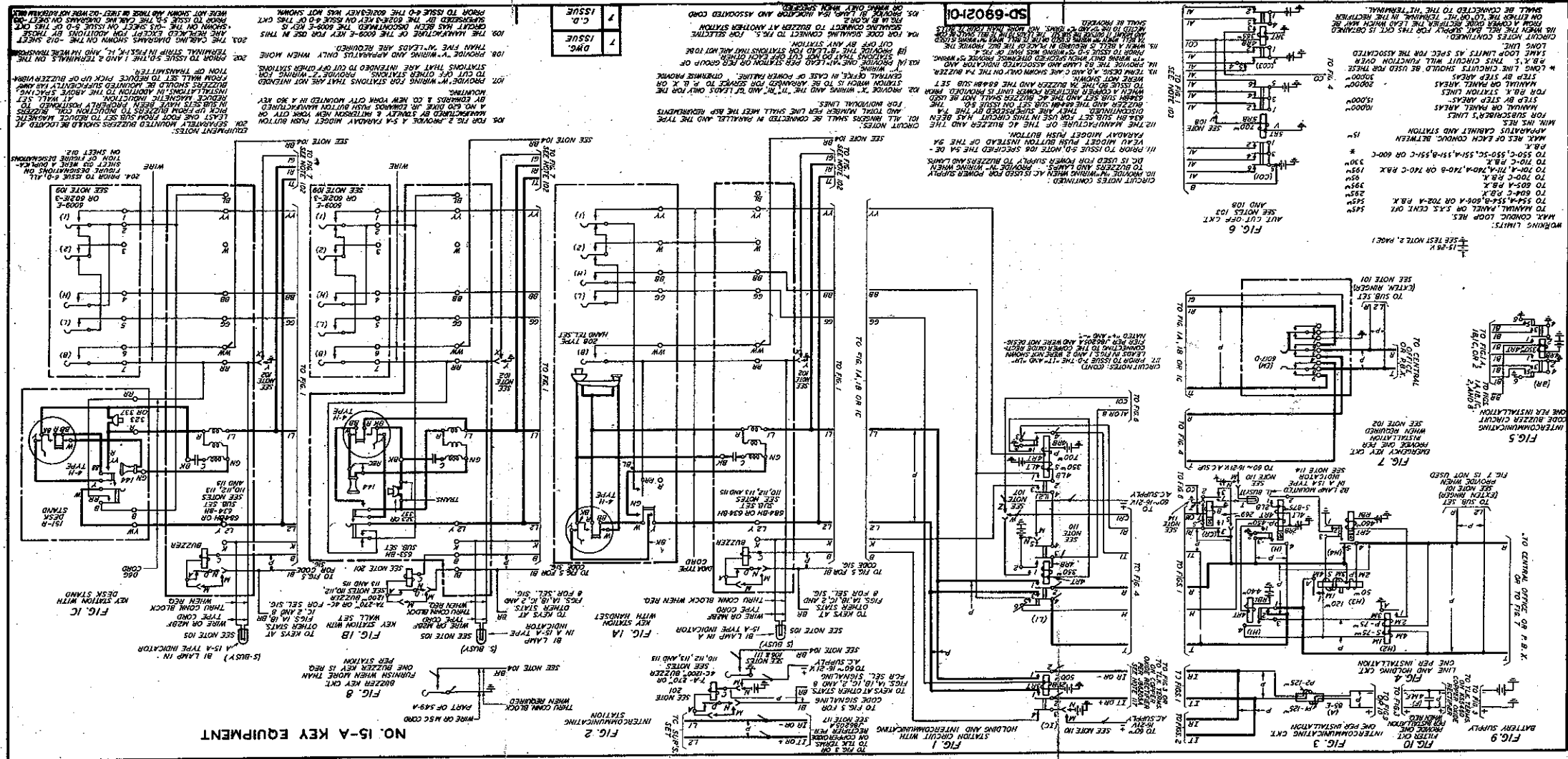


SD-69021-01

7	ISSUE
7	ISSUE
7	ISSUE

SD-69021-01



SD-69021-01

FIG. 2-M
INTERCOMMUNICATING STATIONS
(SHOWN ARRANGED FOR CODE SIGNALING)

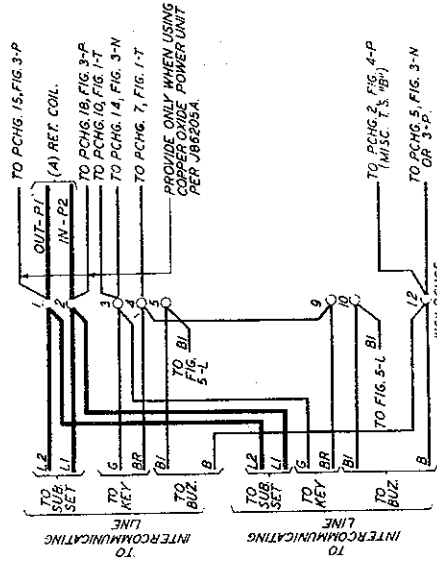
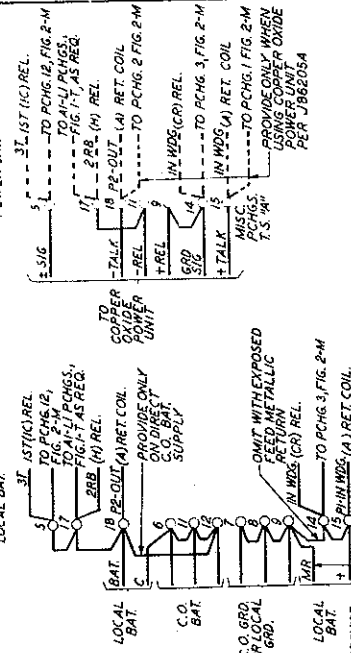


