

OPEN WIRE

TRANSPOSING WORKING CIRCUITS

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1. GENERAL

1.01 Where it is proposed to transpose working circuits if practicable the wires should be removed from service so that the work can be done on dead wires. Where this is impracticable the work should be done in accordance with the following. When the wires cannot be taken out of service the work should be done during the time of the lightest traffic load.

1.02 The term "transposing" as used in this section is understood to include the cutting in or cutting out of transpositions on either physical or phantom circuits and changing the type of transpositions.

1.03 The methods are such as to introduce no serious interruption in the operation of the circuits for voice frequency telephone purposes. In most cases, however, the use of the circuits for telegraph is prevented. D.c. telegraph may be operated on a simplex basis, on a physical circuit which is being transposed or on the side circuits of a phantom group if the transposition work does not involve cutting phantom transpositions in or out. Changing the type of existing phantom transpositions does not affect the use of either of the side circuits for simplex d.c. telegraph.

1.04 Circuits which are being transposed cannot be composed for telegraph operation.

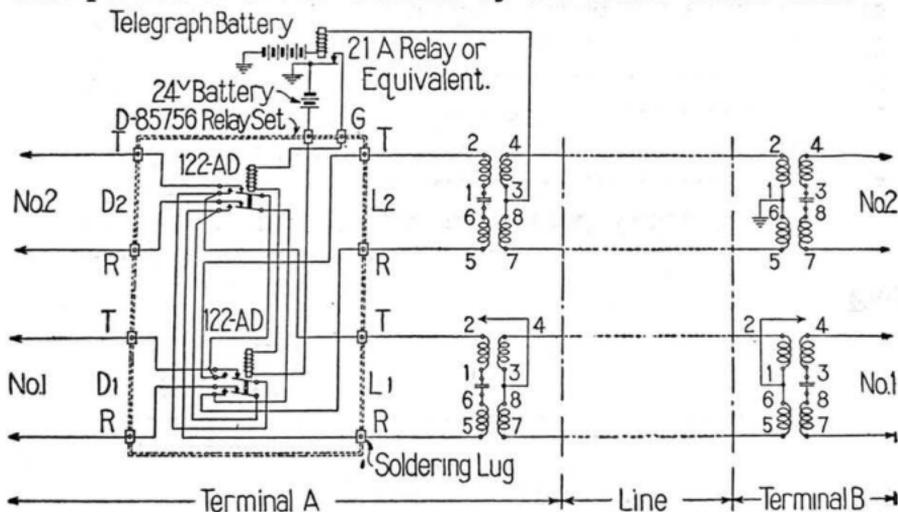
2. APPARATUS AND WIRING AT CENTRAL OFFICE OR TEST STATION

2.01 A Phantom Switching Relay Set is required at one of the terminal offices when the work involves interchanging side circuits.

2.02 The purpose of the relay set is to maintain the proper continuity of the circuits. This is accomplished automatically by the relays through a retransposition of the circuits at the terminal office when the side circuits are interchanged at the transposition point.

2.03 Where the work involves only a change in the type of an existing phantom transposition, no special arrangements are necessary at the terminal office.

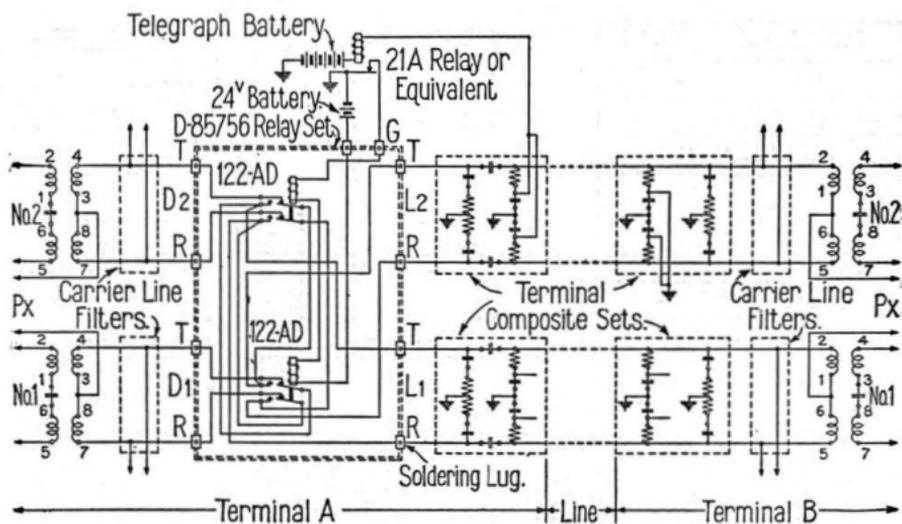
2.04 The arrangement of the Phantom Switching Relay Set and the connections to be made at the terminal points for maintaining voice frequency telephone operation on the side circuits are shown in the following diagram. This arrangement does not permit maintaining service on the phantom circuit nor d.c. telegraph. The Relay Set is represented by that portion of sketch enclosed by the double dotted lines.



Note-Relays are shown in the operated position, circuits straight through relay set.

2.05 The arrangement of the Phantom Switching Relay Set and the connections to be made at the terminal points for maintaining voice frequency telephone service on the Side

and Phantom Circuits and Carrier Telephone Service on the side circuits are shown in the following diagram. The Relay Set is represented by that portion of sketch enclosed by the double set of dotted lines.



Note - Relays are shown in the operated position, circuits straight through relay set.

