

# SUBSTATION WIRING PLANS

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## SUBSTATION APPARATUS

1. The apparatus required for the work covered by these specifications (other than desk stands and subscribers' sets in separate specifications covering SUBSTATION APPARATUS and MACHINE SWITCHING SUBSTATIONS) is given below in alphabetical order.

- Battery Boxes:**    **#1-A BATTERY BOX.**  
Metal box for holding 3 dry cells to provide current for operation of buzzer circuits.
- #2-B BATTERY BOX.**  
Metal box for holding 9 dry cells to provide current for intercommunication.
- Buzzer:**            **BUZZER, A. T. & T. CO. DRAWING 705-678.**  
To be used with 3 dry cells for buzzer circuits.
- Cords:**             **#549 CORD.**  
Two conductor single head receiver cord. Used in Plan 401.
- #551 CORD.**  
Four conductor cord. Used in Plan 401.
- #696 CORD.**  
Two conductor double head receiver cord. Used in Plan 400.
- Head Bands:**     **#1-A HEAD BAND.**  
Double head band. Used with two #528 receivers in Plan 400.
- #3-A HEAD BAND.**  
Single head band. Used with one #528 receiver in Plan 401.
- Instruction Cards:** **SUBSCRIBERS' INSTRUCTION CARDS.**  
Forms E-404 to E-415 inclusive.  
Proper instruction card to be left with subscriber when plan is installed.

Plan Number	Form Number	Plan Number	Form Number
100	.....E-404	202	.....E-410
101	.....E-405	203	.....E-411
102	.....E-406	204	.....E-412
150	.....E-407	300	.....E-413
200	.....E-408	400	.....E-414
201	.....E-409	401	.....E-415

- Jack:** **#190 JACK.**  
Substation jack. Used in Plan 400.
- Keys:** **#6002-B KEY.**  
A mounted two position lever key making and breaking 2 sets of contacts. Used in Plans 100, 101, 102, 150, 400 and 401.
- #6002-D KEY.**  
A mounted two position lever key making and breaking 3 sets of contacts. Used in Plan 100.
- #6002-E KEY.**  
A mounted three position lever key making and breaking 2 sets of contacts. Used in Plans 201, 203 and 204.
- #6009-A KEY.**  
A mounted four button mechanically locking type key. Three lower buttons each make and break 2 sets of contacts. Top button makes two sets of contacts. Holding buttons (red) do not lock. Used in Plans 200 and 300.
- #6009-B KEY.**  
A mounted five button mechanically locking type key. Four lower buttons each make and break two sets of contacts. Top button makes two sets of contacts. Holding buttons (red) do not lock. Used in Plans 201 and 202.
- #6012-A KEY.**  
Combination of three button mechanically locking type key and lever key in same mounting. Two lower buttons each make and break two sets of contacts. Top button and lever each make two sets of contacts. Holding button (red) does not lock. Used in Plan 102.
- Key Mountings:** **#360 KEY MOUNTING.**  
For one push button. Used with buzzer circuits.
- #361 KEY MOUNTING.**  
For two push buttons. Used with buzzer circuits.
- Plug:** **#148 PLUG.**  
Substation plug. Used with double head receivers in Plan 400.

- Push Button:** PUSH BUTTON, A. T. & T. CO. DRAWING 705-679.  
Used with buzzer circuits.
- Receiver:** #528 RECEIVER.  
Used with Plans 400 and 401.
- Subscribers' Sets:** #541-A SUBSCRIBER SET.  
One line talking, holding and intercommunicating set. Used at M Station of Plan 102. Includes retardation coil and holding equipment in addition to ringer, induction coil and condenser. For wiring, see Section 22.
- #542-A SUBSCRIBER SET.  
Two line talking, holding and intercommunicating set. Used at M Station of Plans 200, 201, 202 and 300. Includes retardation coil and holding equipment in addition to two ringers, induction coil and condenser. For wiring, see Section 22.
- #544-A SUBSCRIBER SET.  
Listening in set. Used with Plan 400. Consists of repeating coil and condenser. For wiring, see Section 22.
- Switch:** #2047 SWITCH.  
Two position indicating snap switch making and breaking one set of contacts. Used in Plan 150.

## SCOPE

2. These specifications cover standard wiring plans which may be defined as one or more subscribers' stations with which keys are provided. The standard wiring plans will not be installed in connection with either party lines or magneto lines except when authorized by supplemental instructions.

The specifications for SUBSTATION CONNECTIONS and MACHINE SWITCHING SUBSTATIONS cover, respectively, the connection of subscribers' sets and associated apparatus in manual and in machine switching districts where no keys or equipment for signaling between stations is required.

These specifications cover the connection of subscribers' sets and associated apparatus on common battery individual lines and on private branch exchange extension lines in either manual or machine switching districts where keys are required. The use of certain of these plans on long loops may be limited as specified under Section 23.

The wiring plans covered in these specifications should meet all usual demands for wiring plans at subscribers' stations. All stations of the plans shall be located on the same premises and in the same building. Requests for wiring arrangements other than those covered in these specifications or for wiring arrangements covered in these specifications where stations off the premises or stations on the same premises in different buildings are involved, shall be referred to the Engineering Department for consideration.

The wiring plans which involve only one line have in general a maximum of five stations. The two and three line plans are in general limited to a maximum of six stations.

## CLASSIFICATION AND DESCRIPTION OF PLANS

The wiring plans are divided into the following general groups according to the demands they are designed to meet.

**3. Cut-off plans. Plans 100 to 102.** These plans provide keys at designated stations so that these stations may cut off other stations from the Central Office or Private Branch Exchange line. One of these plans provides also the holding and intercommunicating features.\*

**Plan 150.** This plan provides for a switch or key to cut-off an extension bell from the Central Office or Private Branch Exchange line.

**4. Pick-up plans. Plans 200 to 204.** These plans provide keys at designated stations so that these stations can pick up any of two or three lines. Certain of these plans provide the holding and intercommunicating features.

**5. Secretarial plan. Plan 300.** This plan provides a key so that a secretary can answer calls on either of two lines. The holding feature is provided at the secretary's station.

**6. Listening plans. Plan 400.** This plan provides receiver equipment at a designated station for use where equipment is desired so that a second party may listen in for the purpose of recording telephone conversations.

**Plan 401.** This plan provides key and auxiliary receiver equipment so that the subscriber may use either a hand or head receiver.

\*The holding feature provides facilities so that a call on the C. O. or P. B. X. line may be held at a station. This feature is generally used for holding a call while talking locally with another station over the inter-communicating line or while answering or making a call on another C. O. or P. B. X. line.

## Summary of Plan Features

7. The various features of the plans are given under Section 13. For convenient reference they are summarized below:

Plan	No. of Stations		No. of Bells		Cut Off	Pick Up	Hold-ing	Inter Com-muni-cation			
	Lines	Min. Max.	Min.	Max*							
100	1	2	5	1	4	Yes	No	No	No		
101	1	2	5	2	4	Yes	No	No	No		
102	1	2	5	1	4	Yes	No	Yes	Yes		
150	Bell Cut-off Plan			1	1	Yes	No	No	No		
200	2	1	2	1	per line	4	per line	No	Yes	Yes	No
201	2	2	6	1	per line	4	per line	No	Yes	Yes	Yes
202	2	2	6	1	per line	4	per line	No	Yes	Yes	Yes
203	2	2	6	1	per line	4	per line	No	Yes	No	No
204	3	3	6	1	per line	4	per line	No	Yes	No	No
300	2	2	3	1	per line	4	per line	No	Yes	Yes	No
400	Key connects double head receivers										
401	Key connects either hand or head receiver										

\*See Section 17.

## DESIGNATION OF STATIONS

8. The stations comprising the wiring plans are designated "Master," "Controlled" and "Line" stations. These designations are used to differentiate these stations from stations not a part of a wiring plan [covered in separate specifications for SUBSTATION CONNECTIONS AND MACHINE SWITCHING SUBSTATIONS] and to which the designations "Main" and "Extension" will continue to apply.

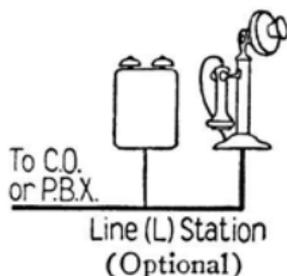
9. **Master Stations** are the principal stations and control certain functions of the plan. All plans must have at least one Master station and some plans may have more than one.

10. **Controlled Stations** are, in general, dependent upon the Master Station for some of their functions. In certain of the plans Controlled Stations permanently connected to the intercommunicating line are optional and are shown in outline for these plans.

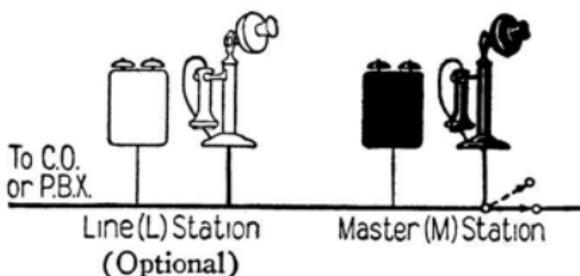
**11. Line Stations** are permanently connected to the line and are independent of all key operation. In general such stations are optional. They are shown in outline in the diagrams and circuits for those plans with which they are allowed.

**12. Code System.** When Master, Controlled and Line Stations are provided with bells they are designated respectively M, C and L stations. When they are without bells they are designated respectively MX, CX and LX stations.

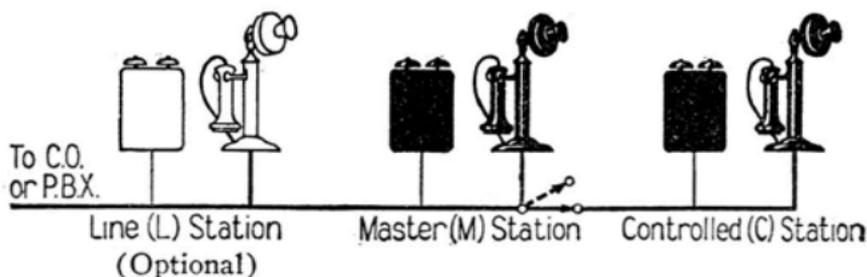
Line Stations with bells (L) or without bells (LX) are shown on the diagrams (as below) nearest the Central Office or Private Branch Exchange. When two or three C. O. or P. B. X. lines are involved, Line Stations connected to the first line are coded L when equipped with bells and LX when not equipped with bells. Line Stations connected to the second line are coded LA when equipped with bells and LXA when not equipped with bells. Line Stations connected to the third line are coded LB when equipped with bells and LXB when not equipped with bells.



Master stations with bells (M) or without bells (MX) and always having a key, are shown to the right of the Line Station.



Controlled stations with bells (C) or without bells (CX) are shown at the right of the Master Station. When two C. O. or P. B. X. lines are involved, a Controlled Station connected to the first line is coded C when equipped with bells and CX when not equipped with bells. A controlled Station connected to the second line is coded CA when equipped with bells and CXA when not equipped with bells. Controlled stations permanently connected to an inter-communicating line are never equipped with bells and are coded CR.



In writing the code number of any plan, the plan number precedes the letters, i. e., 100, L, M, C. This code number designates a plan 100 having a Line Station with bells, a Master Station with bells and a Controlled Station with bells. If the Line Station were without bells the code number would be 100, LX, M, C. The code number 201, M, 2 CX, CR designates a plan 201 having a Master Station with bells, two Controlled Stations without bells and a Controlled Station permanently connected to the inter-communicating line. The code number 203, L, LXA, M designates a plan 203 having a Line Station with bells connected to the first line, a Line Station without bells connected to the second line and a Master Station with bells.

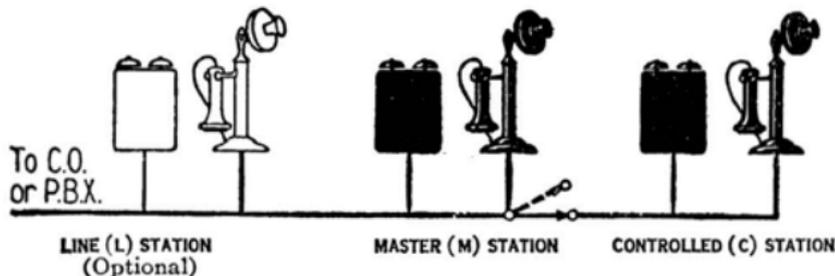
All permissible combinations of stations (with and without bells) for the various plans are shown under "Station and Bell Combinations" for each plan in Section 13.

