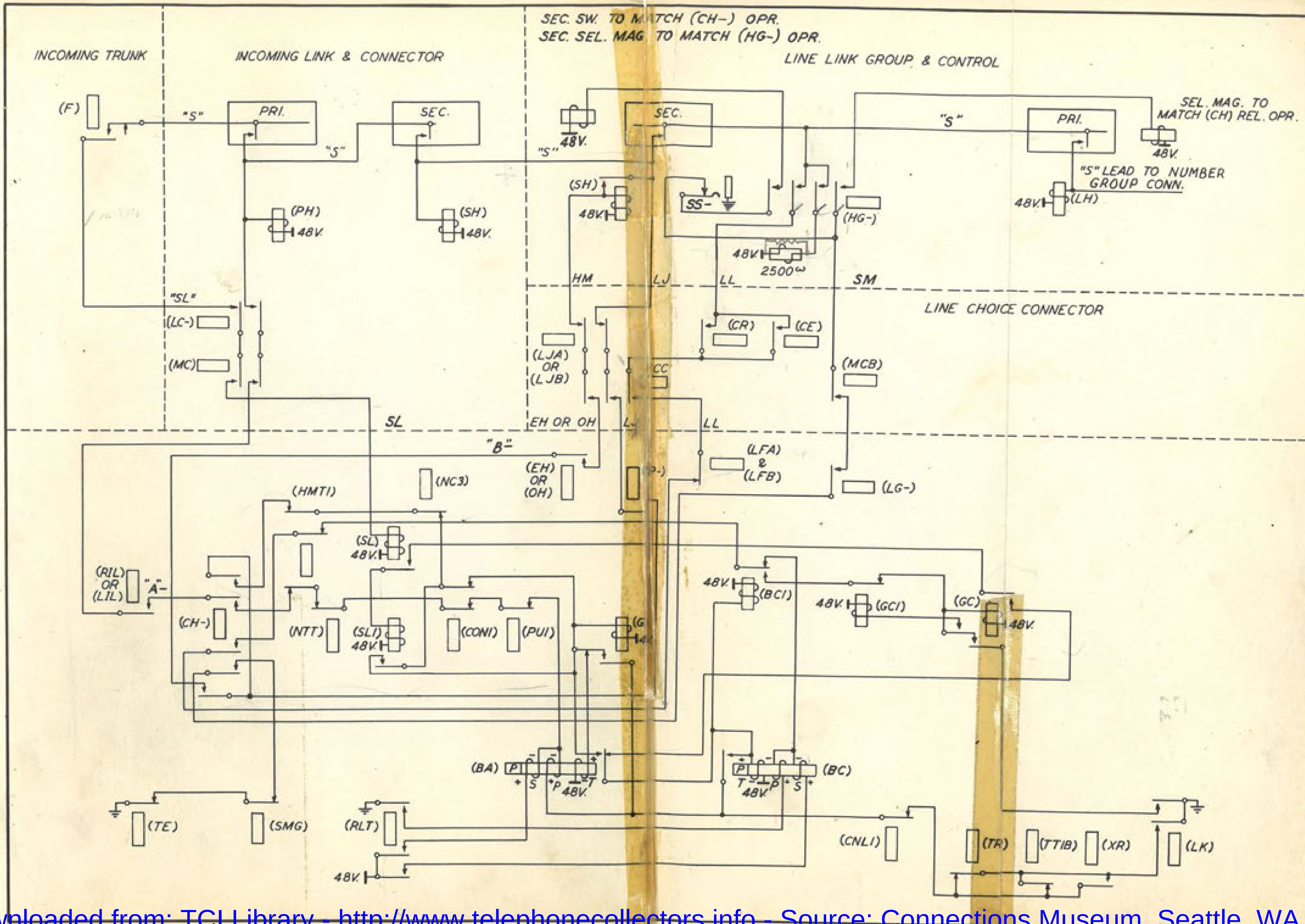
The operation of a (CH-) relay closes ground over a corresponding "SM" lead to operate the proper primary and secondary select magnets in the line link frame under control of the operated (HG-) relay, and directs the links and line junctor of one channel into a testing and operating circuit after relay (HMT1) released - see XB-309.

The differentially connected primary and secondary windings of polarized relay (BA) are applied to the sleeve of the incoming link, if this sleeve is not grounded and has battery on it showing that it is continuous, relay (BA) will operate. Failure of the (BA) relay to operate may indicate any of the following:

1. Open incoming test lead.
2. Open winding on the (AB) relay resulting in the selection of a busy incoming link.
3. Double connection resulting in grounded link test lead when the hold magnet operates.
4. Defective (BA) relay.

At the same time that the incoming link is being tested by relay (BA), the line link will be tested by relay (BC) whose primary and secondary windings are connected to its sleeve. The line link will have battery in series with a 2500 ohm retard coil closed through by the operation of relay (HG-) in the line link control circuit. The (BC) relay testing for this battery will operate and lock through its tertiary winding and in turn operate (BC1) relay. Relay (BC1) operated transfers the line link test lead to the winding of relay (GC).

With relays (BA) and (BC) operated ground through the make contact of relay (BC), through the make contact of relay (BA), (1) operates relay (GJ) which locks, (2) grounds the line junctor through the back contacts of relay (CON1), (NC3), (HMT1) and front contacts of (CH). The incoming secondary hold magnet and line link secondary hold magnets now start to operate. If the incoming secondary hold magnet operates before relay (GJ), the ground from the line junctor sleeve attempts to release relay (BA) but the (BA) hold on its tertiary winding until relay (GJ) has operated and locked opening the back contact of its continuity spring. When relay (GJ) has operated, relay (BA) is shunted down by the double effect of having its secondary winding grounded and its primary winding shunted. When the line link secondary hold magnet has operated, its operating ground is closed to the winding of relay (GC) which operates and locks and then operates relay (GC1) which opens the line link test lead. The same ground that operated the primary hold magnet of the incoming link is closed through a make contact of the incoming trunk (F) relay to the marker to operate relay (SL). Relay (SL) operated operates relay (SL1). This is a signal that all hold magnets necessary to set up the call, except a line hold magnet are operated. Relay (SL1) operated closes a ground to hold the chain of hold magnets when relay (CON1) operates later in the call.



TERMINATING MARKER

CHECK OF HOLD MAGNET LEADS AND THE OPERATION OF INCOMING LINK PRIMARY AND SECONDARY HOLD MAGNETS ALSO OPERATION OF LINE LINK SECONDARY HOLD MAGNET

N.Y. TEL. CO.
G.P.S. - L.I.

XB-310

1/2

OPERATING THE LINE HOLD MAGNET

To save marker holding time in intervals when the demand for markers is heavy, the marker varies the method of operating hold magnets depending upon whether traffic is light or heavy. When traffic is light, the marker delays the operation of the line hold magnet until the (FCG) relay has checked for false cross and ground conditions on the tip and ring up to the line cross-points, see XB-312. When traffic is heavy the false charge test is cut off early by the operation of relay (GLH) and the line hold magnet is operated at the same time as the junctor magnets. The marker measures the density of traffic by the ability of slow release relays (XS1) and (XS2) to release between calls, see XB-300 for operation and release of (XS) relays.

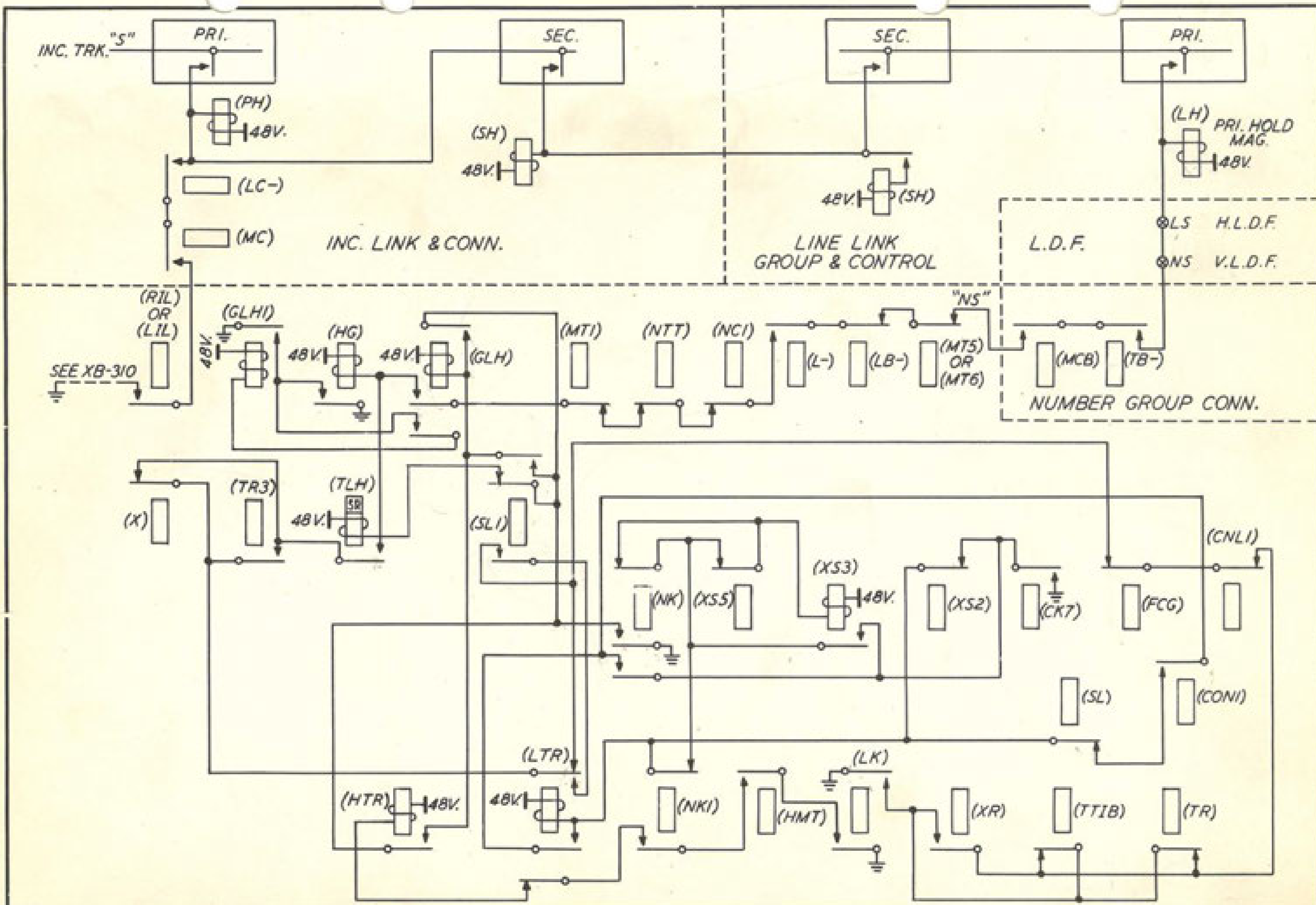
If relay (XS2) is normal at the beginning of a call relay (LTR) operates through a back contact of relay (XS2) to ground on (CK7) and locks to this same ground through a make contact of relay (MK). Relay (LTR) operated directs the "NS" lead to the (SL1) relay and prevents the operation of relay (HTR).

Relay (SL1) operates relay (GLH) which locks and cuts off the (FCG) relay and opens the ground which has been operating the ringing and tone control relays in the incoming see XB-313 and also grounds the lead for operating the line hold magnet. It will be noted that a make contact of relay (TLH) is used in this circuit and that the (TLH) relay had its operating circuit opened when relay (SL1) operated, but relay (TLH) is slow releasing and remains operated long enough for the line hold magnet to operate which holds over the circuit shown on XB-310 under control of relay (SL1) which is in turn controlled by relay (F) in the incoming trunk circuit.

In case of heavy traffic, relay (XS2) does not release between calls and the operating circuit for (LTR) is held open. With (LTR) normal (HTR) operates through a back contact of (LTR) and make of (MK1) when (HMT) operates. This operates and locks relay (GLH) which operates the line hold magnet. In this case the line hold magnet operates at the same time as the other hold magnets and the (FCG) test is not made.

If (LTR) has not previously operated it does when (SL) releases following the continuity test, this is needed in the release of the marker which will be explained later.

When relay (GLH) operated it in turn operated relay (HG) which operated relay (GLH1) which locks under control of relay (GLH).



N.Y. TEL. CO.
G.P.S. —L.I.

TERMINATING MARKER
OPERATING THE LINE HOLD MAGNET

1 2

XB-311

FALSE CROSS AND GROUND TEST ALSO CROSSPOINT CONTINUITY TEST

The false cross and ground test is made while relay (GLH) and (GLH1) are normal, since the line link primary hold magnet would not be operated at this time the tip and ring are tested up to the primary switch crosspoints of the line link frame. A false battery on the tip, a false ground on the ring or a shorted tip and ring in the incoming or line switches will operate the supervisory relay of the incoming trunk regardless of the status of the called line. The function of the (FCG) relay is to detect these conditions. The battery winding of relay (FCG) is connected to the ring over the "RT" lead and the ground winding to the tip over the "TT" lead, if relay (FCG) should operate due to a trouble condition it will lock and open the operating ground for the primary hold magnet of the line link frame, see XB-311, causing the marker to block and call in the trouble indicator.

The operation of the line hold magnet cuts off the subscriber's line relay and closes the tip and ring of the subscriber's line through the switches to the marker for continuity test. The subscriber's line is connected tip side to 500 ohm ground and the ring side in series with the (A) condenser and the secondary winding of the (CON) transformer which steps up the ringing voltage.

The control elements of the vacuum tube (terminals 1 and 4), one of which is in series with 200000 ohm, are connected, one on either side of condenser A. The anode (plate) circuit is connected in series with relays (CON) and (CON3) to 110 volt positive battery.

The primary circuit of transformer (CON) is not closed until relay (NK1) operates to reduce the drain on the ringing supply.

The #1 terminal of the ionic tube (A) is grounded by the (CON1) relay after the tube has operated. Without this ground a sputter condition results which increases the variation in breakdown voltage and shortens the life of the tube.

When relay (GLH) operates, relay (GLH1) operates from ground on relay (HG), see XB-311. The (GLH) relay removes the (FCG) relay battery circuit from the "RT" lead and connects the "RT" lead to ground on relay (GLH1). During the operating time of relay (GLH1) this lead is grounded to discharge the "RT" - "TT" lead capacity before connecting the ionic tube for the continuity test. The "TT" lead is maintained at ground potential through the ground winding of the (FCG) relay. When relay (GLH1) operates it connects the "RT" lead to the ionic tube circuit for individual, P.B.X. and ring party lines and the "TT" lead for tip party lines, since relay (RV) operates when a tip party is called. The other side is grounded.

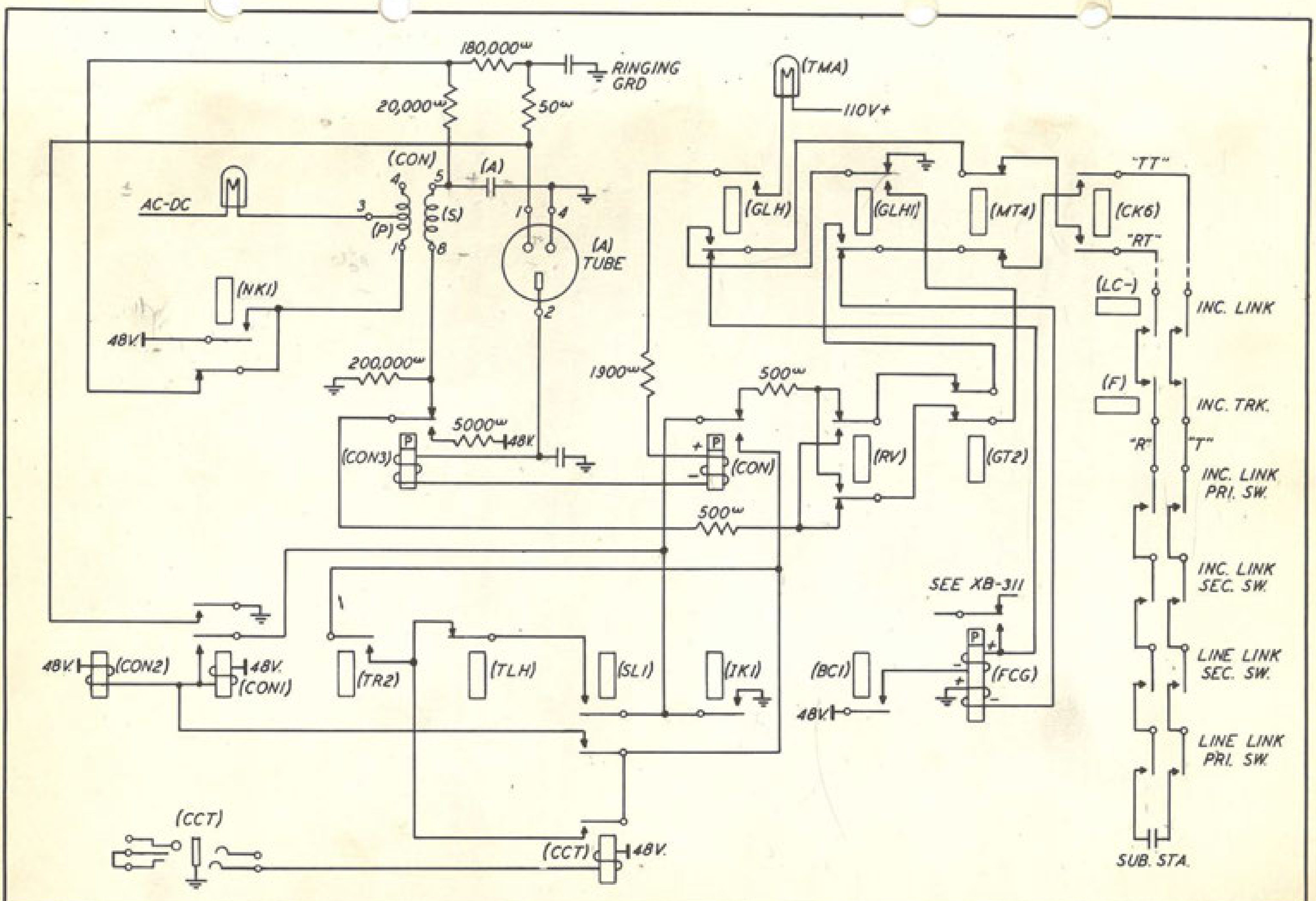
Closure of the (A) condenser to the line causes a voltage drop across the condenser. If the voltage drop is caused only by capacity and leak of the switches and associated cabling, it is less than the breakdown voltage of the tube. When the line hold magnet operates, adding the capacity of the line, the voltage drop across condenser (A) as measured by the control elements of tube (A) is sufficient to cause the control gap of the tube to breakdown and the

FALSE CROSS AND GROUND TEST ALSO CROSSPOINT CONTINUITY TEST

anode circuit becomes effective. Current flow in the anode (plate) circuit operates relays (CON) and (CON3). Relay (CON) causes relays (CON1) and (CON2) to operate and lock. Relay (CON3) opens the continuity test circuit to prevent bell tapping, and connects battery to the line to charge the line capacity so that the surge, which occurs when relay (GT) is later connected to the line, will be reduced.

