Type CN-J Network Phasing Relay

INSTRUCTIONS

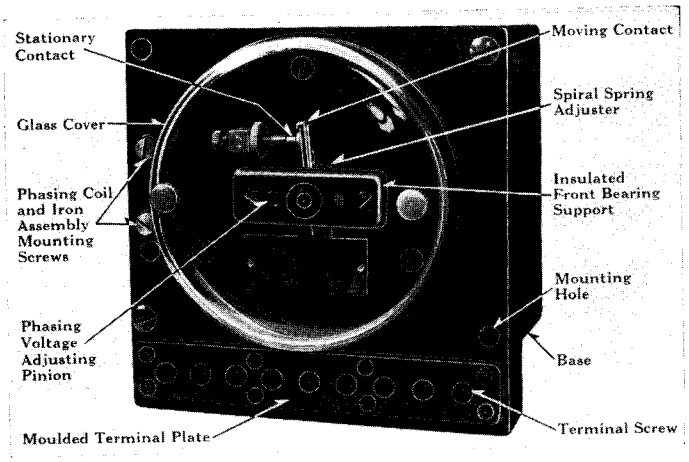

FIG. 1—TYPE CN-J NETWORK PHASING RELAY FRONT VIEW WITH COVER ON.

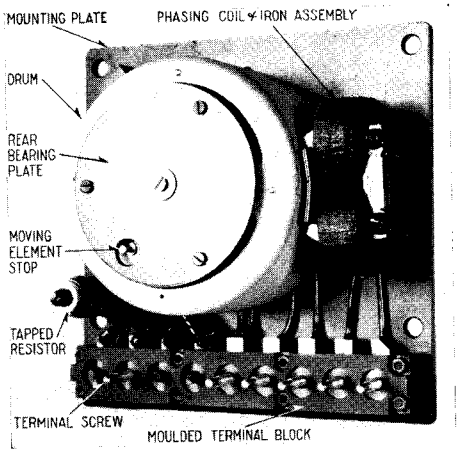

FIG. 2—TYPE CN-J NETWORK PHASING RELAY. REAR VIEW OF RELAY REMOVED FROM BASE

GENERAL

The type CN-J Network Phasing Relay is used in conjunction with the type CN-33 Network Master Relay to prevent the possibility of closing the circuit breaker under conditions which would result in reverse power flow and which would therefore cause the type CN-33 relay to immediately reopen the circuit breaker. This condition may exist whenever the network voltage may be out of phase with the transformer voltage. A particular network may or may not require the CN-J relay although in general this relay will be required on all networks except those which are supplied from a single generating station so that the feeders to the network will always be in phase with each other.

CONSTRUCTION

The type CN-J network phasing relay shown in Figs. 1 and 2 is a single-phase relay which operates on the induction principle. It is very similar to the type CN-33 relay. The same principles of construction are used throughout, and many of its parts, such as the moving element, bearings, spring adjuster, damping magnet, terminals, and glass cover are the same as those used in the type CN-33 relay. The single electromagnet of the type CN-J relay uses the same iron circuits and potential coil as does the master relay. The method of mounting and shifting the outer coil and iron assembly to obtain the range of overvoltage adjustment is also the same as that used in the type CN-33 relay. The phasing relay is mounted on the network protector in the same manner as is the master relay.

The following points of construction embodied in the type CN-J relay are not covered in the instructions for the type CN-33 relay. The type CN-J relay is equipped with single-pole, single-throw contacts of pure silver instead of double-throw contacts. The relay has no current coils and the entire winding space on the outer iron assembly is thus available for the phasing coils so that no external phasing resistor is necessary. A tapped resistor is located in the relay and connected in series with the potential coil. The purpose of this resistor is to change the slope of the closing curve of the relay. Each tap on the resistor is brought to a separate terminal of the relay as can be seen by referring to Fig. 3. There is only one terminal screw for the four terminals to which the resistor taps are connected. The desired closing curve is selected and the terminal screw ls located in the terminal associated with the tap which gives that curve. Short dummy screws are screwed into the other three terminals to keep dust and dirt from entering the relay base. There is only one set of terminals, located at the lower end of the relay, instead of two sets as in the type CN-33 relay.