FIG. 3-N
BAT. SUPPLY
DIRECT FROM C. O. OR
LOCAL BAT.



7	DWG.
7	ISSUE
7	C. D.
7	ISSUE

SD-69021-01

FIGS. 4-P & 7-M
HOLDING CRT

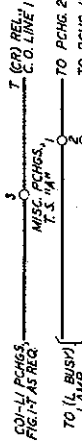
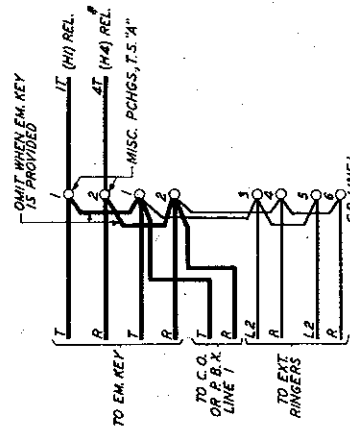


FIG. 5-L
INTERCOMMUNICATING CODE
CALL CRT

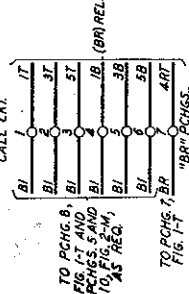


FIG. 6-L
AUT. CUT OFF CRT

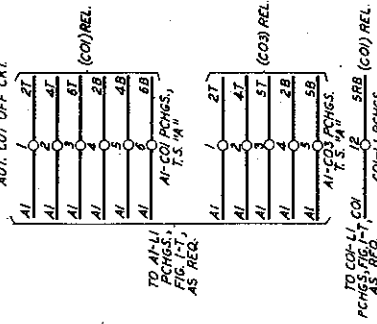


FIG. 7-L
AUT. CUT OFF CRT

7	DWG.
7	ISSUE
7	C. D.
7	ISSUE

SD-69021-01

SD-69021-011 2 PAGES									
CIRCUIT REQUIREMENTS									
IS-A KEY EQUIPMENT									
APPARATUS	MECH. REQ.	CIRCUIT PREPARATION	TEST	SEE DIRECT CURRENT FLOW REQ.	REMARKS				
DESIG. CODE	BSP. CONT. ARM. FIG. PRESS. TRVL.	BLOCK TEST CLIP DATA OR INSULATE CONN. BAT. CONN. GRD.	TEST NOTE	TEST AFTER SOAK	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.
RELAYS									
FIG. 1									
IC E577 10/1	H .015		RT(1C) GRD.	O	.023	.017			
L1 R1933 23/25	H .030		RT(L1) GRD.	O	.0345	.0325			
			RT(L1) GRD.	NO	.0131	.0138			
L2 R1948 11/46	L .030		RT(L2) GRD.	P	.0155	.0145			
			RT(L2) GRD.	S	.031	.0126			
		(L1) NO	LB(L2) GRD.	S					OPERATE REL. ELECTRICALLY ON THE PRI. WDG.
FIG. 4									
CR 178-AS F/F			T(CR) BAT.	O	.0505	.048			ARM. TRAVEL .030" MAX.
			T(CR) BAT.	NO	.0285	.030			
H R1949 46/1	H .030	(H4) O	RT(H) GRD.	P	.0245	.023			
		(H4) O	RT(H) GRD.	S	.0125	.0145			OPERATE REL. ELECTRICALLY ON THE PRI. WDG.
		(H4) O	LB(H) GRD.	S	.0165	.0155			
H1 R1487 47	H .035		RT(H1) GRD.	O					
H2 B74	I .030	4T(H1) NO	IT(H1) B/G	S	.009	.0085			
		(H1) O	IT(H1) B/G	S	.0023	.0025			OPEN "Y" & "R" TOWARD CENT. OFF. OR P.B.X.
		(H1) O	IT(H1) B/G	O	.0047				
H3 B552	6 .030	4T(H4) NO	IT(H4) B/G	I	.0059	.0056			OPEN "R" TOWARD CENT. OFF.
		(H4) O	IT(H4) B/G	I	.0013	.0014			
H4 R1934 50	H .040	(H2) NO	RT(H4) GRD.	O	.022	.0205			
TEST NOTES:									
1. INSULATE 4T(H4).									
2. THE NOMINAL VOLTAGES FOR THE KS-5460 AND J86205A RECTIFIERS AT THE RATED AMPERAGE ARE GIVEN BELOW. THESE VOLTAGES ARE NOMINAL ONLY AND WILL VARY CONSIDERABLY WITH THE LOAD ON ANY OF THE TAPS.									
D.C. SUPPLY FOR RELAYS - 18 V. AT 0.5 AMP.									
D.C. SUPPLY FOR TALKING - 3 V. AT 0.1 AMP.									
A.E. SUPPLY FOR BUZZER AND LAMPS - 16 V. AT 1 AMP.									