The (CCT) jack on the trouble indicator frame is provided to cancel the continuity test. Failure of the (CON) relay to operate will often be due to line troubles in outside plant equipment. The (CCT) jack is provided to prevent a large number of trouble indicator records in such cases. When a plug is inserted in the (CCT) jack, relay (CCT) is operated. Should relay (CON) fail to operate, the release of relay (TLH) will provide an operating circuit for relays (CON1) and (CON2) from ground on relay (IK1) through contacts of relays (SL1) and (CCT).

While the (NK1) relay is normal, a low current circuit is provided for ionizing the gas in the vacuum tube.



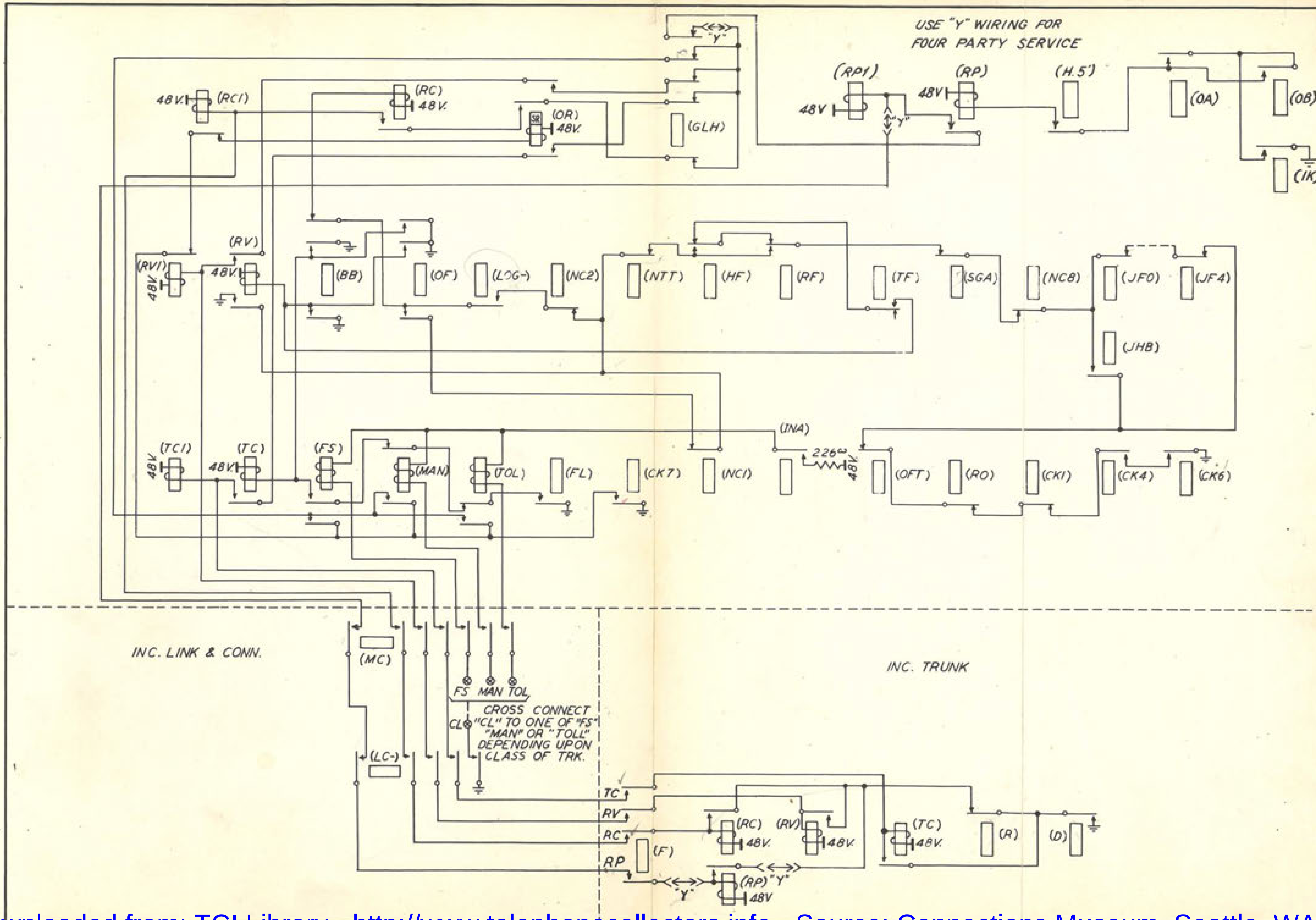
N.Y. TEL. CO.
G.P.S. – L.I.

TERMINATING MARKER

FALSE CROSS AND GROUND TEST ALSO CROSSPOINT CONTINUITY TEST

1

XB-312



TERMINATING MARKER
RINGING CONTROL

XB-313

N.Y. TEL. CO.
G.P.S. L.I.

OPERATION OF (GT1) AND (GT2) RELAYS AND CHECK OF RINGING CONTROL RELAYS

As was shown on XB-313 the ringing relays in the incoming trunk are operated in parallel with correspondingly designated check relays in the marker, namely (RC1), (RV1) and (TC1). On a regular call when one of these relays is held operated by ground from the incoming trunk, the correspondingly designated (RC), (RV) or (TC) in the marker should match and close the circuit from ground on the make contact of relay (CON2) to operate relays (GT1) and (GT2) for the purpose of cutting off the continuity test, see XB-312 and applying the ground test. Relay (GT2) operated also operates relay (SMG) to release primary select magnet in the line link.

On an individual or ring party line, the only relay of these three relays operated is the (RC) together with its associated (RC1) relay. The (GT1) and (GT2) relay operating circuit is as follows: ground on the make contact of relay (CON2), make contact of (RC), break contact of (BB), make contact of (RC1), break contact of (RV) and break contacts of (TF), (RV1), (TC), (OF), (BB), (FL), (TC1) and (X) to windings of (GT1) and (GT2) relays, these relays lock directly to the operating ground on relay (CON2).

Should a false ground be tested on any of the leads not supposed to be grounded for a particular call, the above circuit will not close because of false operation of one of the check relays and the marker will time out. Likewise, should an incoming trunk ringing relay fail to operate or lock, the corresponding relay in the marker will be normal and the checking chain will test open.

In checking through the make contacts of relays (RC) and (RC1), relay (BB) is checked normal since the (RC) and (RC1) relays are not expected to operate on busy back calls. This circuit, therefore, checks for false operation of relay (BB) on non-busy back calls and for false operation of (RC) on busy back calls.

The checking circuit on tip party calls is through a make contact of relay (RV), a make contact of relay (TF) and a make contact of relay (RV1) and on other calls through the break contacts of these relays.

On special calls and intercept calls, the operating circuit of relays (GT1) and (GT2) is direct from relay (CON2), through the make contact of relay (SPL) or (SIN).

On second trials the make contact on relay (TR1) short circuits contacts on (RC), (BB) and (RC1) to prevent blocking the call should an "RC" lead be grounded or open.

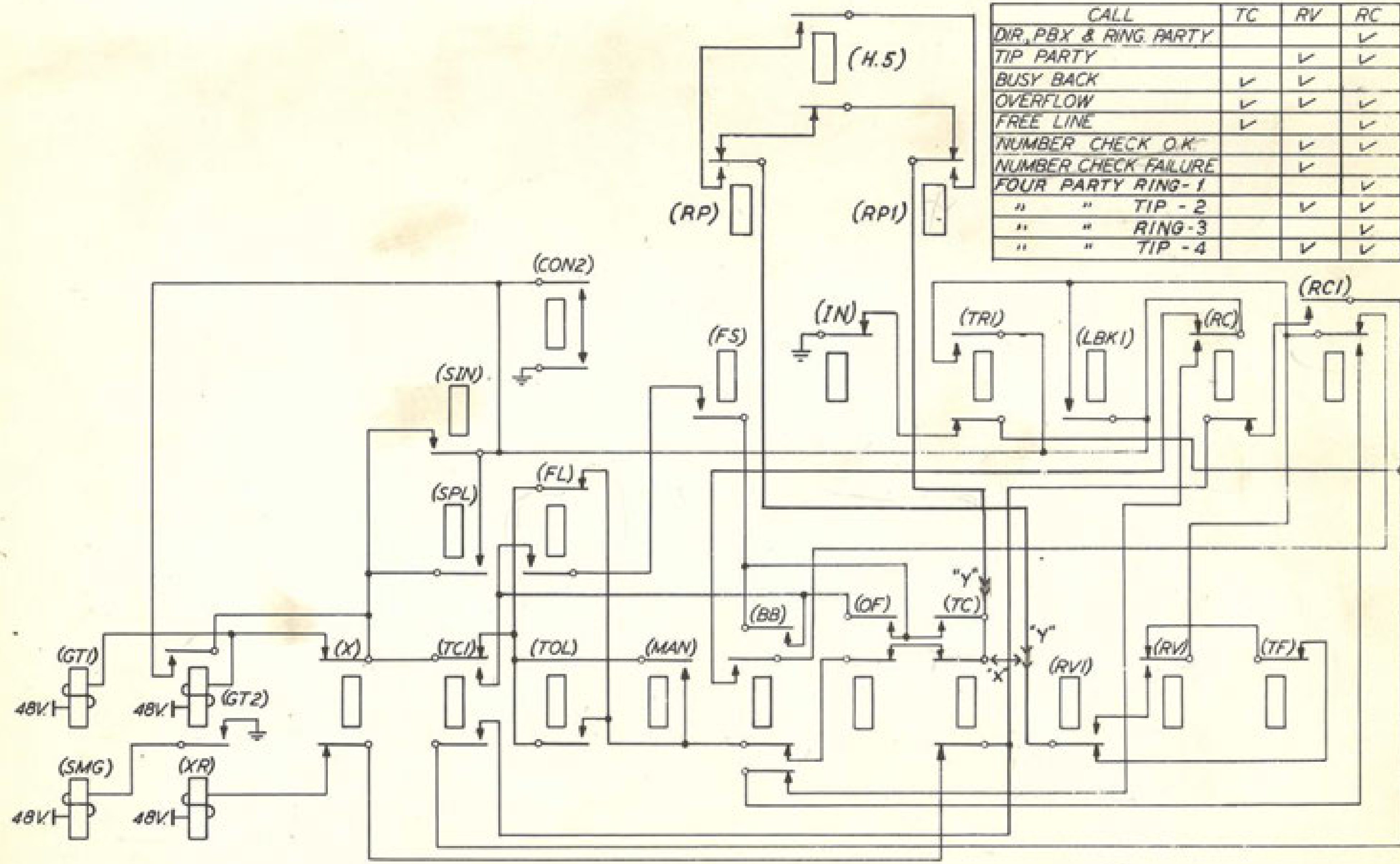
Ring lead troubles which will not result in false charges will not cause a second trial. These troubles may be a falsely grounded "RC" lead or falsely grounded "TC" lead. The first changes busy back to overflow and the second will cancel supervision on all ring party calls and on tip party calls will return overflow. When relays (RC1) or (TC1) operate falsely, they operate relay (XR), whose function is to transfer the trouble release ground to the

OPERATION OF (GT1) AND (GT2) RELAYS AND CHECK OF RINGING CONTROL RELAYS

regular release circuit thus preventing a second trial. Should a falsely grounded "RC" lead be encountered on a second trial, however, it will be disregarded, as relay (TR1) shunts the checking path between (RC) and (RC1).

On calls to a P.B.X., an idle line may be seized and then a channel to that line may not be available. By means of the P.B.X. retest feature, described later, the first seized line is released and a new line in the same P.B.X. group is sought. If one cannot be found, the (BB) relay operates in the usual manner. This causes the operation of relays (TC) and (RV) but not (RC). The (RC) relay will have been operated, however, when relay (LOG-) operated at the first attempt to set up the call. This causes the (RC) relay in the trunk to operate and lock, so that the eventual operation of relays (TC) and (RV) will cause the trunk to return an overflow signal. But in the marker, the (RC1) relay will be operated and locked with the (RC) normal which would prevent operation of (GT1) and (GT2). To prevent blocking under this condition, a make contact on relay (LBK) short circuits the checking path through relays (RC) and (RC1).

CALL	TC	RV	RC	RP
DIR, PBX & RING PARTY			✓	
TIP PARTY		✓	✓	
BUSY BACK	✓	✓		
OVERFLOW	✓	✓	✓	
FREE LINE	✓		✓	
NUMBER CHECK O.K.		✓	✓	
NUMBER CHECK FAILURE		✓		
FOUR PARTY RING - 1			✓	
" " TIP - 2		✓	✓	
" " RING - 3			✓	✓
" " TIP - 4		✓	✓	✓



"X" WIRING - 2 PARTY
"Y" WIRING - 4 PARTY

N.Y. TEL. CO. G.P.S. — L.I.	TERMINATING MARKER OPERATION OF (GT1) & (GT2) RELAYS AND CHECK OF RINGING CONTROL RELAYS	1 2 XB - 314

GROUND TEST AND DOUBLE CONNECTION TEST - NON-COIN LINES ALSO TEST FOR RECEIVER OFF THE HOOK ON COIN LINES

The purpose of the ground test is as follows:

1. To detect party lines which have become grounded and might give a false line indication which would result in a false charge on originating calls.

2. To detect double connections, which would cause the supervisory ground to hold (GT) relay.

3. To detect crosses between tip and message register leads.

As shown on XB-303, relay (GT) operated through a normal contact of relay (GT2) to ground through 3200 ohm resistance when the number group connector is seized and it closes the "FC" lead which is grounded when the incoming connector is seized.

When relay (GT2) operated as shown on XB-314, it removes the operating ground from the (GT) relay and leaves the (GT) relay connected through the primary winding to both the tip and ring, this circuit having been prepared by the operation of relay (CON2). The secondary winding of the (GT) relay is connected in a local circuit through 500 ohms resistance and serves as a biasing winding.

The (GT) relay releases if the line condition on the tip and ring is clear but if a ground is present which is in excess of the allowable minimum insulation resistance or if excessive negative earth potential exists on P.B.X. trunks, the (GT) relay will hold operated and the marker will time out. The biasing resistance determines the release point for the (GT) relay and with 500 ohms resistance, the biasing is such that the (GT) relay will hold in case the working limits are exceeded.

The test is cancelled on second trial, or if a plug is inserted in the (CCT) jack to operate relay (CCT) the test is cancelled on first trial, and when the test is cancelled, the call will be set up regardless of the condition on the tip or ring. Since the (GT) relay test serves to detect double connections, the CCT feature for cancelling the GT test should be used with due regard for this fact.

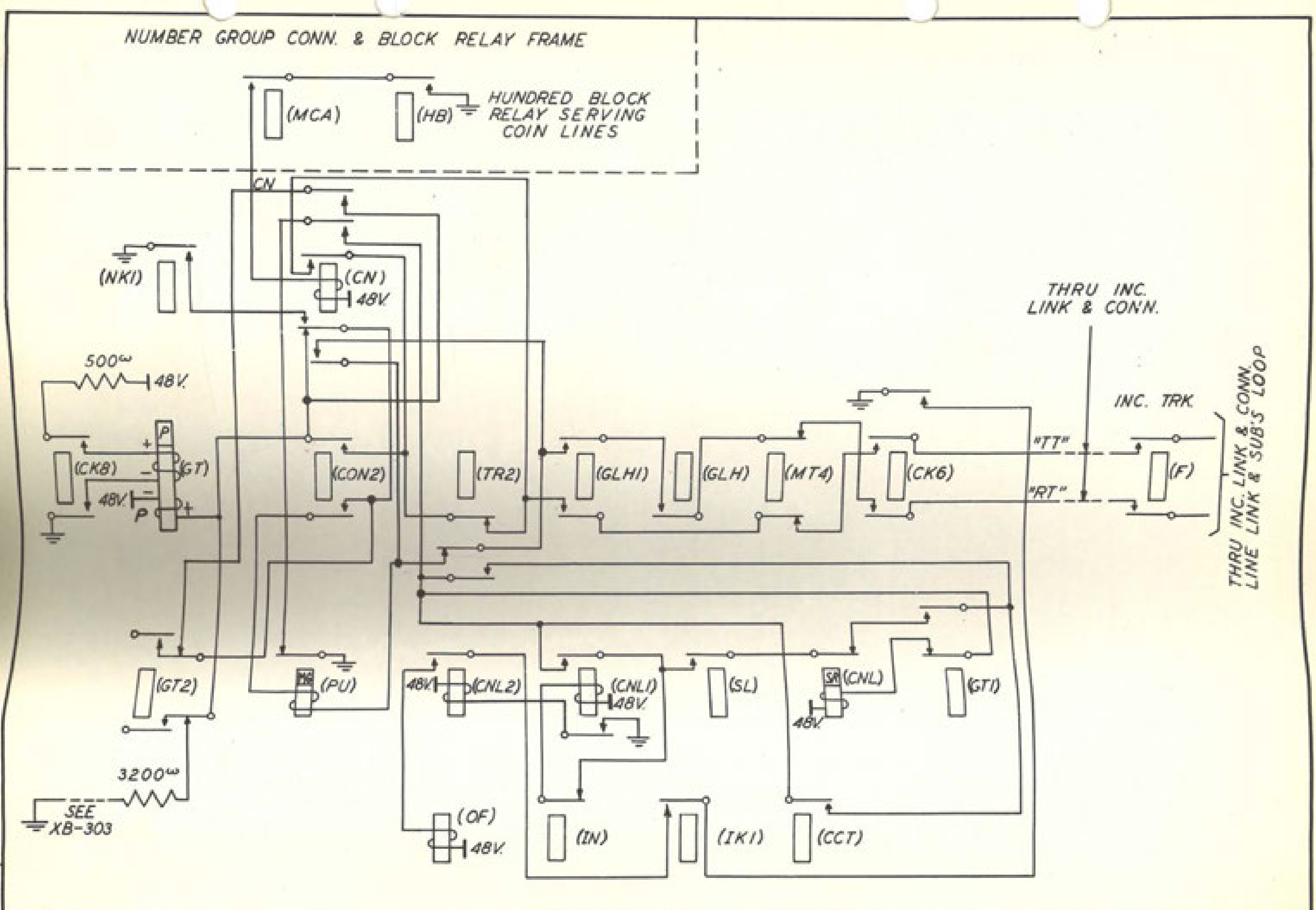
On calls to coin lines, a test is made for receiver off the hook and no coin in the box, this condition does not start an originating call and cause the line to test busy. If a terminating call seizes this line, the short circuit will trip ringing and operate the supervisory relay in the incoming trunk. The marker test for this condition, however, and blocks or returns an overflow signal, if it is encountered and, therefore, prevents a false charge.