OPERATION

By referring to Fig. 4 it can be seen that the potential coil and phasing coils of the type CN-J network phasing relay are connected to phase "A" of the network protector in the same manner as the potential and phasing coils of element "A" of the type CN-33 relay. The operation of the two relays is exactly the same in principle. The type CN-J relay has different closing characteristics from the type CN-33 relay. These characteristics are obtained by means of specially designed phasing coils and the tapped resistor connected in series with the potential coil.

Fig. 5 shows the normal operating characteristics of the type CN-J relay. The relay may be adjusted to have closing characteristics similar to any one of the four curves shown, namely, No. 6, No. 7, No. 8, or No. 9. The network voltage, which is the voltage from ground to line "A" on the network side of the protector, is shown with the line potential end of the vector at the origin. This voltage vector could not be shown in its entirety because of the large scale used. Lines drawn from the origin to one of the curves represent in both magnitude and phase position the phasing voltages which will produce a torque in the relay just sufficient to cause its contacts to close. Any phasing voltage which does not terminate on or to the left of the curve in the zone marked "close" will produce a relay torque to maintain the relay contacts open. It will be noted that the relay will keep its contacts closed when the phasing voltage is reduced to zero if a closing adjustment is used similar to that used when these curves were taken. The curves may be shifted parallel to them-

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

selves either to the right or left by means of the spring adjuster, however, if this is found to be desirable. The relay is connected in the factory to have a characteristic similar to that shown as Curve No. 8 and given a similar adjustment. Any of the closing characteristics shown by Curves No. 6, No. 7, No. 8, and No. 9 can be obtained by placing the terminal screw in any one of the terminals 6, 7, 8 or 9 shown in Fig. 3. For example, if the terminal screw is placed in terminal 8 the relay will have closing characteristics as shown by Curve No. 8 of Fig. 5.

The operation of the type CN-J relay in conjunction with the type CN-33 relay can best be explained by referring to Fig. 6 which illustrates the closing characteristics of both the CN-J and CN-33 relays. Curve 1-A illustrates the closing curve of the type CN-33 relay, which is discussed in the instructions relating to the type CN-33 relay, and Curve No. 8 illustrates the closing curve of the type CN-J relay. The area which lies in the "closing" zone common to both of these two curves is shaded. Thus a phasing voltage, such as E_1 which terminates in this shaded area will cause the type CN-J relay to make its contacts and the type CN-33 relay to make its closing contacts and thus cause the network protector to close. The current which will flow through the protector when it closes will lag the phasing voltage across the open protector by an angle approximately equal to the impedance angle of the system, and for a particular system this current may be as shown by the vector I_1. By noting the position of I_1 with respect to the network voltage and referring to Curve No. 2 of Fig. 7 it will be seen that such a current will keep the type CN-33 relay closing contacts closed and thus the operation of the network protector will be stable. A phasing voltage, such as E_2, however, if the protector were manually closed, would cause a current I_2 to flow through the protector; and by referring again to Curve No. 2 of Fig. 7 it will be seen that this current would cause the type CN-33 relay to make its tripping contacts. The phasing voltage E_2, lying on the closing side of the Curve No. 1-A, causes the type CN-33 relay to make its closing contacts. Thus if the type CN-33 relay alone controlled the network protector, the protector would pump under this condition. The type CN-J relay will not close its contacts, however, when acted upon by a phasing voltage such as E_2; and since the contacts of the two relays are connected in series and must be closed at the same time in order to allow the network protector to close, it will be seen that the type CN-J relay prevents pumping due to phasing voltages which appreciably lag the network voltage. It may be similarly shown that the closing characteristics of the type CN-33 relay prevent pumping from occurring when the phasing voltage leads the network voltage by more than 90°. It should be noted that the closing curve of the type CN-33 relay is such as to prevent the protector from closing under crossed-phase conditions, while the type CN-J relay used alone would allow the protector to close under certain crossed-phase conditions.

Under certain conditions a fairly large and very low power factor load may be carried by adjacent network protectors and cause the phasing voltage E_3 to exist across the protector under consideration. It will be seen, since this phasfng voltage E_3 falls on the opening side of Curve No. 8, that under this condition the phasing relay would prevent the protector from closing. In the event it is desirable to have the protector close so that its associated transformer can assist in carrying the load, Curve No. 7 may be used for the type CN-J relay so as to allow the protector to close if such a change in characteristics will not cause pumping. It is to take care of such more or less special cases that the tapped resistor is provided in the phasing relay to change its closing characteristics.