SD-69021-011 PAGE 1

APPARATUS	MECH. REQ.	CIRCUIT PREPARATION	TEST	SEE DIRECT CURRENT FLOW REQ.	REMARKS				
DESIG. CODE	BSP. CONT. ARM. FIG. PRESS. TRVL.	BLOCK TEST CLIP DATA OR INSULATE CONN. BAT. CONN. GRD.	TEST NOTE	TEST AFTER SOAK	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.	TEST AFTER TEST READ.
FIG. 5									
BR E1360 23/23	L .030		RT(BR) GRD.	O	.032	.026			
FIG. 6									
CO1 R1781 41/41	L .030		RB(CO1) BAT.	O	.0175	.0165			REQ. FOR WDG. ALONE
			RB(CO1) BAT.	O	.0545	.0515			REQ. FOR JOINT CKT. OF (CO1) AND (CO3) RELS.
CO3 R1527 43/17	H .030		RB(CO3) BAT.	O	.035	.027			REQ. FOR WDG. ALONE
			RB(CO3) BAT.	O	.057	.043			REQ. FOR JOINT CKT. OF (CO3) AND (CO1) RELS.

SD-69021-011 (2 PAGES) PAGE 2

CIRCUIT DESCRIPTION
SYSTEMS DEVELOPMENT DEPARTMENT
PRINTED IN U.S.A.

CD-69037-01
Issue 7-D
March 20, 1936
(8 Pages) Page 1

STATION SYSTEMS
NO. 23A KEY EQUIPMENT
ARRANGED FOR REMOTE SWITCHING

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 This circuit was changed to provide for its use with the J36205A copper oxide rectifier by showing the connecting information at the IT & IR leads in Fig. 1 and 2 and adding + and - designations to these leads.

D.2 Note 117 was added.

D.3 The cabling diagram was changed.

All other headings - No change.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is used to provide two-way service between a central office and a group of subscriber's stations over two central office lines, or between a P.B.X. and a group of P.B.X. stations over two P.B.X. station lines. It is also used for intercommunication between stations within the group over a single intercommunicating line.

2. WORKING LIMITS

2.1	Max. Conductor Loop Res.	
	To Man., panel or SxS cent. off.	545Ω
	To 554A, 554B, 606A or 702A P.B.X.	545Ω
	To 604C P.B.X.	295Ω
	To 605A P.B.X.	395Ω
	To 700C P.B.X.	95Ω
	To 701A, 711A, 740A, 740B or 740C P.B.X.	195Ω
	To 710C P.B.X.	330Ω
	To 550C, 550SC, 551A, 551B, 551C or 6000C P.B.X.	*

*Long line circuits should be used with these P.B.X.'s. This circuit will function over same loop limits as specified for the associated long line.

Max. res. of each conductor between apparatus cabinet and station	150
Minimum insulation resistance:	
For subscriber's lines -	10,000Ω
Manual or panel areas	15,000Ω
Step-by-Step areas	
For P.B.X. station lines -	20,000Ω
Manual or panel areas	30,000Ω
Step-by-Step areas	

OPERATION

3. FUNCTIONS

3.1 On Either Central Office or P.B.X. Lines.

3.1.1.1 Provision is made so that each station can cut-off all other stations.

3.1.1.2 Provision is made so that two or more stations can cut-off all other stations but not each other.

3.1.1.3 Provision is made so that a station cannot be cut-off by any other station.

3.1.1.4 If a station not arranged for cutting off other stations is connected to the line and a station arranged for cutting off this first station is later connected to the line, the first station will not be cut off unless the handset or receiver at the first station is replaced on the switchhook.

3.1.1.5 When a talking key at any station is operated and the handset or receiver is off the switchhook, the station will be connected to the line associated with the operated key if the station is not cut-off by another station.

3.1.1.6 Connects a holding condition on the line when the holding key at the station is operated while the talking key associated with the line is already operated and the handset or receiver is off the switchhook.

3.1.1.7 Removes the holding condition when the line is re seized by a station.

3.1.1.8 Provides an audible signal on inward calls.

3.1.1.9 Provides for dialing.

3.1.2.0 Provides for lighting the (S BUSY) lamp when a talking key associated with a busy line is operated and the handset or receiver is removed from the switchhook at a station which is out-off from the line. Provides for lighting the (L BUSY) lamp when the Central Office or P.B.X. line is connected to any station.

