Type SR-2 Network, Voltage Restraining Relay

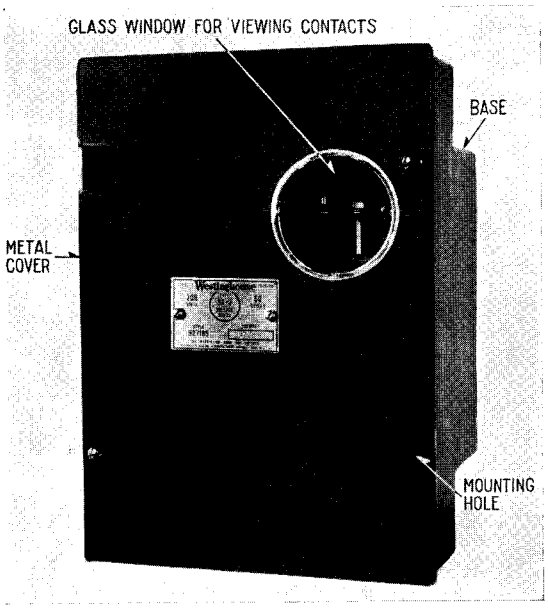

FIG. 1—TYPE SR-2 VOLTAGE RESTRAINING RELAY, FRONT VIEW WITH COVER ON.

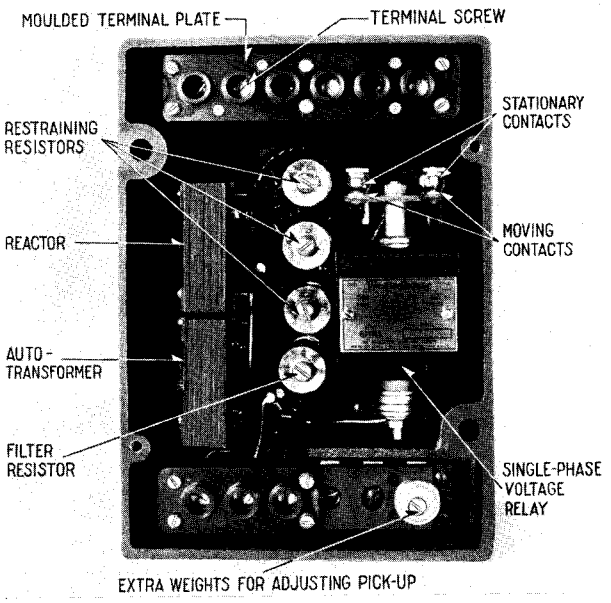

FIG. 2—TYPE SR-2 VOLTAGE RESTRAINING RELAY FRONT VIEW WITH COVER REMOVED.

CONSTRUCTION

1. The type SR-2 voltage restraining relay shown in Figs. 1 and 2 is a three phase voltage device used to make the type CN-33 relay insensitive to small power reversals under normal system conditions and sensitive under short-circuit conditions. The type SR-2 relay consists of a single plunger type voltage relay, a positive sequence voltage filter, and three tapped resistors all mounted in one case. The plunger type relay is a high drop-out over-voltage relay which closes two sets of silver contacts when it picks up. The two moving contacts are connected together so that they are electrically one. Weights are added on the bottom of the movable plunger to vary the minimum voltage at which the contacts close. A number of extra weights are located in the relay case to be used in adjusting the pick-up voltage should it be desired to change the standard setting of the relay. The positive sequence voltage filter consists of an autotransformer tapped at approximately its mid-point, a resistor, and a reactor. The resistor and reactor in series have a combined impedance angle of 60°. The voltage drop across the resistor is equal in magnitude to the voltage which appears across half the autotransformer. When the filter is properly connected to a positive sequence voltage source, the voltage across half the autotransformer and the drop across the resistor add together at 60°. The resultant voltage is proportional to the positive sequence voltage applied to the terminals of the filter. When only negative sequence voltage is applied to the filter the drop across the resistor is 180° from the autotransformer voltage so that the two cancel and give zero voltage across the coil of the voltage relay. The three tapped or restraining resistors are connected between the contacts of the voltage relay and the relay terminals as shown in Fig. 3. This figure also shows how the positive sequence voltage filter and the relay coil are connected inside the relay case.

2. The case and terminal construction of the SR-2 relay is similar to that used in the type CN-33 and type CN-J relays. The cover consists of a flat steel plate with a circular glass window in it through which the relay contacts are visible. The relay is mounted on two studs and held securely in place by two thumb nuts which when tightened force the terminal screws firmly into engagement with their associated terminal jaws on the protector.