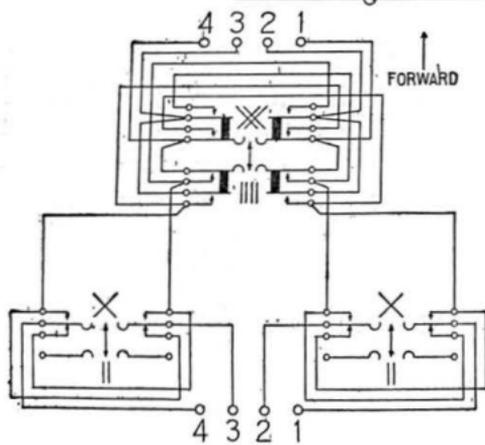
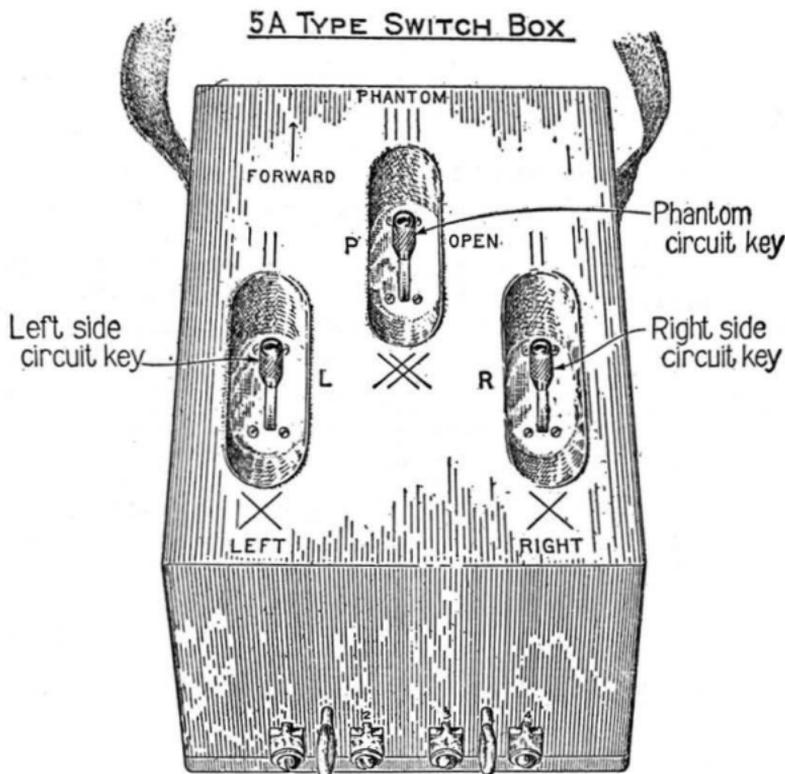
3. AUXILIARY APPARATUS

3.01 A transposition switch box is required at the point where the transposing is to be done. The use of two types of switch boxes, the new key type (No. 5A) and the former dial type (No. 12039) is described in Part 4 of this section. The 5A type is preferable for use particularly on High Grade Toll Circuits.

3.02 The following illustrations show the general appearance of the two types. A circuit diagram for the No. 5A box is also shown. It will be noted that when the Phantom Key of the No. 5A box is in the open position the side circuits are also open through the box.

This arrangement does not permit maintaining d.c. telegraph either simplex or composite and under such conditions any voice frequency carrier telegraph circuits assigned to voice frequency telephone circuits should be rerouted.

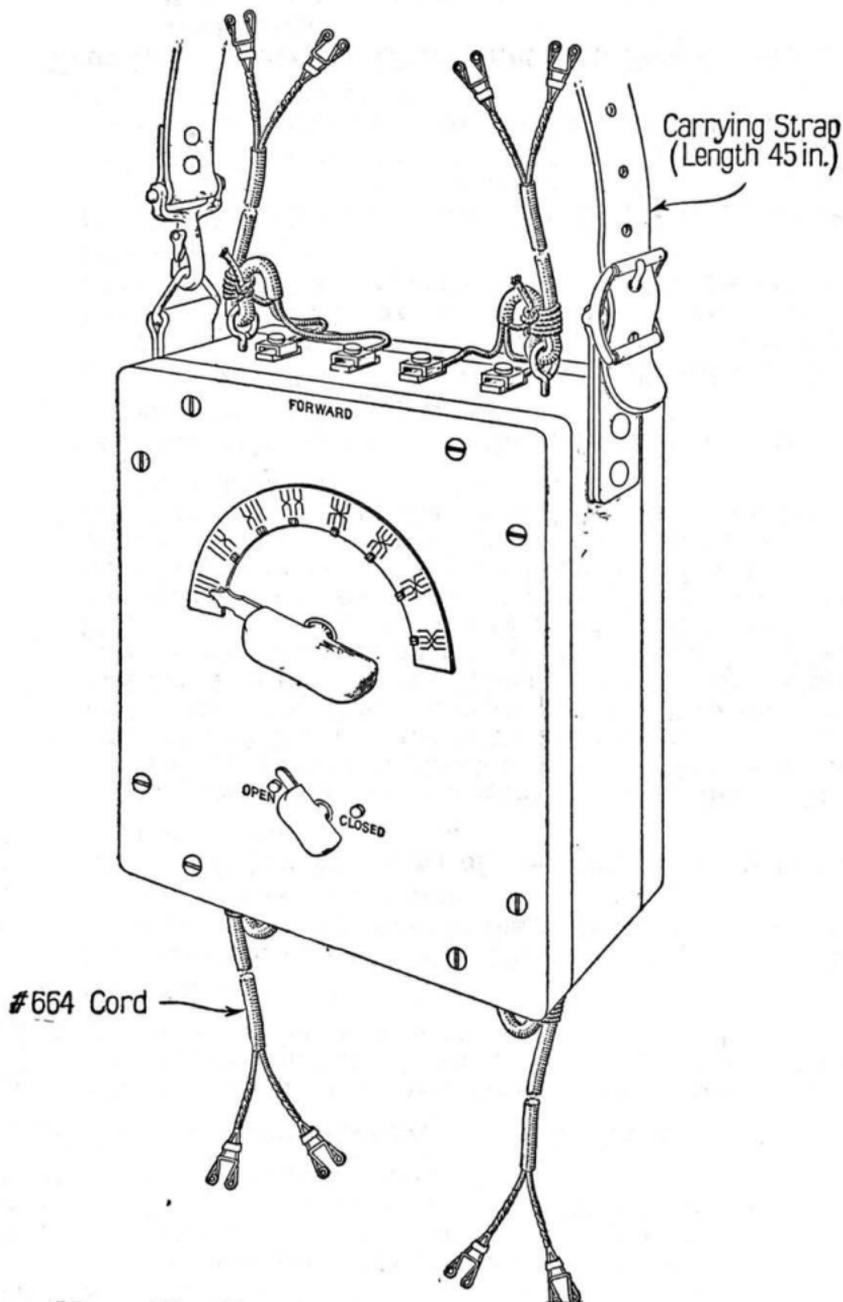
(a) No. 5A Type Switch Box.



