INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN REVERSE POWER RELAY FOR MARINE SERVICE

CAUTION Before putting relays into service remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The Type CRN relay is a single-phase timed directional relay used to protect a-c generators from motoring. When such a condition occurs and persists for a preset time interval, the generator may be tripped or an alarm sounded. The directional element has watt characteristics and the timer element is adjustable from approximately 2 to 25 seconds. The relay is designed to withstand the 2000 lb. Class H-I shock Test.

CONSTRUCTION AND OPERATION

The relay consists of two induction disc type elements. The upper one is the timer element and the lower one is a directional element.

Timer Element

This element is a geared induction disc type element. The induction disc is four inches in diameter, mounted on a vertical shaft. The steel bearing pin at the bottom of the shaft is supported by a steel ball bearing. This ball is spring mounted. The upper end of the shaft has a phosphor bronze olive jewel, and this rides on a steel bearing pin, held by a screw mounted on the main movement frame.

The two upper bearing screws of the timer element should be screwed down until there is four to five thousandths inch clearance between the end of the bearing screw and the top of the shaft.

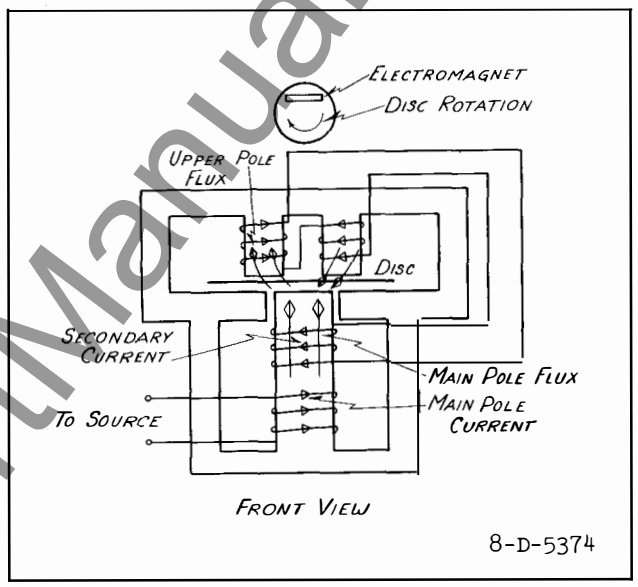

Fig. 1—Flux And Current Relations In The Induction Type Relay Element.

The moving contact is a small silver hemisphere fastened on the end of an arm. The other end of this arm is clamped to an insulated shaft geared to the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other, to a slotted spring adjuster disc which in turn fastens to the moulded block mounted on the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf spring, This spring is fastened to the moulded block. A small set screw provides adjustment of the contact follow.

The disc is rotated by an electromagnet in

SUPERSEDES I. L. 41-288.1B
(New I. L. Number—No Changes)

EFFECTIVE MARCH 1955

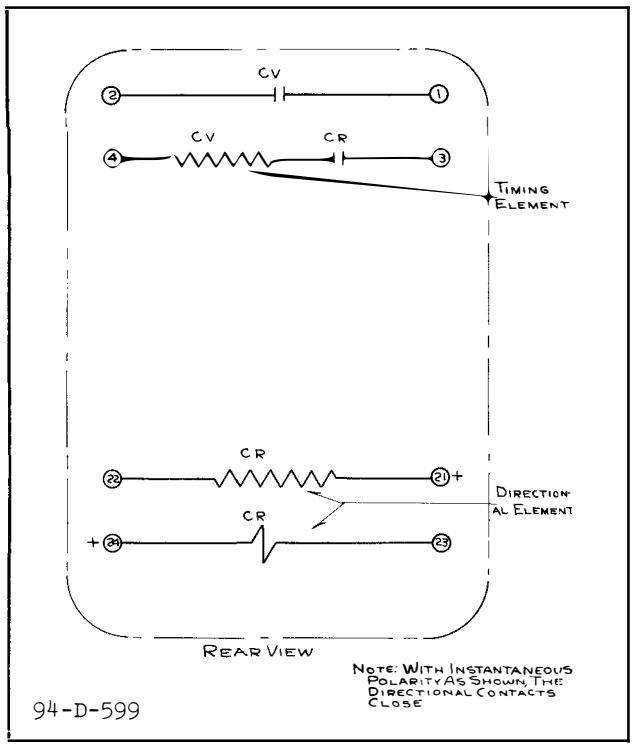

Fig. 2—Internal Schematic Connections Of The Type CRN Relay.

the rear and damped by a permanent magnet in front. The permanent magnet is mounted on the movement frame by means of four mounting screws--two at the front and two at the side. Above the two side screws and between the magnet bracket and the movement frame, are two adjusting hex-head screws. With the mounting screws loose, the hex-head screws are adjusted so that the disc rides midway in the air gap. The locking nuts are screwed down first and then the four mounting screws securely tightened.