OPERATION

3. The way in which the type SR-2 voltage restraining relay operates to render the type CN-33 relay and its associated network protector insensitive to small power reversals under normal system conditions and sensitive under short-circuit conditions can best be described in connection with Fig. 4. When the network protector is open the simultaneous closing of the type CN-J relay contacts and the closing contacts of the type CN-33 relay energizes the operating coil of the closing contactor or type SG relay. One set of the SG relay contacts shunts the contacts of the CN-J and CN-33 relays, thus sealing the SG relay in the energized position, and the other set of contacts completes the circuit of the closing motor. When the protector closes, its cut-off switch deenergizes the operating coil of the SG relay which drops out, thus deenergizing the closing motor and removing the shunt around the closing contacts of the CN-J and CN-33 relays. Two of the terminals of the positive sequence voltage filter in the SR-2 relay, namely,

WESTINGHOUSE TYPE SR-2 NETWORK RELAY—Continued

terminals No. 8 and No. 9 are permanently connected to phases "B" and "C" respectively of the network protector. The closing of the protector connects the third terminal, namely, terminal No. 7 of the filter through an auxiliary switch on the protector to phase "A". This places normal voltage on the positive sequence voltage filter and causes the voltage relay of the type SR-2 to pick up and close its contacts. The closing of these contacts connects the phasing coils of the type CN-33 relay in star through the tapped resistors of the type SR-2 relay, so that the phasing coils acting in conjunction with the CN-33 relay potential coils produce a restraining torque which holds the closing contacts of the type CN-33 relay firmly closed. In order to overcome this restraining torque additional current must be passed through the current coils of the CN-33 relay in the reverse direction before its tripping contacts can close. The amount of reverse current necessary to overcome the restraining torque and trip the network protector can be adjusted by changing taps on the resistors in the type SR-2 relay, which varies the amount of current through the phasing coils of the type CN-33 relay.

4. Only three terminal screws are supplied in the upper terminal block of the type SR-2 relay. The other three terminals are provided with short dummy screws to keep dust and dirt from entering the relay base. With these terminal screws located in terminals No. 1, No. 3, and No. 5 all of each tapped resistor in the SR-2 relay is connected in series with a phasing circuit of the CN-33 relay. Under this condition an in-phase reversal of approximately 20% of the protector rating is required to close the tripping contacts of the type CN-33 relay. By placing the three terminal screws in terminals No. 2, No. 4 and No. 6 only a portion of each tapped resistor in the SR-2 relay is connected in series with a phasing circuit of the CN-33 relay, and an in-phase reverse current setting of approximately 40% of the protector rating is obtained. The opening curve of the type CN-33 when the type SR-2 relay is in the normally energized position, so that the CN-33 relay phasing coils are functioning as restraining coils, is shown in Fig. 5. The SR-2 relay provides these in-phase reverse current setting of 20% or 40% when the type CN-33 relay has the usual sensitive reverse current setting of 0.2% of its protector rating. If the in-phase reverse current setting of the type CN-33 relay is increased by means of its reverse current adjusting screw to 10% the 20% and 40% settings obtained with the type SR-2 relay will increase to approximately 30% and 50% respectively. Thus by taking advantage of the adjustments and settings provided on the type CN-33 and type SR-2 relays, in-phase reverse current settings between approximately 0 to 10%, 20 to 30%, or 40 to 50% of the protector rating can be secured.

5. Having selected the reverse current setting desired and placed the terminal screws in the proper terminals no other setting or adjustment of the type SR-2 relay will ordinarily be required in service. The relay is adjusted at the factory to pick up on about 95% and drop out on 90% of normal positive sequence voltage. The pick-up voltage can be changed, however, if necessary by changing the number of weights attached to the movable plunger. The

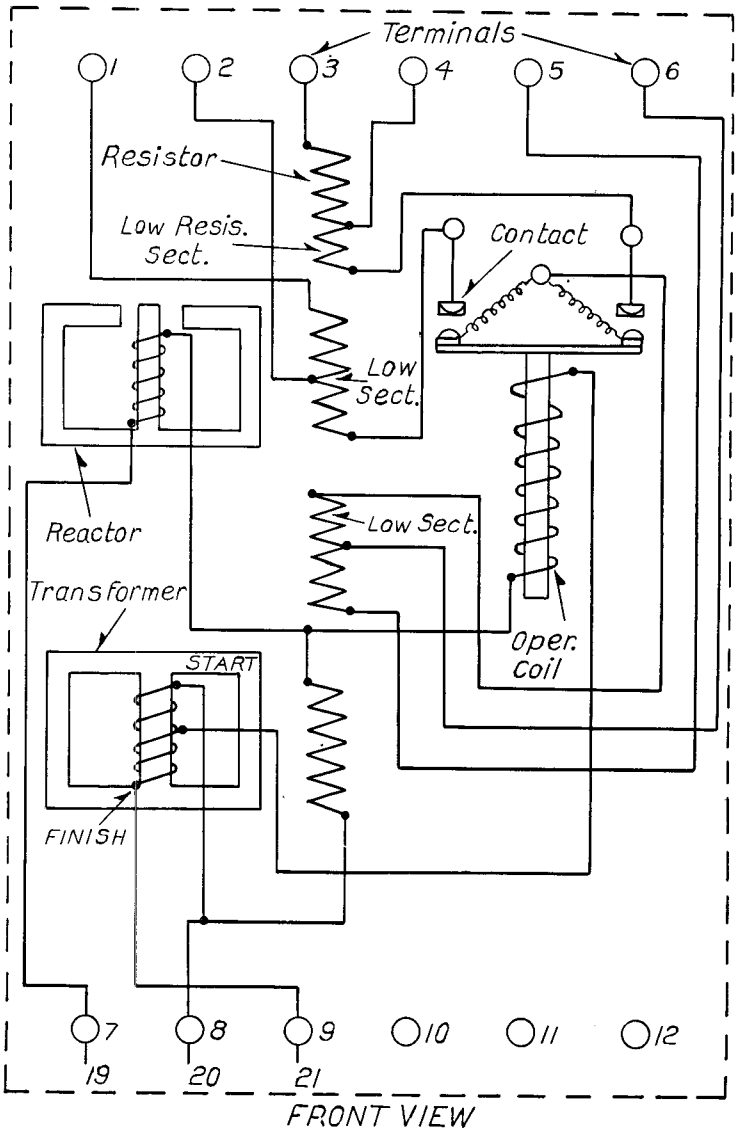

FIG. 3—WIRING DIAGRAM OF THE INTERNAL CONNECTIONS OF THE TYPE SR-2 VOLTAGE RESTRAINING RELAY.