3.2 With the two keys depressed only one line can be connected to the station.

3.3 Provides for code or selective signalling or intercommunicating calls.

3.4 Provision is made to enable one station to have access to central office or P.B.X. in case of power failure.

3.5 Provision is made so that the buzzer at the station at which the buzzer key is operated will not operate if the local key is operated and the handset or receiver is removed from the switchhook.

4. CONNECTING CIRCUITS

4.1 Standard Line Circuits at Manual, Panel or Step-by-Step Central Offices.

4.2 Standard P.B.X. Station Line Circuits.

DETAILED DESCRIPTION

5. INCOMING CALLS

5.1 On an incoming call an audible signal is received by the operation of the ringer associated with the line. Any station associated with the line can answer the call.

6. ANSWERING OR ORIGINATING A CALL ON THE FIRST CENTRAL OFFICE OR P.B.X. LINE

6.1 To answer or originate a call the No. 1 key which is associated with the first line must be operated. When the handset or receiver is removed from the switchhook the (I2) relay operates. The operation of the (I2) relay shorts the line to prevent excessive clicks being introduced in the receiver; operates the (L1) relay, connects the "S" winding of the (I2) relay to the holding key and closes a circuit to the busy lamp which is associated with the station. The operation of the (L1) relay closes the talking circuit through

to the subscriber set, closes part of the operating circuit of the (H) relay, opens the busy lamp circuit, operates the (C03) and (C01) relays if "Z" wiring is used or operates the (CR) relay if "W" wiring is used, and connects battery to its own winding to hold itself operated when battery for operating the relay is opened by the operation of the (C03) or (C01) relays.

The operation of the (C03) and (C01) relays opens battery to all the (L1) relays thus preventing other stations becoming connected to the line at this time if all stations are arranged for the full lock-out feature. The operation of the (C03) relay also operates the (CR) relay, which opens the short which had been placed across the line, and lights the (L BUSY) lamp if provided. This (CR) relay is a slow operate relay and therefore the station will be connected to the line before the short is removed. The purpose of the (L BUSY) lamp is to provide a signal to a person such as a secretary when a call which has been transferred by this person has been taken up.

6.2 Dialing

In the case of an outgoing call that requires dialing, the dial is operated in the usual manner.

6.3 Holding

In case a call is to be transferred to another station, the party who has answered the call will operate the (H) key which holds the (L2) relay operated, operates the (H) relay and releases the No. 1 key. The contacts of the (H) key make before the contacts of the No. 1 key break thus insuring the holding of the (L2) relay. The (H) relay operates the (H1) relay and places a short across the line to prevent excessive clicks being induced in the receiver at this time. Relay (H) locks operated under control of the (H4) relay to insure the holding circuit functioning in case the (H) key is operated momentarily. Relay (H1) opens the line towards the station and the short, and bridges the (H2) relay across the line operating the (H2) relay which operates the (H4) relay. When the (H) key which is non-locking is released, the (L2), and (H) relays release. The release of the (H) relay releases the (H1) relay. The release of the (L2) relay releases the (L1) relay. Relay (H1) may release before the (L1) relay releases. This

00 00
00 00

CD-69037-01 - Issue 7-D - Page 5

will close the talking circuit through the (H3) relay which may operate momentarily and in turn may release the (H2) relay. The (H4) relay which is a slow release relay will not release under this condition thus preventing the opening of the bridge which is across the line. The (L1) relay releases, opens the talking circuit to the station and releases the (C3) and (C1) relays, the (C03) relay releasing the (CR) relay which extinguishes the (L BUSY) lamp. The (H1) relay released also opens the "P" winding of the (H2) relay.

6.4 Transferring Calls

Whenever a call is transferred the line must be held by the operation of the holding key, otherwise the line will be open momentarily which may cause the call to be lost. This applies to either an inward or an outward call. The called party will be signalled by the operation of the (B) key and also the (L) key. The operation of the (L) key operates the (IC) relay (assuming the handset or receiver is still removed from the switchhook) which opens the buzzer circuit of the station calling and connects the station talking leads to the intercommunicating line. The operation of the (B) key will operate the buzzer direct or will operate the (BR) relay which in turn will operate the buzzer.

6.5 Release of the Holding Circuit

If the party at the called station desires to talk on the central office or P.B.X. line, the No. 1 key at that station will be operated which will operate the associated (L2) relay if the handset or receiver is off the switchhook. The operation of the (L2) relay causes the (L1) relay to operate which performs the same function as the (L1) relay associated with the first station. When the line is closed through to the station, the (H3) relay will operate through the talking circuit causing the (H2) relay to release by short-circuiting its "S" winding. The release of the (H2) relay releases the (H4) relay which releases the (H3) relay by short-circuiting its "P" winding. The operation of the No. 1 key also releases the (L) key which releases the (IC) relay, opening the intercommunicating line to the station.

6.6 Disconnection

When the party at the called station replaces the handset or receiver on the switchhook all operated

relays release.