Circuit looking at underside of panel.

Side Circuit Keys	
up	straight through
center	straight through
down	transposed
Phantom Key	
up	straight through
center	open
down	transposed

(b) No. 12039 Dial Switch Box and No. 670 Cord.
DIAL SWITCH BOX AND NO. 670 CORD



Note: The No. 670 cord consists of four No. 664 cords.

3.03 A battery in series with a receiver can be used for making continuity tests of the switch box to insure that it is in proper operating condition. The 17 type test set, which is ordinarily furnished to men working on open wire lines is suitable for making these tests.

4. USE OF TRANSPOSITION SWITCH BOX

4.01 The methods of using the Transposition Switch Boxes are described in the following. It is important that the steps be followed in the order given.

(a) 5A Type Switch Box.

- (1) Place the Phantom Key (P) in the "Open" position and the two side keys in the middle positions before taking the box up the pole.
- (2) Attach box by means of the carrying strap to the pole, a pin or crossarm.
- (3) Connect top or forward leads, ahead on line. When making horizontal phantom transpositions, connect lead marked No. 1 to the left hand wire of the group, that marked No. 2 to the next wire, No. 3 to the third and No. 4 to the fourth. When making vertical phantom transpositions, connect leads marked No. 1 and No. 2 to the upper pair of wires (5 and 6) and leads No. 3 and No. 4 to the lower pair of wires (15 and 16). Connect bottom or back leads, back on line, No. 1 to the wire in the same pin position as No. 1 ahead on line. No. 2 to the wire in the same pin position as No. 2 ahead on line, etc.
- (4) Attach the wire grips to the wires to be transposed, as described in Part 5.
- (5) With the phantom key in the "Open" position, place side circuit keys to agree with the existing arrangement of the wires at the transposition pole. Move phantom circuit key quickly to agree with the existing arrangement.
- (6) Cut the wires and move the keys quickly to the arrangement that gives the desired type of transposition. Move phantom key last. In order to obtain the various types of phantom transpositions, throw the keys as described below.

Type 1. The Phantom Circuit and both Side Circuits are transposed.

Throw all keys to the down positions.

Type 2. The Phantom Circuit and Left Side Circuit are transposed.

Throw Phantom Circuit Key (P) down and Left Side Circuit Key (L) down. Leave Right Side Circuit Key (R) in middle position. Keys are designated by the above letters on the box as shown in Part 3.

Type 3. The Phantom Circuit and Right Side Circuit are transposed.

Throw Phantom Circuit Key (P) down and Right Side Circuit Key (R) down. Leave Left Side Circuit Key (L) in middle position.

Type 4. The Phantom Circuit only is transposed.

Throw Phantom Circuit Key (P) down. Leave Right Side Circuit Key (R) and Left Side Circuit Key (L) in middle position.

(7) Splice the wires in accordance with the new arrangement.

(8) Move the Phantom Circuit Key quickly to the "Open" position. It is not necessary to move the side circuit keys.

(9) Disconnect the leads.

(10) Single Transposition. If only one side circuit is to be transposed, use only leads No. 1 and No. 2 and operate Left Side Circuit Key (L) for transposing wires. Use the Phantom Key for opening and closing the circuit through the box.

(b) Dial Switch Box.

(1) Set pointer of the lower switch in the "Open" position before taking the box up the pole.

(2) Secure the box and connect the leads as described in (a) (2) and (a) (3) above.

(3) With the lower key in the "Open" position, place the pointer of the upper switch at the diagram which agrees with the existing arrangement of the wires.

(4) Move pointer of lower switch to "Closed" position.

(5) Cut the wires and then turn the main switch quickly until it points to the arrangement desired.

(6) Splice the wires in accordance with that arrangement.

(7) Open lower switch and disconnect the leads.