## **PLAN DIAGRAMS, LIMITS, USE, OPERATION AND CIRCUITS**

**13.** The following pages give in detail for each of the wiring plans the

Diagram  
Number of Lines, Stations and Bells  
Station and Bell Combinations  
Use  
Operation and  
Circuit

## PLAN 100—Diagram



Number of Lines	Number of Stations		Number of Bells		Station and Bell Combinations*
	Minimum	Maximum	Minimum	Maximum	
1	2	5	1	4	(Minimum) M, CX 3L, M, CX    2L, M, CX    L, M, CX L, M, C    L, M, 2C    M, C    M, 2C

**Use**

Where subscriber desires to cut-off the controlled stations.

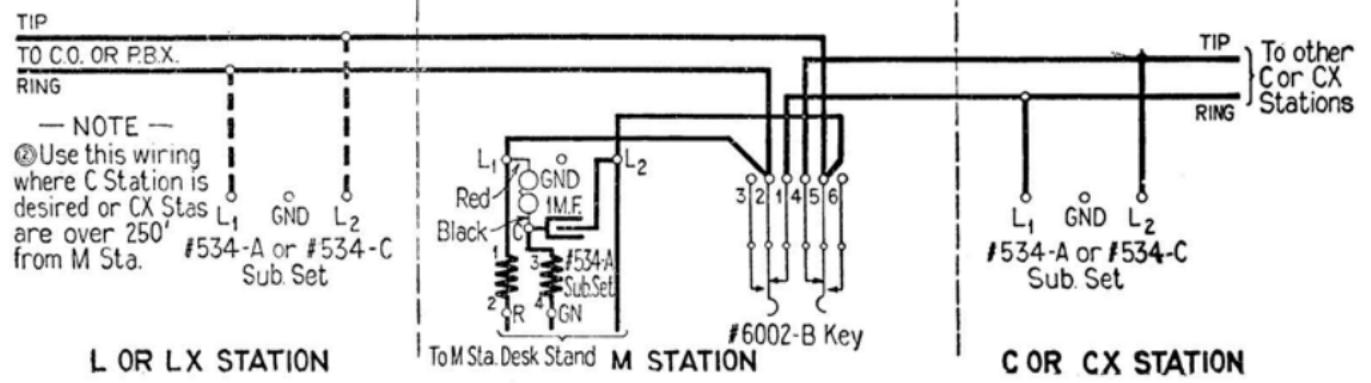
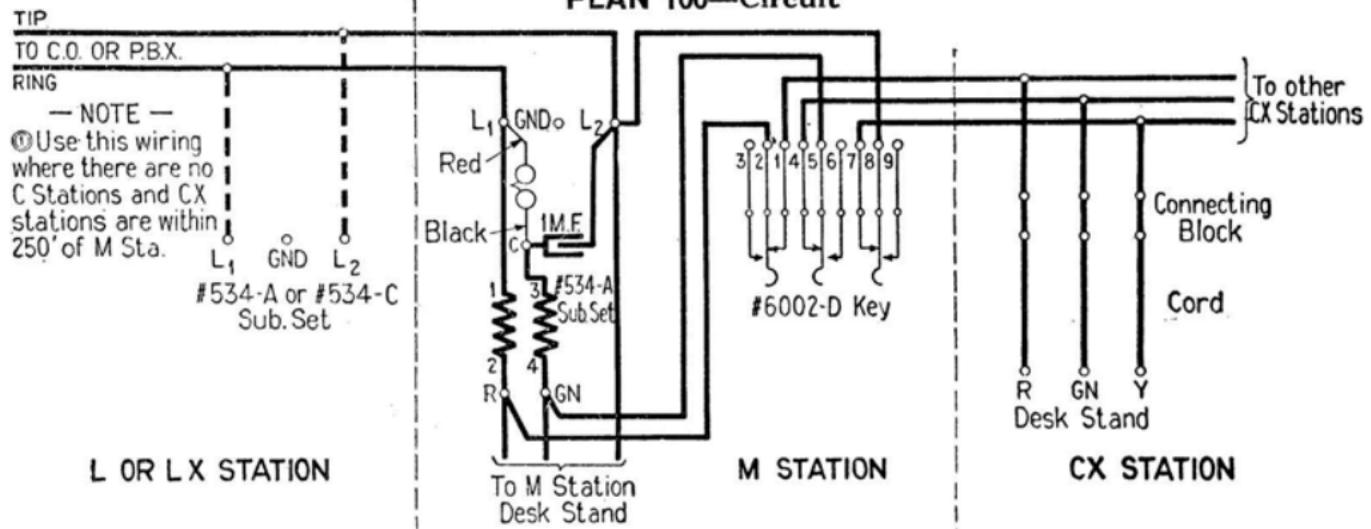
**Operation**

With key normal, all stations are connected to the line.

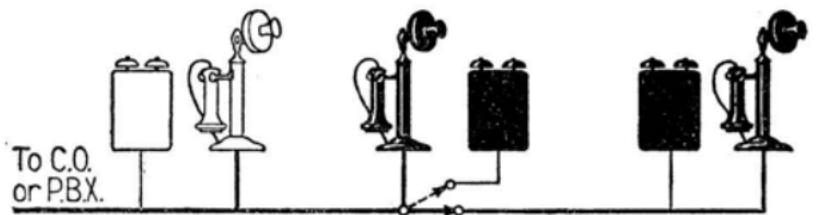
With key operated, C and CX stations are cut-off.

\*Any number of LX and CX stations may be added to these combinations provided the limit of 5 stations is not exceeded.  
For extension bells see Section 18.

**PLAN 100—Circuit**



PLAN 101—Diagram



Number of Lines	LINE (L) STATION (Optional) Number of Stations		MASTER (M) STATION Number of Bells		CONTROLLED (C) STATION	Station and Bell Combinations* (Minimum) M, C
	Minimum	Maximum	Minimum	Maximum		
1	2	5	2	4	2L, M, C	L, M, C L, M, 2C M, 2C M, 3C

**Use**

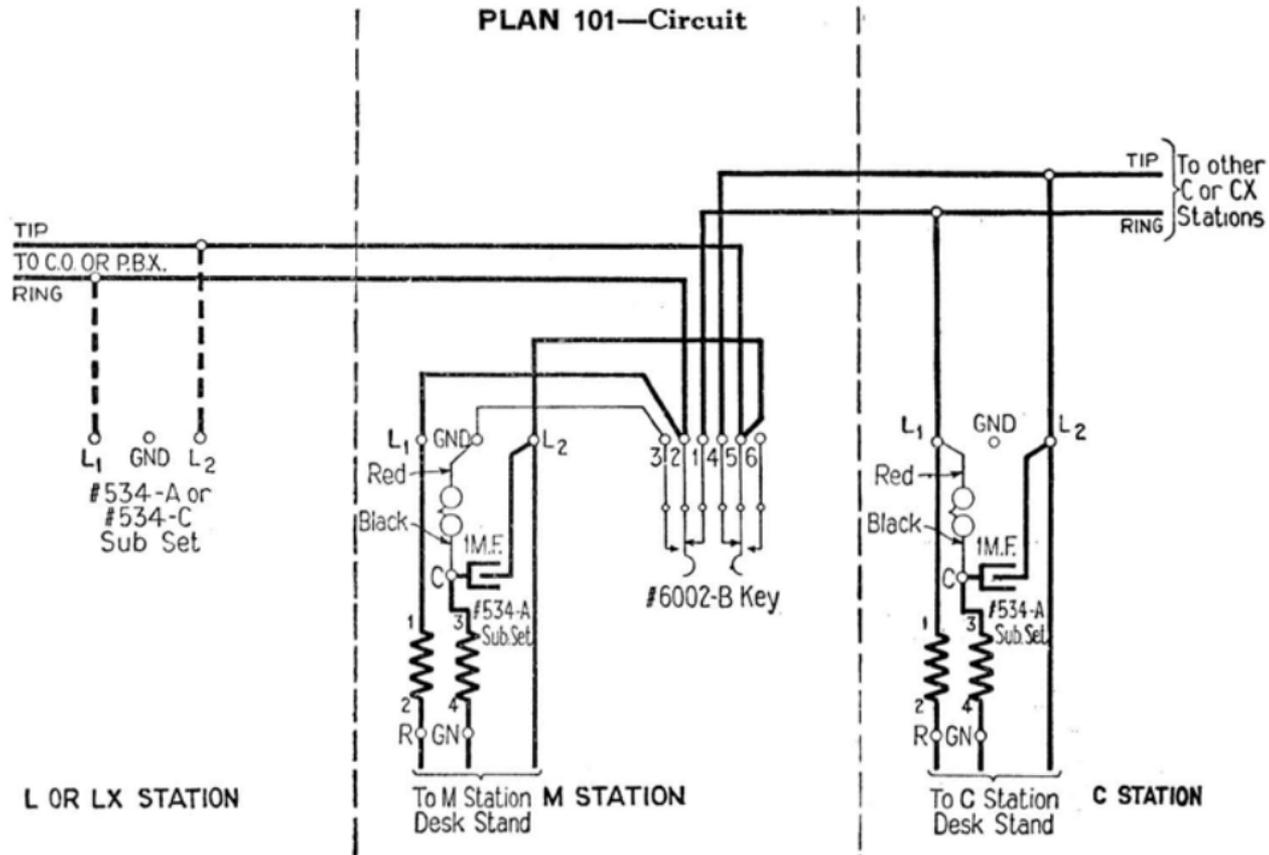
Where subscriber desires to have calls normally received at the controlled stations and be able to cut-off the controlled stations. When controlled stations are cut-off calls are received at the master station.

**Operation**

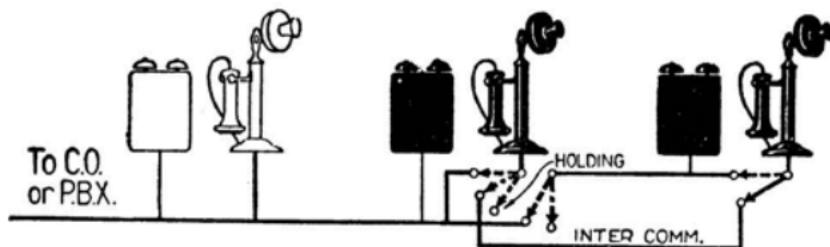
With key normal, all stations are connected to the line and the bell at the M station is cut-off. With key operated, C and CX stations are cut-off and the bell at the M station is connected to the line.

\*Any number of LX and CX stations may be added to these combinations provided the limit of 5 stations is not exceeded. For extension bells see Section 18.

PLAN 101—Circuit



## PLAN 102—Diagram



Number of Lines	LINE (L) STATION (Optional)		MASTER (M) STATION		Station and Bell Combinations* (Minimum)
	Number of Stations	Number of Bells	Minimum	Maximum	
1	2	5	1	4	M, CX, L, M, C L, M, CX L, M, 2C M, C M, 2C

**Use**

Where subscriber desires to cut-off the controlled stations from the C.O. or P.B.X. line and to inter-communicate between master and controlled stations or between controlled stations.

**Operation**

Calls will normally be answered at the M station and may be transferred to the C and CX stations.

Each C and CX station may pick up either the inter-communicating line or the C.O. or P.B.X. line by means of the #6002-B key.

With #6012-A key normal, the M station is disconnected from all lines.

Operating the lever unit of the #6012-A key connects the C and CX stations to the C.O. or P.B.X. line.