WESTINGHOUSE TYPE SR-2 NETWORK RELAY—Continued

pick-up voltage can be varied in this manner over a range of about 75% to 96% of normal voltage when used on 120/208 volt network system. When the pick-up voltage is changed the drop-out voltage will also change. The latter in all cases will be approximately 94% of the former.

6. When a fault occurs on any phase or phases which appreciably affects the system voltage at the protector the positive sequence voltage at that point will be reduced. A reduction of about 10% in the positive sequence voltage will cause the type SR-2 relay to open its contacts and deenergize the phasing coils of the type CN-33 relay, thus reducing the restraining torque to zero and restoring the master relay to its sensitive condition. This puts the network protector under the control of a sensitive directional relay which will operate quickly and positively to trip if the fault is located so as to cause a reversal of power through the protector. Fig. 5 shows the CN 33 trip characteristics under restrained conditions.

7. The SR-2 relay is connected in the protector control circuits as shown in Fig. 4. As long as the relay terminals are fully screwed into their proper places, the SR-2 relay renders the protector insensitive to reversed currents according to the location of the terminal screws in the upper terminal block. The protector can be restored to continuously sensitive operation by simply removing the SR-2 relay from the protector, or by removing two of the three screws 7, 8 and 9. When using the type SR-2 relay it is essential that the protector be connected to the system with the phase rotation as shown in Fig. 4. Phase "A" in this figure is the left hand pole when facing the protector.

ADJUSTMENTS AND TESTS

8. The only adjustment necessary on the type SR-2 relay is that of the minimum voltage at which its contacts close. This is made by adding weights to the movable plunger. The recommended setting is 95% of normal network voltage, and can best be made by energizing the relay with balanced three-phase voltages as indicated in Fig. 6. Switches "M" and "Y" should be closed for this test. With the relay adjusted to close its contacts on 95% of normal 120/208 volts it should just open its contacts when the balanced voltages are reduced to about 90% of normal. The stationary contacts of the relay