Coin lines which are to be tested for this condition must be segregated in blocks of 100. Each hundred block relay in the number group connector has a grounded contact which it is possible to cross-connect to a "CN" lead. The operation of a coin hundred block relay in the number group causes the (CN)

GROUND TEST AND DOUBLE CONNECTION TEST - NON-COIN LINES
ALSO TEST FOR RECEIVER OFF THE HOOK ON COIN LINES

relay in the marker to operate. The (CN) relay operates the slow release (CNL) relay and prepares the tip and ring for the (GT) test. When the (GT2) relay operates the (GT) relay operating circuit is removed and the (GT) relay is left applied to the tip of the line, and ground in series with the (PU) relay is applied to the ring of the line. This provides a circuit for making a loop test of the line. The secondary winding of (GT) is connected in a local circuit through 500 ohms resistance and serves as a biasing winding, determining the point at which the (GT) relay will release with respect to the loop circuit closure. If a short circuit is found on the called line as in the case where the receiver is off the hook, the (GT) relay remains operated. Also, if the insulation resistance is less than the minimum allowable value the (GT) relay will remain operated. If the (GT) relay fails to release due to the line condition not being clear, the marker will time out on first trials and will engage the trouble indicator for record. On second trials, the (GT) test is cancelled and the (GT) test is also cancelled on first trials if a plug is inserted in the (CCT) jack to operate relay (CCT). When the test is cancelled or on second trials the release of the (CNL) relay operates (CNL1) and (CNL2) relays which lock. These relays operate the (OF) relay and the marker is released as on an overflow call.

In the case of plugged up lines, the ground from the plugging up circuit hold relay (GT) over the tip and battery operates relay (PU) over the ring, this will be explained in detail later.



N.Y. TEL. CO.
G.P.S. – L. I.

TERMINATING MARKER

GROUND & DOUBLE CONNECTION TEST – NON COIN LINES
ALSO TEST FOR RECEIVER OFF THE HOOK ON COIN LINES

1	2				

XB-315

MARKER RELEASE ON A REGULAR CALL

The operation of relay (GT2) left relay (GT) connected to the line and if there was no ground on either side of the line relay (GT) released, see XB-315. The release of relay (GT) removes ground from lead "FC" and relay (F) in the incoming trunk releases, see XB-303. On second trials on non-coin lines the circuit to relay (GT) is held open at relay (TR2) and (GT) releases regardless of the condition on the line, see XB-315.

The release of relay (F) in the incoming trunk results in the following operations:

1. It releases relay (LC) in the incoming connector, see XB-303 and the incoming class relays in the marker, see XB-313.

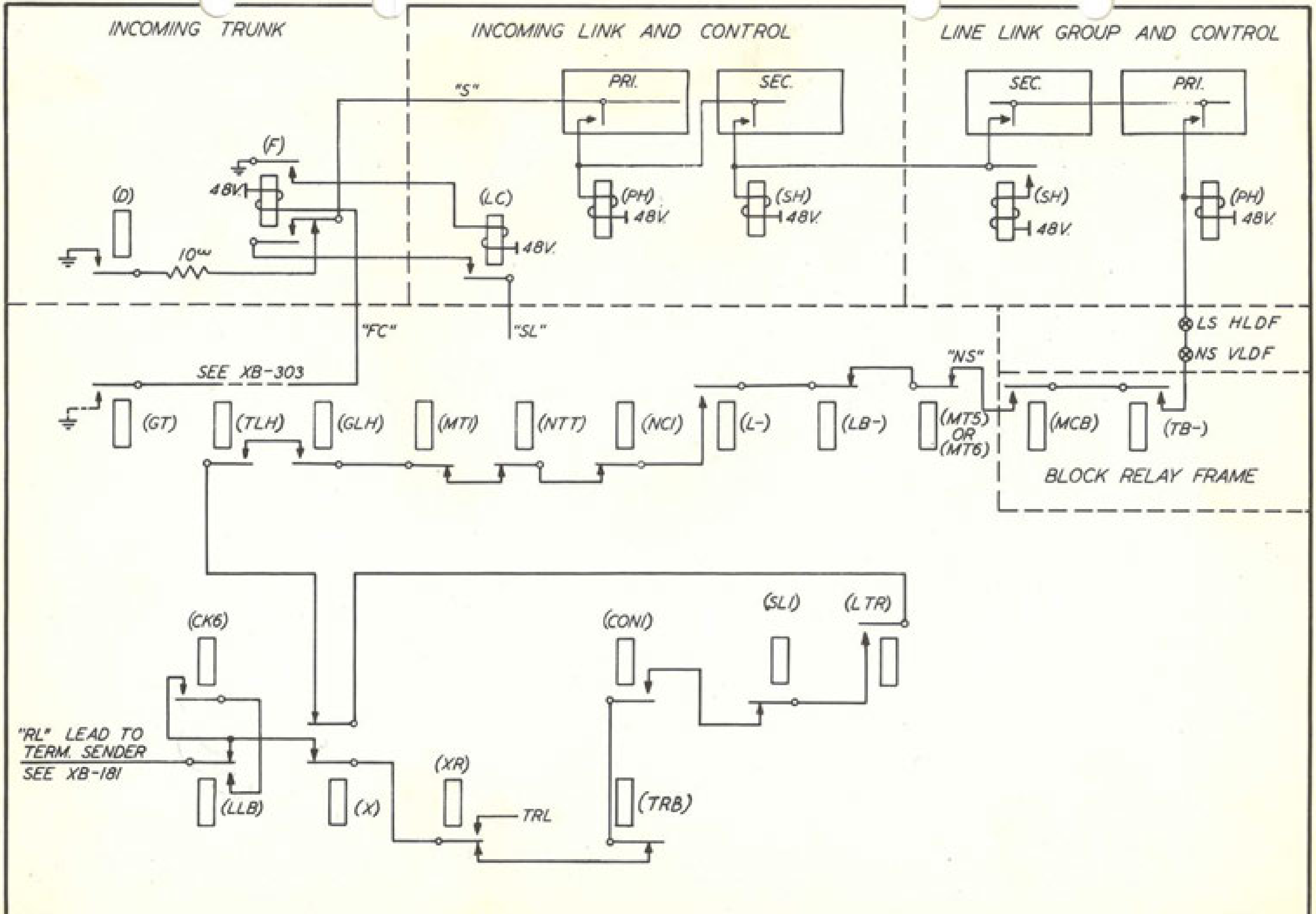
2. It places a 10 ohm ground on the sleeve to hold the incoming and line link hold magnets.

3. It removes ground from lead "SL" to the incoming connector which causes the marker (SL) relay to release followed by relay (SL1) see XB-310.

The release of relay (SL1) removes the ground to the incoming link (PH) hold magnet which was holding the connection prior to the release of relay (F). Relay (SL1) releasing also operated relay (TLH) see XB-311.

If all the crosspoints are properly closed the 10 ohm ground from the incoming trunk is now closed through to the marker over lead "NS" to the "RL" lead of the terminating sender causing it to release the marker connector, see XB-181 and XB-180.

The release of the marker connector opens the register leads and lead "CKG", causing the release of the marker register relays, relays (CK6), (CK7), (CK8), (CK4) and (CK5) and the translator relays. The release of (CK6) removes start battery from the incoming connector circuit which also releases. Relay (CK6) also opens the release lead to prevent an overlap in case the marker is immediately reseized. (CK7) opens the start lead to the line choice and opens the 20 block relay operating circuit. Relays (CK6) and (CK7) also open a large number of off-normal ground leads. The release of the register relays followed by the release of the translator relays removes the start battery to the number group connector.



N.Y. TEL. CO. G.P.S. - L.I.	TERMINATING MARKER MARKER RELEASE ON A REGULAR CALL	1 2 XB-316

BUSY LINE

If an individual line has ground on its sleeve or if all terminal hunting line sleeves of a P.B.X. group are grounded, the marker will attempt to set up the incoming trunk for busy back.

In either case ground originally supplied over the "LR" lead, see XB-305, to an (S-) and (HT-) relays will operate relay (BB). The (BB) relay is slightly slow in operating to prevent a false busy back should an (HT) relay prove slower in operating than the interval allowed by relay (TLT) see XB-305.

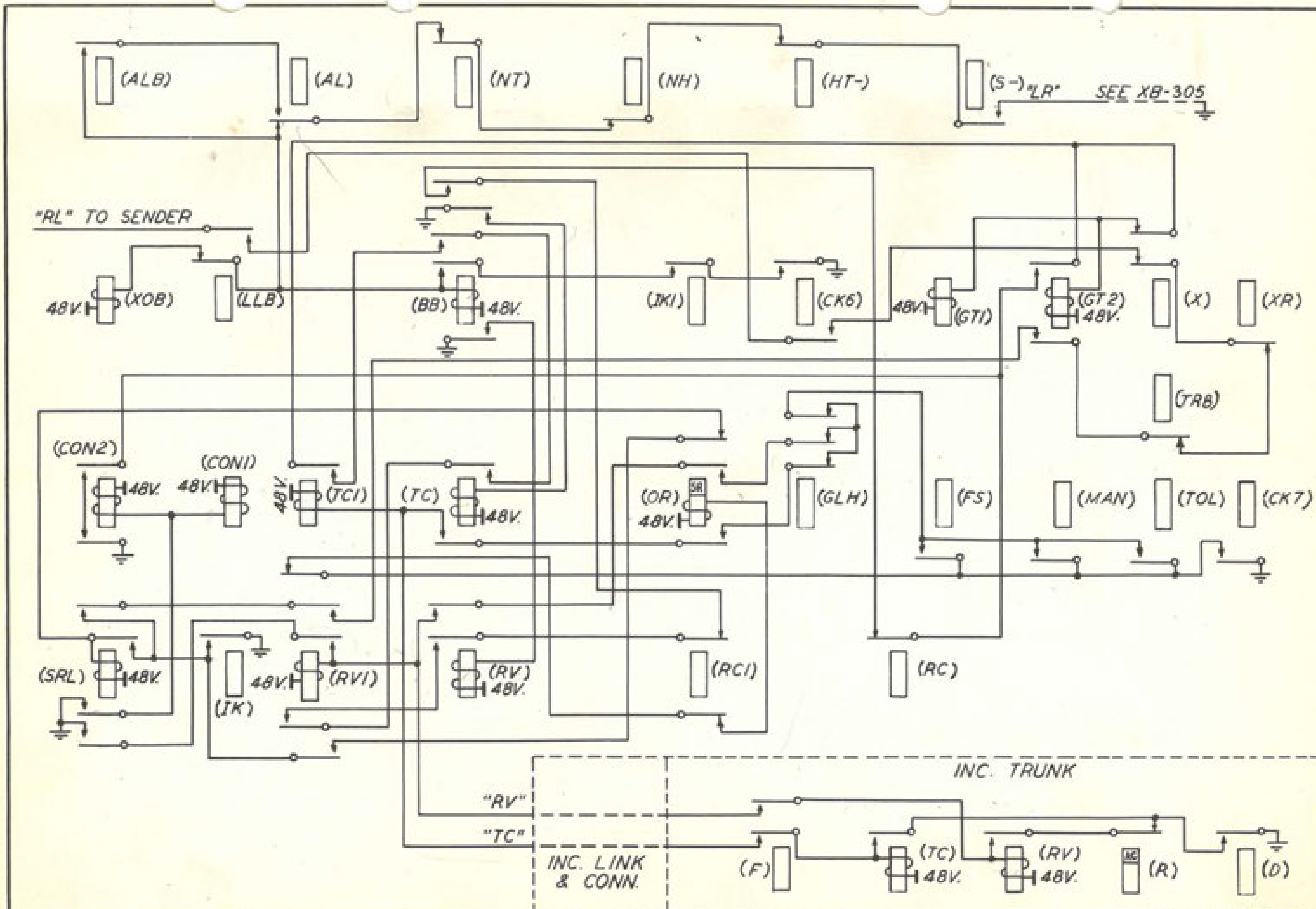
With relay (BB) operated, relays (TC) and (RV) operate which in turn operates relays (TC1) and (RV1) in the marker and (TC) and (RV) in the incoming trunk.

Relay (RV1) operated, opens the operating circuit for slow release relay (OR) which previously operated to off-normal ground, relay (OR) is slow enough in releasing to permit the slowest (RC), (TC) or (RV) relay in the incoming trunk to operate. Upon the release of the (OR) relay, the (SRL) relays operates and in turn operates relays (CON1) and (CON2).

When relay (CON2) operated, it supplied ground to operate relays (GT1) and (GT2), the operating circuit for these relays is as follows; battery at the windings of the (GT1) and (GT2) relays normal contact of (X), make contacts of (TC1), (BB), (TC), (RV1) and (RV), break contact of (RC1), make contact of (BB), break contact of (RC) to ground at the make contact of (CON2).

With relay (GT2) operated, the "RL" lead to the sender is grounded over the following circuit, ground at the make contact of (IK) through make contacts of (SRL), (RV1) and (GT2), break contacts of (XR) and (X), make contact of (CK6) and (LLB) to the "RL" lead. The marker is now released as on a regular call.

The (SRL) relay maintains the (RV1) relay locked in order to prevent a short closure on the "RL" lead, otherwise the operation of the (GT2) relay and consequent release of (GT) relay and the trunk (F) relay and marker (RV1) relay in cascade would cause the reoperation of the (OR) relay and thus interrupt the release ground.



N.Y. TEL. CO. G.P.S. - L.I.	TERMINATING MARKER BUSY LINE	1 2 GLW XB-317

TC + RV

OVERFLOW

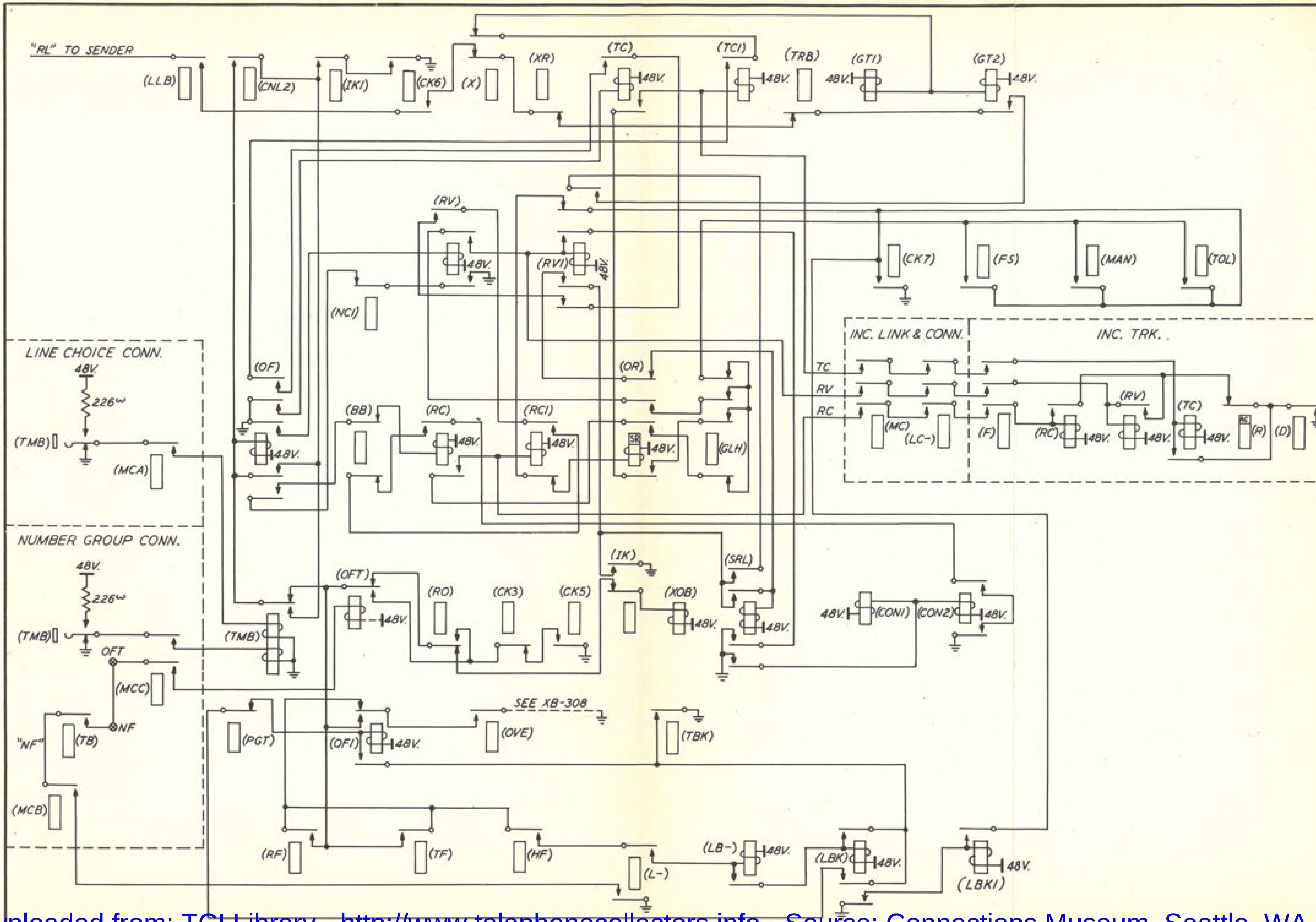
If all available channels are busy, relay (PGT) operates and closes ground through the operated (OVE) relay, see XB-308 to operate the (OF) relay if the call is for a line other than first or intermediate of a P.B.X. group. If the called line was a first or intermediate line of a P.B.X. group relay (HF) would be operated and this ground would operate a (LB-) relay and in turn relay (LBK) which locks to relay (TBK), when relay (PGT) returns to normal, relay (OF1) operates to ground through a make contact of relay (LBK). As will be described later, the (LB-) relay caused the selected line to appear busy and another line is selected. If all available channels to this second line are busy, ground supplied a second time from relay (OVE) will operate relay (OF) through the make contacts of relay (OF1).

Should the selected number group connector or line choice connector frame be made busy, relay (TMB) will operate, which in turn operates relay (OF) as soon as relay (IK1) is operated.

When a special number is assigned to test overflow tone, the "NF" punching of the twenty block relay is cross-connected to the "OFT" punching, ground from the operated (L-) relay operates relay (OFT) which in turn operates relay (OF).

On reorder calls, relay (RO) is operated which also operates relay (OF).

When relay (OF) is operated, it locks to off-normal ground, and operates relays (TC) and (RV), the latter in turn operating relay (RC). Relays (RC1), (TC1) and (RV1) operate locally and relays (RC), (TC) and (RV) in the incoming trunk from the contacts of correspondingly designated marker relays. The (RV1) and (RC1) relays open the operating path for relay (OR), which is slow release to insure time to operate the incoming trunk relays. The release of relay (OR) closes a path to operate relay (SRL) which operates relays (CON1) and (CON3). Ground from the make contact of relay (CON2) operates relay (GT1) and (GT2). With relay (GT2) operated, the release lead to the sender is grounded from ground supplied through make contacts of relay (SRL).



1/2
XB-318

TERMINATING MARKER
OVERFLOW

N.Y. TEL. CO.
G.P.S. - L.I.