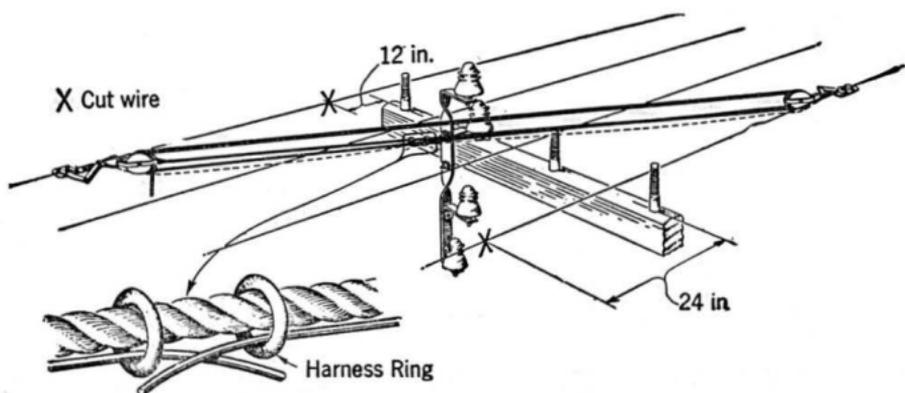
4.02 In connection with the operation of the transposition switch boxes, it is essential that the following precautions be taken.

- (a) When using either type of switch box for transposing a physical circuit take care to see that the two leads which are not required for this work are kept free from electrical contact with any of the line wires.
- (b) When the box is being carried up or down the pole, and while the leads are being connected to or disconnected from the line wires, it is important that the phantom key of the 5A type box and the lower key of the Dial type box be in the "Open" position in order to prevent interrupting the service if the clips accidentally touch the wires.
- (c) Take special care to see that the leads are connected to the proper wires before the phantom or lower key is moved from the "Open" position.
- (d) Move the keys or pointer of the dial type box quickly from position to position because during the time they are being moved the service is interrupted.
- (e) When cutting line wires, exercise care so that free ends of the wires do not touch adjacent wires.
- (f) When twisting or rolling sleeves do not permit sleeve twisters or sleeve roller to make contact with adjacent wires.
- (g) When carrying pieces of wire and tools up the pole do not permit contacts with line wires.
- (h) When placing wire grips or the clips of the cords on the line wires, stagger them to prevent contacts.

5. TRANSPOSING WIRES

5.01 Check Central Office or Test Station arrangements when phantom transpositions are to be made and be sure that the apparatus in the terminal offices is ready before any work is done on the open wires.

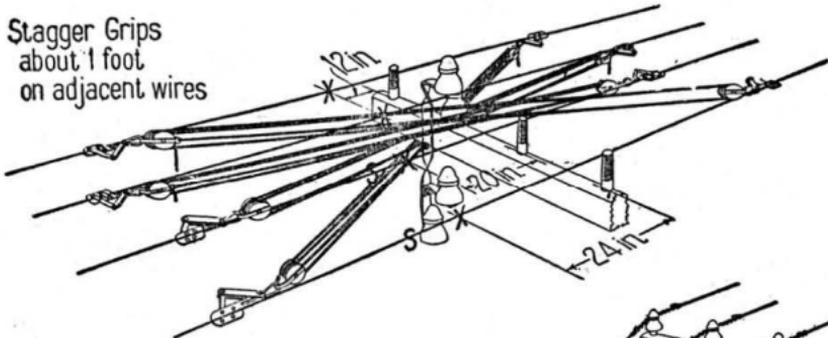
5.02 In order to prevent wire contacts after the wires are cut, place the ends in small harness rings or loops of wire which are placed over the end of the rope that is fastened to the 2-sheave block. When the wire is to be spliced the small ring or loop should be slipped over the end of the wire.



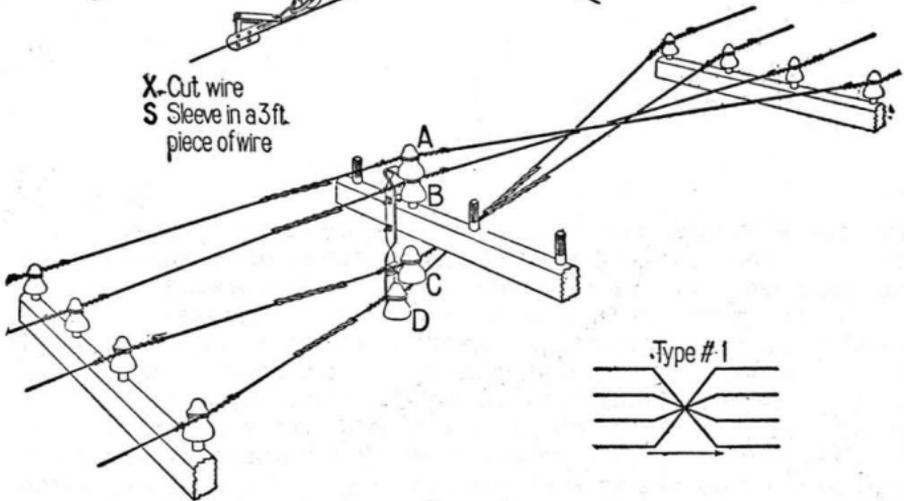
5.03 The following diagrams show the position of the wire grips for cutting in the different types of horizontal phantom transpositions when using twisted sleeve joints. Section G31.121 shows the arrangements to be followed when using the Sleeve Rolling Tool for making the joints. The wires are transposed left over right. The pin positions at the pole concerned in the transposition are shown in the tables below the diagrams. In transposing a physical or side circuit the lowest numbered wire at the pole preceding the transposition occupies position "A" at the transposition pole, etc. Referring to the diagrams place the grips so that the tackle will occupy the proper position with respect to the crossarm, that is, the tackle is placed above or below the crossarm depending on the final position the line wire is to occupy. After the grips have been properly placed cut the wires and sleeve in the 3-foot pieces of wire as indicated.

(a) Type 1 Horizontal Phantom Transposition.