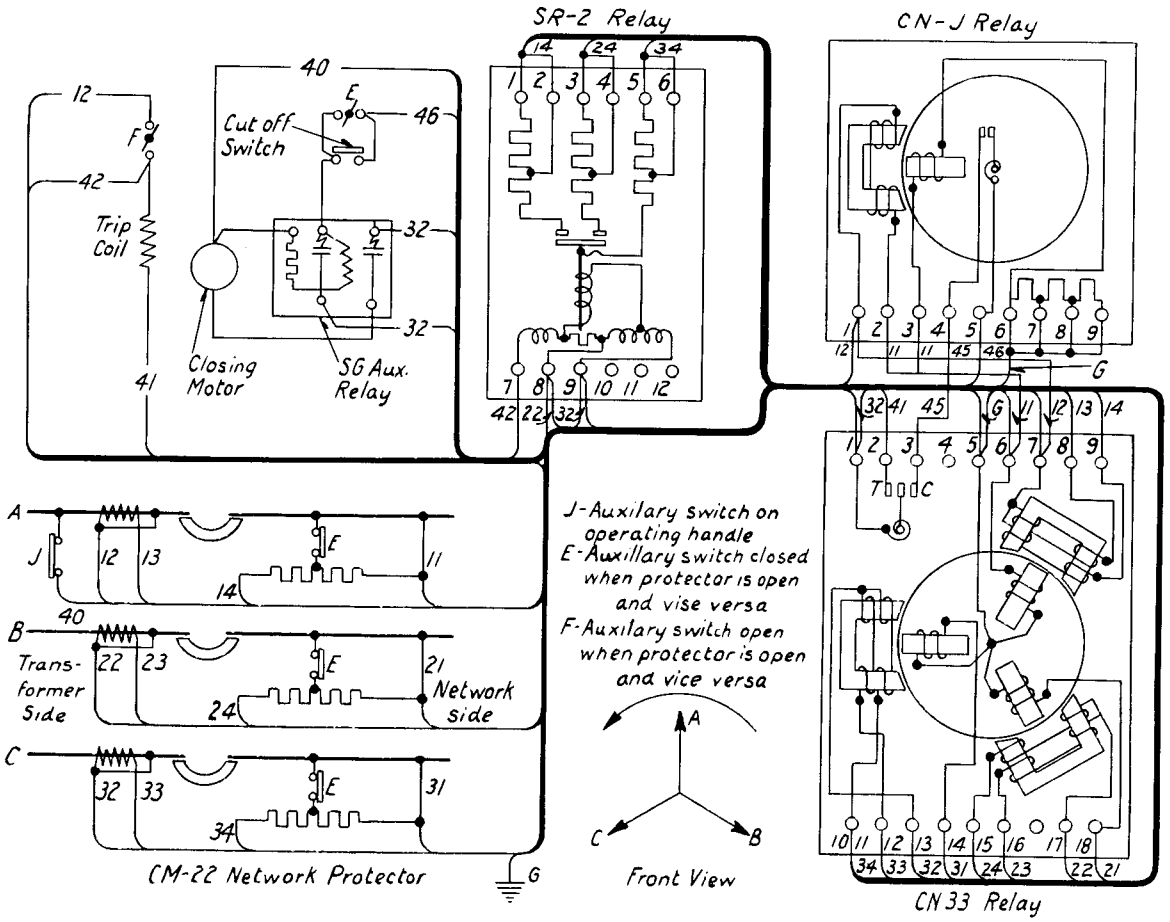

FIG. 4—SCHEMATIC WIRING DIAGRAM OF A NETWORK PROTECTOR CONTROLLED BY TYPE CN-33, TYPE CN-J, AND TYPE SR-2 NETWORK RELAYS.

WESTINGHOUSE TYPE SR-2 NETWORK RELAY—Continued

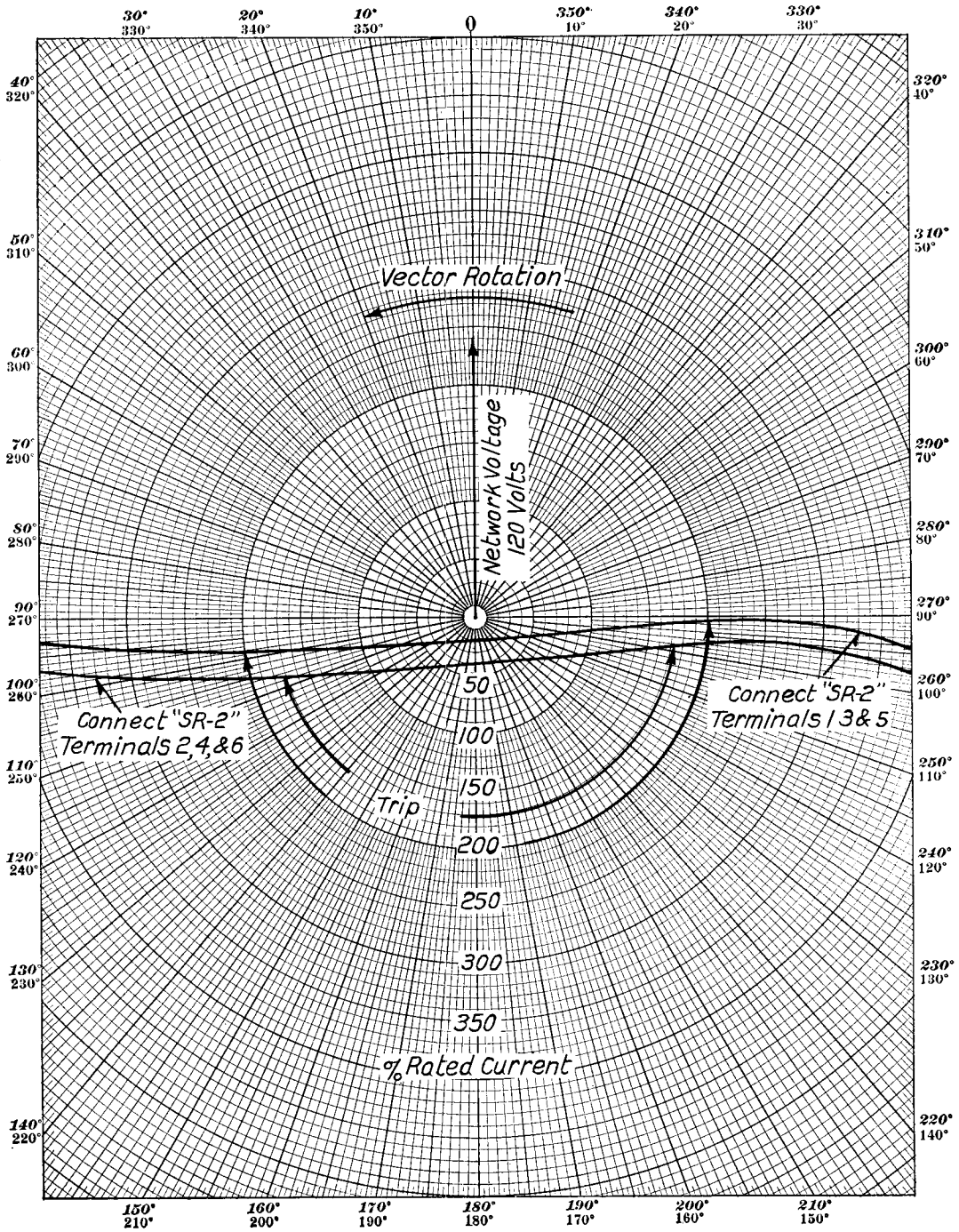

FIG. 5—OPENING CHARACTERISTICS OF THE TYPE CN-33 NETWORK MASTER RELAY WHEN THE TYPE SR-2 VOLTAGE RESTRAINING RELAY IS IN THE NORMALLY ENERGIZED POSITION.