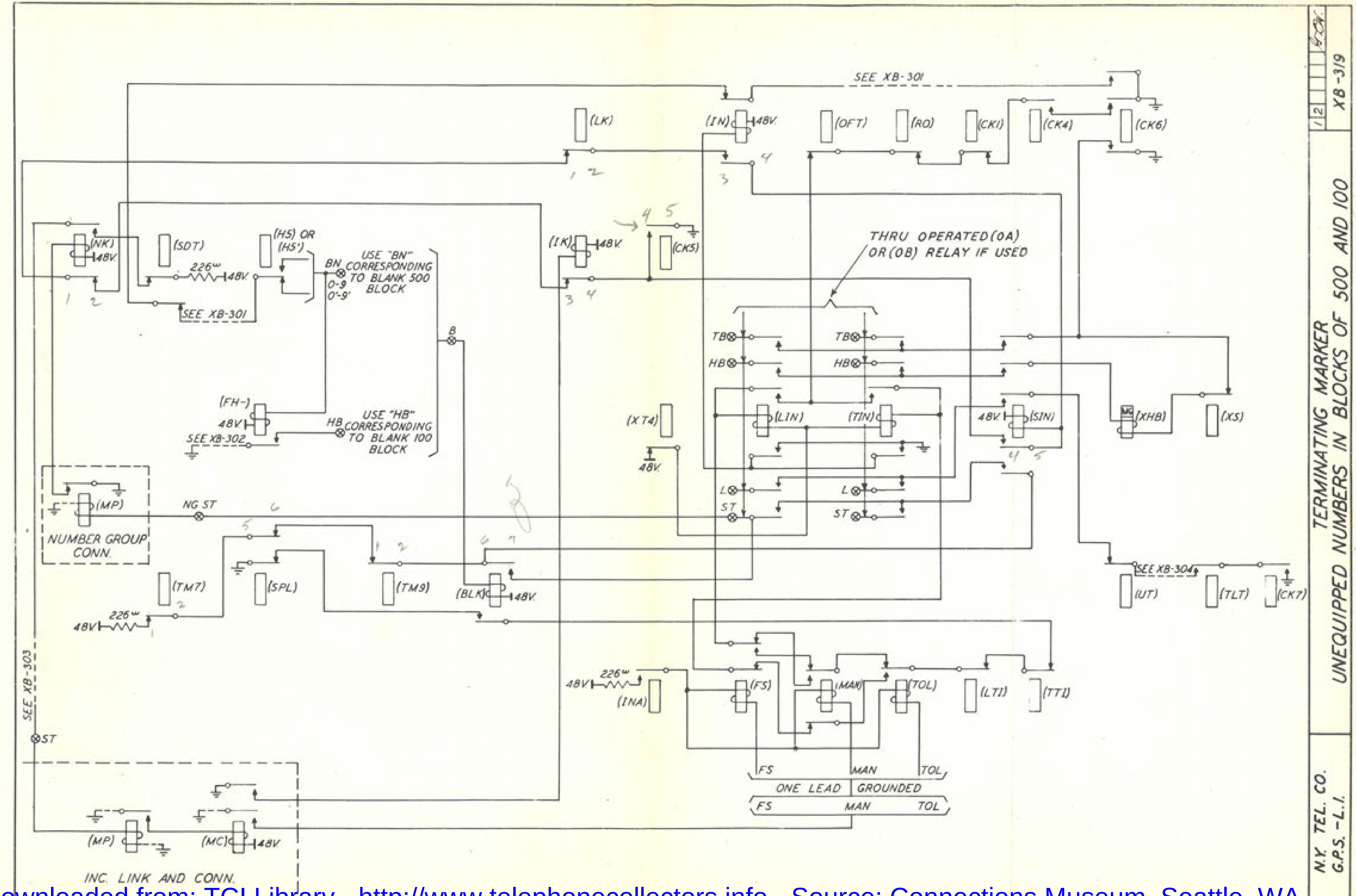
UNEQUIPPED NUMBERS IN BLOCKS OF 500 AND 100

When a 500-block is omitted, corresponding relays for that block in the number group connector and marker need not be furnished. When a 500-block is not equipped, the corresponding terminal "BN" is cross-connected to terminal "B" to operate the blank number relay (BLK).

When a five hundreds block relay is equipped but one or more of its hundred blocks of numbers are blank, the corresponding "HB" terminals are cross-connected to terminal "B" to operate the blank number relay (BLK).

The ground which normally operates relay (FH-) or grounds the "HB" lead to the number group, grounds the "B" terminal and operates relay (BLK) to which it is cross-connected. Relay (BLK) operated, places battery on the start lead to the number group connector in which the local intercept trunks have their terminals. The marker preference relay in the number group connector operates and in turn operates the (NK) relay which places battery on the incoming connector start lead. Seizure of the incoming connector results in the operation of one of the class relays (FS), (MAN) or (TOL). The operation of (FS) or (MAN) will operate relay (LIN) for local intercepting or if relay (TOL) operates it in turn, operate relay (TIN) for toll intercept. With either (LIN) or (TIN) operated relay (IN) will operate, which opens the operating circuit for relay (BLK). This drops the number group connector and incoming connector, releasing relays (NK) and (IK). With these relays normal, relay (SIN) operates through contacts of the operated (IN) relay, making effective the cross-connections of the operated (LIN) or (TIN) relay for routing the call to intercept.

The intercept trunks appear on primary verticals of line link frames in the same manner as a subscriber's line and a group of these trunks are tested as a P.B.X. The "ST", "HB" and "TB" leads of relay (LIN) and (TIN) are cross-connected as for a regular call while the "L" terminal is cross-connected to operate an (L-) relay corresponding to the location in the twenty block relay.


TERMINATING MARKER
UNEQUIPPED NUMBERS IN BLOCKS OF 500 AND 100
N.Y. TEL. CO.
G.P.S.-L.I.
XB-319
SEE XB-301
(LK)
(IN)
48V.
(OFT)
(RO)
(CK1)
(CK4)
(CK6)
(NK)
48V
(SDT)
(HS) OR (HS')
226ω
48V
USE "BN" CORRESPONDING TO BLANK 500 BLOCK
BN
0-9
0'-9'
SEE XB-301
(IK)
48V.
(CK5)
THRU OPERATED (OA) OR (OB) RELAY IF USED
TB
HB
L
ST
B
(FH-)
48V
SEE XB-302
USE "HB" CORRESPONDING TO BLANK 100 BLOCK
HB
(XT4)
48V.
(LIN)
(TIN)
48V
(SIN)
(XHB)
(XS)
(MP)
NG ST
NUMBER GROUP CONN.
(TM7)
(SPL)
(TM9)
(BLK)
48V.
226ω
48V
SEE XB-304
(UT)
(TLT)
(CK7)
SEE XB-303
ST
48V
226ω
(INA)
(FS)
(MAN)
(TOL)
(LT1)
(TT1)
FS
MAN
TOL
ONE LEAD GROUNDED
FS
MAN
TOL
(MP)
(MC)
48V
INC. LINK AND CONN.

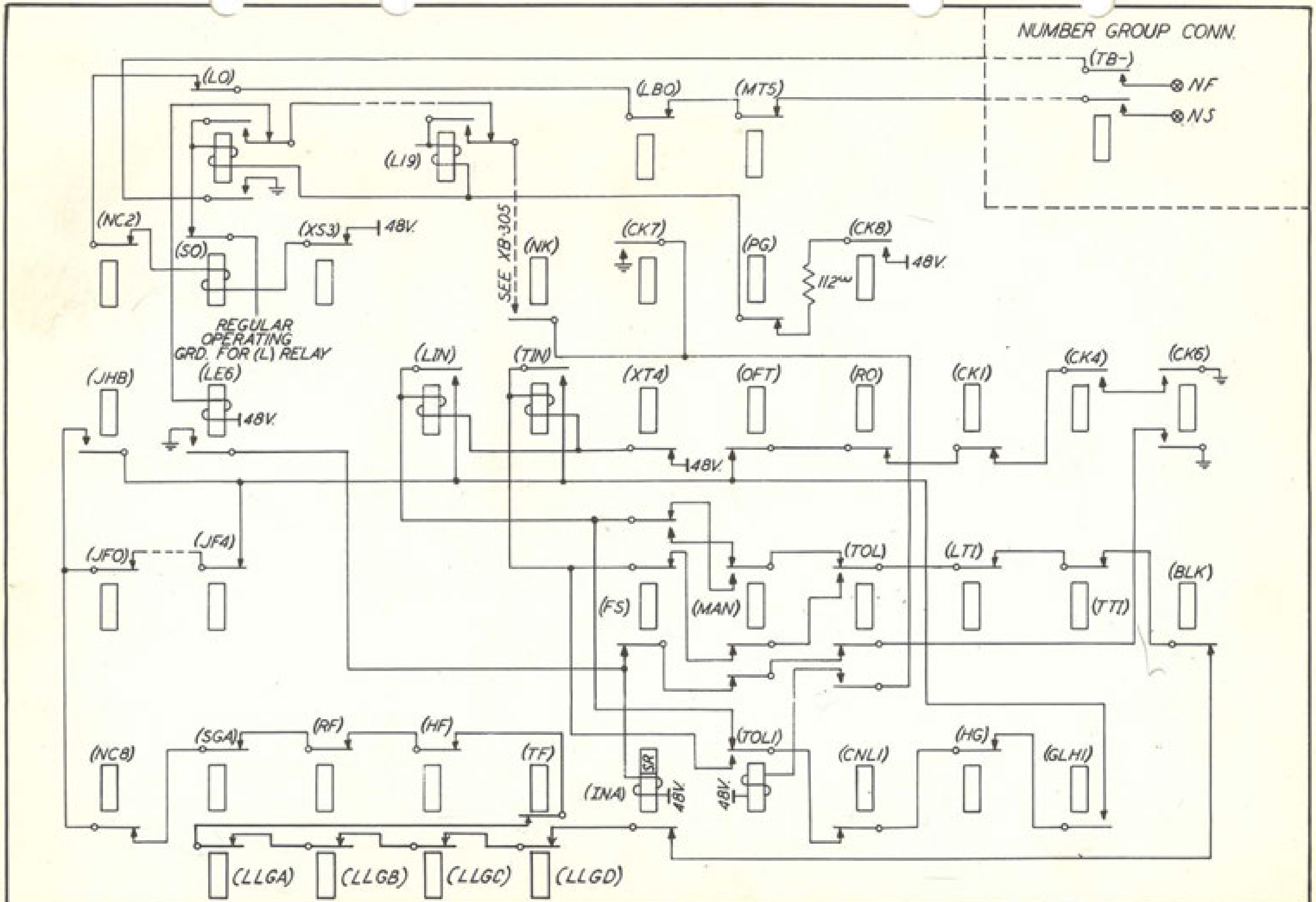
UNEQUIPPED INDIVIDUAL NUMBERS

An individual number may be left blank or placed on intercept by omitting the line cross-connections in the number group connector. The marker in testing will find either the "NF" or the "NS" lead open and will recognize the open lead as a signal to route the call to the intercept operator.

Assuming that all the line cross-connections have been removed as in the case of a line permanently disconnected, the marker proceeds with the call in the normal manner up to the operation of the (L) relay following the selection of the line. The operated (L) relay grounds leads "NF" and "NC". Normally one of the (RF), (HF) or (TF) relays would operate to the "NF" lead and in a like manner one of the (LLGA), (LLGB), (LLGC) or (LLGD) relays would operate to the "NC" lead. In this case however the "NF" and "NC" cross-connections have been omitted, these relays will fail to operate. The operated (L) relay releases relay (LEG) removing ground which has been holding slow release relay (INA) operated. With relay (INA) released, ground is closed through contacts of the (RF), (HF), (TF), (LLGA), (LLGB), (LLGC) and (LLGD) relays normal and relays (TOL), (MAN) and (FS) normal or operated to operate relay (LIN) and (FS) normal or operated to operate relay (LIN) for local intercept or (TIN) for toll intercept.

A call will also be routed to intercept if the "F" and "C" leads are closed but the "S" lead is open. In this case, the call proceeds up to the operation of relay (SL1) in the usual manner. (SL1) operates (GLH) and (HG) and opens the circuit to slow release (TLH) which operated to ground on (MK). When (GLH) operates, it operates (GLH1) from ground on (HG) relay. (GLH1) locks through (GLH). Should the line sleeve be open (HG) will release when (TLH) releases, see XB-311. With relay (HG) normal either (LIN) or (TIN) will operate.

The call will now be routed to intercept which will be explained later.



N.Y. TEL. CO.
G.P.S. – L.I.

TERMINATING MARKER
UNEQUIPPED INDIVIDUAL NUMBERS

1	2				

XB-320

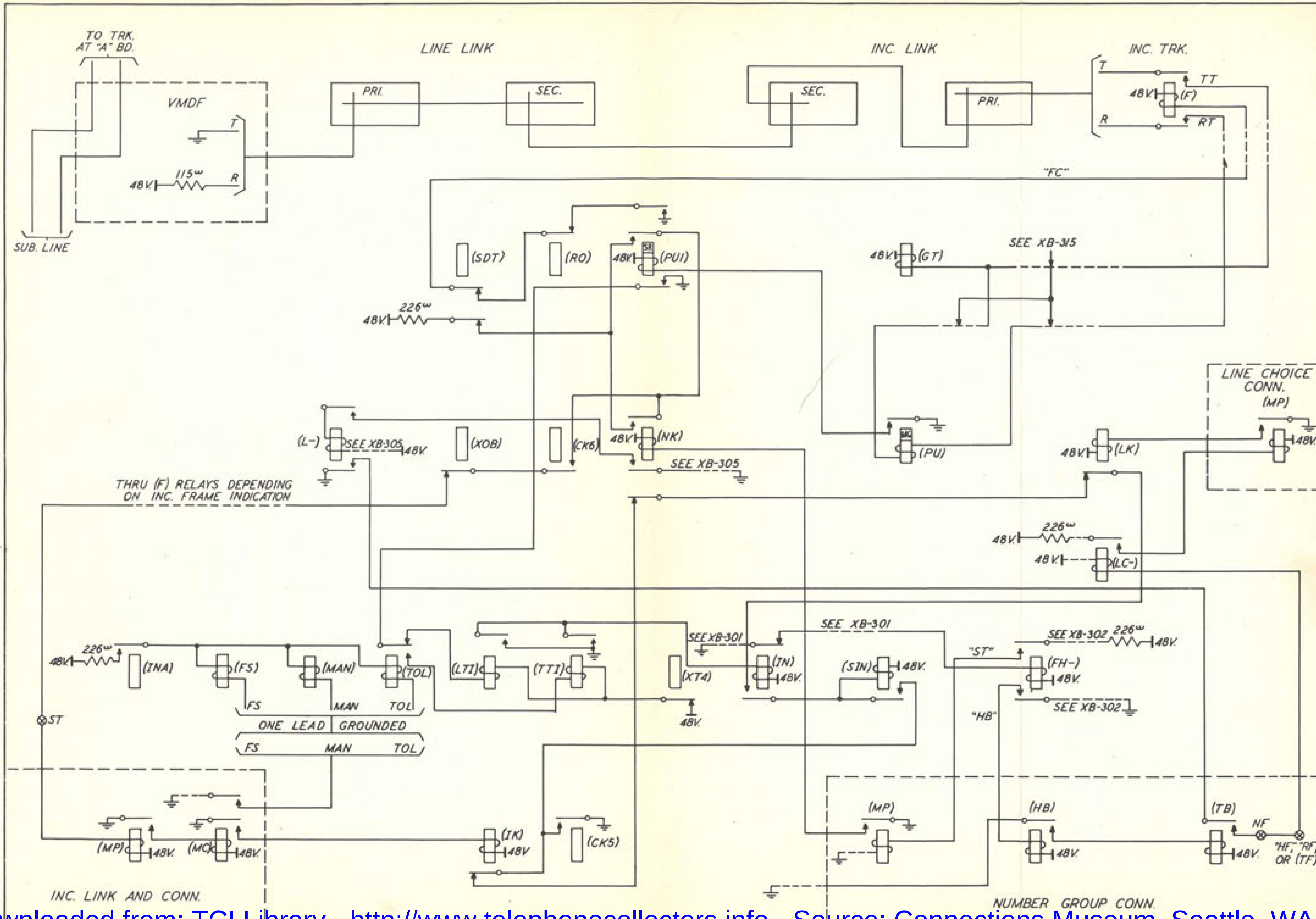
TROUBLE INTERCEPT

When a line is plugged up, a shoe is inserted at the V.M.D.F. which splits the originating end from the terminating end, placing a trunk circuit at the "A" board on the originating end and solid ground on the tip and 115 ohm battery on the ring of the terminating end.

When the marker makes the ground test on a plugged up line, it finds the plugging up ground on the tip which holds relay (GT) operated and prevents the release of the incoming (F) relay. It also finds low resistance battery on the ring which operates relay (PU), and in turn operating relay (PU1). With relay (PU1) operated, it holds the (F) relay in the incoming trunk circuit operated and operates and locks either the (LTI) or (TTI) depending on whether relay (TOL) is operated or normal.

Relay (LTI) or (TTI) operates relay (IN) which releases relay (FH-). The number group connector is thereupon released, releasing relay (NK). The operated (CH-) relay held by ground from relay (NK) is released, this opens the hold magnet operating ground supplied by the marker and the train of hold magnets starts to release, see XB-309 and 310. As soon as the first tip or ring crosspoint opens, relay (PU) releases, which opens the operating circuit for relay (PU1) but relay (PU1) is slow releasing to delay the release of the (F) relay of the incoming trunk circuit until the train of holding magnets has had ample time to release; otherwise the release of relay (F) would provide a holding circuit and prevent the release of the holding magnets. The (PU1) relay also maintains battery on the incoming start lead to prevent another marker from seizing the incoming frame, operating another (F) relay and possibly causing interference.

The release of relay (PU1) releases the incoming connector and with relays (NK), (IK) and (LK) normal, relay (SIN) operates making effective the contacts of relays (LTI) and (TTI) which will be described later.



XB-321

TERMINATING MARKER
TROUBLE INTERCEPT

N.Y. TEL. CO.
G.P.S.-L.I.