Stagger Grips
about 1 foot
on adjacent wires



X- Cut wire
S Sleeve in a 3 ft.
piece of wire

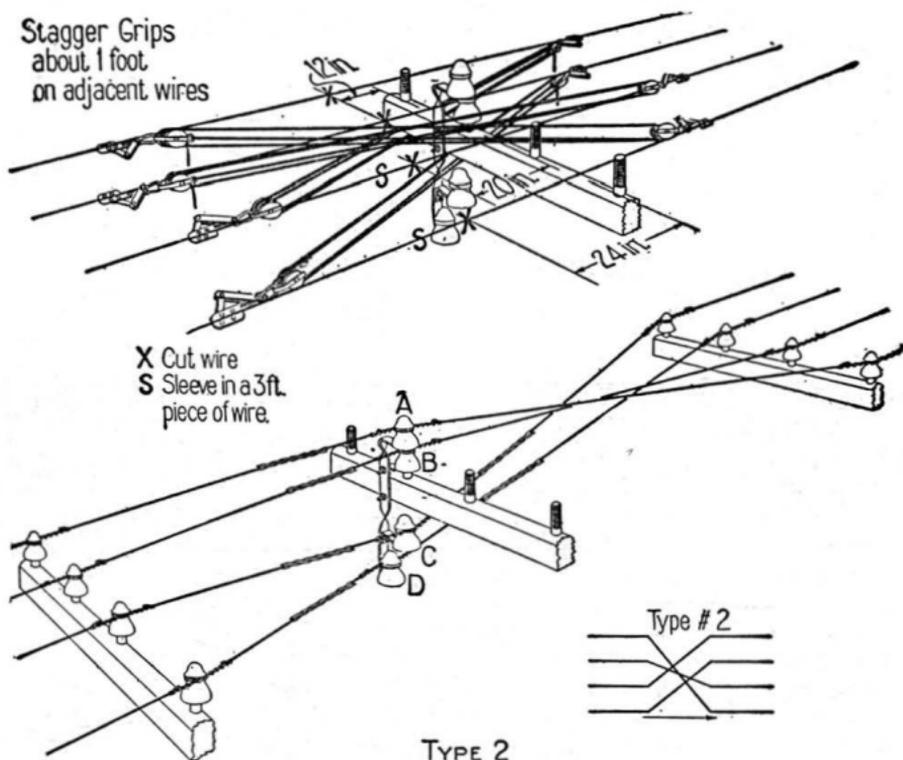


TYPE 1

PIN POSITION	PHANTOM GROUP															
	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Preceding pole	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Transposition pole	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Following pole	4	3	2	1	6	5	4	3	8	7	6	5	10	9	8	7

(b) Type 2 Horizontal Phantom Transposition.

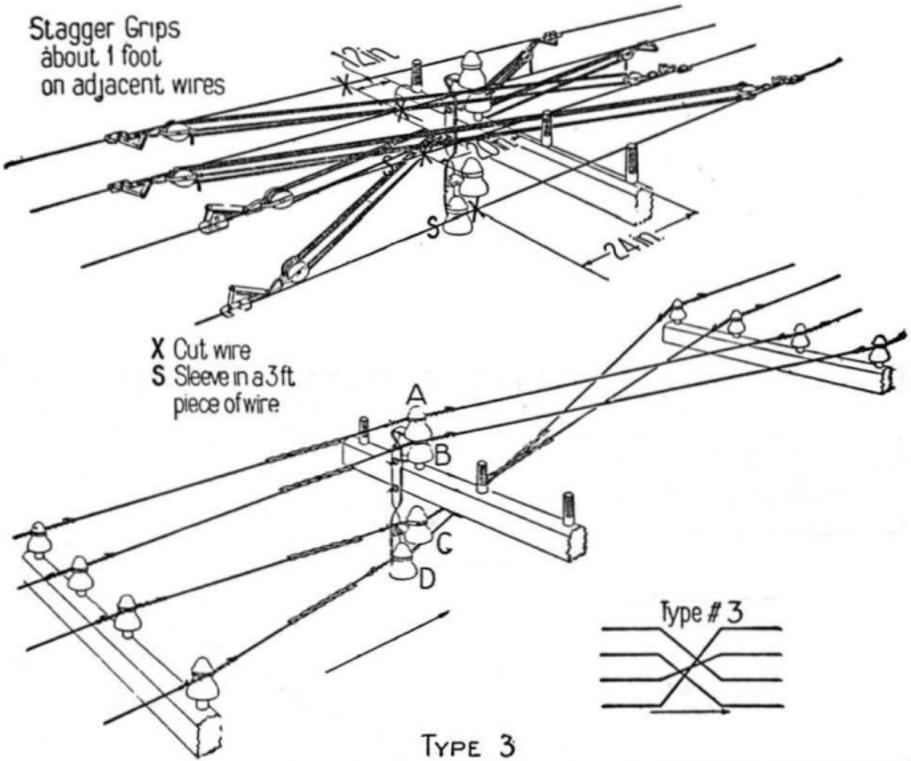
Stagger Grips
about 1 foot
on adjacent wires



PIN POSITION	PHANTOM GROUP															
	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Preceding pole	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Transposition pole	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Following pole	4	3	1	2	6	5	3	4	8	7	5	6	10	9	7	8

(c) Type 3 Horizontal Phantom Transposition.