The magnetic shunt in the center of the permanent magnet assembly can be rotated up or down to calibrate the timer element. It is locked in place by a small set screw.

The operating torque is obtained by the electromagnet construction shown in Figure 1. The main pole coil of the element is energized by line voltage. This coil acts as a primary of a transformer and induces a voltage in a secondary coil. Current from this secondary coil flows through the upper pole coils and thus produces torque on the disc by the reaction between the fluxes of the upper and lower poles.

The timer element cannot be energized unless the power flow is in the tripping direction, because its potential coil is connected in series with the contacts of the directional element. Hence, the relay is directionally controlled.

Directional Element

This element is similar to the timing element, except that the quantities used to rotate the disc and the contact assembly are different. The two upper poles of the electromagnet are energized by line current, and the lower pole by polarizing voltage. The fluxes produced by these two electrical quantities cause rotation of the disc in a direction depending on the phase angle between the current and voltage. As power reverses, the current in the relay reverses, while the polarizing voltage remains fixed. Thus, a directional torque is obtained.

The contact assembly and permanent magnet construction are the same as for the timer element. The moving element is non-geared and the bearings are the same as for the timer element disc shaft.

Mechanical Balance

The moving elements of the Type CRN relay are balanced in the factory. This is provided for to insure proper operation of the relay in tilted positions up to 45 degrees from the vertical position.

CHARACTERISTICS

The timer element is rated at 115 volts, 60 cycles. The minimum trip value is 65 volts, or 57 percent of rated voltage. The continuous rating is 127 volts, or 110 percent of rated voltage. The characteristic time curves are shown in Figure 3 for various voltage and time-lever settings.

The directional element has a watt characteristic with maximum torque when current and

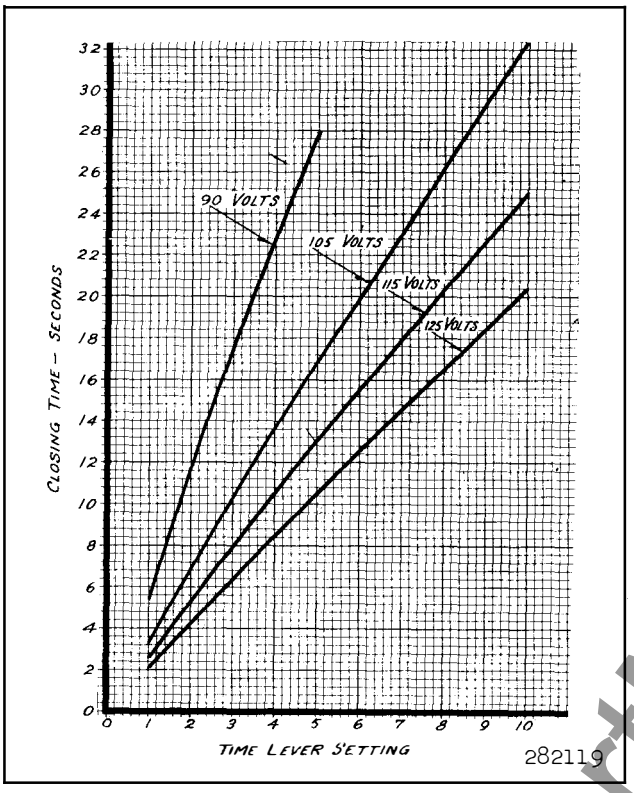

Fig. 3—Typical Time Curves Of The Timer Element Of The Type CRN Relay.