Operating the first button of the #6012 A key connects the M station to the inter-communicating line

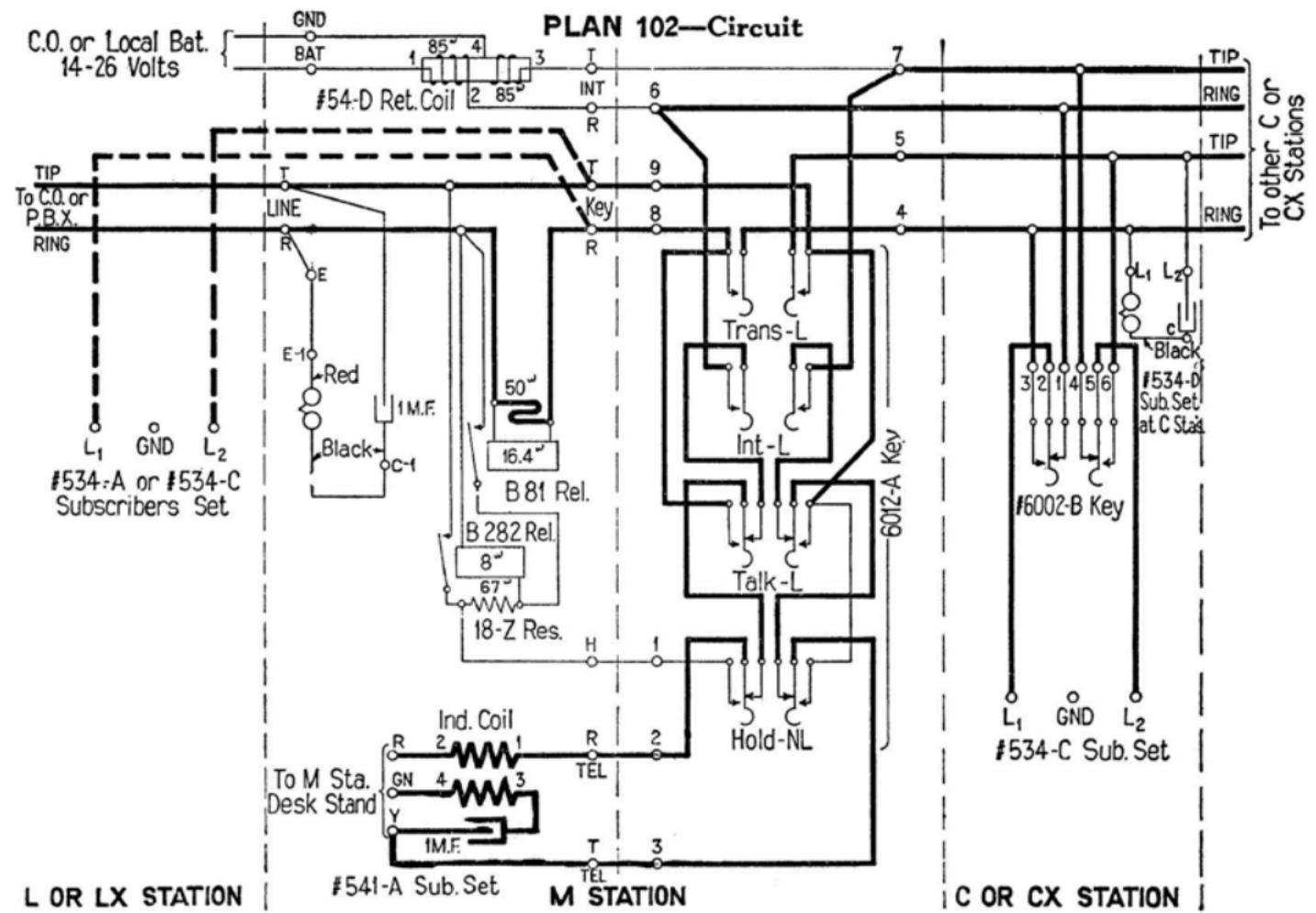
Operating the second button connects the M station to the C.O. or P.B.X. line.

Operating the third button holds the C.O. or P.B.X. line.

For explanation of operation of relay holding circuit see Section 23.

\*Any number of LX and CX stations may be added to these combinations provided the limit of 5 stations is not exceeded, For extension bells see Section 18.

**PLAN 102—Circuit**

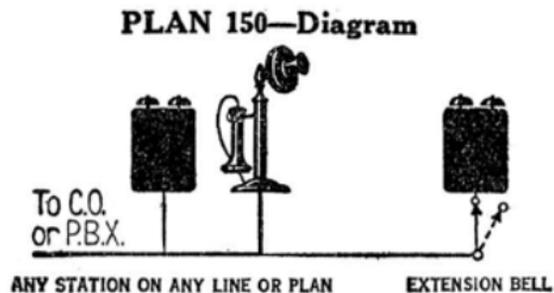


To other C or  
CX Stations

L OR LX STATION

M STATION

C OR CX STATION



Write code number as "Plan 150."

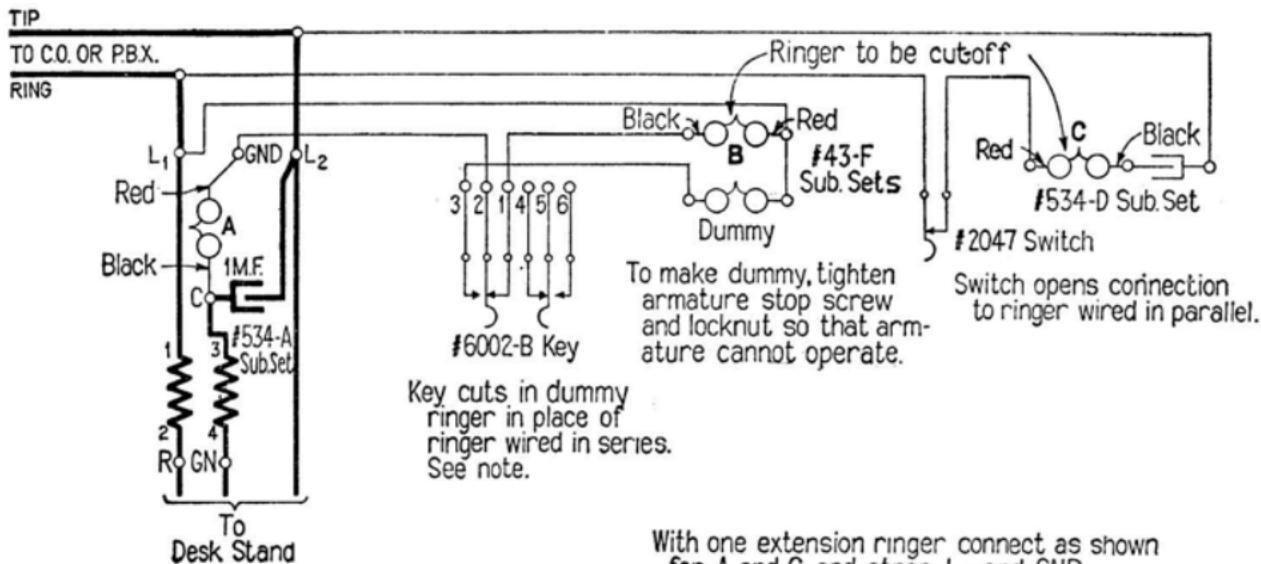
**Use**

Where subscriber desires an extension bell which he may cut-off.

**Operation**

With key or switch normal, the associated extension bell is connected to the line.  
With key or switch operated, the associated extension bell is cut-off.

### PLAN 150—Circuit



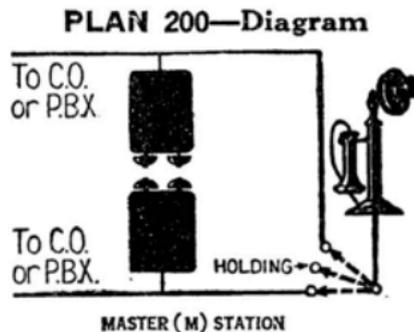
Key cuts in dummy ringer in place of ringer wired in series. See note.

To make dummy, tighten armature stop screw and locknut so that armature cannot operate.

Switch opens connection to ringer wired in parallel.

With one extension ringer connect as shown for A and C and strap L<sub>1</sub> and GND.  
With two extension ringers connect as shown for A, B and C.

Note:- In manual central office districts dummy ringer may be omitted and #6002-B key replaced by #2047 switch so wired that when operated it will shunt ringer B.



Number of Lines	Number of Stations		Number of Bells		Station and Bell Combinations (Minimum) One bell on each line with one master station*
	Minimum	Maximum	Minimum	Maximum	
2	1	2	1 per line	4 per line	

### Use

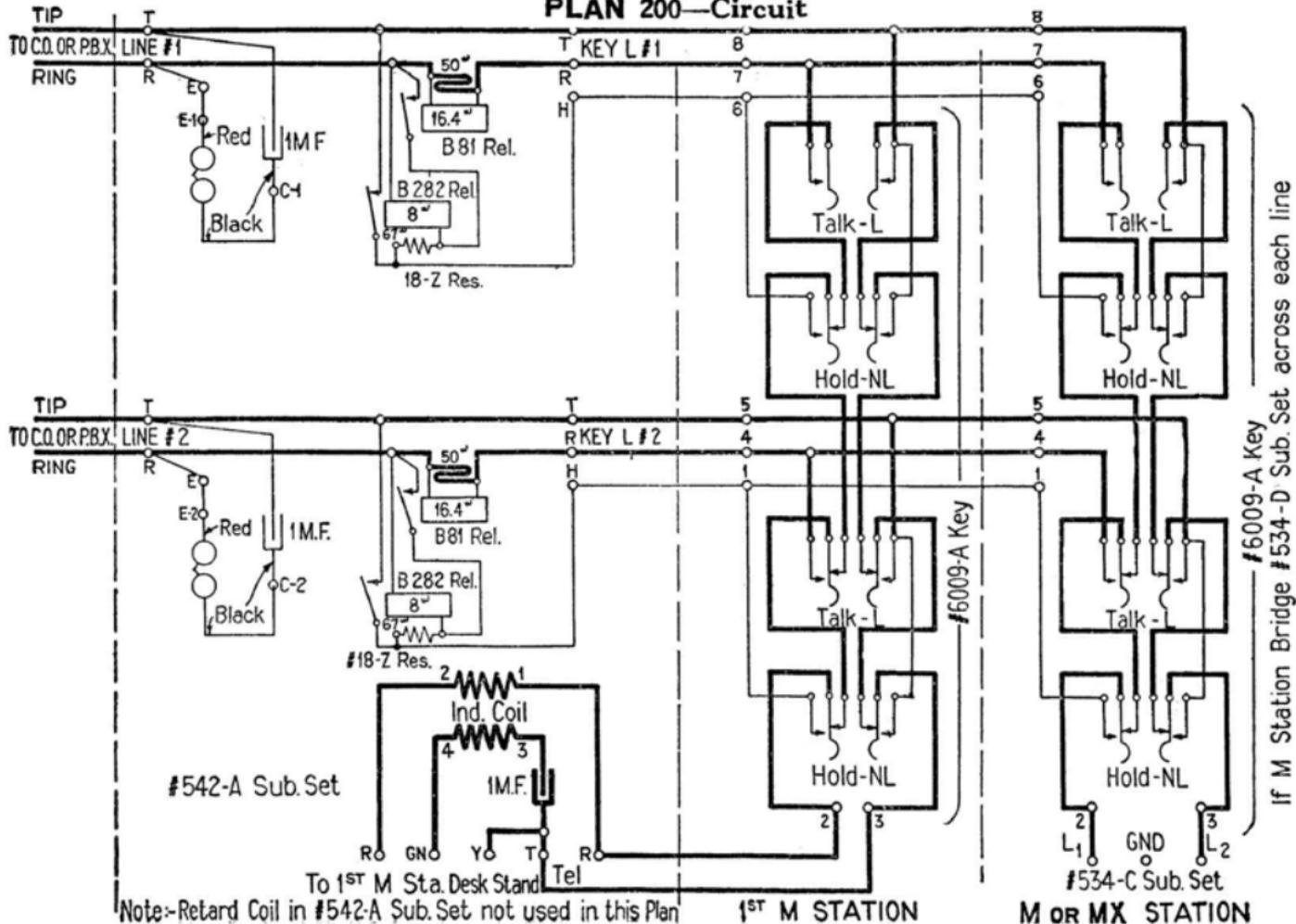
Where subscriber desires to have one or two stations able to pick-up and hold either of two C.O. or P.B.X. lines.