7. CUT-OFF FEATURE ON CENTRAL OFFICE OR P.B.X. LINES

- 7.1 If two or more stations are to cut-off other stations but not each other the "A1" or "A2" leads of these stations are multipled and connected to one "A1" or one "A2" lead per Figure 6. In case one station is connected to the line and a second line key and removes the handset or receiver from the switchhook, the (I1) or (I3) relay of the second station will operate from the battery which holds operated the (I1) or (I3) relay of the first station thus connecting the second station to the line. However, if a station of another group operates the associated line key and removes the handset or receiver from the switchhook, the (I2) or (I4) relay will operate but the (I1) or (I3) relay will not operate as the operating paths of these relays will be open at the contacts of the (CO1), (CO2), (CO3), or (CO4) relays. The operation of the (I2) or (I4) relay with the associated (I1) or (I3) relay non-operated will cause the busy lamp at the station to light. The "B" lead is used in case a station is not to be cut off by any other station.

8. NON-CUT-OFF FEATURE ON CENTRAL OFFICE OR P.B.X. LINES

- 8.1 When stations are not to cut-off other stations but are to be cut-off the "CO1" or "CO2" leads to these stations are left open at "W" wiring. This prevents the (CO1) and (CO3) or (CO2) and (CO4) relays operating when a call is made from these stations thus allowing other stations to come in on the connection. The (I1) or (I3) relay, however, at these non-cut-off stations will be locked operated until the handset or receiver is replaced on the switchhook. This prevents the cut-off station cutting off the connection.

9. ANSWERING OR ORIGINATING A CALL ON SECOND CENTRAL OFFICE OR P.B.X. LINE

- 9.1 The description of operation for this line is the same as for the first line except that the No. 2 key must be operated instead of the No. 1 key. This operates the (I3) and (I4) relays associated with the station instead of the (I1) and (I2) relays and the (CO2) and (CO4) relays will operate instead of the (CO1) and (CO3) relays.

CD-89037-01 - Issue 7-D - Page 7

10. INTERCOMMUNICATION

- 10.1 When a party at one station desires to call a party at another station, the (I) key will be operated and the handset or receiver removed from the switchhook. This will operate the (IC) relay which connects the station to the intercommunicating line and opens the buzzer circuit. The (B) key will then be operated which will operate the buzzer at the desired station direct or will operate the (BR) relay which will operate the buzzer. When the party answers, the (I) key at that station will be operated and the handset or receiver will be removed from the switchhook. This will cause the (IC) relay at the called station to operate connecting the station to the intercommunicating line. This will enable both parties to communicate with each other.

11. BUZZERS

- 11.1 The buzzers are arranged for both code and selective signalling. For code signalling the (B) key when operated will operate the (BR) relay which in turn will operate all the buzzers that are to be operated code. For selective signalling the (B) key when operated will operate the buzzer direct. When a buzzer is required to operate on code signalling from one or more stations and selective from other stations, the (B) keys at the stations signalling on the code signalling basis will operate the (BR) relay which in turn operates the buzzer as previously described, whereas the keys at the stations operated on a selective signalling basis will operate the buzzers direct as also previously described.

12. EMERGENCY KEY CIRCUIT

In the event of a power failure, calls can be made to the central office or the P.B.X. only from the particular station designated for this purpose. When the (EM) key in Figure 7 is operated the Central Office or P.B.X. line will be opened to all stations through the holding circuit and connected to the designated station direct. The operation of this key also opens the ground lead to the keys of this station thus preventing the relays associated with the station from operating in case the power is again supplied to the system. This prevents the first line becoming crossed

with the second line or the intercommunicating
line.

BELL TELEPHONE LABORATORIES, INC.