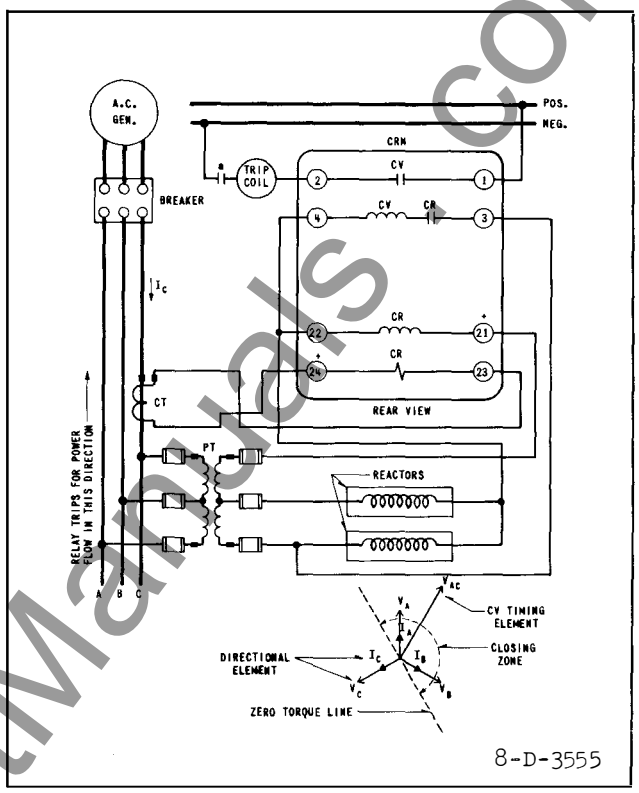

Fig. 4—External Connections Of The Type CRN Relay Using Open Delta Potential Transformer And External Reactors.

voltage are in phase. The potential coil is rated 70 volts, 60 cycles, with continuous rating of 77 volts, or 110 percent of rated value.

The current coil is rated 5 amperes, 60 cycles. This is also its continuous rating. The minimum pickup current is 0.100 ampere in the current coil in phase with 65 volts across the potential coil. Under minimum trip conditions, the directional element contact pressure is sufficient to energize the timer element so that the latter closes contacts. However, the timing characteristics of the relay may be erratic under these conditions.

INSTALLATION

The relays should be mounted on switchboard panels, or their equivalent, in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes at top and bottom of the case flange. One of the mounting screws may be utilized for grounding the relay case. The electrical connections may be made direct to the terminals by means of screws.

For correct operation, the Type CRN relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional element has a watt characteristic, this may be accomplished by using line to neutral voltage for the directional element potential coil and the corresponding line current in the series coils. If a neutral is not available, a dummy neutral may be obtained by using two reactors. The directional element voltage coil then constitutes one leg of a wye connection, and the reactors the other two legs.

The voltage-operated timer element should be connected across the line. An external diagram is shown in Figure 4.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d.c., and will safely carry this current long enough to trip a breaker.

The time for the main contacts to break after operation can be decreased by eliminating the follow. This is done by screwing in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the moulded support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage-operated timer, and it is adjusted by the position of the time lever along the time lever scale This scale has ten divisions, and Figure 3 gives a curve of time delay vs. lever setting for various impressed voltages. Time is approximately proportional to lever setting.

In order to prevent operation of the relay during shock, the minimum setting of the time lever is limited by a screw in the scale to the #1 time lever setting.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after the relay is received by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

Note that because the moving element is balanced, no parts in this assembly can be replaced separately. The complete element, including spring, spring adjuster, moving contact, shaft, disc, and lower bearing pinholder, must be replaced as a complete unit.

All contacts should be periodically cleaned with a fine file. File S#1002110 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

Timer Element

Each upper bearing screw should be screwed down until there is four to five thousandths inch clearance between it and the shaft, and then securely locked in position with the lock nut. This adjustment can be made best by carefully screwing down the top bearing screw until the shaft fails to turn freely and then backing up a fraction of a turn. . Great care must be taken in making this adjustment to prevent damage to the bearings.

Adjust the back stop on the time lever so that the moving contact just touches the stationary contacts at the zero time lever setting. The small adjustment screw on the stationary contact should not be screwed in far enough to limit the follow of the stationary contact.