### Operation

With #6009-A key normal, the associated M station is disconnected from both lines.  
 Operating the first button of the #6009-A key connects the associated M station to the first line.  
 Operating the second button holds the first line.  
 Operating the third button connects the associated M station to the second line.  
 Operating the fourth button holds the second line.  
 For explanation of operation of relay holding circuit see Section 23.

\*One M or MX station may be added to the station shown as the minimum station and bell combination. For extension bells see Section 18.

**PLAN 200—Circuit**



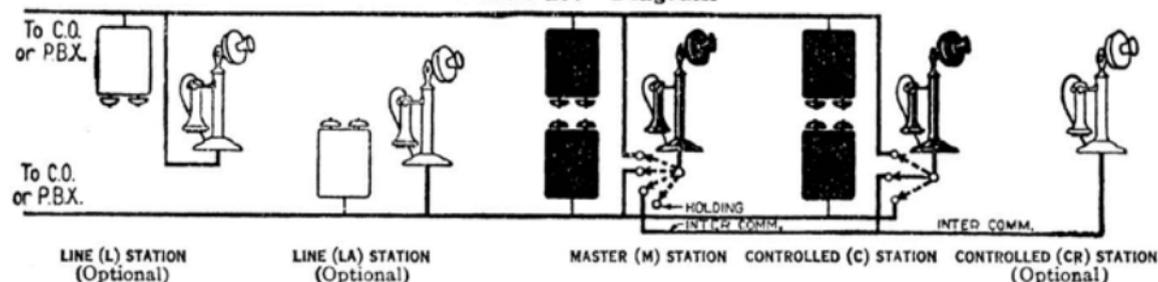
Note:-Retard Coil in #542-A Sub. Set not used in this Plan

1<sup>ST</sup> M STATION

M OR MX STATION

**SUBSTATION  
WIRING  
PLANS**

PLAN 201—Diagram



Number of Lines	Number of Stations		Number of Bells		Station and Bell Combinations (Minimum) One bell on each line with one Master station and one controlled station*
	Minimum	Maximum	Minimum	Maximum	
2	2	6	1 per line	4 per line	

**Use**

Where subscriber desires to have one station able to pick up and hold either of two C.O. or P.B.X. lines and able to inter-communicate with other stations which can also pick up but not hold either of the two lines.

**Operation**

Calls will normally be answered at the M station and may be transferred to the C and CX stations. Each C and CX station is provided with a #6002-E key by means of which either of the C.O. or P.B.X. lines or the inter-communicating line may be picked up.

With #6009-B key normal, the M station is disconnected from all lines.

Operating the first button of the #6009-B key connects the M station to the inter-communicating line.

Operating the second button connects the M station to the first line.

Operating the third button holds the first line.

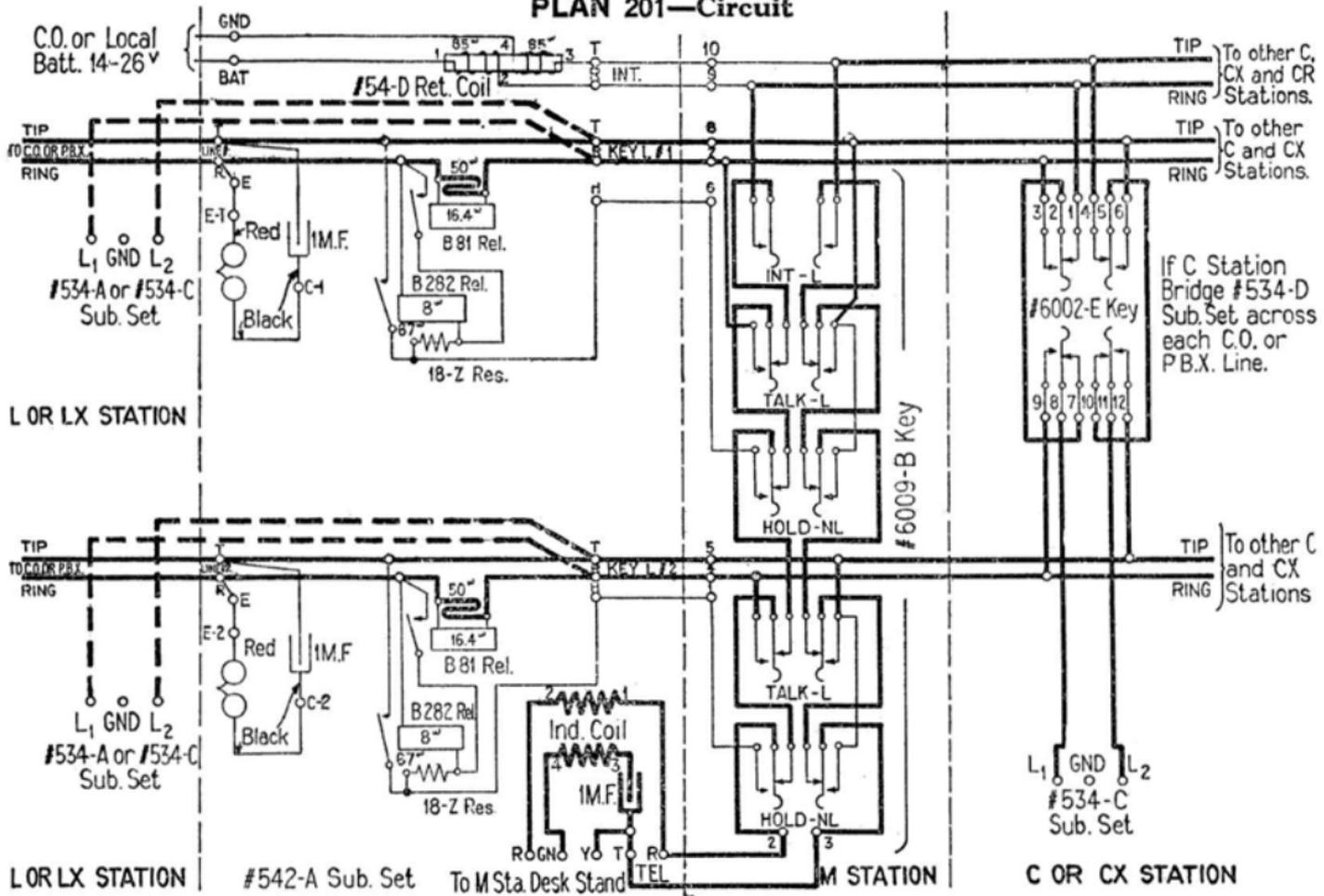
Operating the fourth button connects the M station to the second line.

Operating the fifth button holds the second line.

For explanation of operation of relay holding circuit see Section 23.

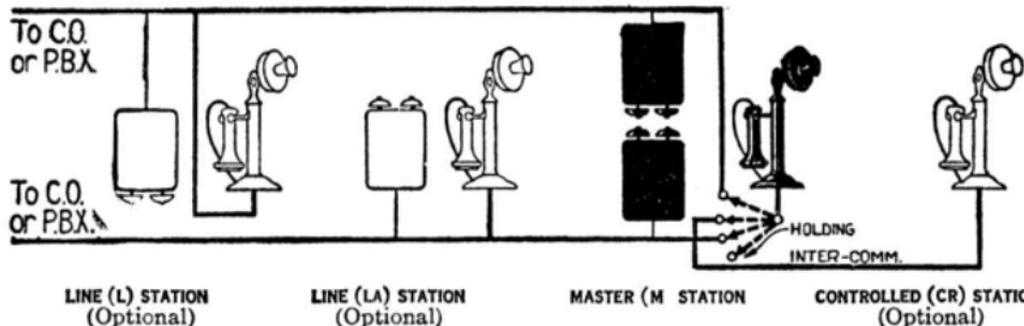
\*Any number of L, LX, LA, LXA, C, CX and CR stations may be added to the stations shown as the minimum station and bell combination provided the limits of 4 bells per line and a total of 6 stations are not exceeded. For extension bells see Section 18.

# PLAN 201—Circuit



SUBSTATION  
WIRING  
PLANS

PLAN 202—Diagram



Number of Lines	Number of Stations (Optional)		Number of Bells		Station and Bell Combinations (Minimum) One bell on each line with two master stations*
	Minimum	Maximum	Minimum	Maximum	
2	2	6	1 per line	4 per line	

**Use**

Where subscriber desires to have several stations able to pick-up and hold either of two C.O. or P.B.X. lines and able to inter-communicate with each other.

**Operation**

With #6009-B key normal, the associated M station is disconnected from all lines.

Operating the first button of the #6009-B key connects the associated M station to the inter-communicating line.

Operating the second button connects the associated M station to the first line.

Operating the third button holds the first line.

Operating the fourth button connects the associated M station to the second line.

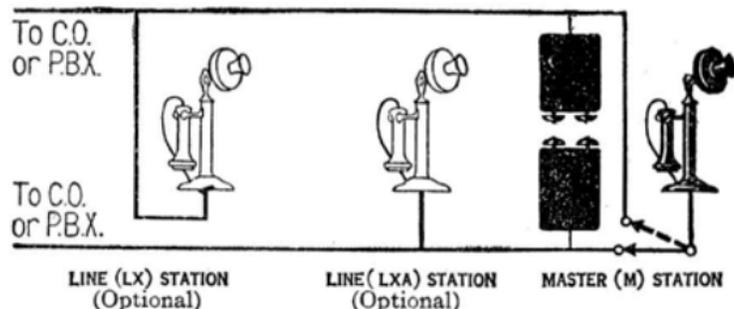
Operating the fifth button holds the second line.

For explanation of operation of relay holding circuit see Section 23.

\*Any number of L, LX, LA, LXA, M, MX and CR stations may be added to the stations shown as the minimum station and bell combination provided the limits of 4 bells per line and a total of 6 stations is not exceeded. For extension bells see Section 18.



PLAN 203—Diagram



Number of Lines	Number of Stations		Number of Bells		Station and Bell Combinations (Minimum) One bell on each line with either (a) two master stations or (b) one line station on each line and one master station*
	Minimum	Maximum	Minimum	Maximum	
2	2	6	1 per line	4 per line	

### Use

Where subscriber desires to have one or more stations able to pick-up either of two C.O. or P.B.X. lines.

### Operation

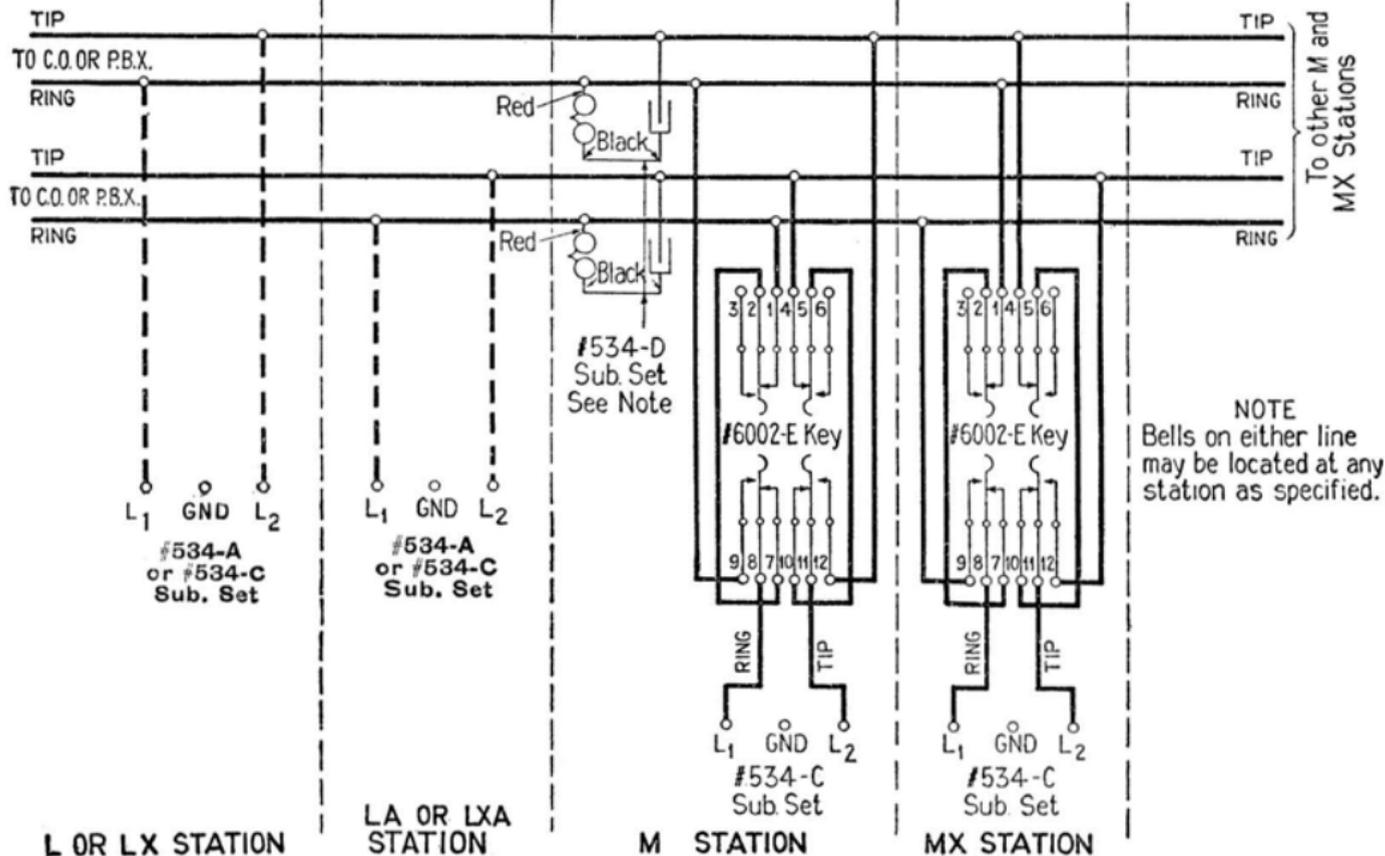
With the #6002-E key normal, the associated M station is connected to one of the lines.