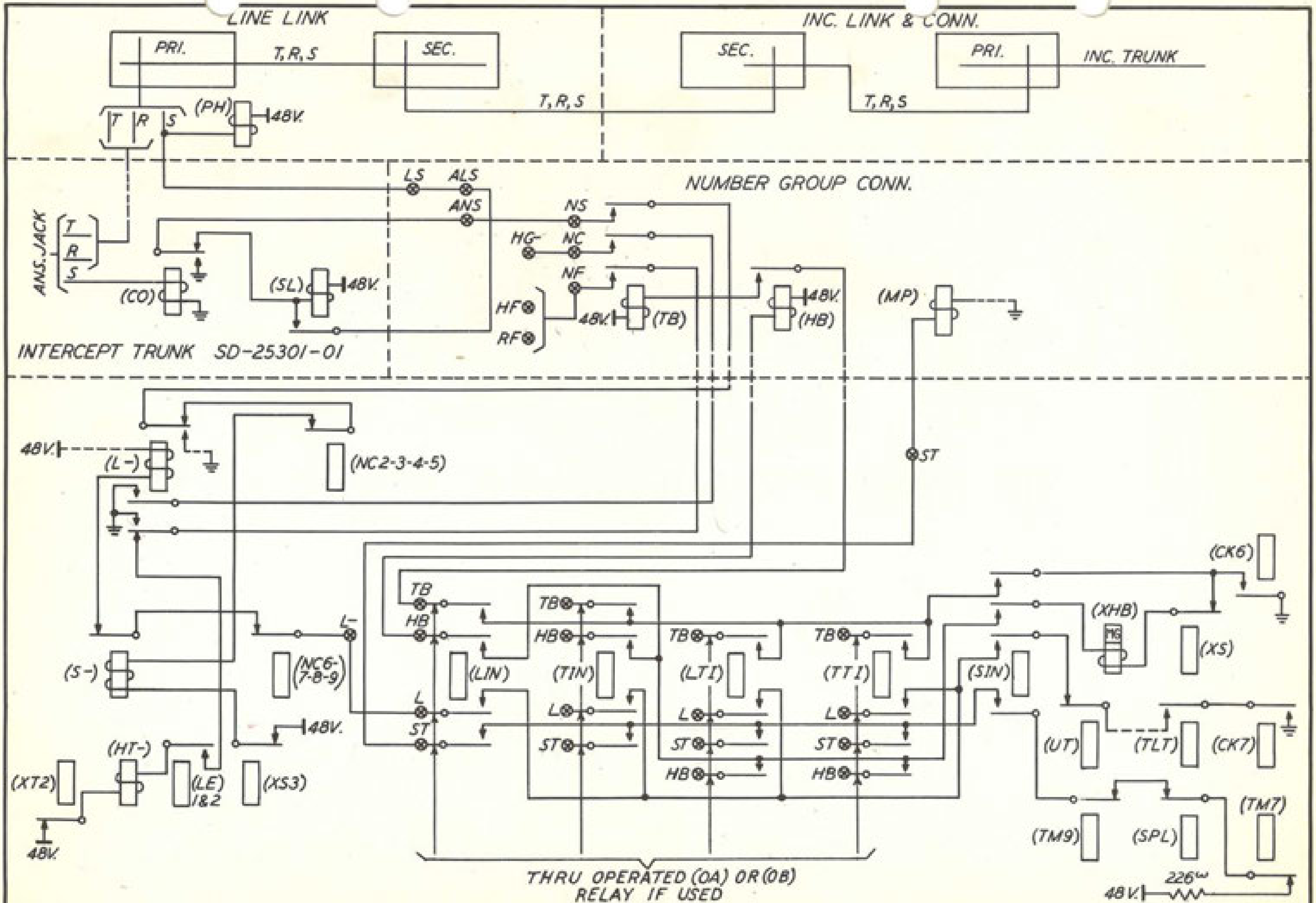
INTERCEPTED CALLS

When relay (LIN), (TIN), (LTI) or (TTI) operates it has indicated that the call is to be terminated to local intercept trunks, toll intercept trunks, local trouble intercept trunks or toll trouble intercept trunks, respectively.

All intercept trunks appear on primary switches of line link frames, therefore, in order to terminate a call to them a hundred block and twenty block relay in some number group connector must be operated. The "NC" and "NF" cross-connections will be made the same as for any subscriber's line but the "NS" cross-connection is made to "ANS" punching and its associated "ALS" punching is cross-connected to the "LS" punching.

As has been explained, with any one of the (LIN), (TIN), (LTI) or (TTI) relays operated, relay (SIN) operates and the marker restores any connection that may have been set up, in order to terminate this call to an intercept trunk.

With relay (SIN) operated, the "ST", "HB", "TB" and "L" terminals of the operated intercept relay becomes effective, starting a number group connector and operating a hundred block and twenty block relay in that circuit, also operating one of the (L-) relays in the marker. Since the "NS" lead is cross-connected to a "ANS" punching associated with an intercept trunk and if that trunk is busy, as indicated by its (CO) relay being operated, the (HT-1) relay will operate if the trunk is not the last of the group. Should the trunk be idle, however, one of the marker (L-) relays will operate as on a regular call and ground the "NS" lead which would normally operate the line link primary hold magnet, but in this case, it grounds the "ANS" lead to the intercept trunk to operate relay (SL) which in turn grounds the "ALS" lead to operate the primary hold magnet of the line link frame. The subscriber now receives audible ringing until the intercept operator answers.



N.Y. TEL. CO.
G.P.S. - L.I.

TERMINATING MARKER INTERCEPTED CALLS

1 2

XB-322

P.B.X. ALLOTTER AND FREE LINES

P.B.X. ALLOTTER

The function of this circuit is to distribute calls on large or busy P.B.X. groups over two number group connectors should the load prove to be excessive for one connector. Relays (ALW) and (ALZ) function on every call regardless of its type and operate either relay (AL1) or (AL2) from ground on (ALW). On calls to an allotted P.B.X., the "ST" lead of relay (FH) is cross-connected to operate an (SH) relay and from the (SH) relay the leads associated with twenty directory numbers are cross-connected as follows: the "AL" lead to the "AL" punching to operate relay (AL) and (NFL), leads "ST", "HB" and "TB" to one of the twenty sets of punchings "ALC-ST", "ALC-HB" and "ALC-TB" associated with relays (AL1) and (AL2), causing this set of punchings on one of the relays (AL1) or (AL2) to become effective when relay (HPE) operates. With relay (AL) operated the circuit is opened which normally operates an even numbered (HP) relay. With all the (HP) relays normal, relay (HPE) operates through their back contacts, through an operated contact of relay (AL) or (NAL), back contact of (ALA) to ground on (CK7). The number group connector associated with the effective leads now functions in a normal manner, if an idle line is found in the first 20-block the call is completed, but if no idle line is found, the marker end of block hunts, using operated (UT) relay, see XB-304, until it encounters a busy "last line" which will be the last line of that P.B.X. in the first selected number group connector. This causes the operation of relay (ALA) from ground which normally operates relay (BB) but which is switched by relay (AL) to the winding of relay (ALA). The operation of relay (ALA) causes the (ALW) and (ALZ) combination to function so that the operated (AL1) or (AL2) relay releases, in turn releasing the number group connector which releases relay (NK) along with other relays. With relay (NK) normal a circuit is closed to operate relay (ALB) which allows relay (ALW) and (ALZ) to again function and complete a circuit to operate (AL1) or (AL2) but this time a different one than was operated on the last attempt. This causes a second number group connector to be seized and the call proceeds as on the first attempt, if all lines again appear busy, relay (BB) will operate through a make contact of relay (ALB).

FREE LINES

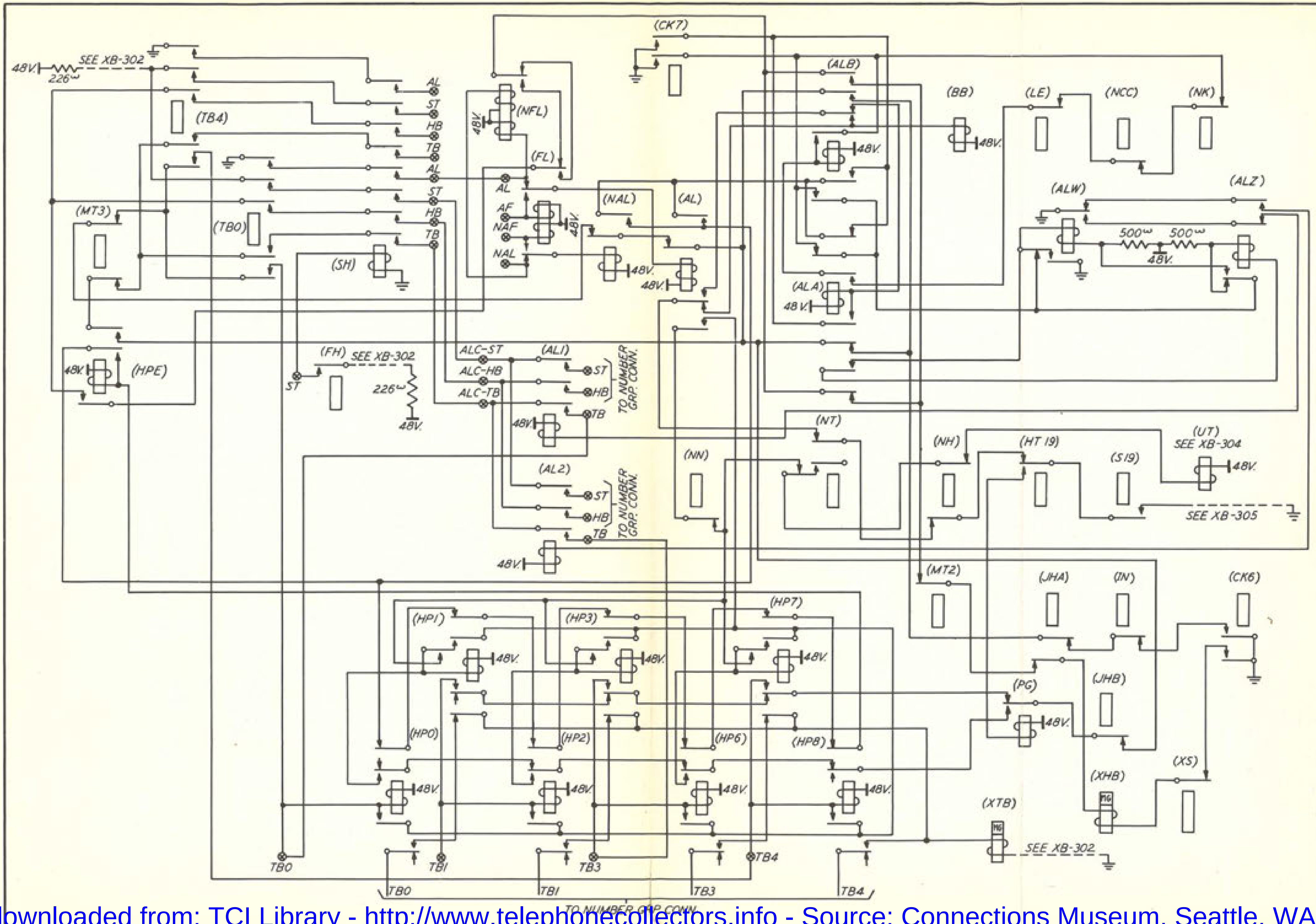
Lines which may be called free of charge are grouped in special 20 blocks on the number group connectors. If any line in a 20 block is a free line all in that block must be free. If any 20 block in a hundred block consists of free lines, a (SH) "split hundreds" relay must be furnished for that hundred block. The "AL" terminal of the (SH) relay for the free line 20 blocks are cross-connected to (NAF) punching on relay (FL), if the free lines are not allotted between two number groups, and to punching "AF" if they are allotted. Operation of (FL) causes the operation of (AL) or (NAL) relay depending on which terminal is grounded.

For non free line 20 blocks on a split hundreds relay, the "AL" terminal on relay (SH) is cross-connected to terminal "AL" or "NAL". In addition to relay (NFL) operating, one of relays (AL) or (NAL) is operated depending upon whether the 20 block is allotted. The operation of relay (FL) plus relay (NFL) because of trouble, blocks the call by opening the 100 block operating circuit.

P.B.X. ALLOTTER AND FREE LINES

FREE LINES

As shown on XB-313 and 314, when class relay (FS) is operated by the incoming trunk, the operated (FL) relay operates relay (TC), which in turn operates relay (TC1) locally and relay (TC) in the incoming trunk circuit. The marker also checks relay (TC) against (TC1). The function of relay (TC) in the incoming trunk when incoming trunk relay (RV) is normal is to cancel supervision and thus prevent charging. Since the combinations of (TC) with (RC) and (RV) are used for busy back and overflow signals, tip party lines cannot be free lines.



TERMINATING MARKER P.B.X. ALLOTTER AND FREE LINES

XB-323

N.Y. TEL. CO.
G.P.S. - L.I.

JUMP HUNTING

By means of specially cross-connected terminals in the number group connector, the marker may be made to furnish the type of terminal hunting progress known as jump hunting. This feature is used principally to increase the size of a terminal hunting group without changing numbers when the numbers following the group have been assigned to subscribers.

In order to jump hunt, the last terminal of the first group, which will usually be some terminal other than the twentieth of a 20-block, must be specially cross-connected and is, therefore, not available for cross-connection to a line unit. The "NF" and "NC" punchings of this number on the twenty block relay cross-connect to jump hunting fields on the block relay frames, the "NF" cross-connecting to one of five strips designated "JFO" to "JF4" and the "NC" to one of the ten even numbered strips designated "JCO" to "JC18". Since the "NS" lead of this specially cross-connected line is left open, this line tests idle to the marker and the corresponding (L) relay operates and grounds the "NC" and "NF" leads.

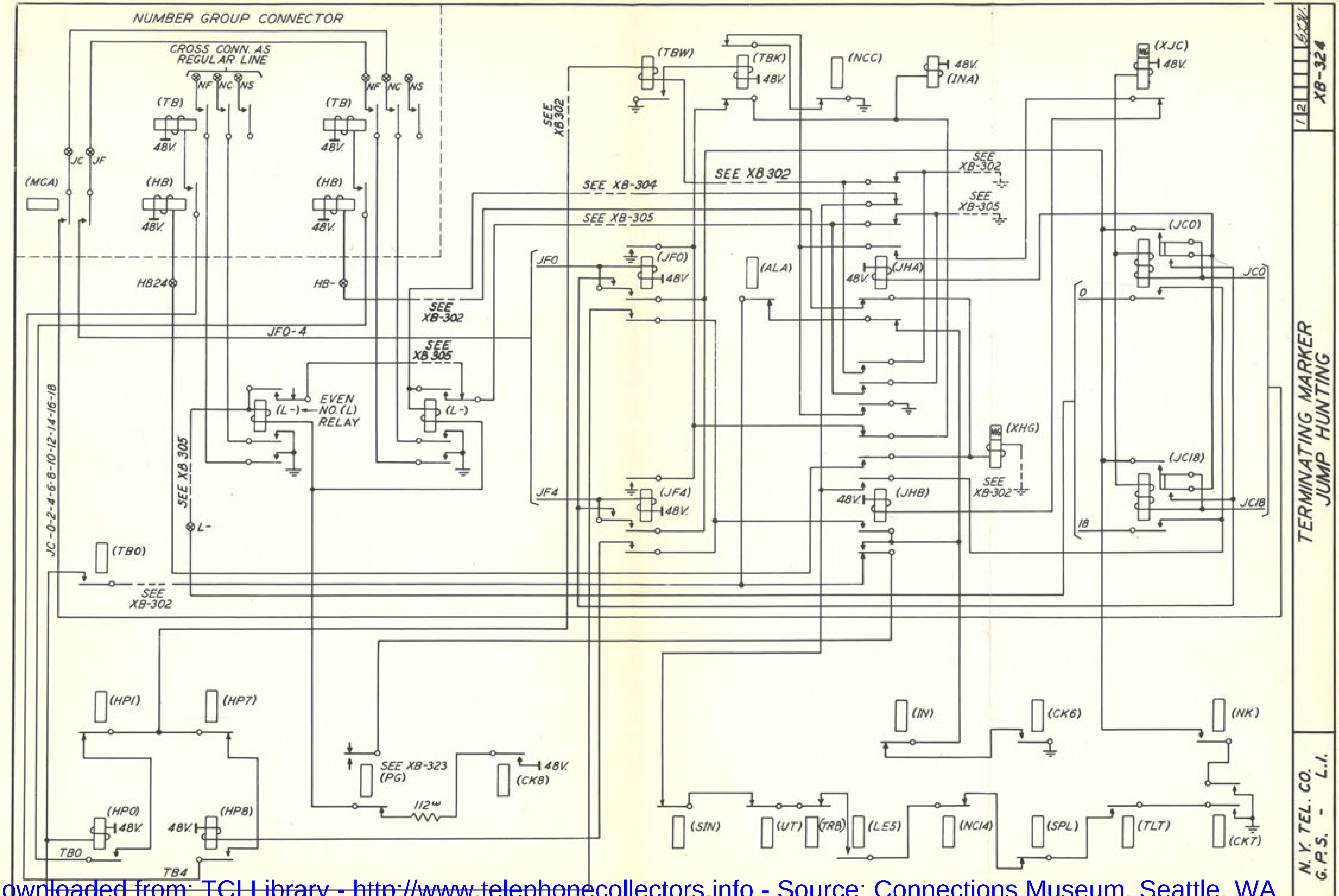
The ground on the "JF" lead operates one of five relays in the marker (JFO) to (JF4) which corresponds to the 20-block of the 100-block jumped to. Ground on the "NC" lead operates one of ten relays (JCO) to (JC18) which corresponds to one of ten even numbered start points in the 20-block jumped to. The 100-block jumped to is always (HB24) of the same number group.

The operation of one of the relays (JFO) to (JF4) and one of the relays (JCO) to (JC18) causes relay (JHA) to operate. With relay (JHA) operated (1) the 100-block relay (HB) in the number group connector releases (2) the operating and locking, ground for the (L) relay used is opened (3) the ground which operated an even numbered (HP) relay is removed which in turn removes the ground which operated a (TB) relay in the number group connector in series with relay (TBW). When relay (TBW) releases indicating the number group connector twenty-block relay has been released, relay (TBK) releases, closing a path to operate relay (JHB).

With relay (JHB) operated (1) it connects the (L) relay operating ground previously disconnected from the tens and units register by relay (JHA) through the contacts of the operated (JC) relay to operate one of the even numbered (L) relays; (2) it opens one of the parallel grounding paths from one of the (JF) relays to the winding of relay (IMA); (3) it closes ground to the "HB24" lead to operate the (HB) relay in the number group connector through which jump hunting lines are seized (4) it grounds a lead to operate an even numbered (HP) relay under control of the operated (JFO) to (JF4) relay operated for the purpose of seizing a 20-block relay; (5) it recloses the 20-block relay operating ground; (6) it recloses the armature of the (PG) relay.

With the jump hunting 100-block and 20-block relay operated and an (L) relay operated, the call is handled as a regular call since the "NF", "NC" and "NS" cross-connections are made in the regular way.

The jump hunting feature can only be used once on a call, but the marker can jump hunt after end of block hunting and end of block hunt after jump hunting, any end of block hunting which occurs after jump hunting must be confined to the twenty blocks associated with lead "HB24" of the number group.


NUMBER GROUP CONNECTOR
CROSS CONN. AS REGULAR LINE
NF NC NS
(TB)
48V.
JC JF
(MCA)
(HB)
HB24
HB-
JFO-4
SEE XB-302
SEE XB 305
EVEN NO. (L) RELAY
(L-)
JC-0-2-4-6-8-10-12-14-16-18
SEE XB 305
L-
(TBO)
SEE XB-302
(TBW)
(TBK)
(NCC)
(INA)
(XJC)
SEE XB302
SEE XB-304
SEE XB-305
SEE XB 302
SEE XB-302
SEE XB-305
JFO
(JFO)
(ALA)
(JHA)
(JCO)
JCO
O
(XHG)
(JC18)
JF4
(JF4)
(JHB)
JC18
18
(HP1)
(HP7)
SEE XB-323 (PG)
(CK8)
112ω
(HPO)
(HP8)
TBO
TB4
(IN)
(CK6)
(NK)
(SIN)
(UT)
(TRB)
(LES)
(NC14)
(SPL)
(TLT)
(CK7)
TERMINATING MARKER JUMP HUNTING
XB-324
1 2
N.Y. TEL. CO.
G.P.S. - L.I.