Stagger Grips
about 1 foot
on adjacent wires

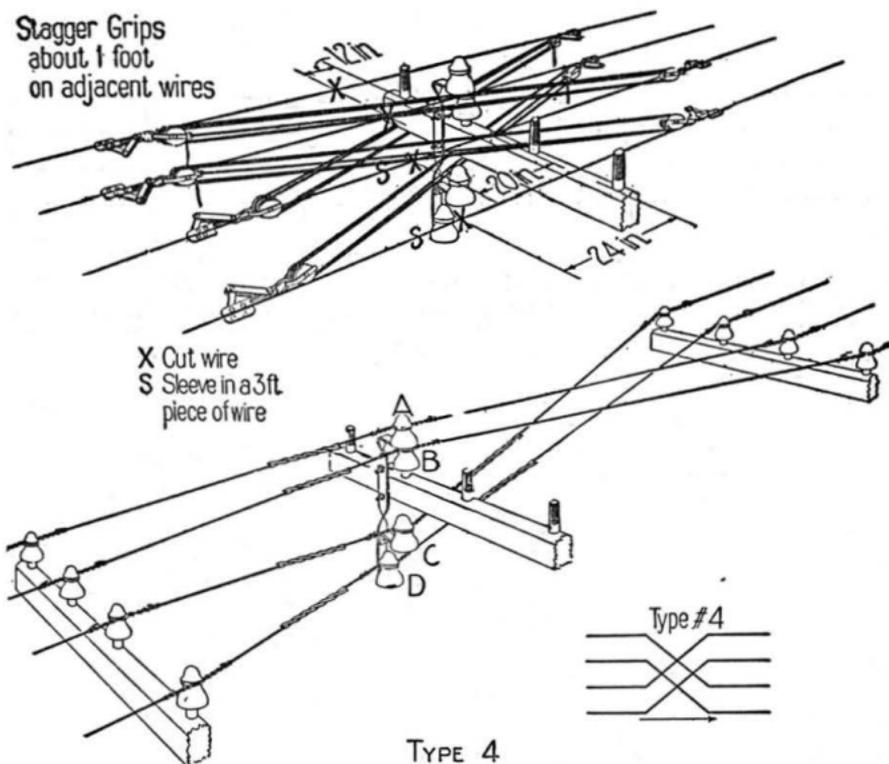


TYPE 3

PIN POSITION	PHANTOM GROUP															
	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Preceding pole	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Transposition pole	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Following pole	3	4	2	1	5	6	4	3	7	8	6	5	9	10	8	7

(d) Type 4 Horizontal Phantom Transposition.

Stagger Grips
about 1 foot
on adjacent wires

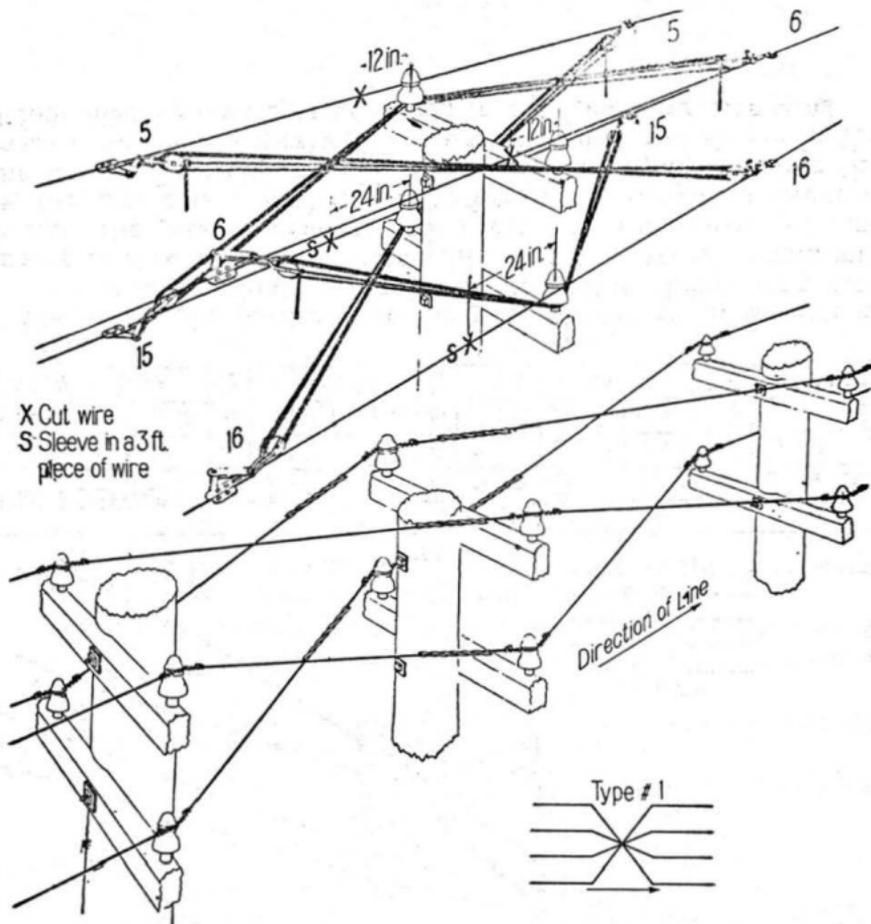


TYPE 4

PIN POSITION	PHANTOM GROUP															
	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Preceding pole	1	2	3	4	3	4	5	6	5	6	7	8	7	8	9	10
Transposition pole	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Following pole	3	4	1	2	5	6	3	4	7	8	5	6	9	10	7	8

5.04 The pin positions at the pole concerned in a vertical transposition are shown in the tables below the diagrams of this paragraph. Place the grips so that the tackle will occupy the proper position with respect to the crossarm, that is, the tackle is placed above or below the crossarm depending on the final position the line wire is to occupy. After the grips have been properly placed cut the wires and sleeve in the 3-foot pieces of wire as indicated in the following diagrams.