The spiral spring should have approximately 1-1/4 turns initial tension with the moving contact in the #10 time lever position. The convolutions of the spring should not touch each other for all positions of the moving contacts. Adjust the tension of the spiral spring so that the contacts will operate at 65 volts and follow the time curve as shown. The timing may be checked with a cycle counter connected as shown in Fig. 15, and may be adjusted by rotating the magnetic shunt on the damping magnet up or down.

Directional Element

The upper bearing screw should be screwed down until there is four to five thousandths inch clearance between it and the shaft, and then securely locked in position with the lock nut. This adjustment can be made best by carefully screwing down the top bearing screw until the disc fails to turn freely and then

backing up a fraction of a turn. Great care must be taken in making this adjustment to prevent damage to the bearings.

The contact travel of the directional element should be adjusted to 3/32 inch, and the back-stop lever locked in place. The spring tension should be adjusted so that the directional element contacts close at 65 volts and 0.100 ampere at unity power factor. This adjustment should be such that the timer element closes contacts from the #10 lever setting when energized at 115 volts.

External Reactors

Connect the potential coil of the type CRN directional element in series with the two reactors. Apply three times rated voltage to the combination (220 volts for 70-volt relays). Using a high resistance voltmeter, check the voltage across each reactor and across the directional element potential coil. All three voltages should be equal within ± two volts. Adjustments may be made by varying the air gap in the reactor iron.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The 60-cycle burden of the elements of the Type CRN relay are as follows:

Coil	Burden at	Watts	Volt-Amperes	Power Factor† Angle
Timer	115 Volts	4.72	8.13	54.5°
Directional Potential	70 Volts	4.22	25.3	80.4°
Directional Current	5 Amps.	1.96	2.75	43.4°

†Angle that current lags the voltage.

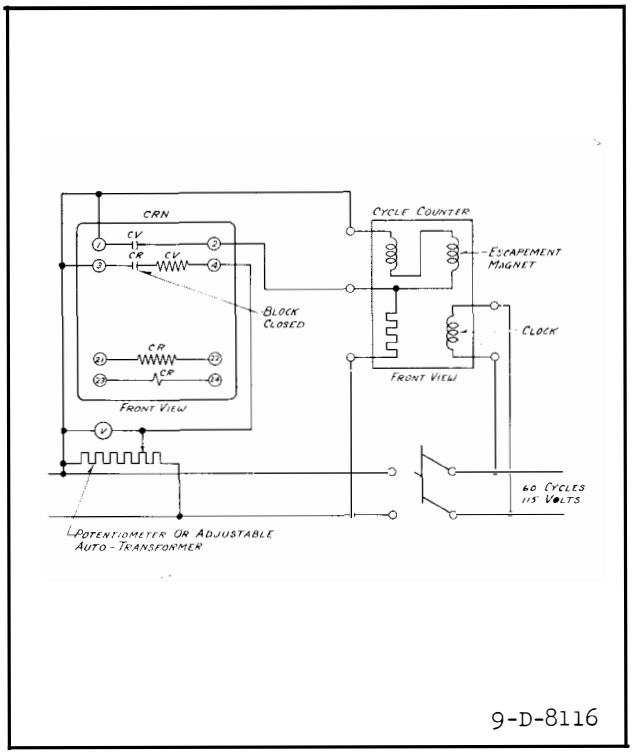

Fig. 5—Test Connections For The Timer Element Of The Type CRN Relay.