NUMBER CHECKING CALL

When one of the two special markers is seized for a number checking call, relay (SPL) is operated from the terminating marker connector. Registration, translation and seizure of a number group connector frame and the incoming link and connector frame proceeds as for a regular call up to the point at which the line busy test is made. This busy test is cancelled. Although the (S) relay may operate from ground on a busy terminal sleeve, the (S) relays are made ineffective for returning a busy signal because the ground which the (TLT) relay ordinarily closes is opened in this case at a break contact of the (SPL) relay. When the incoming frame is seized, the (NC1) relay operates from a ground supplied by the incoming trunk circuit. The operation of relay (NC1) causes the operation of relays (NC2-5), (NC6-9) and when the (TBK) relay is operated, a circuit through the (NC1) relay also operates relays (NC10-13). This same circuit also continues after the (NC10-13) relays are operated and causes the operation of relay (NC14). When the (NC2-5) relays have operated, the circuits to the (S) relays are opened as shown on XB-305, the sleeve leads with (NC2-5) operated are directed to the number checking circuit.

At the time the (NC14) relay operated, the (NCT) relay starts to release. The (NCT) relay had previously been operated by ground supplied when the (SPL) relay operated. The (NCT) relay is a slow release relay to introduce a time element allowing for the return of a number check signal. The operation of the (NC1) relay also opens the circuits to the ringing and tone control relays, see XB-313.

When the (NC14) relay has operated, a circuit is closed from the 135 cycle generator through the (NCC) relay normal, (NC14) relay operated, with other relays to one of the "L" leads, relays (NC6-9) operated through the resistance and condenser and (NC10-13) relays operated, (NC2-5) relays operated to the "NS" leads. This 135 cycle path will be closed to the sleeve of the called line and if the called line is one of a terminal hunting group, the (HT) relays corresponding to the first and intermediate lines will have operated in the usual manner. The operation of the (HT) relays will extend the 135 cycle path through contacts of the operated (HT) relays to each of the line sleeves of the terminal hunting group in the same 20-block. If the sleeve is connected to an "A" operator trunk, the 135 cycle current will be extended through the cord circuit and condenser in the cord circuit and will return to the marker over the "CTL" lead to operate the (NC) relay since it will respond to the 135 cycle current and cause relay (NCA) to operate. With relay (NCA) operated, relay (OK) operates, relay (NCA) also removes ground from the armature of relay (NCT) to make it ineffective in causing a failure signal to be transmitted or in causing a test to be made of additional terminal hunting lines. With relay (OK) operated, relays (RV) and (RC) operate, in turn operating relays (RV1) and (RC1) in the marker, also (RV) and (RC) in the incoming trunk to give a steady light to the operator as an O.K. check. The operating circuit of relay (OR) is opened by relays (OK), (RC1) and (RV1) and this slow releasing relay allows enough time during its release to insure the operation of the trunk relays. Relay (OR) released, operates relay (SRL) in turn operating relays (CON1), (CON2), (GT1) and (GT2), grounding the release lead and releasing the marker, these operating circuits are shown on XB-314 and 317.

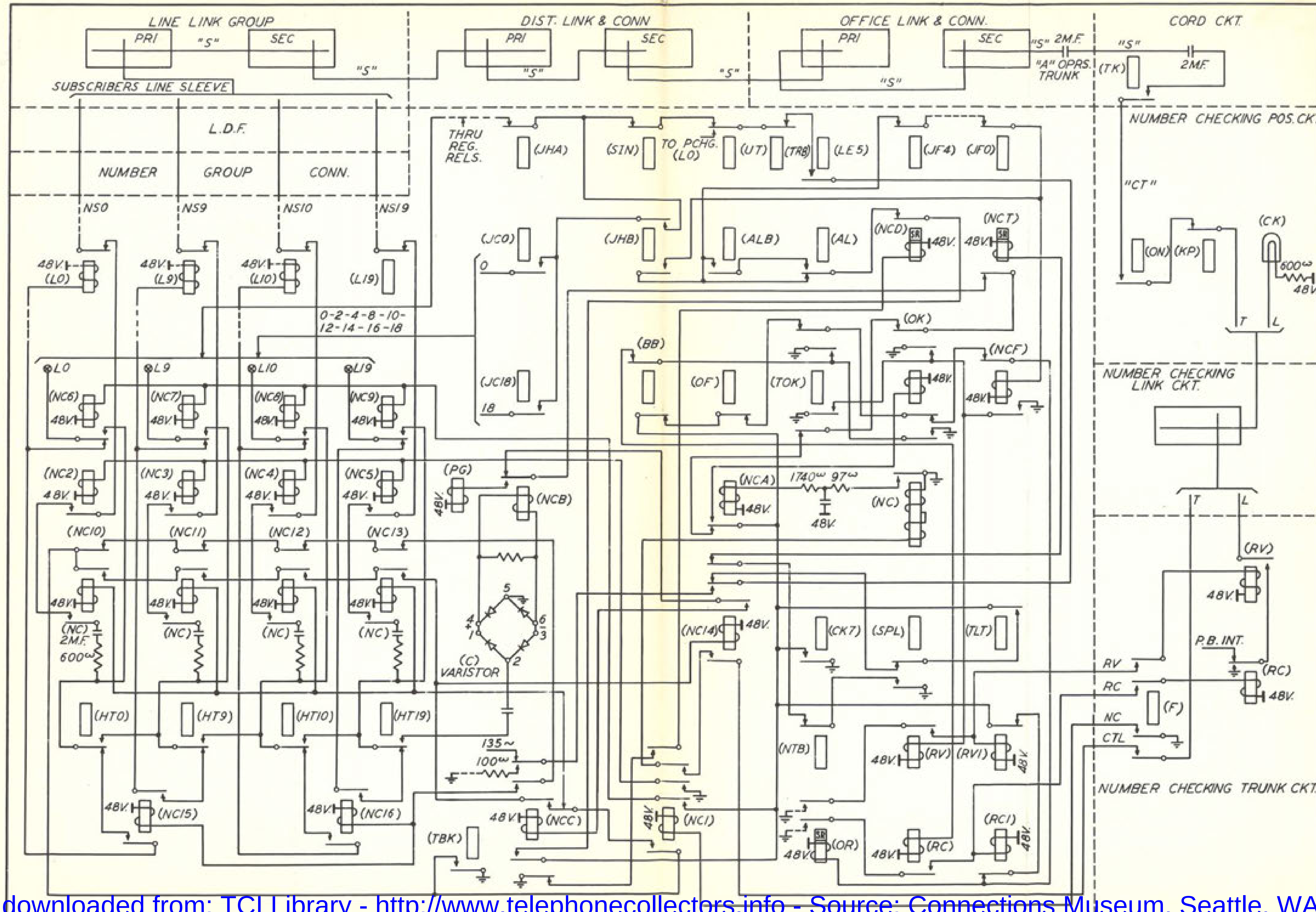
NUMBER CHECKING CALL

If the number check is unsuccessful, the (NCC) relay will operate when the (NCT) relay has released. The operation of the (NCC) relay releases the (NC10-13) relays for the purpose of removing the "NC" condensers from the circuit so that these condensers cannot interfere with the operating circuit for the (L) relay. The (NCC) relay provides a path for maintaining the (NC14) relay operated and when the (NC10-13) relays are released, a circuit is closed which causes the operation of relays (NC15-16). With the (NCC) and the (NC15-16) relays operated, a circuit is closed for the operation of the (L) relay corresponding to the individual line called or to the last line of a terminal hunting group. The (NCC) relay transfers from the 135 cycle power supply to ground for operating the (L) relay. A resistance is used in the ground circuit to protect against damage to the (NCC) relay contacts and to protect against overloading the 135 cycle power supply. When the (NCC) relay operated, the (NCD) relay started to release. The (NCD) relay is slow to release, to permit the operation of the (L) relay and the subsequent grounding of the "NF" and "NC" leads. If the (L) relay which is operated corresponds to a line not cross-connected for jump hunting, the (LC-) and (CA) or (CB) relays cannot operate because their battery supply is open at the (NC1) relay, see XB-305.

The (NCD) relay allows time for the return of a successful number check signal, and if the (NCC) relay is still operated when the (NCD) relay releases, a number check failure is indicated and causes the operation of the (NCF) relay. When the (NCF) relay operates, it operates the (RV) relay and in turn the (RV1) relay, also the (RV) relay in the incoming trunk to give a flashing "CK" lamp to the operator indicating a number check failure. Relay (RV1) starts the (OR) relay to release, which allows the subsequent operation of the (SRL) relay for starting the marker release signal.

In case all of the lines of a terminal hunting group are not in the same 20-block and additional lines are located in the next 20-block, the (HT19) relay will be operated to indicate this and the 135 cycle current will be carried through the (HT) relays and rectified by varistor (C) to operate relay (NCB). This connects the (PG) relay winding to ground on the back contact of relay (NCA) when relay (NCT) releases. Relay (NCT) operates from ground on (SPL) and starts to release when relay (NC14) operates. The release of relay (NCT) operates relay (PG) which causes the (HP) relays to function, see XB-323 which permits the next 20-block to be connected to the marker as on a regular call. Relay (NCT) is slow in releasing to allow time for the (NC), (NCA) and (CK) relays to operate if a line in the first 20-block is used for the call being number checked. The action of the marker for the second and succeeding 20-blocks is the same as for the first.

In case there is an additional group of terminal hunting lines in another part of the number group which it is desired to check with the first tested lines, the jump hunting feature of the marker will gain access to them. This is accomplished by the operation of relay (NCC) which operates one of relays (L0) to (L19) as described above. The (L) relay grounds leads "NF" and "NC" which through jump hunting cross-connections operates a (JF-) and (JC-) relay and causes the additional group of lines to be connected as on a regular jump hunting call. When the first 20-block is released, relay (TBK) releases, causing relays (NC10) to (NC16) and (NCC) to release and when the second 20-block relay operates the additional lines are checked in the same manner as the first group.



TERMINATING MARKER
NUMBER CHECKING CALL

XB-325

N.Y. TEL. CO.
G.P.S. - L.I.

NO TEST CALL

No test calls may originate at verification positions at D.S.A. boards or at test desks. If the line called is idle, the connection to that line will be set up over the regular train. The only difference between this call and a regular call is that terminal hunting is cancelled, and because the "RT" and "TT" leads are open at the trunk, tests of the subscriber line and test for plugged up condition are omitted. When the marker connector seizes the marker on any special call including no test calls, relay (SPL) operates and closes lead "NT". When the no test incoming trunk (F) relay operates, it operates relay (NT) through contacts of relay (SPL). Relay (NT) operated, holds open the operating paths of relays (LE1) and (LE2) which in turn hold open the operating paths of relays (HTO) to (HT19) thus preventing terminal hunting and making all lines appear as individual lines, see XB-305.

If the line is busy, a connection is set up over a no test train to the line link which is connected to the busy line. Registration, translation and seizure of the line choice and incoming frames proceed up to the point at which the line busy test is made. This test is delayed by the operation of the (SPL) relay which holds open the (L-) relay operating circuit until the (NT1) relay operates and closes the path opened at the (SPL) relay. The (NT) relay operates the (NTH) relay by ground from relay (TE) and also operates the (NT1) relay. The (NT1) relay closes a circuit through the tens and units relay contacts to the armature of the (S) relay corresponding to the called line, see XB-304. If this relay is normal, the call is set up in the regular manner, but if the line is busy, the (S) relay will be operated from ground on the sleeve of the subscriber's line and ground is connected through the front contact of the (S) relay and back contact of the (HT) relay and (NH) relay, front contact of the (NT) relay and the (NTR) relay to operate relay (NTT) as a signal to employ the no-test train. With relay (NTT) operated, relays (NC2) to (NC5) operate grounding the armature of relay (JB). If the no-test connector is busy, relay (JB) will operate and in turn operate relay (OF) to set up an overflow signal in the regular manner.

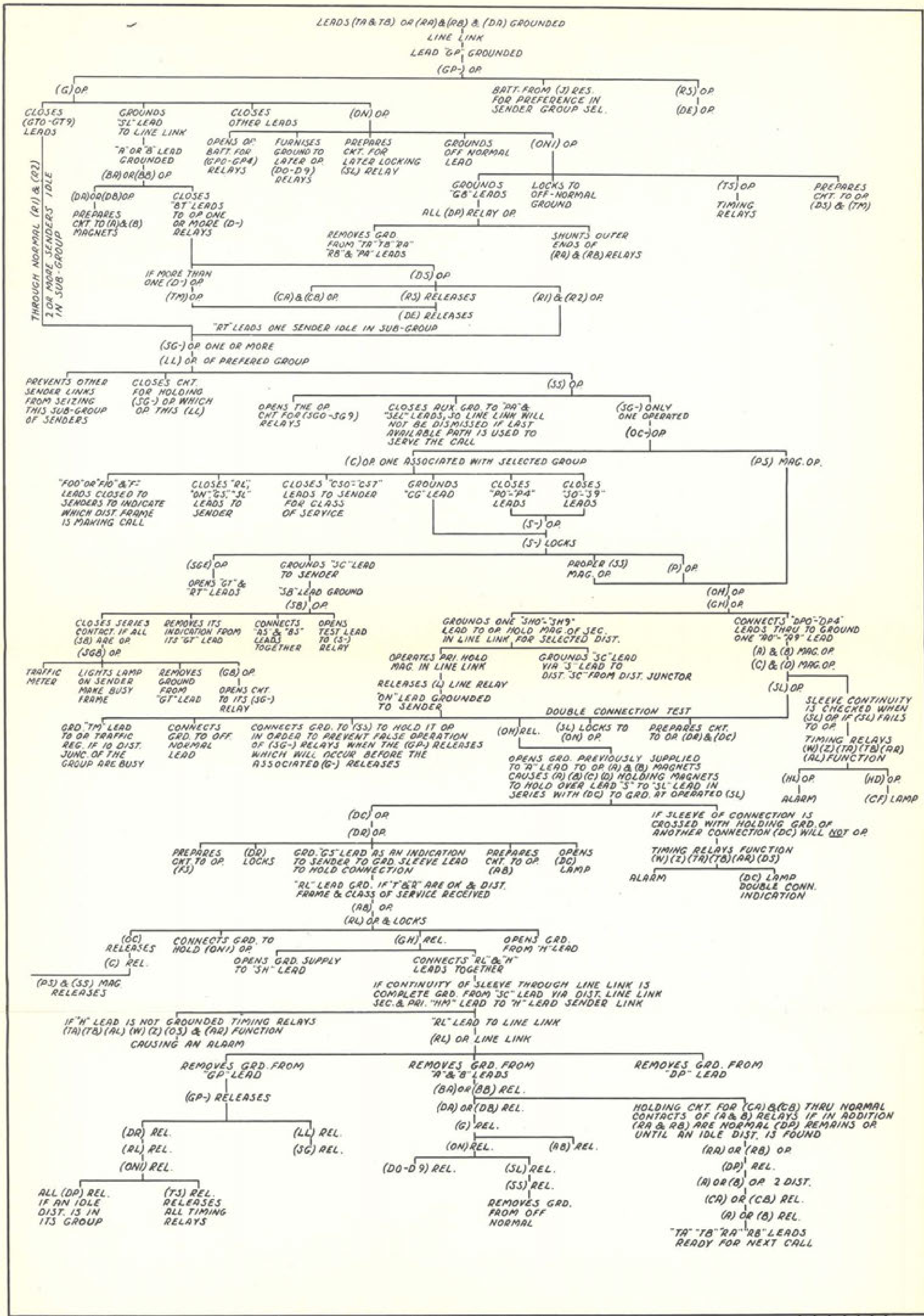
When relay (NC2) to (NC5) operated, the operated (S-) relays released. The (S-) relay must be released to prepare the circuit for operation of the associated (L-) relay. The (L-) relay operates to ground closed at the (NT1) relay. The operated (NTT) relay also closes a circuit from 24 volts positive battery to the sleeve lead when the (L-) relay operates. The (NTT) relay also operates the (LFA) and (LFB) relays for transferring the line link test leads to the line finder (LF) relays. There are ten (LF) relays, one applied to each of the ten line links having access to the called line. The ten links are tested for the positive battery potential and the (LF) relay will operate which corresponds to the link which has this potential connected to it over the "NS" lead. The line link connected to the called line is thus identified by the operation of one of the (LF) relays. The (LF-) relay operates the corresponding (CH-) relay which locks and energizes the line link primary select magnet corresponding to the desired line link, and releases relay (TE). The release of relay (TE) releases relay (NTH) which connects ground to the "NT" lead to energize the hold magnet of the no-test connector and then energize the no-test verticals hold magnets of the line link frame, thus establishing the connection between the no-test incoming trunk and the line link which is connected to the called line.

NO TEST CALL

A no-test connector crossbar switch is associated with each line choice. Two hold magnets of this switch are used to serve a line link frame, one serving calls on line link primary switches 0 to 4 and the other for calls on primary switches 5 to 9.

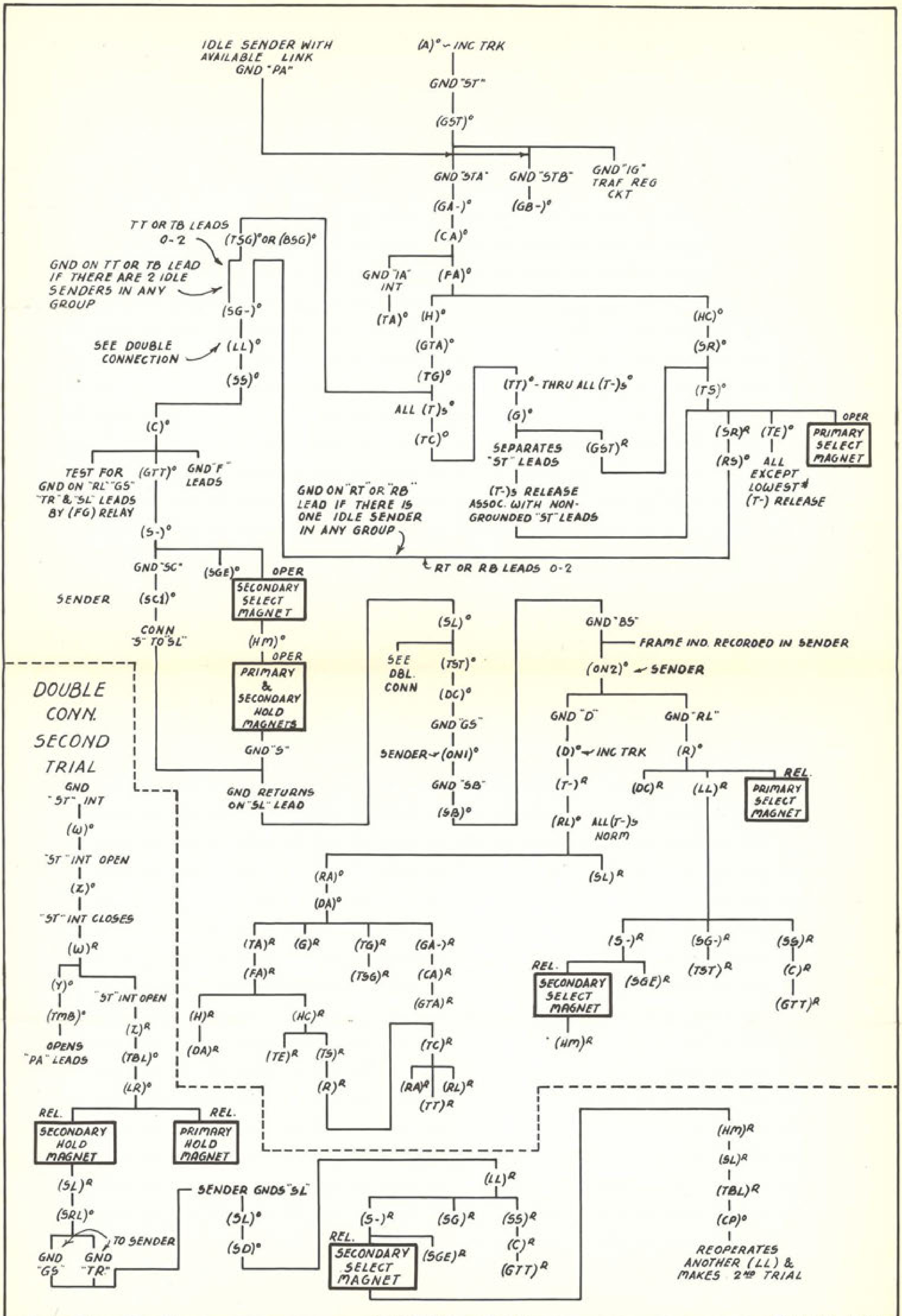
The (NTH) relay is slow in releasing to allow time for the line link primary select magnet to operate before a circuit is closed to operate the hold magnet.