WESTINGHOUSE TYPE SR-2 NETWORK RELAY—Continued

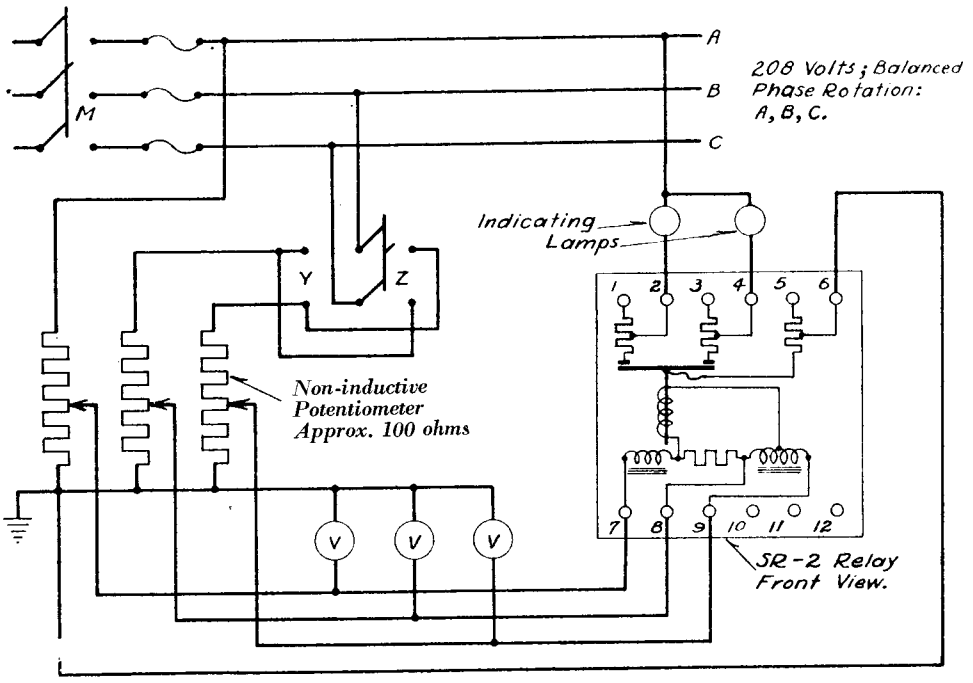

FIG. 6—TEST CONNECTIONS FOR THREE-PHASE TEST AND ADJUSTMENT OF THE TYPE SR-2 VOLTAGE RESTRAINING RELAY.

should be adjusted so that they make simultaneously with the moving contact as indicated by the two lamps. The stationary contacts must also be placed to limit the total travel of the plunger to approximately ⅛ inch and to give an initial contact gap of 1/16 inch. The leads to the moving contact must be sufficiently long and flexible to avoid interference with the movement of the plunger.

9. A proper balance of the positive sequence voltage filter parts can be checked by energizing the relay with a balanced negative sequence voltage. This can be done by closing switches "M" and "Z" and adjusting all voltages as read on the voltmeters "V" to 120 volts. Then measure the voltage from the autotransformer tap to the connection between the filter resistor and reactor, that is, the voltage across the coil of the plunger relay, with a high resistance voltmeter. This voltage should not exceed 5 volts. If this value of voltage is appreciably exceeded, the balance of the three-phase voltages should be checked. Should the filter output still be too high with balanced three-phase voltages this is an indication that the autotransformer, reactor, resistor, or some of their connections is defective.

INSTALLATION

10. The type SR-2 relay is shipped separate from the network protector. This decreases the possibility of damage during shipment. Carefully unpack and closely examine the relay to see that none of its parts have been bent or broken in transit. Inspect the relay to see that the plunger moves freely and that the leads to the moving element are smooth and arranged to avoid interference with the motion of the contacts. See that the contacts are properly adjusted. It is also advisable to check the minimum pick-up and drop-out voltage setting of the relay as described under "Tests and Adjustments". Be sure that the three upper terminal screws are in the correct terminals, that is, Nos. 1, 3 and 5 or Nos. 2, 4 and 6 depending upon the desired reverse current setting. All terminal screws and cover screws should be securely tightened. The relay should be mounted on the protector and securely fastened in place by means of its two thumb nuts after the protector has been completely installed and is ready to be placed in service.

MAINTENANCE

11. The plunger and contacts of the type SR-2 voltage restraining relay are practically the only parts that will require attention. During each periodic inspection of the network protector the relay contacts should be examined to see that they are clean and properly adjusted to close at the same time. Movement of the plunger should be checked to see that it is free from obstructions. The leads to the moving contacts must be flexible and long enough to avoid interference with the movement of the plunger.

WESTINGHOUSE TYPE SR-2 NETWORK RELAY—Continued

RENEWAL PARTS DATA

The following is a list of the Renewal Parts and the quantities of each that we recommend should be stocked by the user of this apparatus to minimize interrupted operation caused by breakdowns. The parts recommended are those most subject to wear in normal operation or those subject to damage or breakage due to possible abnormal conditions. This list of Renewal Parts is given only as a guide. When continuous operation is a primary consideration additional insurance against shut-downs is desirable. Under such conditions more Renewal Parts should be carried, the amount depending upon the severity of the service and the time required to secure replacement.