INSTALLATION

The type CN-J relay will generally be shipped in place on the control panel of the CSP Power Transformer. It should be thoroughly inspected to see that none of the parts have been bent or broken in transit and that they are free from friction. The relay should also be checked to see that all locking and contact screws are securely tightened or locked in place by their associated thumb nuts.

If any of the above inspections indicate that the relay has been subject to severe shipping stresses so that the adjustments may have changed, the relay should be taken to the laboratory and checked according to the instructions given in the section on maintenance.

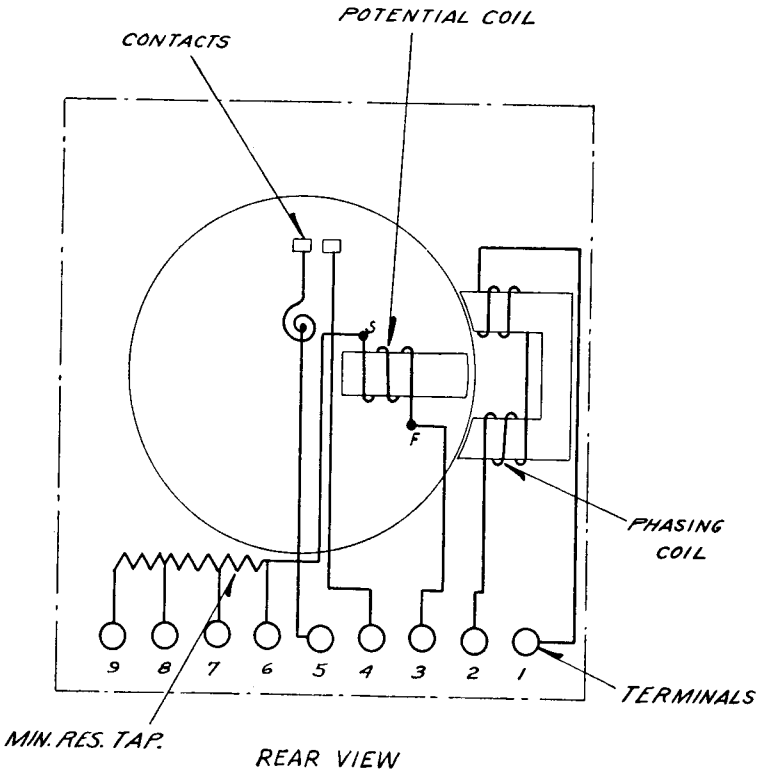

FIG. 3—WIRING DIAGRAM OF THE INTERNAL CONNECTIONS OF THE TYPE CN-J NETWORK PHASING RELAY.