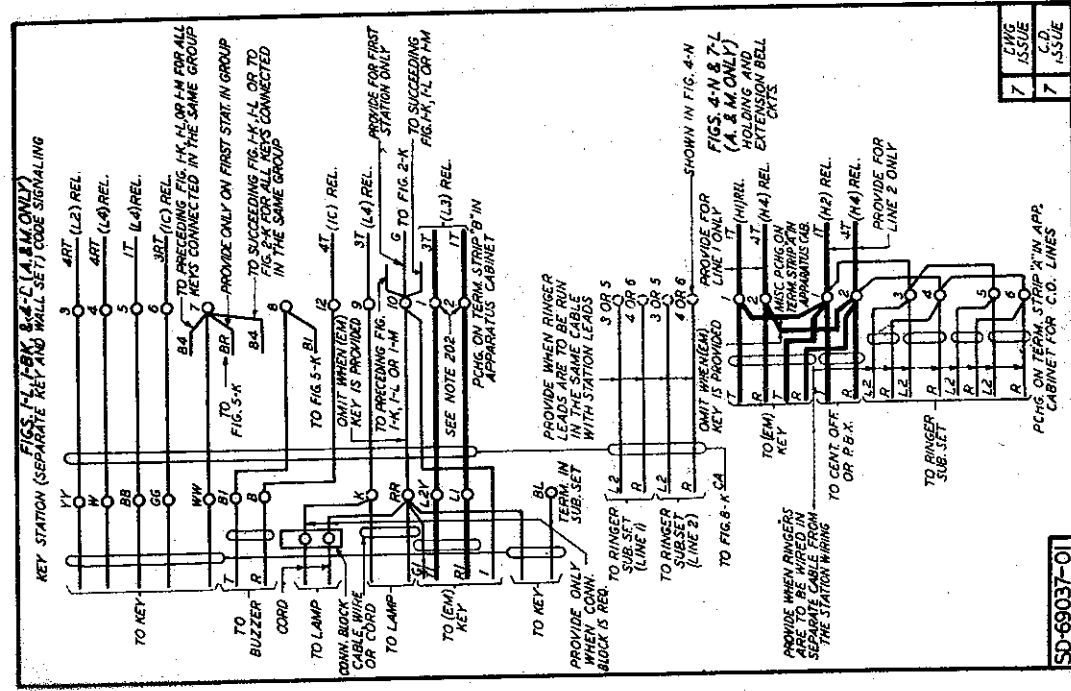
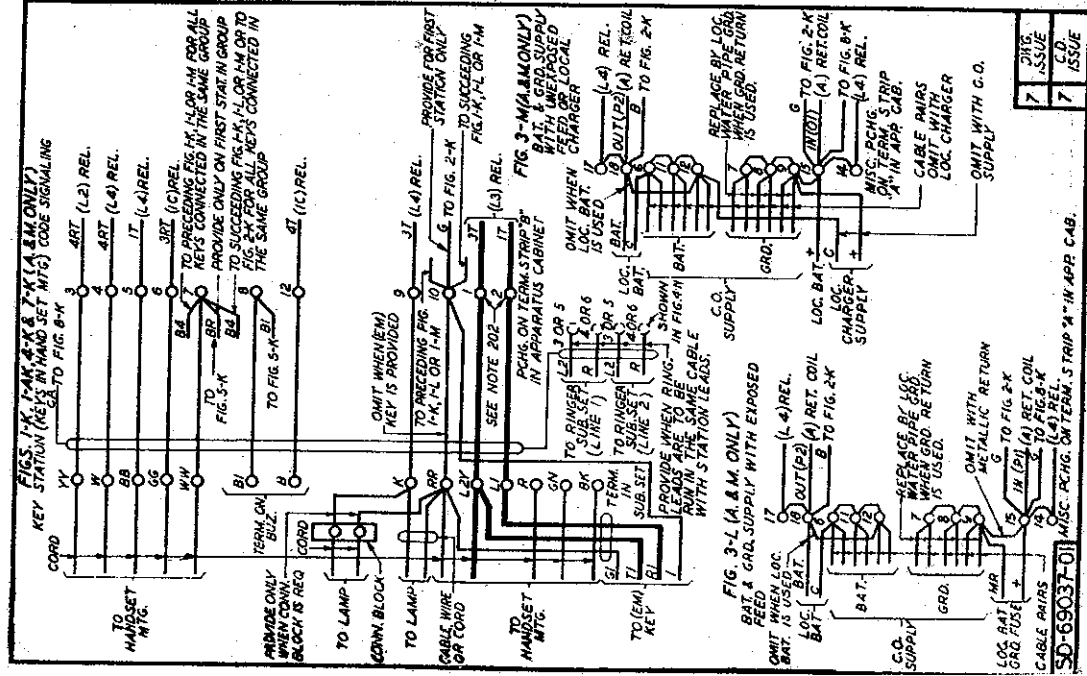
DEPT. 332

WMB)VD
WLF)

NO. 23-A KEY EQUIPMENT



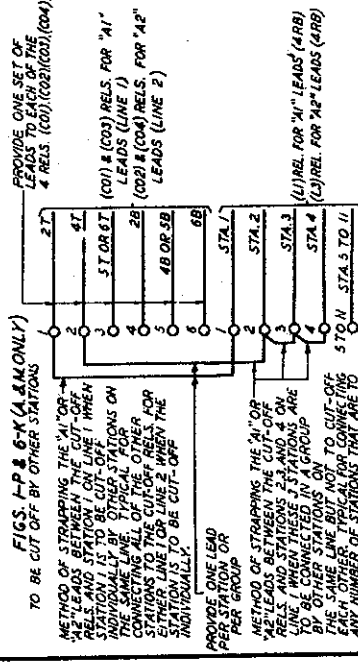
04. PRIOR TO ISSUE 6-D ALL FIG. DESIGNATIONS ON SHEET -013 WERE A DUPLICATION OF FIG. DESIGNATIONS ON SHEET -012.