Operating the #6002-E key to one of its operated positions disconnects the associated M station from the line to which it is normally connected and connects it to the other line.

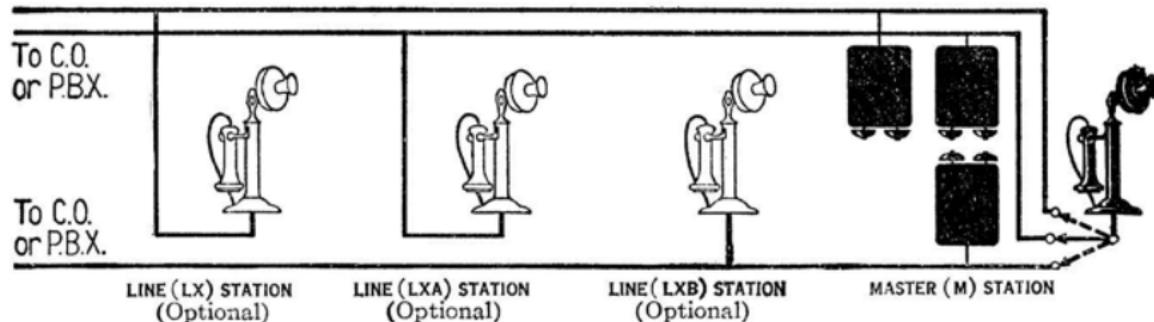
The other operated position of the key is provided so that this plan may be readily converted to plan 204.

\*Any number of L, LX, LA, LXA, M and MX stations may be added to the stations shown as the minimum station and bell combinations provided the limits of 4 bells per line and a total of 6 stations are not exceeded. For extension bells see Section 18.

PLAN 203—Circuit



PLAN 204—Diagram



Number of Lines	Number of Stations		Number of Bells		Station and Bell Combinations (Minimum) One bell on each line with either (a) three master stations or (b) one line station on each line and one master station*
	Minimum	Maximum	Minimum	Maximum	
3	3	6	1 per line	4 per line	

**Use**

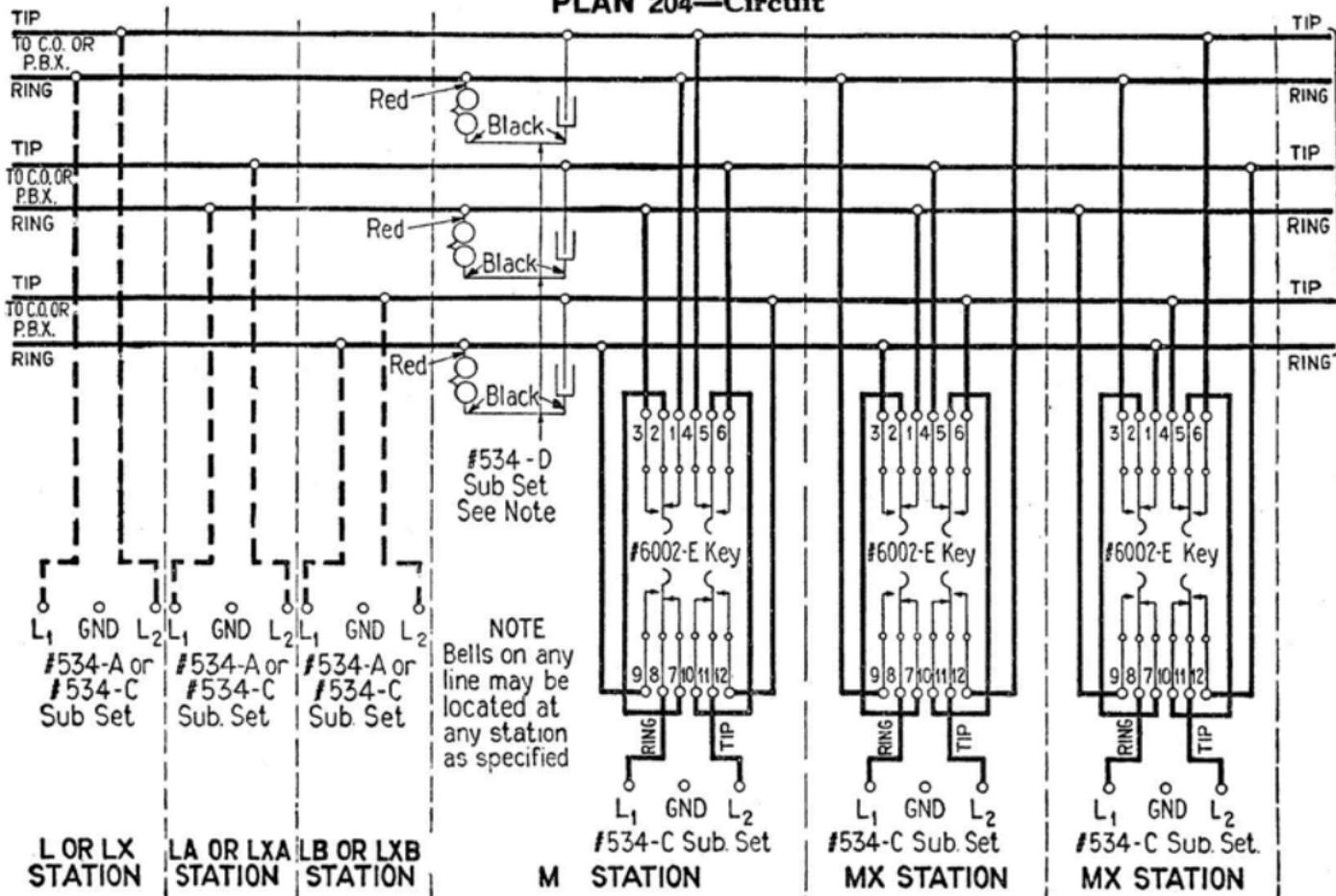
Where subscriber desires to have one or more stations able to pick up any one of three C. O. or P.B.X. lines.

**Operation**

With the #6002-E key normal, the associated M station is connected to one of the lines. Operating the #6002-E key to either of its two operated positions disconnects the associated M station from the line to which it is normally connected and connects it to one of the other two lines.

\*Any number of L, LX, LA, LXA, LB, LXB, M and MX stations may be added to the stations shown as the minimum station and bell combinations provided the limits of 4 bells per line and a total of 6 stations are not exceeded. For extension bells see Section 18.

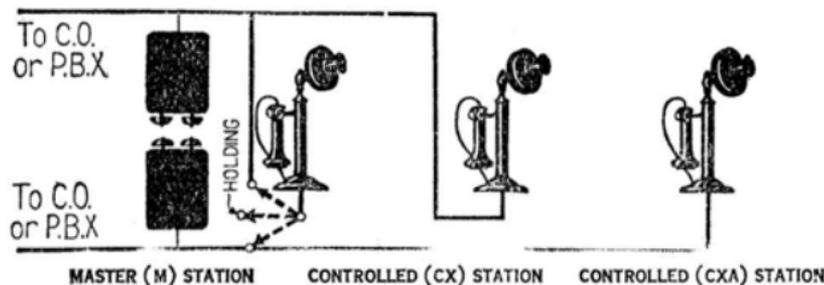
# PLAN 204—Circuit



#534 - D  
Sub Set  
See Note

**NOTE**  
Bells on any  
line may be  
located at  
any station  
as specified

## PLAN 300—Diagram



Number of Lines	MASTER (M) STATION		CONTROLLED (CX) STATION		CONTROLLED (CXA) STATION	
	Number of Stations	Minimum	Maximum	Number of Bells	Station and Bell Combinations	
2	2	2	3	Minimum 1 per line	Maximum 4 per line	(Minimum) One bell on each line with one master station and one controlled station*

**Use**

Where subscriber desires either one or two stations each permanently connected to different lines and an additional station able to pick up and hold either of the two lines.

**Operation**

Calls will normally be answered at the M station and may be transferred to the controlled station connected to the line on which the call is received.

Operating first button of the #6009-A key connects M station to the first line.

Operating second button holds the first line.

Operating third button connects M station to the second line.

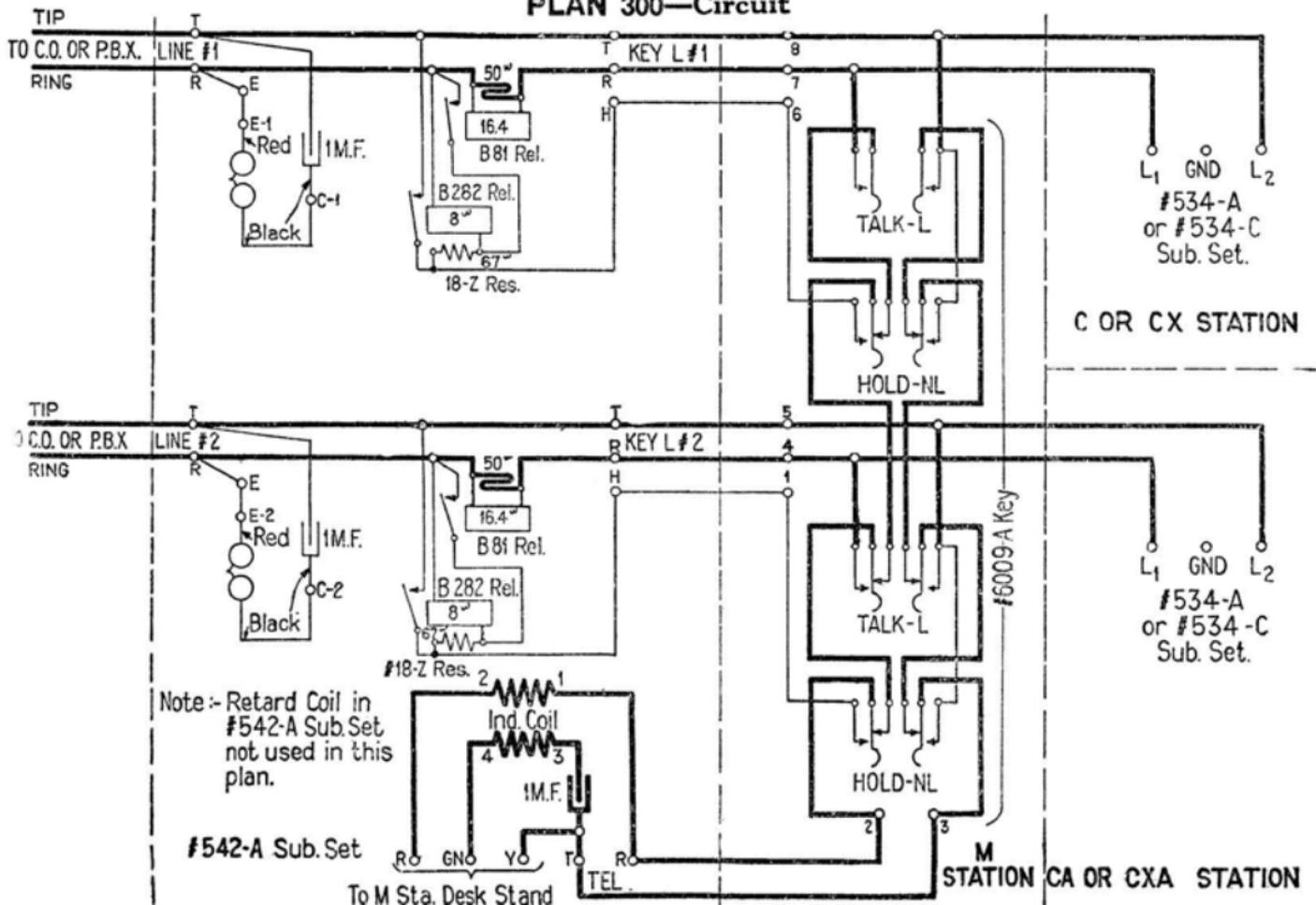
Operating fourth button holds the second line.