With the (NTH) relay released, the (NTR) relay releases, grounding the "RL" lead to cause the sender to release the marker in the regular manner. The (NTR) relay is slow in releasing to permit the hold magnets to energize, close the crosspoints and operate the holding relay of the incoming trunk.

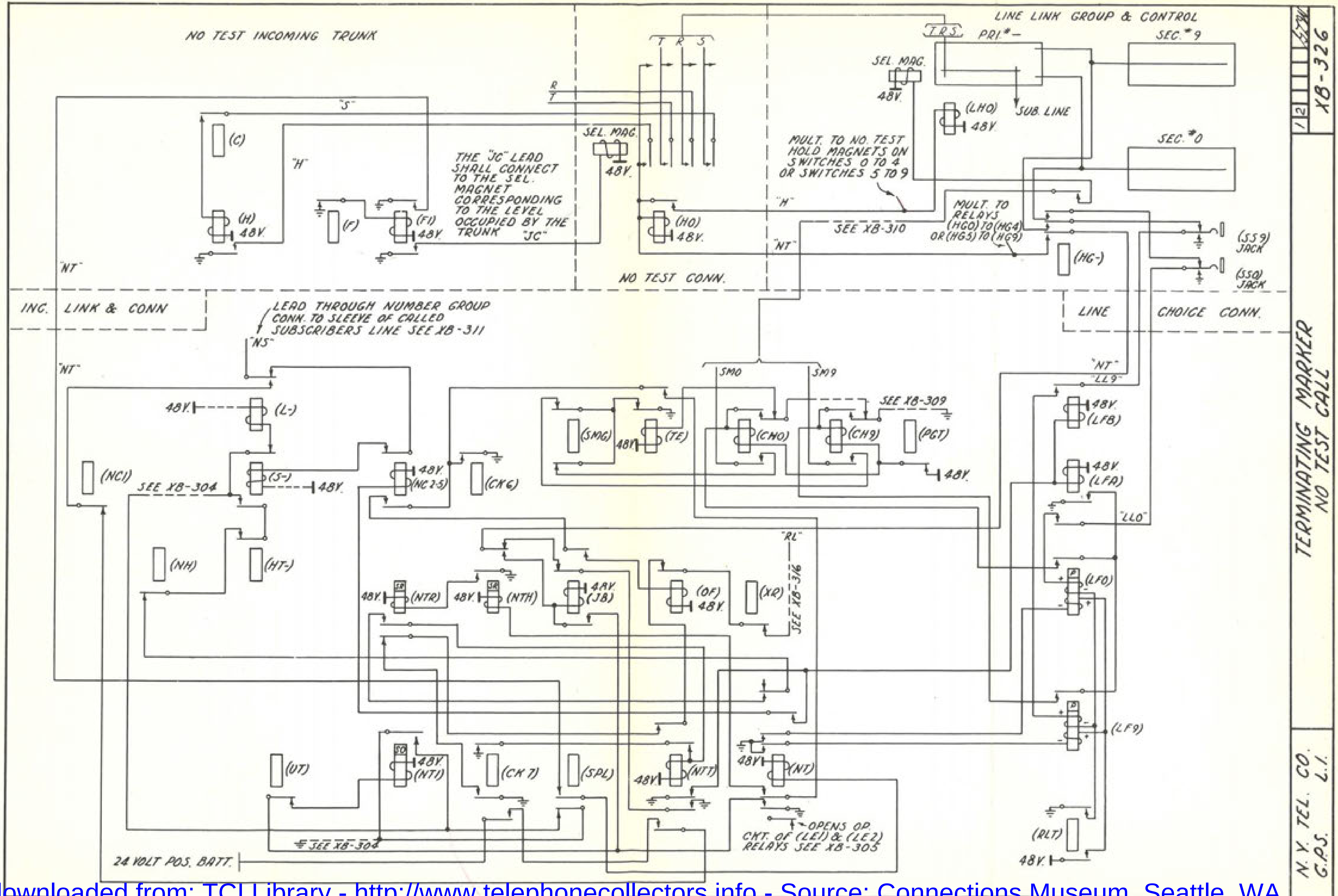


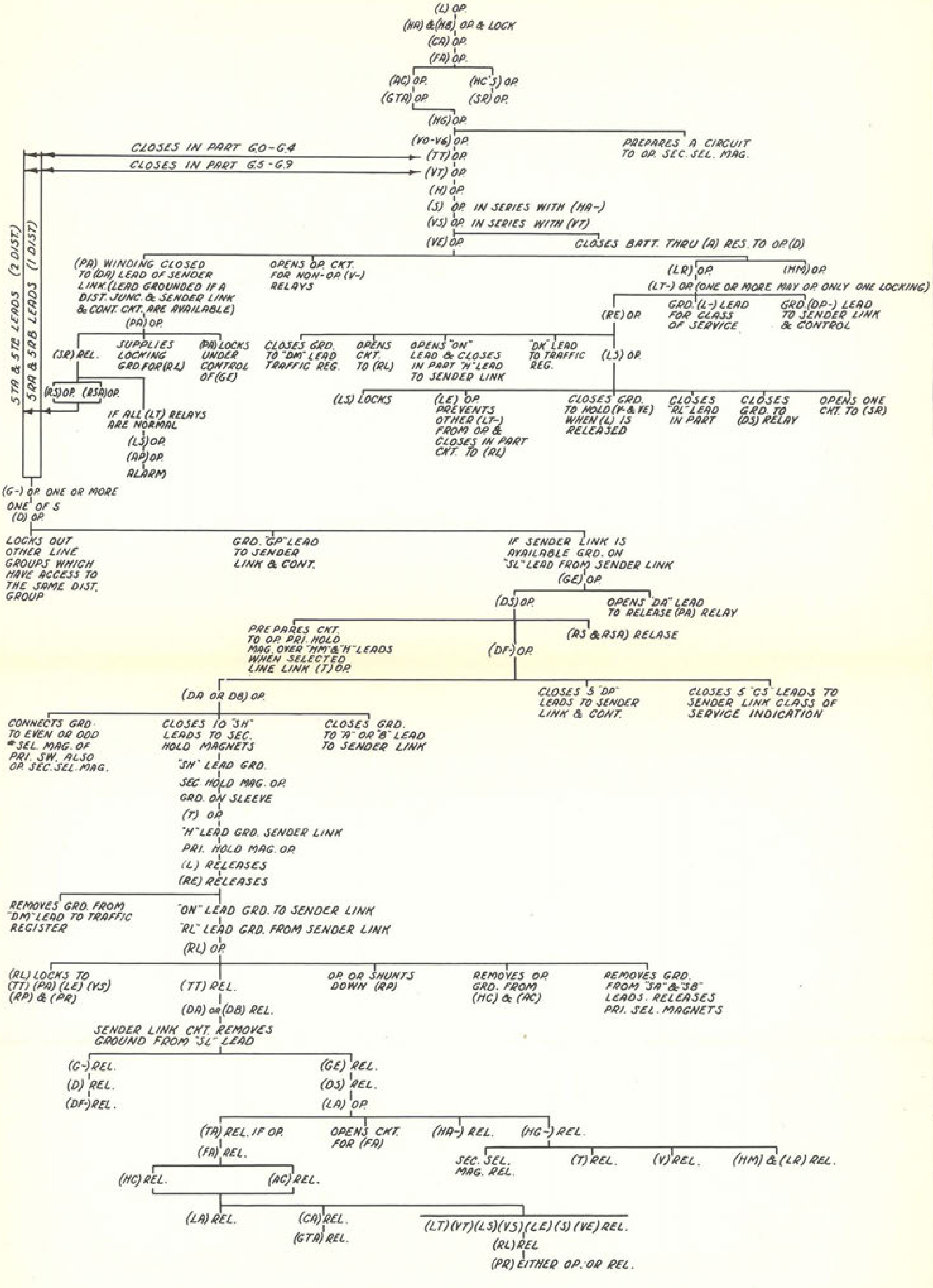
N.Y. TEL. CO.

FAMILY TREE



N. Y. TEL. CO.	FAMILY TREE	

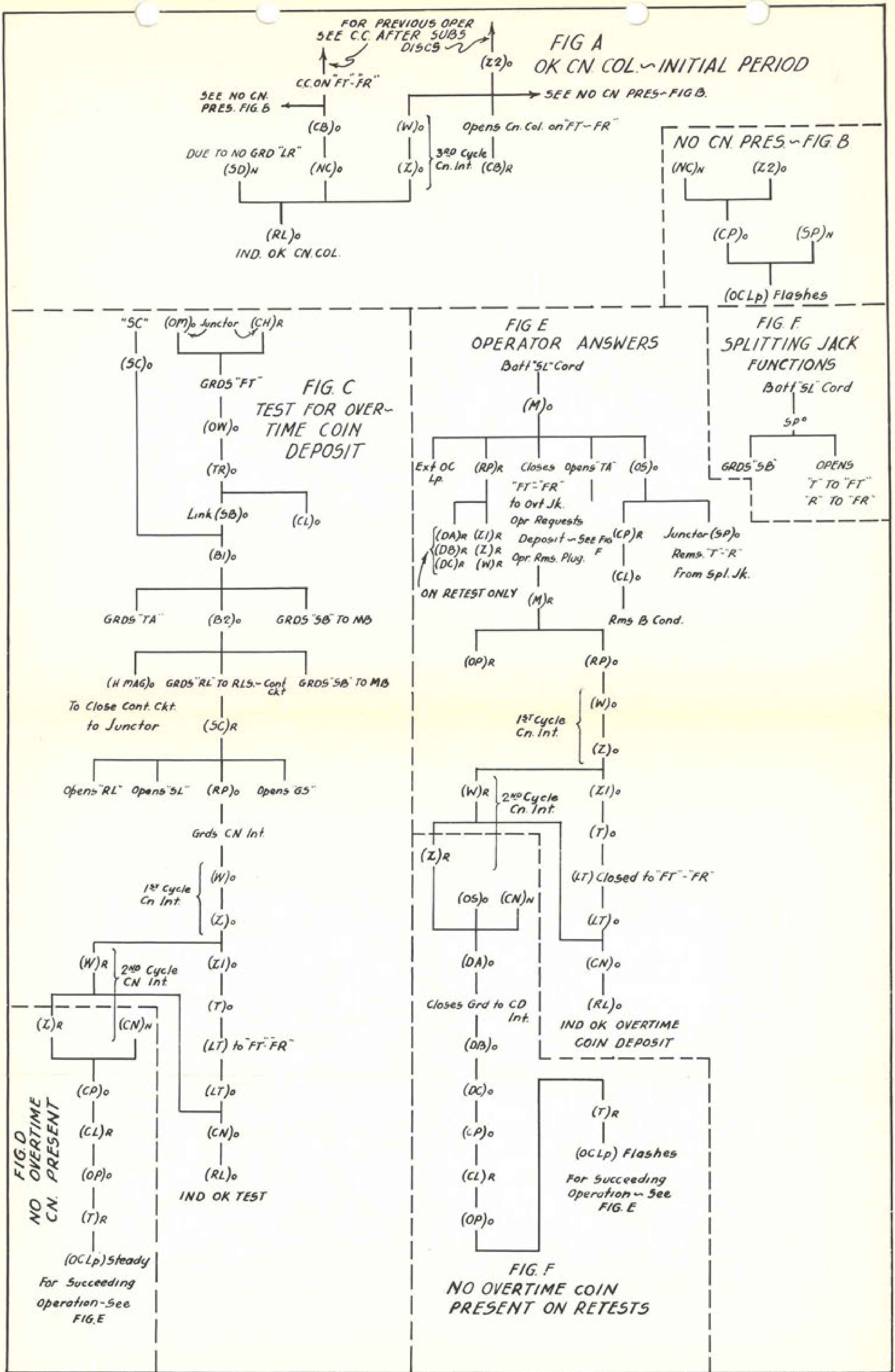

TERMINATING MARKER
NO TEST CALL
XB-326
N.Y. TEL. CO.
G.P.S. L.I.
NO TEST INCOMING TRUNK
NO TEST CONN.
INC. LINK & CONN
LINE LINK GROUP & CONTROL
LINE CHOICE CONN.
THE "JC" LEAD SHALL CONNECT TO THE SEL. MAGNET CORRESPONDING TO THE LEVEL OCCUPIED BY THE TRUNK "JC"
SEL. MAG.
48V.
T R S
PRI.# -
SEC.# 9
SEC.# 0
SUB. LINE
MULT. TO NO. TEST HOLD MAGNETS ON SWITCHES 0 TO 4 OR SWITCHES 5 TO 9
MULT. TO RELAYS (HG0) TO (HG4) OR (HG5) TO (HG9)
SEE XB-310
(SS9) JACK
(SS0) JACK
(HG-)
(LH0)
(C)
(H)
(F)
(FI)
(H0)
"S"
"H"
"NT"
"NS"
"LL9"
"LL0"
"RL"
LEAD THROUGH NUMBER GROUP CONN. TO SLEEVE OF CALLED SUBSCRIBERS LINE SEE XB-311
SEE XB-304
SEE XB-309
SEE XB-316
SM0
SM9
(L-)
(S-)
(NC1)
(NC 2-5)
(CK6)
(NH)
(HT-)
(SMG)
(TE)
(CH0)
(CH9)
(PGT)
(LFB)
(LFA)
(LF0)
(LF9)
(NTR)
(NTH)
(JB)
(OF)
(XR)
(UT)
(NTI)
(CK7)
(SPL)
(NTT)
(NT)
(RLT)
OPENS OP. CKT. OF (LE1) & (LE2) RELAYS SEE XB-305
24 VOLT POS. BATT.



N.Y. TEL. CO.
G.P.S. L.L.

FAMILY TREE
LINE LINK GROUP & CONTROL CIRCUIT SD 25003-01

1 2

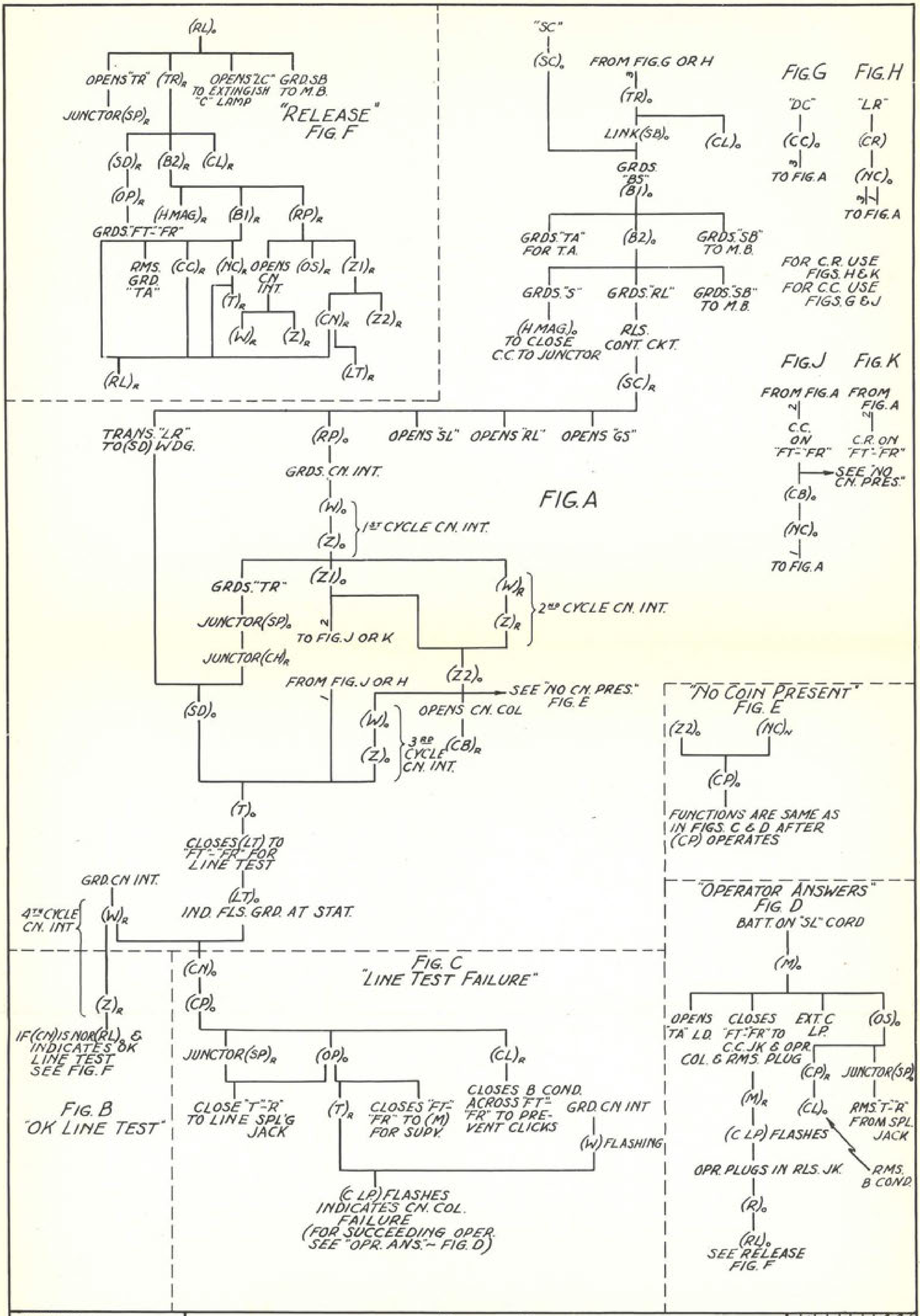


N.Y. TEL. CO.
G.P.S. ~ L.I.