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

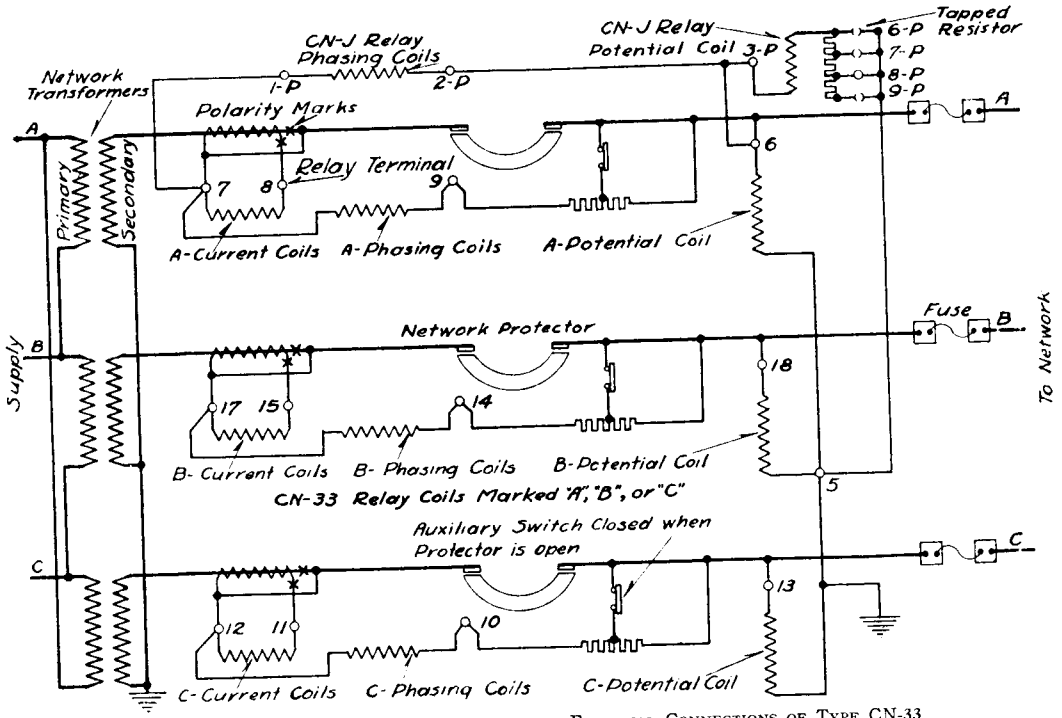

FIG. 4—SCHEMATIC DIAGRAM OF INTERNAL AND EXTERNAL CONNECTIONS OF TYPE CN-33 AND CN-J NETWORK RELAYS USED ON A THREE-PHASE NETWORK WITH A GROUNDED NEUTRAL —CONTROL CIRCUITS OMITTED.

MAINTENANCE

There is only one adjustment to make on the type CN-J relay, namely, the overvoltage closing adjustment. This adjustment is made by means of the geared spring adjuster by rotating the adjuster pinion with a screwdriver as in the CN-33 relay. The range of overvoltage closing adjustment is set at the factory at 0 to 1.5 volts leading the network voltage 75 degrees with the resistor terminal screw in terminal No. 6. This range is sufficient for practically all applications; if it is necessary to use settings outside of this range the range can be changed by shifting the outer coil and iron assembly.

Fig 8 shows the test diagram to be used for checking the range of adjustment and for adjusting the type CN-J relay in the laboratory. The air core reactor shown in the diagram is similar to the 75° air core reactor used in testing the type CN-33 relay, and has an impedance of approximately 8 ohms. The amount of voltage drop across the reactor, which is the voltage impressed across the phasing coils, is determined by the ammeter shown in the circuit and can be adjusted by means of the variable resistance load. Care must be exercised in mounting the reactor to avoid changing its impedance. It should be mounted with non-magnetic materials away from iron or steel.

The following is a brief description of the proper method of testing the type CN-J relay. Connect the relay exactly as shown in Fig. 8. First, see that the relay is mounted straight in a vertical plane and that the moving element is free from friction. Then check the position of the moving contact on the drum shaft. The contact should move through equal angles on each side of a vertical line through the center of the shaft when the drum is rotated till it strikes its stop in both directions. Adjust the stationary contact screw to deflect the contact springs until the back of the contact almost touches the main supporting arm when the drum is rotated counterclockwise to its extreme position. Securely lock the contact screw in this position by means of its associated thumb nut. See that the inner spiral spring support cannot touch the spring adjuster. The end play of the drum shaft should be adjusted to approximately 0.005 inch. Rotate the spiral spring adjuster until the moving contact arm comes to rest with contacts just open.

The range of overvoltage adjustment of the CN-J relay can be checked in the following manner: with the relay completely deenergized increase the closing tension, beyond the point where the contacts just close, by ¼ turn of the screwdriver adjuster. Then close switches B, L and M and increase the current through the reactor until the contacts just close. The corresponding phasing voltage (drop in the reactor) is the maximum limit of the overvoltage adjustment range. Open switch L and it should be possible to increase the spring tension until the relay contacts will again just close. This corresponds to zero phasing voltage.