Recommended Stock of Renewal Parts

Type SR-2 Voltage Restraining Relay

FOR ILLUSTRATION OF PARTS SEE FIGS. 1 AND 2

Relays in use up to and including			1	5
Fig. No.	Name of Part	Style No. of Part	No. Req.	Recommended For Stock
17	Relay Complete	937 185	1	0	0
18	Single Phase Voltage Relay	.....	1	0	0
18	Moving Contact	819 792	1	1	2
*	Shunt	724 041	1	0	0
*	Coil	703 435	1	0	1
18	Stationary Contact	819 793	2	2	4
17	Metal Cover with Glass Window	939 391	1	0	0
17	Glass Window	376 740	1	0	0
17	Base	939 390	1	0	0
18	Moulded Terminal Plate (Top)	939 392	1	0	0
18	Moulded Terminal Plate (Bottom)	939 393	1	0	0
18	Restraining Resistor	723 989	3	0	1
18	Reactor	724 024	1	0	0
18	Autotransformer	724 025	1	0	0
18	Filter Resistor (1150 Ohms)	407 279	1	0	1
18	Terminal Screw	1 009 350	6	0	0
18	Extra Weights for Adjusting Pick-Up	780 812	3	0	0

* Not illustrated.
Parts indented are included in the part under which they are indented.

ORDERING INSTRUCTIONS

When ordering Renewal Parts, always specify the name of the part wanted as shown on the illustrations in this Instruction Book, giving Style Number, and the type of Relay as shown on the nameplate. For Example: **One Moving Contact, Style No. 819792, for Type SR-2 Network Relay, Style No. 937185.**

To avoid delays and misunderstandings, note carefully the following points:

1. Send all correspondence and orders to the nearest Sales Office of the Company.
2. State whether shipment is to be made by freight, express or parcel post. In the absence of instructions, goods will be shipped at our discretion. Parcel post shipments will be insured only on request. All shipments are at purchaser's risk.
3. Small orders should be combined so as to amount to a value of at least **$1.00** net. Where the total of the sale is less than this, the material will be invoiced at **$1.00.**

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SIOUX CITY, IOWA, 1005 Dace St.
SPOKANE, WASH., 152 So. Monroe St.
SPRINGFIELD, MASS., 46 Hampden St.
SYRACUSE, N. Y., 961 W. Genesee St.
①TACOMA, WASH., 1115 "A" St.
TAMPA, FLA., 417 Ellamae St.
TERRE HAUTE, IND., 234 So. 3rd St.
TOLEDO, OHIO, 1920 N. Thirteenth St.
TRENTON, N. J., 245 N. Broad St.
①TULSA, OKLA., 303 East Brady St.
UTICA, N. Y., 113 N. Genesee St.
WASHINGTON, D. C., 1216 "K" St., N.W
WATERLOO, IOWA, 328 Jefferson St.
WHEELING, W. VA., 1117 Main St.
WICHITA, KANSAS, 233 So. St. Francis Ave.
WILLIAMSPORT, PA., 348 W. Fourth St.
WILMINGTON, DEL., 216 E. Second St.
①WORCESTER, MASS., 17 Mulberry St.
YORK, PA., 143 S. George St.

* Sales Office † Service Shop x Works # Warehouse ° First Class Mail Only § Merchandising Products Only z Headquarters ‡ Apparatus Products Only

①**Changed or added since previous issue.**

October, 1940

HP DOP. SEP BA Spl.

WESTINGHOUSE AGENT JOBBERS—Continued
Other Agent Jobbers

ABILENE, KAN., Union Electric Co.
AKRON, OHIO, The Moock Electric Supply Co.
BIRMINGHAM, ALA., Moore Handley Hdwe. Co.
BLUEFIELD, W. VA., Superior-Sterling Co.
BUFFALO, N. Y., Buffalo Electric Co., Inc.
CANTON, OHIO, The Moock Electric Supply Co.
‡CHATTANOOGA, TENN., Mills & Lupton Supply Co.
CHICAGO, ILL., Hyland Electrical Supply Co.
CINCINNATI, OHIO, The Johnson Electric Supply Co.
COLUMBUS, OHIO, Pixley Electric Supply Co.
‡DENVER, COL., The Mine & Smelter Supply Co.
‡EL PASO, TEX., Mine & Smelter Supply Co.
ERIE, PA., Star Electrical Co.
HUNTINGTON, W. VA., Banks Miller Supply Co.
KANSAS CITY, MO., Columbian Elec'l Co.
KANSAS CITY, MO., Continental Elec. Co.
LEXINGTON, KY., Tafel Elec. & Supply Co.
LOUISVILLE, KY., Tafel Electric & Supply Co.
MONROE, LA., Monroe Hardware Co.
NASHVILLE, TENN., Tafel Electric & Supply Co.
NEW ORLEANS, LA. Electrical Supply Co.
NEW YORK, N. Y., Times Appliance Co., Inc.
SAN DIEGO, CALIF., The Electric Supplies Distributing Co.
SCRANTON, PA., Penn Elect'l Engineering Co.
YOUNGSTOWN, OHIO, Moock Electric Supply Co.

WESTINGHOUSE ELECTRIC & MFG. CO., LAMP DIVISION
Headquarters—Clearfield Ave., Bloomfield, N. J.