COIN OVERTIME MONITORING FAMILY TREE

1 2 3

SD-25061-02



N.Y. TEL. CO. G.P.S. - L.I.	FAMILY TREE COIN COLLECT OR RETURN AFTER SUBS DISCONNECTS	1 2 3 SD 25061-02

C R O S S B A R   E Q U I P M E N T

W A S H I N G T O N

TRAINING DATA

AND

OTHER CROSSBAR INFORMATION

SEATTLE, WASHINGTON

SEPTEMBER, 1941

. . .

Items Marked With Asterisk (*) Not For General Distribution. Copies on File.

. . .

INDEX

GENERAL

XB-W00	Crossbar Training, General
XB-W01	List of Major Features and Ideas Crossbar System
XB-W02	Names and Designations of Major Crossbar Frames
XB-W03	Functions and Block Chart Association of Major Crossbar Frames
XB-W04	Packing In Crossbar System
XB-W05	Packing In Crossbar Dial Offices
XB-W06	*Seattle Plant Department Organization Chart
XB-W07	*Large "Block Chart" Schematic of Originating Equipment Showing Link Arrangement
XB-W08	*Large "Block Chart" Schematic of Terminating Equipment Showing Link Arrangement
XB-W09	*Large "Block Chart" Without Link Arrangement
XB-W10	Strapping For (D) Relays in Line Link Control Circuit
XB-W11	Cross-Connection Notes
XB-W12	*Questions "The Crossbar Switch"
XB-W13	*Crossbar "Link Spread Grids"
XB-W14	*Crossbar "Link Spread Grids"
XB-W15	Crossbar Office Chain Circuits
XB-W16	*Equipment and Nomenclature Relationships, Line Link, Subs. Sender Link, District Junctor and Originating Sender Circuits
XB-W17	*Questions - Line Link, Sender Link, Control Circuits
XB-W18	Functional Steps Crossbar to Crossbar Call
XB-W19	Slow Release, Slow Operate and Transmission Relays #1 Crossbar Dial System
XB-W20	Alphabetical Index of Circuits and Associated Equipment Drawings #1 Crossbar Dial System
XB-W21	*Equipment Nomenclature Relationships, Originating Marker, District Link, Office Link, District Junctor, and Originating Sender
XB-W22	Operation of Select and Hold Magnets Originating Equipment
XB-W23	Operation of Select and Hold Magnets Terminating Equipment

XB-W24	Small "Block Chart" Crossbar Call
XB-W25	Crossbar Circuit Timing
XB-W26	Questions and Answers on Crossbar Dial System (General) Miscellaneous Make Busy Features Originating
XB-W27	Miscellaneous Make Busy Features Originating
XB-W28	*Blank Index Sheets
XB-W29	*Eight Hour Appreciation Course, Crossbar Dial System
XB-W30	*Appreciation Course
XB-W31	W. E. Co. 313 C.A. Vacuum Tube

LINE LINK

XB-W100	Typical Cabling Schematic of Junctor Subgroups
XB-W101	Subscribers Line Circuit
XB-W102	District Group Test and Selection
XB-W103	Operating and Locking Paths of Relays CA, CB, FA, FB, Under Normal and Make Busy Conditions
XB-W104	Subscribers Class of Service Registration
XB-W105	Relay Designations - Functional Meaning - Orientation
XB-W106	Line Link Spread or Slip Multiple
XB-W107	Subscribers M.D.F. Cross-connections
XB-W108	Leads Cut Through Multi-Contact Relays, Line Link and Control Circuit
XB-W109	Arrangement of Select Magnets and M.B. Jacks on Link Frames
XB-W110	Line Distributing Frame
XB-W111	Primary Hold Magnet Operation - Terminating Call
XB-W112	"D" Relay Chain Circuit
XB-W113	Method of Omitting "R" and "RR" Wiring When Line Circuit Is Used For Terminating Service Only

SUBSCRIBER SENDER LINK

XB-W200	Arrangement of Sender Subgroups on Horizontal Multiple of Sender Link Secondary Switches
XB-W201	Typical Distribution of Sender Link and District Junctor Frames
XB-W202	Schematic Arrangement of "DA" Leads
XB-W203	Sender Group Selection (Subs. Send. Link and Control)
XB-W204	Relay Designations - Functional Meaning Orientation
XB-W205	Chain Circuits "Subscribers Sender Link,Sender Link Circuit"
XB-W206	Leads Cut Through Multi-Contact Relays, "Sender Link and Control Circuit

SUBSCRIBER SENDER

XB-W300	Two-Party Message Test Crossbar Subscriber Sender
XB-W301	Station Delay Feature
XB-W302	Operating Paths for (AV-1) Relay
XB-W303	Relay Designations - Functional Meaning "Subscribers Sender Circuit"
XB-W304	New Dialing Circuit for Panel and Crossbar Systems
XB-W305	*Questions "Subscriber Sender"
XB-W306	Subscriber Sender (FO-1) Relay Functions
XB-W307	Operation of Timing Circuit Relays "Originating Sender"
XB-W308	Sender Dial Pulsing (L) Relay
XB-W309	Principal Parts of a Subscribers Sender and Optional Features
XB-W310	Connection of Pulsing Circuit to Dial Register
XB-W311	Operating Cycle of (PG) Relay for Timing of P.C.I. Pulse

ORIGINATING MARKER AND CONNECTOR

XB-W426	Marker Channel Testing
XB-W427	Cross-connections, Terminal Strip Equipment Originating Marker
XB-W428	Association of Trunk Number, "K" and "LC" Relays, Office Secondary Switch Number and Level for Split and Non-Split Office Frame
XB-W429	Trunk and Office Link Selection and Channel Testing
XB-W430	Cross-connections for Office Junctor Distribution
XB-W431	"JC" Relay Requirements and Assignment of Contacts
XB-W432	The Information From the Sender to Originating Marker
XB-W433	Timing Features Originating Marker
XB-W434	
XB-W435	*Originating Marker Connections (Aval)

ORIGINATING TROUBLE INDICATOR

XB-W500	Relay Designations - Functional Meaning, Orientation, "Originating Trouble Indicator"
XB-W501	Equipment Information, Originating Trouble Indicator

DISTRICT JUNCTOR, DISTRICT AND OFFICE LINKS

XB-W600	Secondary Selecting Magnet Operation
XB-W601	Relay Designations - Functional Meaning, Orientation - Non-Coin District Junctor
XB-W602	Link Test Leads and Primary Switch Make Busy Features
XB-W603	Assignment of Office Junctor Connector (JC) Relays "District Link Frames"
XB-W604	Wiring Side of (JC) Relay Contacts
XB-W605	Assignment of (JC) Relay Contacts, Wiring of #0 Secondary Hold Magnets, District Link Frame #0
XB-W606	Assignment of Secondary Hold Magnets to "JC0","JC1" Relay Contacts, District Link Frame #0
XB-W607	*Questions on District Junctor
XB-W608	~~New~~ Not Issued
XB-W609	Coin Supervisory Group Selections and Preference Based on Kenwood Office (30 Coin Junctors, 6 Coin Sup. Ccts.)
XB-W610	Not Issued
XB-W611	Notes on Office Junctors and Line Junctors
XB-W612	District Junctor Grouping Frame - Avalon Office

INCOMING TRUNK AND TERMINATING SENDER LINK

XB-W700	Relay Designations - Functional Meaning and Orientation, "Terminating Sender Link"
XB-W701	Conditions Affecting Incoming (A) and (T) Relays
XB-W702	Wiring for Home and Mate Control Circuit, Terminating Sender Link

TERMINATING SENDER

TERMINATING MARKER AND CONNECTOR

XB-W900	Use of Split Hundreds Relays
XB-W901	Relay Designations, Functional Meaning and Orientation, Terminating Marker Circuit
XB-W902	*Cancelled Print - Unsatisfactory
XB-W903	Non Consecutive End of Block Hunting
XB-W904	* Terminating Marker Cross-connecting Field
XB-W905	Notes on Terminating Marker
XB-W906	Terminating Marker Cross-connections For Channel Preference
XB-W907	Operation of Incoming Link and Line Link Secondary Hold Magnets
XB-W908	Cold Cathode Tube, "Terminating Marker"
XB-W909	Timing Relay Operation 1st, 2nd, 3rd and 6th Stages
XB-W910	Continuity Test, "Terminating Marker" (Also, see XB-W919)
XB-W911	Special Calls, "Terminating Marker"
XB-W912	Channel Selection (Terminating)
XB-W913	Working Limits of (GT) Relay, "Terminating Marker"
XB-W914	*Questions and Answers, "Terminating Marker"
XB-W915	Operating Path of (X) Relays, "Terminating Marker"
XB-W916	Manual Tests, "Terminating Marker"
XB-W917	Cancelled - Changed to W1557 - Ball and Chain
XB-W918	*Terminating Marker Cross-Connections - Avalon
XB-W919	Continuity Test "Terminating Marker" (Also, see XB-W910)

TERMINATING TROUBLE INDICATOR

XB-W1000	Relay Designations - Functional Meaning Orientation "Terminating Trouble Indicator"
XB-W1001	Cross Lamps "Terminating Trouble Indicator"

INCOMING LINK, NUMBER GROUP, LINE CHOICE, LINE JUNCTOR BLOCK RELAY

XB-W1100	Association of Line Group Connector Relays (CR) and (CE) "Line Choice Connector Frame"
XB-W1101	Line Junctor Grouping Frame, Plan #1 - With No Incoming Extension Frames 200 Line Junctors Per Incoming Line Frame
XB-W1102	Line Junctor Relays (LJA and LJB) Arrangements of J, HM, and LJ Leads
XB-W1103	*Block Relay Frame Cross-connection Field
XB-W1104	Cross-connection Individual Line
XB-W1105	Cabling and Wiring, Line Junctor Connector Frame
XB-W1106	Checking Operation of (HG) Relay
XB-W1107	Division of One Block Relay Frame into Four Number Groups
XB-W1108	Block Relay Cross-connecting Fields
XB-W1109	Cross-connections of 20 Trunk P.B.X. having all Lines Located on one 20 Block (TB) Relay
XB-W1110	Strapping of (HB) Relay Windings to Number Group Hundreds Block NG, -HB Leads (Number Group Connector Circuit)
XB-W1111	Strapping of TB, TBA, and SHA Punchings (Number Group Connector Circuit)
XB-W1112	Closing SM Leads to Operate Line Link Primary Selecting Magnets (Line Choice Connector Circuit #0 Assumed)
XB-W1113	Operation of, and Leads Closed By (CE) and (CR) Relays, Line Choice Connector Circuit #0 Assumed
XB-W1114	Closing Leads to Operate Proper (HG) Relay (Line Choice Connector Circuit #0 Assumed)
XB-W1115	Closing LR, LE, and LO Leads to Four Line Link Frames (Line Choice Connector Circuit #0 Assumed)
XB-W1116	Arrangement of Terminal Strip for TB and SH Punchings, Located to the Left of the Twenty Block Relays
XB-W1117	Line Junctor Grouping Frame, Description
XB-W1118	Incoming Link Circuit, 160 Trunk
XB-W1119	
XB-W1120	"E" Test Choice, "Line Junctor Distribution"

TEST FRAMES

XB-W1200 District Junctor Test Frame "SD25158-01"

MISCELLANEOUS

XB-W1300	Subscriber Line Cross-connections and Associated Equipment
XB-W1301	*Ringing Control Groups (Kenwood)
XB-W1302	*Assignment of Line Questions and Answers
XB-W1303	Operation of Traffic Registers

MISCELLANEOUS

XB-W1300	Subscriber Line Cross-connections and Associated Equipment
XB-W1301	*Ringing Control Groups (Kenwood)
XB-W1302	*Assignment of Line Questions and Answers
XB-W1303	Operation of Traffic Registers

POWER

XB-W1400

XB-W1401

XB-W1402

CROSSBAR CIRCUIT

SYMBOL METHOD OF OPERATIONS

XB-W1500	*Crossbar to Crossbar Call
XB-W1501	Seizure of Originating Trouble Indicator
XB-W1502	Non-consecutive End of Block Hunting
XB-W1503	Busy Line Regular
XB-W1504	Sender Coin Test
XB-W1505	P.C.I. Call
XB-W1506	Line Junctor Distribution
XB-W1507	*Analysis Chart, Originating Trouble Indicator
XB-W1508	Subs. Line Overflow Register, Idle and Busy Lines
XB-W1509	Terminating Marker 2nd Trial
XB-W1510	Consecutive End of Block Hunting
XB-W1511	Free Lines
XB-W1512	Intercepting - Unequipped Individual Numbers
XB-W1513	P.B.X. Allotter Circuit
XB-W1514	P.B.X. Retest
XB-W1515	Jump Hunting
XB-W1516	No Hunt Call
XB-W1517	Interrupter Checking Circuit for District Junctor (Also see 1546)
XB-W1518	Central "A" Board Incoming Trunk Circuit. "Non Coin From Coin"
XB-W1519	Signal Circuit For Overflow Tone and Reorder
XB-W1520	Timing Circuit For Incoming Trunk Circuit
XB-W1521	Vacant Code Tone "Non Coin"
XB-W1522	Regular Intercept Circuit
XB-W1523	P.B.X. Retest if P.B.X. Trunks are Picked Off Normal
XB-W1524	Line Link
XB-W1525	Subs. Recording Completing Trunk 2-Wire

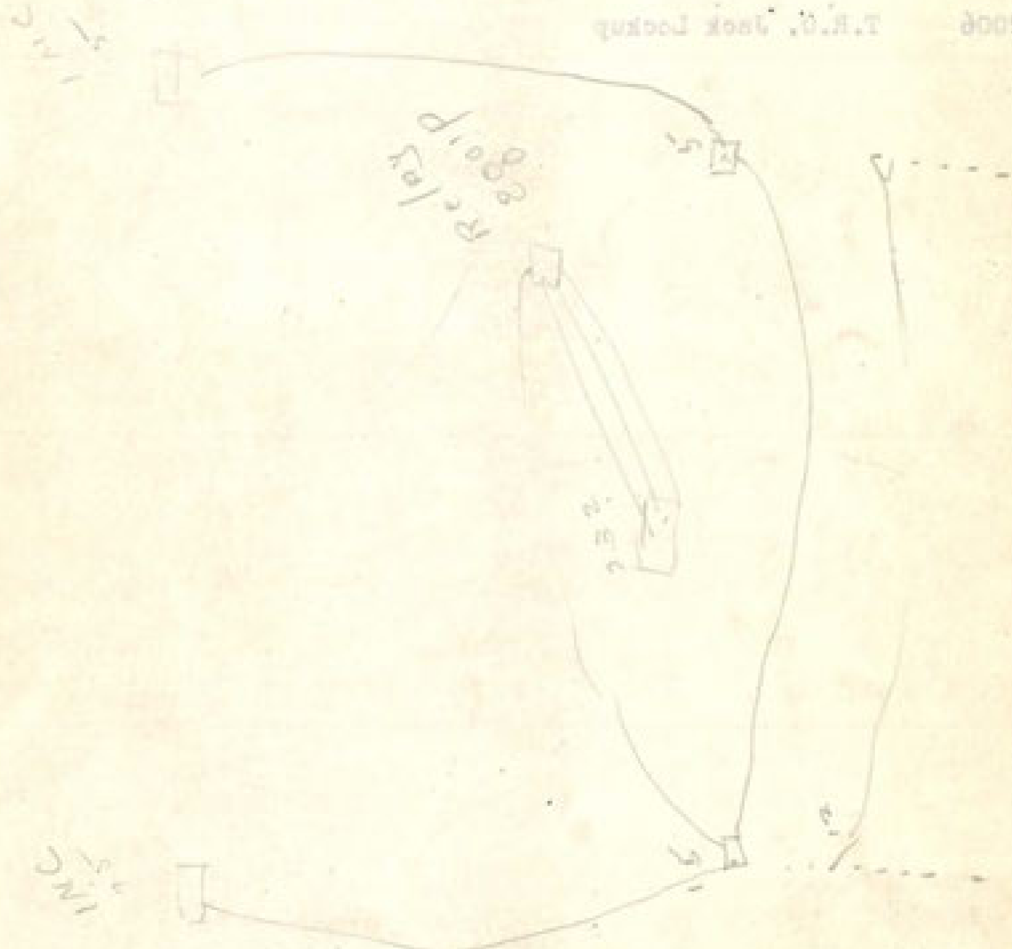
XB-W1526	Line Link Frames - Wiring for Home and Mate Control Ccts.
XB-W1527	P.S.H. Trunk
XB-W1528	Outgoing Trunk Circuit - Non Coin Special Service
XB-W1529	Dial Pulse Sender Circuit
XB-W1530	Dial Regular and No Test
XB-W1531	O.G.T. From the "A" Board
XB-W1532	Call From Local Test Desk
XB-W1533	Line Link Partially Operated (L) Relay
XB-W1534	Coin Collect Circuit
XB-W1535	Originating Sender Load Control
XB-W1536	Functions of the Terminating Trouble Indicator
XB-W1537	Terminating Marker Test Call Using TTI, TFT Per FD25284-01
XB-W1538	Not Issued
XB-W1539	Incoming Trunk from Toll
XB-W1540	Emergency Line Circuit
XB-W1541	Dial Terminating - Manual Line Circuit
XB-W1542	Originating Sender Test Frame
XB-W1543	Start of Crossbar Call
XB-W1544	District Junctor Test Circuit
XB-W1545	Terminating Marker Intercepting Individual Line
XB-W1546	Terminating Marker Intercepting Blank 500 or 100 Block (Also See 1517)
XB-W1547	Subscribers Recording Completing Trunk "Outgoing to Toll"
XB-W1548	Part 1, Incoming Trunk Circuit
XB-W1549	Dial Terminating Manual Line
XB-W1550	Incoming Trunk from Toll or Central
XB-W1551	Int. Checking Cct. for Dist. Junctor or Tandem Trunk Cct.
XB-W1552	Emergency Line Circuit

XB-W1553	Non Coin Outgoing Trunk
XB-W1554	Coin Special Service Trunk Circuit
XB-W1555	Subs. Recording Completing Trunk Circuit
XB-W1556	O.G.T. Intc. Local and Toll
XB-W1557	Term. Marker Timing Stages
XB-W1558	No. 1A Bd., No. 13 Cord, No. 15 Cord Plugging Up Line Cct.
XB-W1559	Aux. Line Cct. for 10-Party Terminal per Station, Code Ringing Lines
XB-W1560	Seizure of Term. Trble. Ind.
XB-W1561	Ringing Int. and Alarm Cct. for 10-Party Terminal per Station - Code Ringing

CROSSBAR INFORMATION

NOT NECESSARILY A PART OF TRAINING COURSE

XB-W2000	Battery Feeder Originating Senders Crossbar Offices
XB-W2001	Originating Marker Connector Cross-connections, "Avalon Office"
XB-W2002	Terminating Marker Preference, "Avalon Office"
XB-W2003	Chain Circuits Terminating Marker Connector, "Avalon Office"
XB-W2004	False X.F.C. Indication on Terminating Trouble Indicator
XB-W2005	Vibrating Circuit for (GT) Relay
XB-W2006	T.R.O. Jack Lockup



Board
Relay

12.5 KW

.746 KW = 1 HP