To make the desired phasing voltage setting move the terminal screw located in terminal No. 6 to the terminal to give the desired phase angle characteristics—terminal No. 8 is recommended for the usual application—and make the overvoltage setting of the type CN-J relay in the following manner. Close switches B, L and M and adjust the current through the reactor to give the desired phasing potential. Then adjust the spring tension so that the contacts just close. It is recommended that the phasing relay be adjusted to close at ap-

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

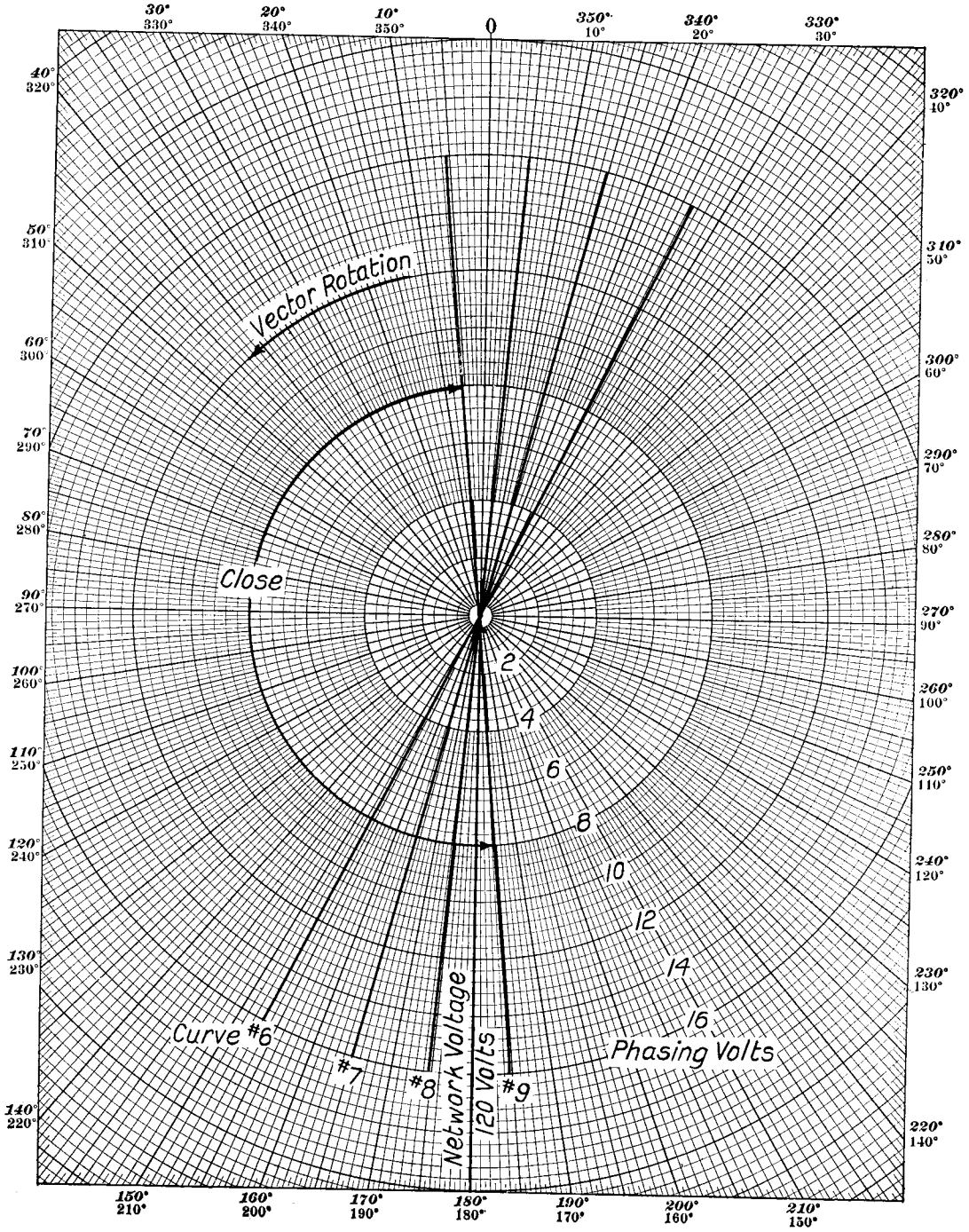

FIG. 5—CLOSING CHARACTERISTICS OF THE TYPE CN-J NETWORK PHASING RELAY.