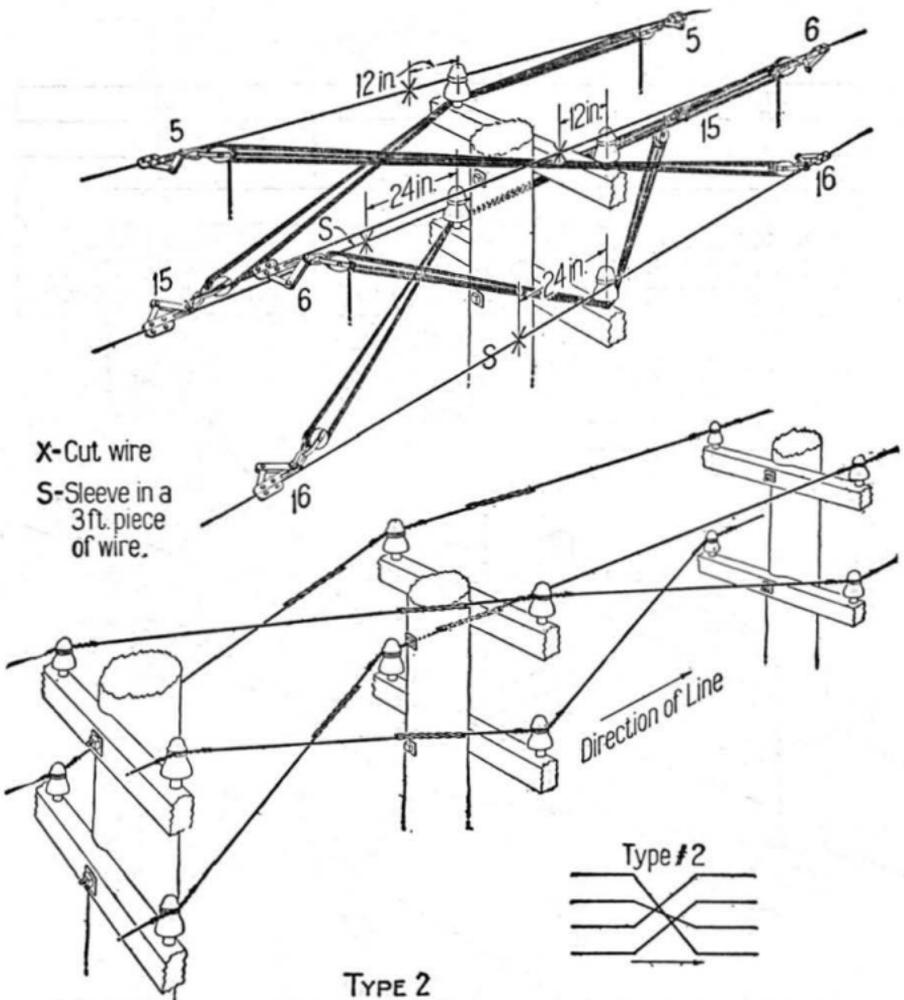
(a) Type 1 Vertical Phantom Transposition.



TYPE 1

Location of wire on pole preceding transposition	Location of wire on transposition pole	Location of wire on pole following transposition
5	6	16
6	16	15
15	5	6
16	15	5

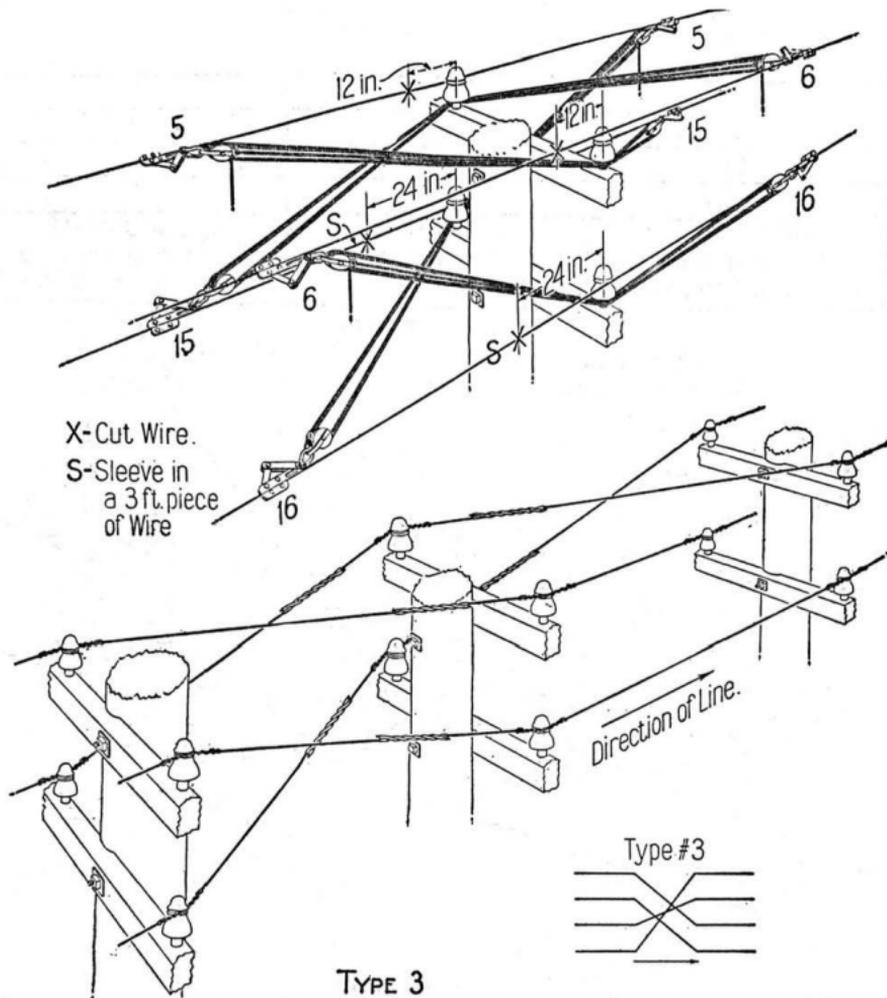
(b) Type 2 Vertical Phantom Transposition.