*ALBANY, N. Y., 454 N. Pearl St.
#*ATLANTA, GA., 426 Marietta St.
*BALTIMORE, MD., 118 E. Lombard St.
xBELLEVILLE, N. J., 720 Washington Ave.
zxBLOOMFIELD, N. J., Clearfield Ave.
①*BLOOMFIELD, N. J., Clearfield Ave.
#yBLOOMFIELD, N. J., Clearfield Ave.
*BOSTON, MASS., 10 High St.
①#BOSTON, MASS., 44 Farnsworth St., Boston, Mass.
*BUFFALO, N. Y., 295 Main St.
*CHICAGO, ILL., 20 North Wacker Drive
#CHICAGO, ILL., 2211 W. Pershing Road
*CINCINNATI, OHIO, Third & Elm Sts.
*CLEVELAND, OHIO, 1216 W. 58th St.
*COLUMBUS, OHIO, 85 E. Gay St.
*DALLAS, TEXAS, 209 Browder St.
*DAVENPORT, IOWA, 206 East Second St.
*DENVER, COLO., 910 Fifteenth St.
#*DETROIT, MICH., 5757 Trumbull Ave.
*EMERYVILLE, CALIF., 5915 Green St.
*HOUSTON, TEXAS, 1314 Texas Ave.
*HUNTINGTON, W. VA., 1029 Seventh Ave.
*INDIANAPOLIS, IND., 137 So. Penna. Ave.
*JACKSON, MICH., 212 W. Michigan Ave.
*KANSAS CITY, MO., 101 W. Eleventh St.
#*LOS ANGELES, CALIF., 420 S. San Pedro St.
*LOUISVILLE, KY., 332 West Broadway
*MEMPHIS, TENN., 130 Madison St.
*MILWAUKEE, WISC., 546 North Broadway
*MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
*NEW ORLEANS, LA., 333 St. Charles St.
①*NEW YORK, N. Y., 150 Varick St.
*OKLAHOMA CITY, OKLA., 850 N.W. Second St.
*OMAHA, NEB., 409 So. Seventeenth St.
①*#ORANGE, N. J., Joyce St.,
*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 306 4th Ave., Box 1017
#PITTSBURGH, PA., 543 N. Lang Ave.
*ROCHESTER, N. Y., 1048 University Ave.
*ST. LOUIS, MO., 411 No. Seventh St.
#ST. LOUIS, MO., 1219 Gratoit St.
①*SALT LAKE CITY, UTAH, 1st South & Main Sts.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
#SAN FRANCISCO, CALIF., 60 Federal St.
*#SEATTLE, WASH., 3451 East Marginal Way
*SYRACUSE, N. Y., 961 W. Genesee St.
①zxTRENTON, N. J., 400 Pennington Ave.
*WASHINGTON, D. C., 1434 N. Y., N. W.

① WESTINGHOUSE ELECTRIC & MFG. CO., X-RAY DIVISION
Headquarters—21-16 43rd Ave., Long Island City, N. Y.

*ATLANTA, GA., 565 W. Peachtree St., N. E.
*BALTIMORE, MD., 118 East Lombard St.
*BOSTON, MASS., 270 Commonwealth Ave.
*CHICAGO, ILL., 14 No. Franklin St.
*CLEVELAND, OHIO, 7016 Euclid Ave.
*DALLAS, TEXAS, 207 Browder St.
*DENVER, COLO., 910 Fifteenth St.
#*DETROIT, MICH., 5757 Trumbull Ave.
*KANSAS CITY, MO., 410 Professional Bldg.
zxLONG ISLAND CITY, N. Y., 21-16 43rd Ave.
*LOS ANGELES, CALIF., 420 S. San Pedro St.
*MILWAUKEE, WISC., 534 North Broadway
*NEW ORLEANS, LA., 427 Baronne St.
*NEW YORK, N. Y., 173 E. Eighty-Seventh St.
*OMAHA, NEB., 117 N. Thirteenth St.
*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 3702 Fifth Ave.
*PORTLAND, OREGON, 1220 S. W. Morrison St.
*ROCHESTER, N. Y., 1048 University Ave.
*SAN FRANCISCO, CALIF., 870 Market St.
*SEATTLE, WASH., 3451 E. Marginal Way

WESTINGHOUSE ELECTRIC ELEVATOR COMPANY
Headquarters—150 Pacific Ave., Jersey City, N. J.

BALTIMORE, MD., 39 West Lexington St.
BOSTON, MASS., 10 High St.
BROOKLYN, N. Y., 58 Schermerhorn St.
BUFFALO, N. Y., 806 Ellicott Sq. Bldg.
CHICAGO, ILL., 222 No. Bank Drive
CINCINNATI, OHIO, Third & Elm Sts.
CLEVELAND, OHIO, 842 Rockefeller Bldg.
◆COLUMBUS, OHIO, 85 E. Gay St.
①DALLAS, TEXAS, 720 Santa Fe Bldg.
◆DENVER, COLO., 1052 Gas & Electric Bldg.
◆DES MOINES, IOWA, 1408 Walnut St.
DETROIT, MICH., 5757 Trumbull Ave.
◆DUBUQUE, IOWA, c-o Roshek Store
◆HARTFORD, CONN., 410 Asylum St.
◆HOUSTON, TEXAS, 2315 Commerce St.
◆INDIANAPOLIS, IND., 551 W. Merrill St.
zxJERSEY CITY, N. J., 150 Pacific Ave.
◆KANSAS CITY, MO., 101 W. Eleventh St.
①◆LANSING, MICH., 522 W. Kilborn Ave.
LOS ANGELES, CALIF., 420 So. San Pedro St.
①◆LOUISVILLE, KY., 1630 Edenside Ave.
①NEWARK, N. J., 17 Academy St.
NEW YORK, N. Y., 9 Rockefeller Plaza
NEW YORK, N. Y., 128 E. 149 St.
PHILADELPHIA, PA., 3001 Walnut St.
PITTSBURGH, PA., 435 Seventh Ave.
◆PORTLAND, ORE., 415 Terminal Sales Bldg.
①◆SACRAMENTO, CALIF., 719 "K" St.
ST. LOUIS, MO., 1601 Ambassador Bldg.
SAN FRANCISCO, CALIF., 1 Montgomery St.
①◆SHREVEPORT, LA.
①◆STEUBENVILLE, OHIO, 551 N. Fifth St.
①◆TULSA, OKLA., 303 East Brady St.
WASHINGTON, D. C., 1112 21st St., N. W.