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

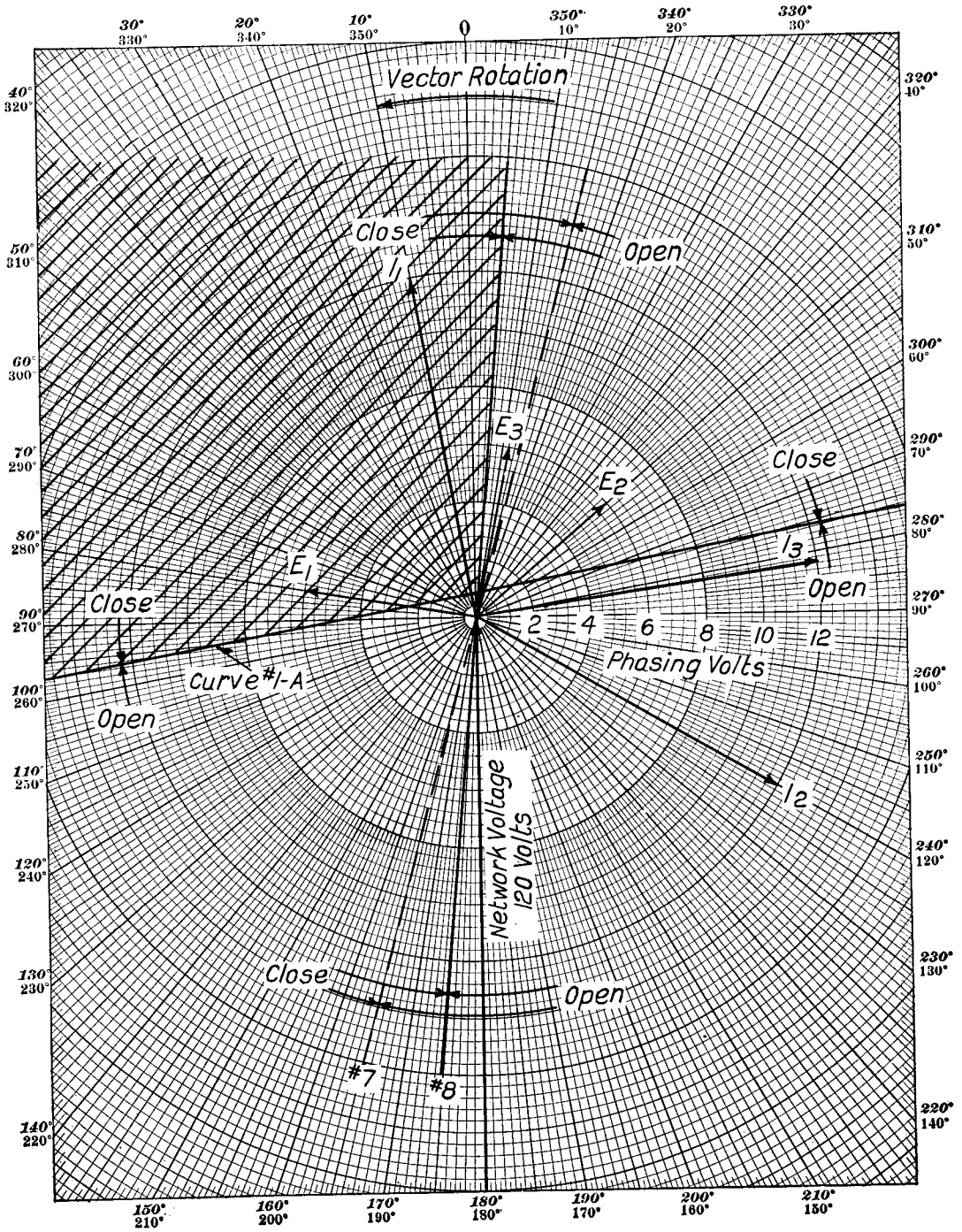

FIG. 6—COMBINED CLOSING CHARACTERISTICS OF THE TYPE CN-33 AND CN-J NETWORK RELAYS.