For explanation of operation of relay holding circuit see Section 23.

\*One CA or CXA station and a bell at the CX station may be added to the stations shown as the minimum station and bell combination. For extension bells see Section 18.

# PLAN 300—Circuit

SUBSTATION  
WIRING  
PLANS



C OR CX STATION

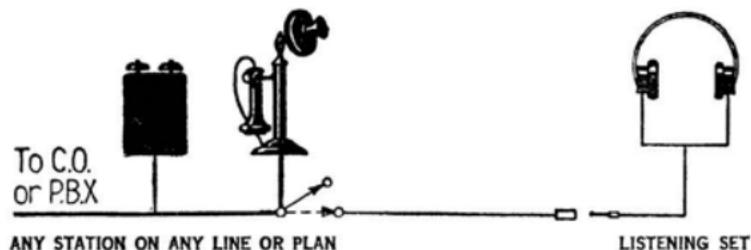
L1 GND L2  
#534-A  
or #534-C  
Sub. Set.

Note:- Retard Coil in #542-A Sub. Set not used in this plan.

#542-A Sub. Set

To M Sta. Desk Stand

M STATION CA OR CXA STATION

**PLAN 400—Diagram**

Write code number as "Plan 400"

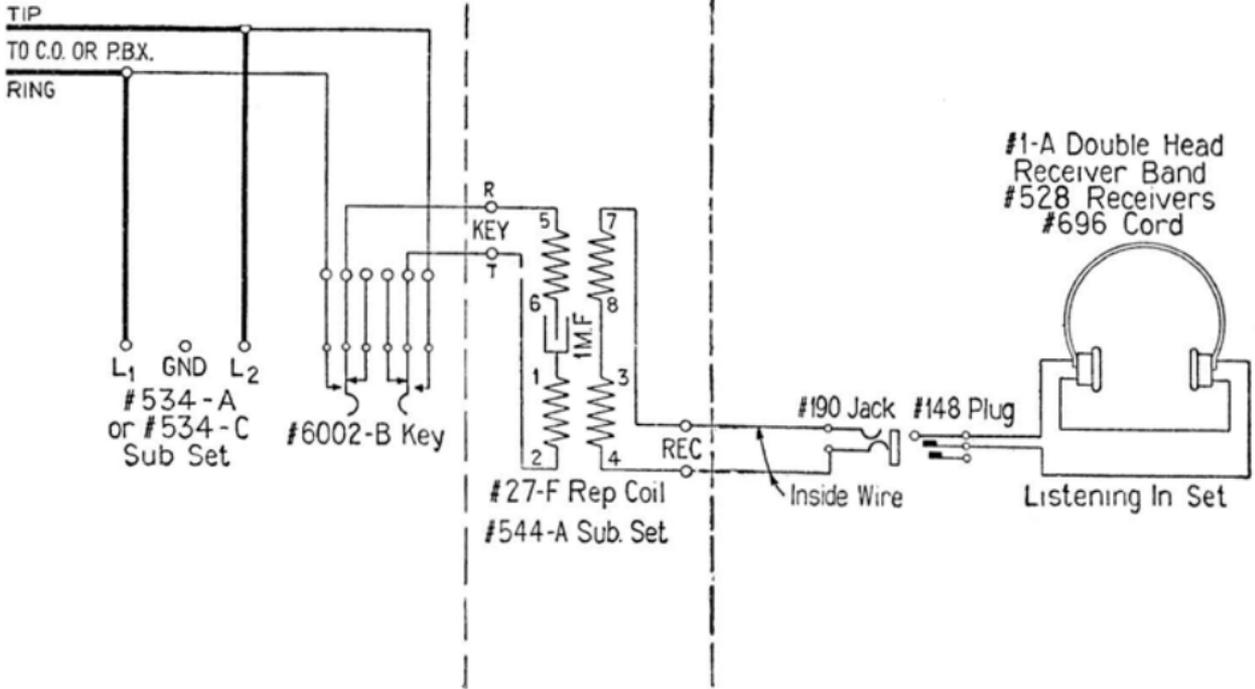
**Use**

Where subscriber desires facilities to enable a second person to listen in (generally for the purpose of recording the conversation). Designed to avoid large receiving loss which would result if another desk stand were used. Key must be located at station.

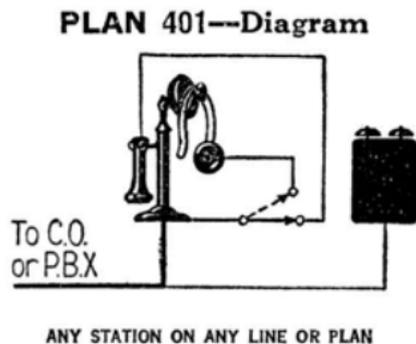
**Operation**

With key normal, listening set is cut-off.  
With key operated, listening set is connected to the line.

**PLAN 400—Circuit**



#1-A Double Head  
Receiver Band  
#528 Receivers  
#696 Cord



Write code number as "Plan 401"

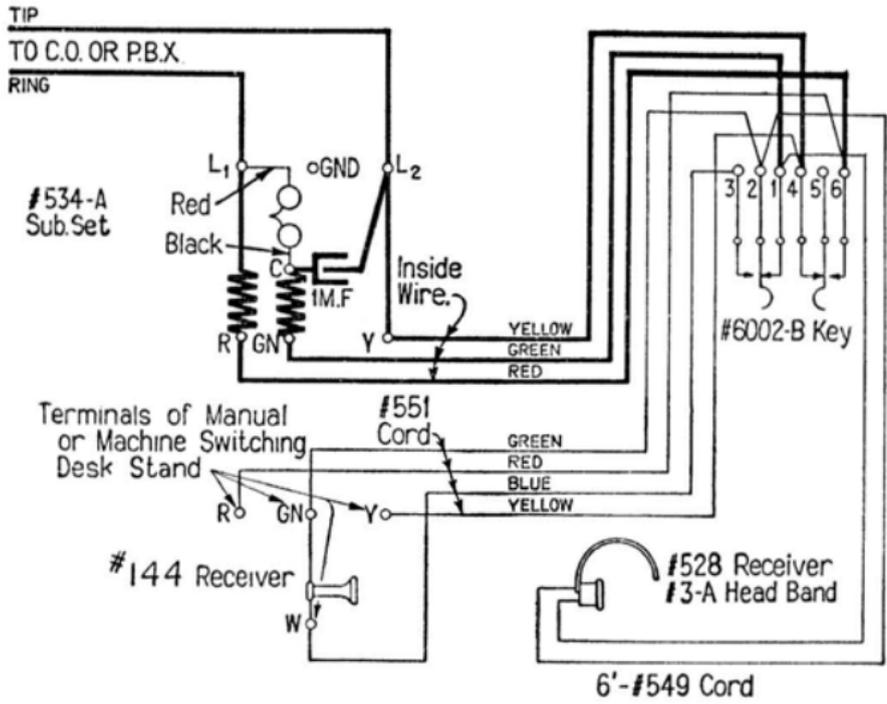
**Use**

Where subscriber desires to be able to use either a hand or a head receiver.

**Operation**

With key normal, hand receiver is connected to desk stand and head receiver is cut-off.  
 With key operated, head receiver is connected to desk stand and hand receiver is cut-off.

**PLAN 401—Circuit**



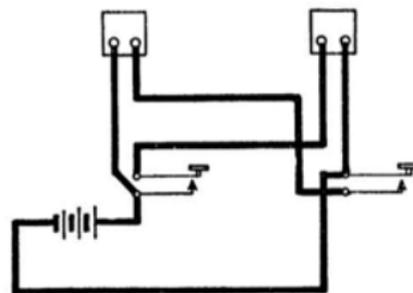
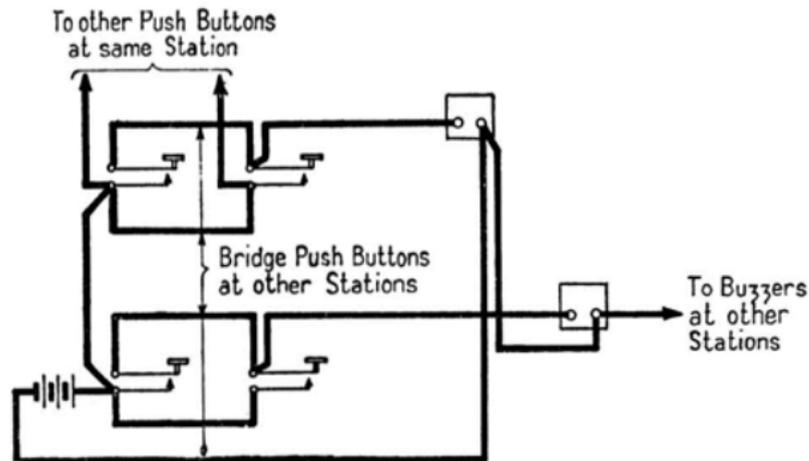
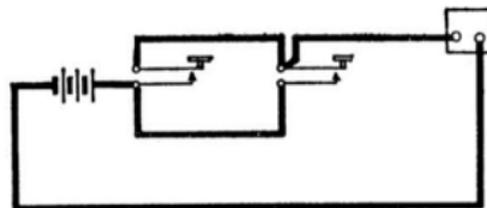
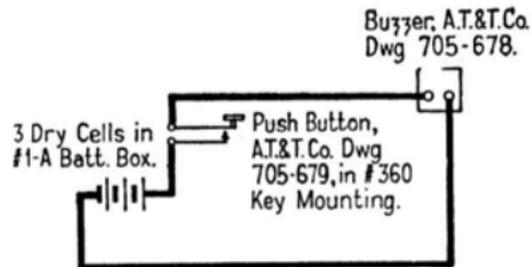
NOTES: Circuit is established between terminals "R" and "W" through switch-hook contact.  
 With machine switching desk stand either whip terminals of # 551 cord or use cord having whipped terminals.

## **BUZZER CIRCUITS**

**14.** Any of the buzzer circuits shown below may be used in combination with any of the wiring plans to provide the signaling arrangement necessary to the operation of the plan under any particular local conditions. The buzzer circuits provide push button and buzzer equipment for signaling between stations and shall be used in future in place of hand generators where these have been used for this purpose in the past.

The buzzer circuits should preferably be installed and maintained by the Telephone Company as they are essential to the proper functioning of certain of the plans. The subscriber may, however, install and maintain his own buzzer circuits. Buzzer circuits are used with but are not a part of the wiring plans and should not be installed unless specifically called for on the order. They should be considered as a separate item in handling wiring plan work.

## BUZZER CIRCUITS



### — NOTES

Loop resistance between push button and associated buzzer not to exceed 15 ohms.