TYPE 2

Location of wire on pole preceding transposition	Location of wire on transposition pole	Location of wire on pole following transposition
5	6	16
6	16	15
15	5	5
16	15	6

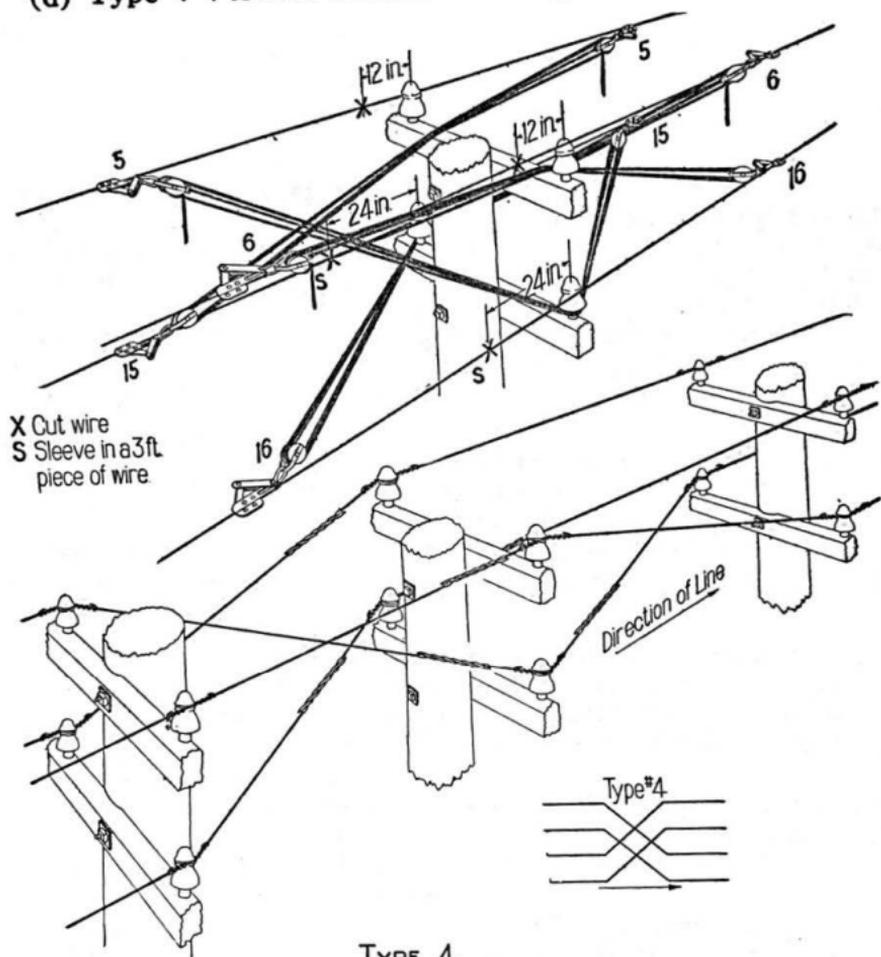
(c) Type 3 Vertical Phantom Transposition.



TYPE 3

Location of wire on pole preceding transposition	Location of wire on transposition pole	Location of wire on pole following transposition
5	6	15
6	16	16
15	5	6
16	15	5

(d) Type 4 Vertical Phantom Transposition.



TYPE 4.

Location of wire on pole preceding transposition	Location of wire on transposition pole	Location of wire on pole following transposition
5	16	15
6	6	16
15	5	5
16	15	6

6. GENERAL PRECAUTIONS

6.01 Observe the following precautions:

- (a) It is important that there be no transposition errors in a completed transposing job.
- (b) Use the transposition diagrams for the sections concerned in laying out the brackets at the transposition poles.
- (c) Refer to the diagrams again in mounting the brackets so that they will be in proper positions. (See Section G22.120 for bracket arrangements.)
- (d) After the transpositions are made, refer to the drawings again to make sure that the transposition is on the proper pole and the proper wires have been transposed as it is difficult and costly to change the construction after the wires have been spliced.
- (e) After the transposition work has been completed, cover the line and, without reference to the diagrams, list by pole number, by wires and by types all transpositions found in the section.
- (f) When the inspection is completed compare this list with the diagrams. If any differences are found recheck in the field and rearrange the wires at the points of difference to make the transpositions agree with the diagrams.

7. AGREEMENT BETWEEN TEST BOARD LINE JACKS

7.01 When the transposition work has been completed on a line or section of line, make a check to see that the line jack numbers agree at the test boards or switchboards between which the work was done, i.e., have the same number for each wire at each board.

7.02 If the check shows that the line jack numbers do not agree, the cross-connecting wires shall be rearranged to bring the jacks into agreement. This rearrangement shall be done at the station at the far end of the line since standard instructions for "Designation of Line Wires at Test Boards and Test Panels" specify that the line jack numbering at the originating end of an open wire line should agree with the pin numbering on the first pole of the line.