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

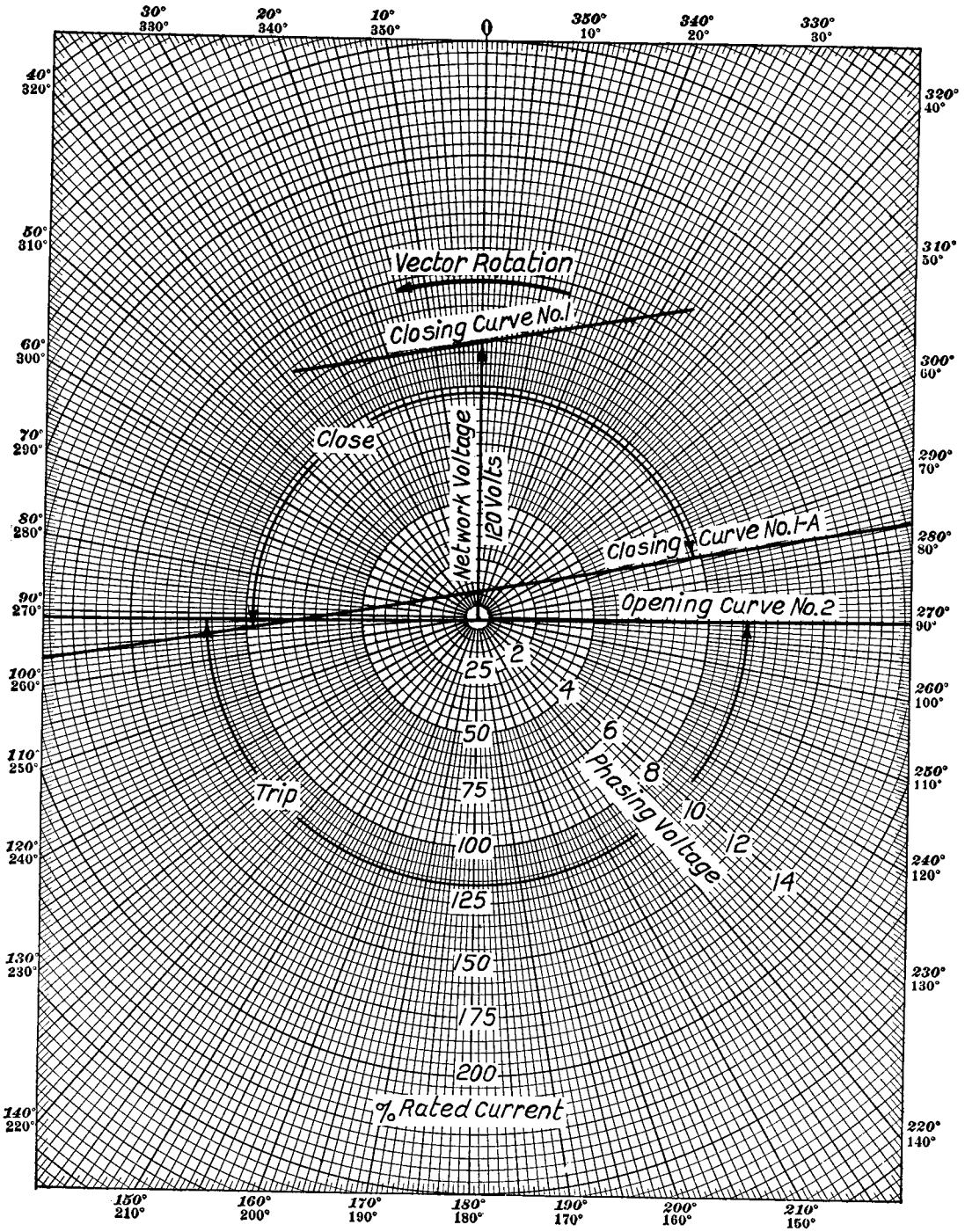

FIG. 7—CLOSING AND TRIPPING CHARACTERISTICS OF THE TYPE CN-33 NETWORK MASTER RELAY. BALANCED THREE-PHASE CONDITIONS ASSUMED.

Type CN-J Network Phasing Relay—Continued

INSTRUCTIONS—Continued

proximately zero volts. If the phasing voltage setting is nearly zero the adjustment should be checked by closing switches B, R and M and determining the voltage 75 degrees leading the network voltage reversed that causes the relay contacts to just open. This voltage should not exceed 0.15 volts. This recommended adjustment gives a value of phasing voltage necessary to close the type CN-J relay contacts practically equal to zero, and still insures that the contacts will remain closed when the network protector is closed and carrying load. This will prove to be the best adjustment for most network systems. However, if it is found desirable to give the relay an adjustment which will require a negative value of phasing voltage leading the network voltage to close its contacts, it will be necessary to change the range of overvoltage by shifting the outer coil and iron assembly and then make the exact setting with the spiral spring adjuster. In no case should the spring tension be less than one-quarter turn of the adjuster pinion as this much tension is necessary to insure closing of the relay contacts on a dead network.