Buzzer to be mounted on insulating surface.

Not more than one buzzer to be operated by one push button.

## **SUBSTATION APPARATUS INSTALLATION**

**15.** Install substation apparatus according to separate specifications covering SUBSTATION APPARATUS INSTALLATION or MACHINE SWITCHING SUBSTATIONS.

Inspect, test and (if necessary) readjust, relays in the Nos. 541-A and 542-A subscriber sets as specified under Section 21 in these specifications.

Test to make sure that each plan functions as specified under "Operation" for the particular plan installed.

If plan does not function properly, check connections referred to under Section 17 in these specifications, and proceed as specified under Sections 20-24 in these specifications.

Leave in subscribers' set at master station (or one of the master stations) any "work sheet" (or other attachment to service order) showing location of stations, buzzer circuits or other information so that it will be available to repairman.

## **SUBSTATION WIRING**

**16.** Install substation wiring according to separate specifications covering SUBSTATION WIRING.

## **SUBSTATION CONNECTIONS**

**17.** Connect substation apparatus according to "Plan Circuits" in these specifications. Where apparatus is not shown on "Plan Circuits," connect according to separate specifications covering SUBSTATION CONNECTIONS or MACHINE SWITCHING SUBSTATIONS.

Ringers may be installed up to the limits provided in Sections 7 and 13. The number of ringers on P. B. X. extension lines (in either a manual or a machine switching area) is limited to four except as covered in separate specifications for MACHINE SWITCHING SUBSTATIONS. Ringers at Line or Master Stations of plans 100, 101 and 102 cannot be wired in series with ringers at Controlled Stations.

**18. Extension Bells** may be installed in connection with any of the plans provided each extension bell is substituted for a station bell shown under "Station and Bell Combinations" for the plan involved. (See Section 13.)

## INSTRUCTIONS TO SUBSCRIBERS

19. The installer shall make sure that the subscriber understands the operation of the plan installed and shall leave with him an instruction card (See Section 1) covering the method of operation of the plan.

## SUBSTATION MAINTENANCE

20. **General.** Troubles in receivers, transmitters, cords, ringers, dials, keys, dry cells, etc., should be taken care of according to the usual practice.

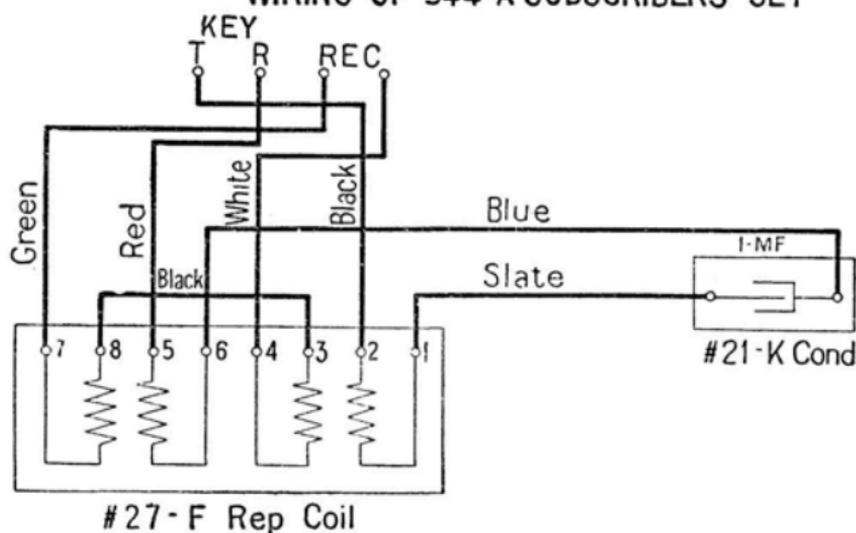
21. **Nos. 541-A and 542-A Subscribers' Sets—Testing and Readjusting Relays.** Inspect relays in the Nos. 541-A and 542-A subscribers' sets for obvious mechanical defects. Then test relays on a current flow basis by means of a current flow test set (in accordance with local routine) using the test values given below. Readjust (using readjust values) any relay which does not meet the test values.

<u>Relay</u>	<u>Test</u>		<u>Readjust</u>	
	<i>Operate—Release</i>		<i>Operate—Release</i>	
B81	.013 Amp.	.002 Amp.	.012 Amp.	.004 Amp.
B282	.016 " "	.0015 " "	.014 " "	.003 " "

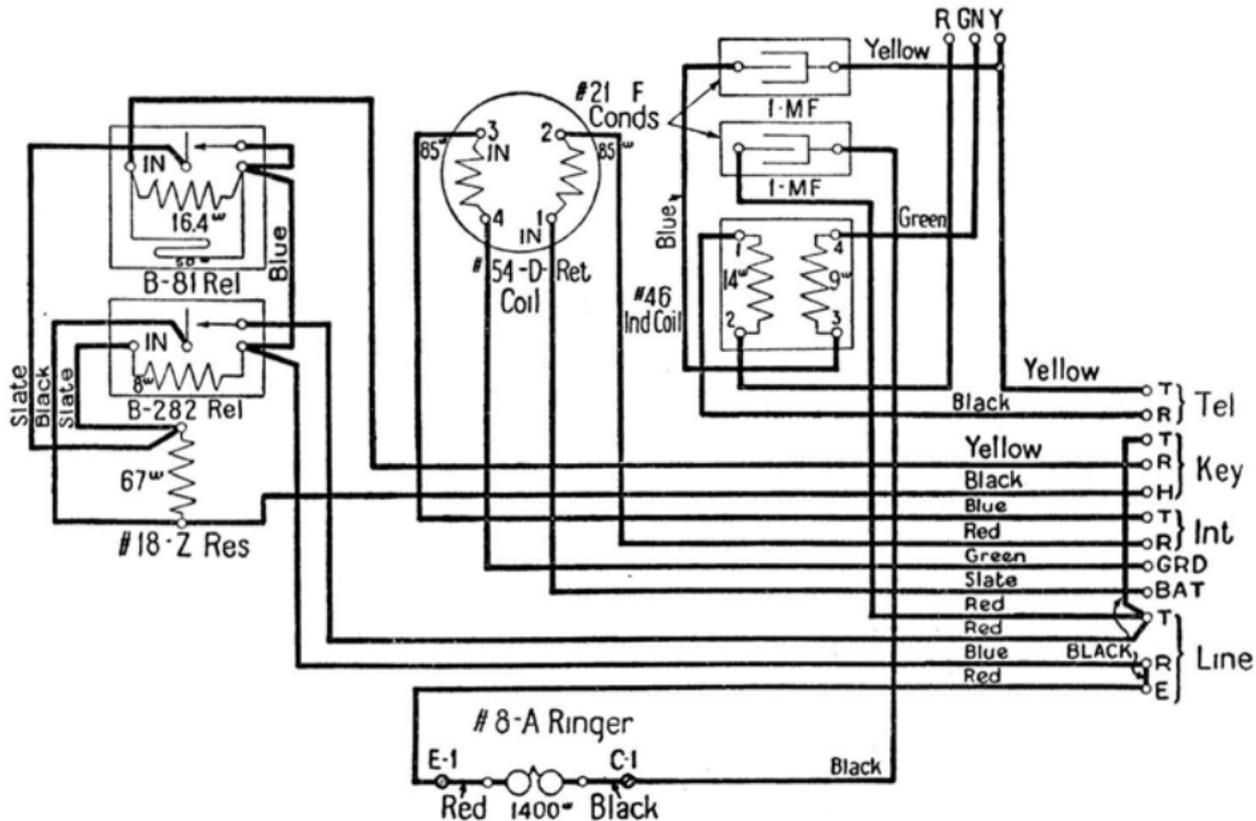
In readjusting the relays follow private branch exchange practices.

22. **Wiring of Nos. 544-A, 541-A and 542-A Subscribers' Sets.** The wiring of these sets (which are standard for use only in connection with the wiring plans) is shown below and on the following pages.