FIGS. 1-M, 1-CK, & 4-M (A. & M. ONLY)



FIGS. 2-K & 3-K (A. & M. ONLY)
INTERCOMMUNICATING STATION
CODE SIGNALING



PROVIDE ONE SET OF
LEADS TO EACH OF THE
4 RELS. (C01), (C02), (C03), (C04)
(C01) & (C03) RELS. FOR "A1"
LEADS (LINE 1)
(C02) & (C04) RELS. FOR "A2"
LEADS (LINE 2)



FIG. 5-A1
CODE SIGNALING

FIG. 5-A1
CODE SIGNALING



STATION 641.
(SHOWN ARRANGED FOR CODE SIGNALING)

STATION 641.
(SHOWN ARRANGED FOR CODE SIGNALING)



FIG. 2-M
INTERCOMMUNICATING STATIONS
(SHOWN ARRANGED FOR CODE SIGNALING)

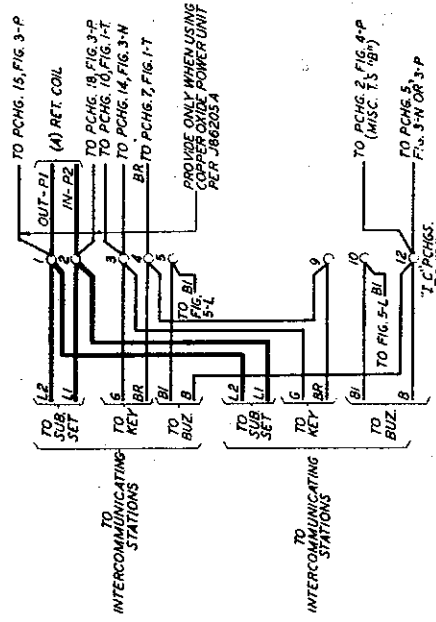
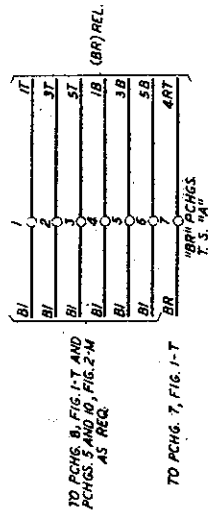


FIG. 5-L
INTERCOMMUNICATING CODE
BUZZER CKT.



SD-69037-01

7	DWG.
7	ISSUE
7	C.D.
7	ISSUE

FIG. 3-N
BAT. SUPPLY
DIRECT FROM C.O. OR
LOCAL BAT.

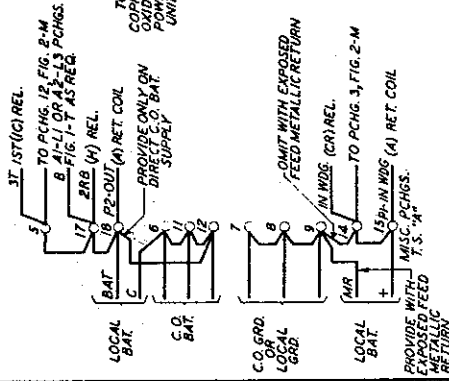
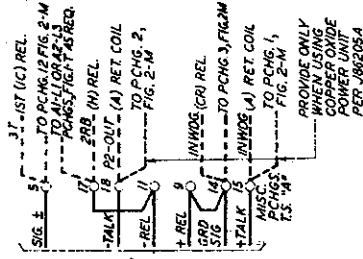
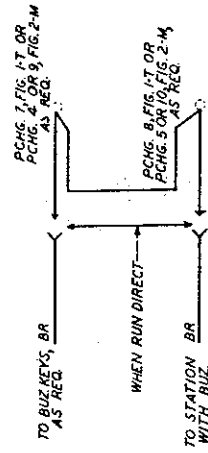


FIG. 3-P
BAT. SUPPLY
COPPER OXIDE
POWER UNIT



FIGS. 1-U, 2-N, & 8-M
SELECTIVE SIGNALING



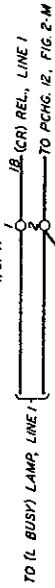
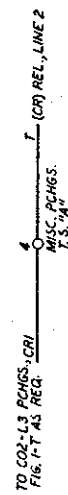
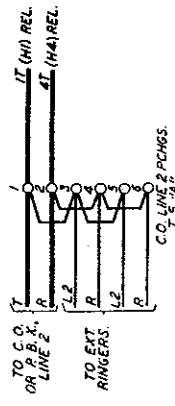
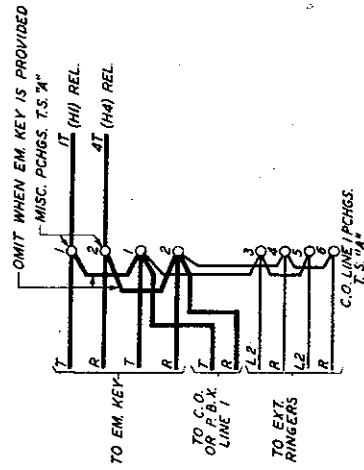
NOTE: WHERE MORE THAN ONE BUZZER KEYS ASSOCIATED WITH A STATION THE "SEL. SIG." PCHGS. ON T.S. "A" CAN BE USED FOR DOUBLING UP PURPOSES, IF REQUIRED.