The construction of the type CN-J network phasing relay has been made as simple and sturdy as possible. All parts have been made readily accessible to facilitate inspection and repairs. After the relay is properly installed and adjusted, it will require little attention. Whenever it is found necessary to inspect the protector, the relay should also be checked to see that it is free from friction and that its contacts are properly adjusted and not badly burned.

As explained in the instructions covering the type CN-33 relay a periodic inspection of all network protectors should be maintained to see whether any units have failed to close when the feeder to which they are connected is energized. The failure of a type CN-J network phasing relay to close under proper voltage conditions may be due to friction, to very dirty or improperly adjusted contacts, or to an improper overvoltage closing adjustment. Friction in the relay may be caused by leads rubbing on the drum, by foreign material collecting on the damping magnet, by the inner support of the spiral spring rubbing on the spring adjuster, by an accumulation of dirt on the knife-edge bearings, or by a light sticky deposit on the drum stop and the points where it makes contact with the rear bearing plate. It is very unlikely that dirty or improperly adjusted contacts will ever cause the relay to fail to complete its contact circuit unless the adjustment is such that the contacts actually fail to touch.

RENEWAL PARTS

The type CN-J network phasing relay is made as simple and rugged as possible and will not normally require replacement parts. If parts should be required, they should be ordered from the nearest Westinghouse Electric and Manufacturing Company District Office or direct from the Sharon, Pa. Works giving a description of the part required and the serial number or stock order number as stamped on the transformer nameplate.

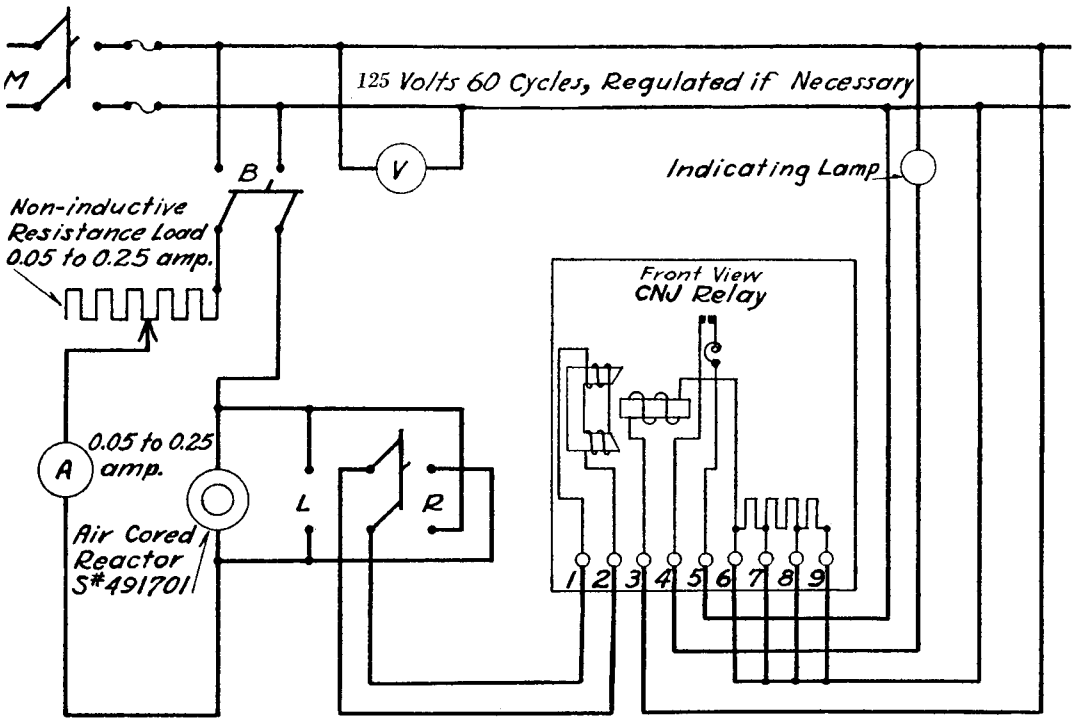

FIG. 8—TEST CONNECTIONS FOR SINGLE-PHASE TEST AND ADJUSTMENT OF THE TYPE CN-J NETWORK PHASING RELAY.

Westinghouse Electric & Manufacturing Company

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