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY
① Headquarters—40 Wall St., New York, N. Y., U. S. A.

*ARGENTINE, BUENOS AIRES, Cia. Westinghouse Electric Internacional, S. A., Rivadavia 819
①*AUSTRALIA, SYDNEY, Box 2364-EE G.P.O.
*BRAZIL, RIO DE JANEIRO, Caixa Postal 1320
*BRAZIL, SAO PAULO, Caixa Postal 4191
①*COLOMBIA, MEDELLIN, Apartado 43
①*CHILE, SANTIAGO, Casilla 1897
①*CUBA, HAVANA, Apartado 2289
*ENGLAND, LONDON, W.C. 2, 2 Norfolk St., Strand
*INDIA, BOMBAY, Westinghouse Electric Co. of India Ltd., 294A Bazargate St.
*ITALY, MILANO, Piazza Crispi 3
*MEXICO, D. F. Mexico, Cia. Westinghouse Electric Internacional, Edificio la Nacional, Apartado 78 Bis.
*PANAMA, REPUBLIC, Panama, Apartado 742
*PERU, LIMA, Casilla 1685
*PHILIPPINE ISLANDS, Manila, P.O. Box 998
*PUERTO RICO, San Juan, P.O. Box 1748
*SOUTH AFRICA, JOHANNESBURG, Westinghouse Electric Co. of South Africa, Ltd., P.O. Box 6067

BRYANT ELECTRIC COMPANY
Headquarters—1421 State St., Bridgeport, Conn.

*BOSTON, MASS.
zxBRIDGEPORT, CONN., Main Plant, 1421 State St.
xBRIDGEPORT, CONN., Plastics Division Plant, 1105 Railroad Ave.
*#CHICAGO, ILL., 844 West Adams St.
*#LOS ANGELES, CALIF., 420 S. San Pedro St.
*NEW YORK, N. Y., 101 Park Ave.
*#SAN FRANCISCO, CALIF., 325 Ninth St.

WESTINGHOUSE RADIO STATIONS, INC.
①Headquarters—1619 Walnut St., Philadelphia, Pa.

①STATION KDKA, Grant Bldg., Pittsburgh, Pa.
①STATION WBZ, 275 Tremont St., Boston, Mass.
STATION KYW, 1619 Walnut St., Philadelphia, Pa.
STATION WBZA, Hotel Kimball, Springfield, Mass.
STATION WOWO, 925 So. Harrison St., Fort Wayne, Ind.
STATION WGL, 925 So. Harrison St., Fort Wayne, Ind.

CANADIAN WESTINGHOUSE COMPANY, LIMITED
Headquarters—Hamilton, Ontario, Canada

*†#CALGARY, 320 Eighth Avenue, West Calgary, Alberta, Can.
#*EDMONTON, 10127, 104th St., Armstrong Block, Edmonton, Alberta, Can.
#*FORT WILLIAM, 112 McVicar St., Fort William, Ontario, Can.
#*HALIFAX, 158 Granville St., Halifax, Nova Scotia, Can. P.O. Box 204
xz*HAMILTON, Hamilton, Ontario, Can.
*LONDON, 504 Huron & Erie Bldg., London, Ontario, Can.
①*MONTREAL, 720 Dominion Sq. Bldg.
§MONTREAL, 400 McGill St., Montreal, Quebec, Can.
#†MONTREAL, 1844 William St., Montreal, Quebec, Can.
*NELSON, B. C. Can., P. O. Box 70
#*OTTAWA, Ahearn & Soper Limited, P.O. Box 794, Ottawa, Ontario, Can
*†#REGINA, 2408 Eleventh Ave., Regina, Saskatchewan, Can.
*SASKATOON, 238 First Ave. N., Saskatchewan, Can.
†#*SWASTIKA, Swastika, Ontario, Can.
*†#TORONTO, 355 King St., West, Toronto, Ontario, Can.
*VANCOUVER, 1418 Marine Bldg., Vancouver, B. C., Can.
†#VANCOUVER, 1090 Homer St., Vancouver, B. C., Can.
#*†WINNIPEG, 158 Portage Ave. East, Winnipeg, Manitoba, Can.

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* Sales Office † Service Shop x Works # Warehouse z Headquarters y Executive Office § Merchandising Products Only ‡ Apparatus Products Only
◆ Service Office only