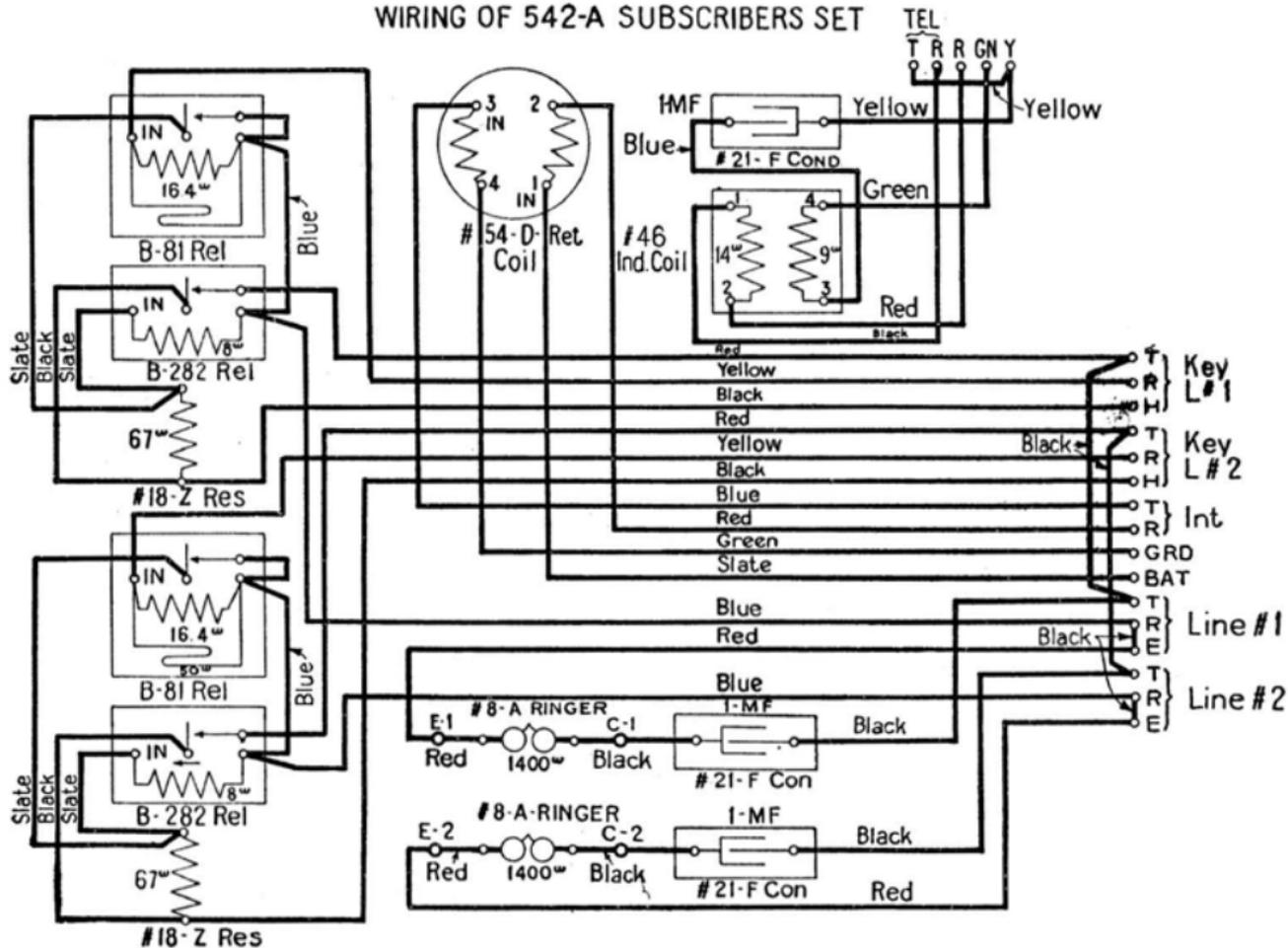
### WIRING OF 544-A SUBSCRIBERS SET



# WIRING OF 541 - A SUBSCRIBERS' SET



# WIRING OF 542-A SUBSCRIBERS SET



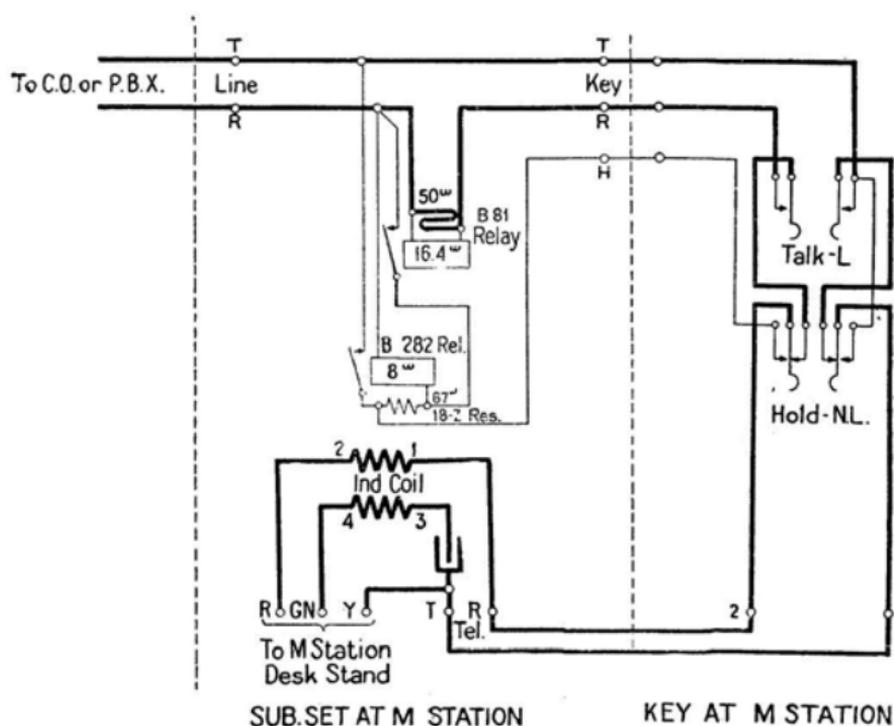
**23. Relay Holding Circuit.** To aid in the maintenance of the wiring plans the operation of the relay holding circuit used in Plans 102, 200, 201, 202 and 300 is given below:

When any station with its receiver off the hook is connected to the line, central office battery operates the B81 relay. This relay short circuits the winding of the B282 relay and the armature of the B282 relay restores to normal thus breaking holding circuit if line was previously held.

With receiver off hook, line is held by operating associated holding button which releases the talking button (after holding button swinging and outer springs have made contact) which in turn releases the B81 relay thus removing the short circuit on the B282 relay. Depressing the holding button also allows current to flow from the ring side of the line through the winding of the B282 relay and the #18-Z resistance, through the contact of the holding button, through the desk stand and then through the key strapping to the tip side of the line. This operates the B282 relay which locks up through its own contact to the tip side of the line.

The installation of such of these plans as involve the relay holding circuit may be limited to some extent by the fact that the loop resistance of the C. O. or P. B. X. line must not exceed a maximum which will allow the current flow necessary for the operation of the supervisory relay (B81) in the holding circuit. This maximum loop resistance must be such that [with the holding relay (B282) and the #18-Z resistance in series across the line] not less than .013 amperes will flow through the B81 relay when the receiver is removed from the hook. In the case of a C. O. line this limits the maximum loop resistance (assuming a maximum loop resistance between the master station and any other station of 15 ohms) from the C. O. to the master station to 550 ohms. In the case of the #550 type and #600 type P. B. X's. the maximum extension loop resistance is correspondingly limited to 30 ohms. Requests for plans involving the holding circuit where these limits are exceeded shall be referred to the Engineering Department.

## RELAY HOLDING CIRCUIT



**24. Inter-communicating Circuit.** Plan circuits 102, 201 and 202 specify C. O. or local battery for obtaining talking current for the inter-communicating circuit. The battery to be used will be specified on the order and will be C. O. battery when its use is practical and economical.

Where C. O. battery is used the resistance of the battery feeder (assuming a maximum inter-communicating loop resistance of 15 ohms) shall not exceed 250 ohms.

## **REFERENCE SPECIFICATIONS**

**25.** The following handbook specifications are referred to herein and installers and repairmen should have these specifications (including any Supplement thereto) for use in connection with this work.

SUBSTATION APPARATUS

SUBSTATION APPARATUS INSTALLATION

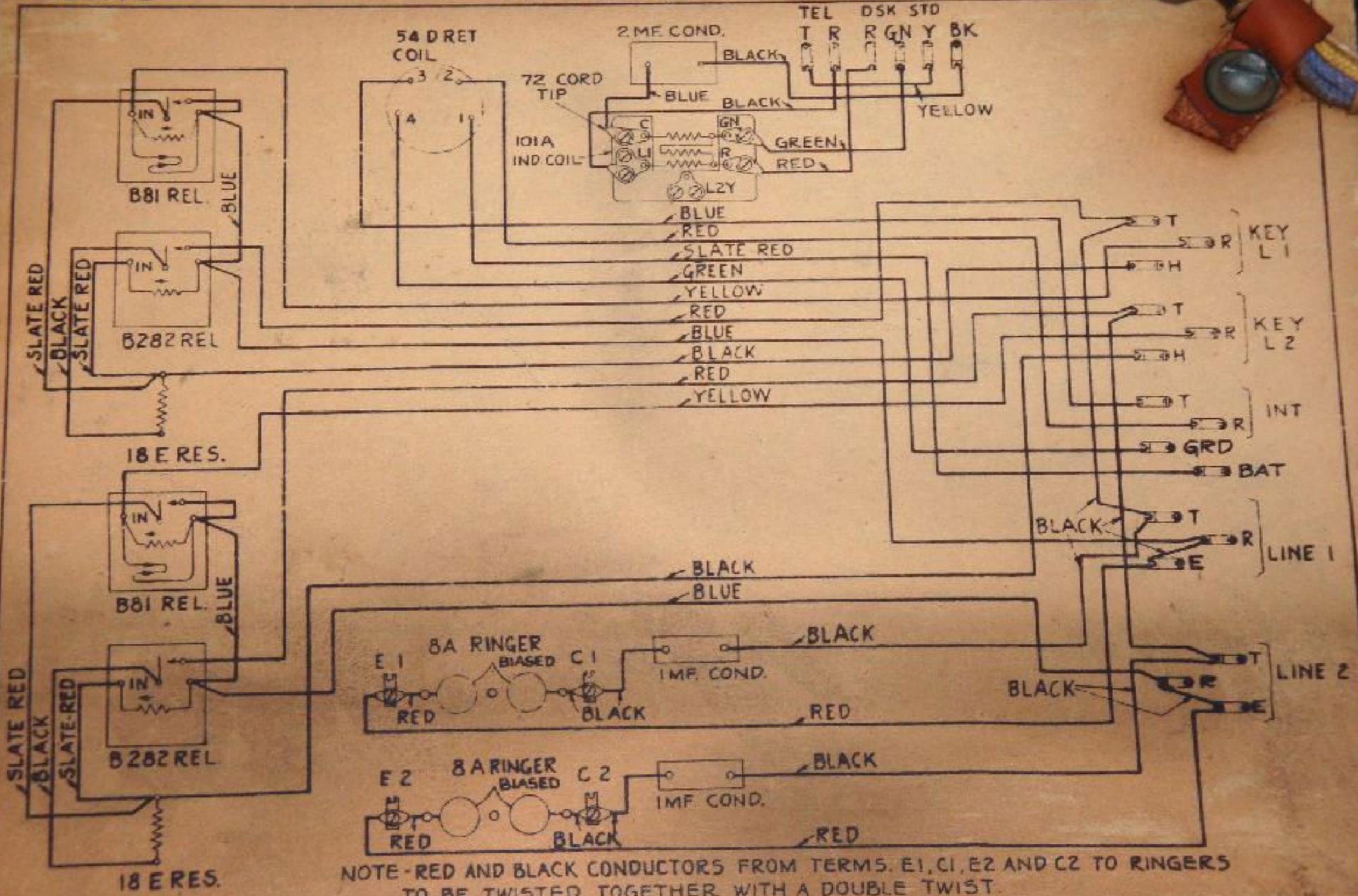
SUBSTATION CONNECTIONS

SUBSTATION WIRING

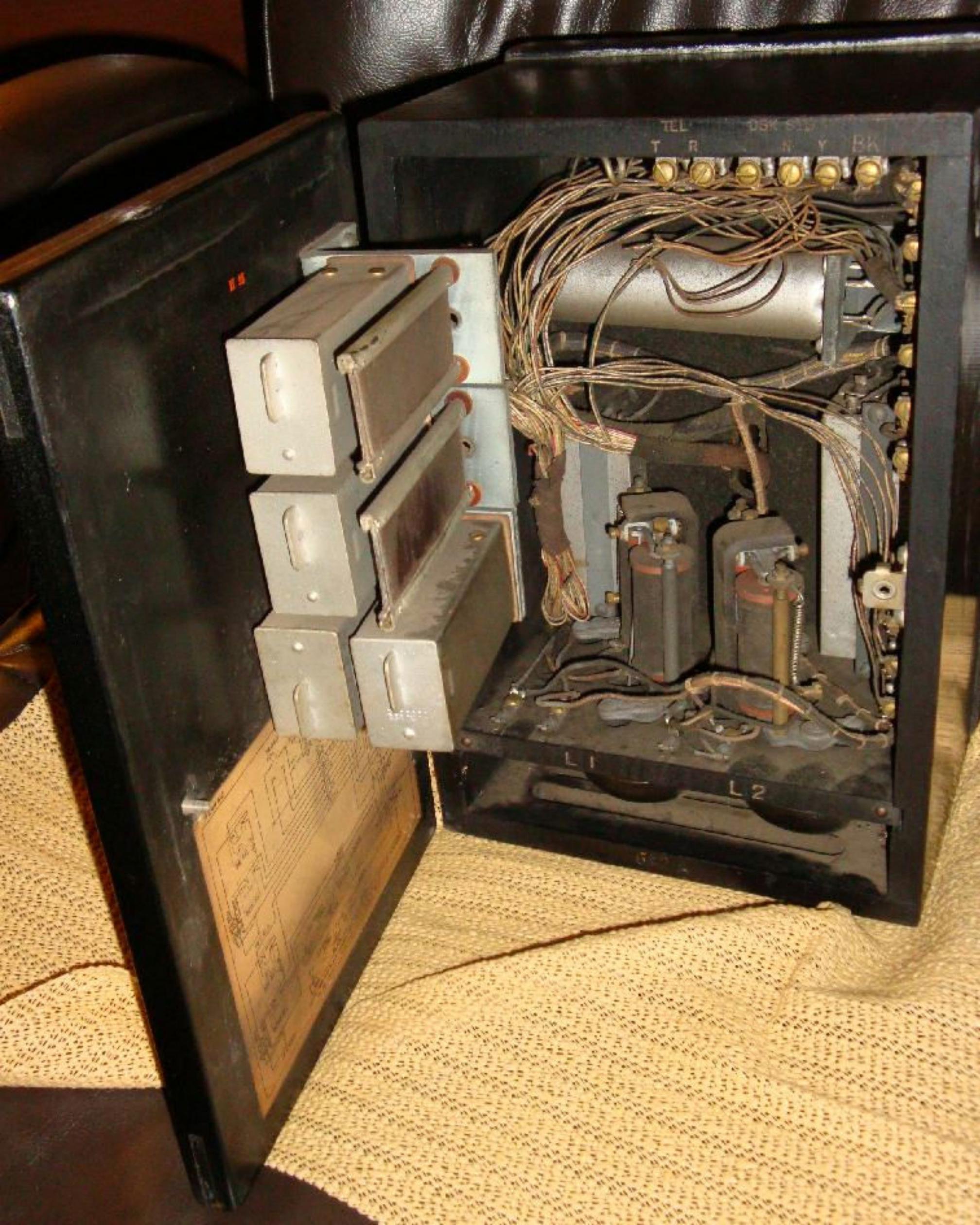
MACHINE SWITCHING SUBSTATIONS

R244812

# 642A SUBSCRIBER SET



NOTE - RED AND BLACK CONDUCTORS FROM TERMS. E1, C1, E2 AND C2 TO RINGERS TO BE TWISTED TOGETHER WITH A DOUBLE TWIST.



15

TEL DSK 510  
T R N Y BK



L1

L2