SD-69037-01

7	DWG.
7	ISSUE
7	C.D.
7	ISSUE

FIGS. 4-P & 7-M

HOLDING CRT

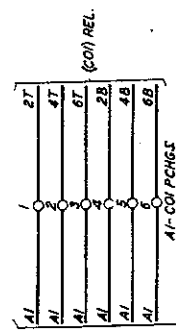


SD-69037-01

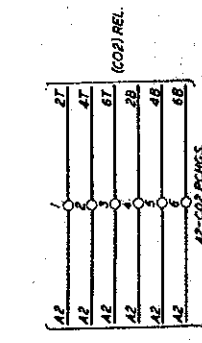
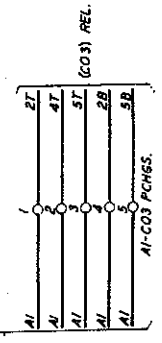
7	DMG.
7	ISSUE
7	C.D.
7	ISSUE

FIG. 6-L

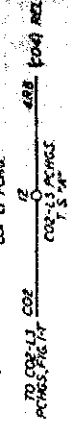
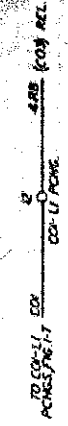
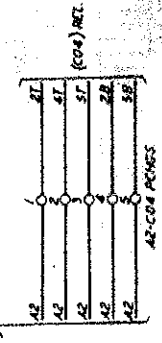
AUT. CUT OFF CRT.



TO 41-1-1 PCHGS. FIG. 1-T, AS REQ.



TO 42-1-1 PCHGS. FIG. 1-T, AS REQ.



SD-69037-01

7	DMG.
7	ISSUE
7	C.D.
7	ISSUE

SD-69037-011 2 PAGES				CIRCUIT REQUIREMENTS												23-A KEY EQUIPMENT	
APPARATUS		MECH. REQ.		CIRCUIT PREPARATION			TEST		SEE DIRECT CURRENT FLOW REQ.				REMARKS				
DESIG.	CODE	BSP FIG.	CONT. PRESS.	ARM TRVL	BLOCK OR INSULATE	TEST CLIP DATA	SET PREP	TEST NO.	TEST WDG.	TEST OR	AFTER SOAK AMP.	TEST READ.	TEST READ.				
RELAYS																	
FIG. 1																	
L1	R1933	23/25	H	030		RT (L1) GRD.				O		023	017				
						RT (L1) GRD.				O		0345	0325				
						LB (L2) GRD.				NO		0131	0136				
L2	R1948	11/46	L	030		RT (L2) GRD.			P	O		0155	0145				
						RT (L2) GRD.			P	H			0126				
						LB (L2) GRD.			S	H		031		OPR. REL. ELECTRICALLY ON THE PRI. WDG.			
L3	R1933	23/25	H	030		RT (L3) GRD.				O		0345	0325				
						RT (L3) GRD.				NO		0131	0136				
L4	R1948	11/46	L	030		RT (L4) GRD.			P	O		0155	0145				
						RT (L4) GRD.			P	H			0126				
						LB (L4) GRD.			S	H		031		OPR. REL. ELECTRICALLY ON THE PRI. WDG.			
FIG. 4																	
CR	V78AS	F/F				T (CR)		BAT.		O		0505	048	ARM. TRVL. .030" MAX.			
						T (CR)		BAT.		NO		0285	030				
H	R1949	46/1	H	030		RT (H) GRD.			P	O		0245	023				
						RT (H) GRD.			P	H			0145				
						LB (H) GRD.			S	H		0125		OPR. REL. ELECTRICALLY ON THE PRI. WDG.			
TEST NOTES:																	
1. THE NOMINAL VOLTAGES FOR THE KS-5460 AND J86205A RECTIFIERS AT THE RATED AMPERAGE ARE GIVEN BELOW. THESE VOLTAGES ARE NOMINAL ONLY AND WILL VARY CONSIDERABLY WITH THE LOAD OF ANY OF THE TAPS.																	
D.C. SUPPLY FOR RELAYS -18 V. AT 0.5 AMP.																	
D.C. SUPPLY FOR TALKING - 3 V. AT 0.1 AMP.																	
A.C. SUPPLY FOR BUZZERS AND LAMPS -15 V. AT 1 AMP.																	

APPARATUS		MECH. REQ.		CIRCUIT PREPARATION		TEST SET		SEE DIRECT CURRENT FLOW REQ.		TEST TEST		TEST TEST		TEST TEST		REMARKS	
DESIG. CODE	BSP FIG.	CONT. PRESS.	ARM TRVL	BLOCK OR INSULATE	TEST CLIP DATA	SET PREP	TEST NO.	TEST WDG.	TEST OR	AFTER SOAK AMP.	TEST READ.	TEST READ.	TEST READ.	TEST READ.	TEST READ.		
H1	R1487	47	H	035													
H2	B74	1		030													
H3	B552	6		030													
H4	R1934	50	H	040													
FIG. 5																	
B	R1960	23/23	L	030													
FIG. 6																	
C	R1781	41/41	L	030													
C	R1781	41/41	L	030													
C	R1781	43/7	H	030													
C	R1781	43/7	H	030													
TEST NOTES:																	
1. INSULATE AT (H4).																	