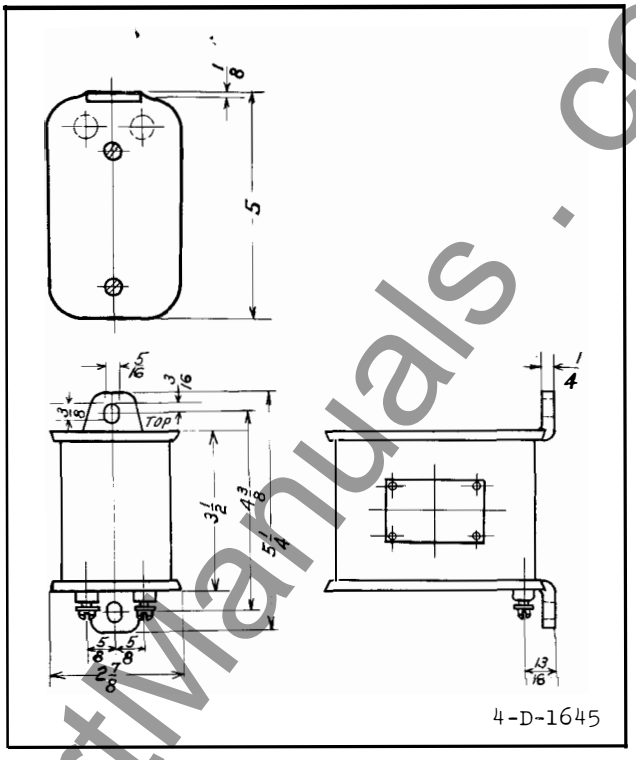

Fig. 6—Outline And Drilling Plan For The External Reactor. For Reference Only.

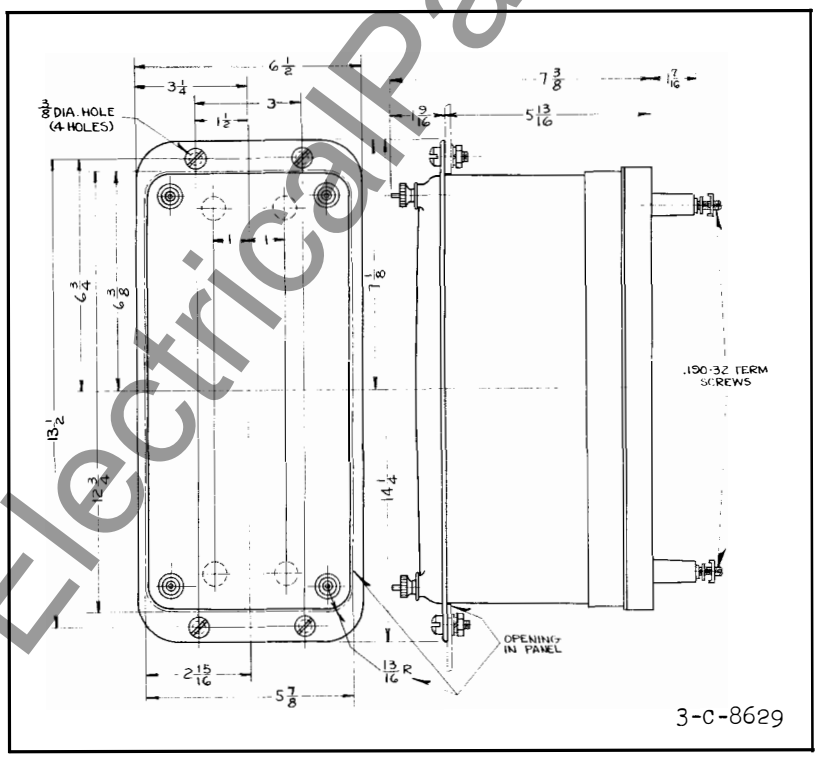

Fig. 7—Outline and Drilling Plan For The Type HI Shockproof Semi-Flush, Non-Detachable Type Case. For Reference Only.

WESTINGHOUSE ELECTRIC CORPORATION
METER DIVISION • **NEWARK, N.J.**

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INSTALLATION • OPERATION • MAINTENANCE

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TYPE CRN REVERSE POWER RELAY FOR MARINE SERVICE

CAUTION Before putting relays into service remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The Type CRN relay is a single-phase timed directional relay used to protect a-c generators from motoring. When such a condition occurs and persists for a preset time interval, the generator may be tripped or an alarm sounded. The directional element has watt characteristics and the timer element is adjustable from approximately 2 to 25 seconds. The relay is designed to withstand the 2000 lb. Class H-I shock Test.

CONSTRUCTION AND OPERATION

The relay consists of two induction disc type elements. The upper one is the timer element and the lower one is a directional element.

Timer Element

This element is a geared induction disc type element. The induction disc is four inches in diameter, mounted on a vertical shaft. The steel bearing pin at the bottom of the shaft is supported by a steel ball bearing. This ball is spring mounted. The upper end of the shaft has a phosphor bronze olive jewel, and this rides on a steel bearing pin, held by a screw mounted on the main movement frame.

The two upper bearing screws of the timer element should be screwed down until there is four to five thousandths inch clearance between the end of the bearing screw and the top of the shaft.

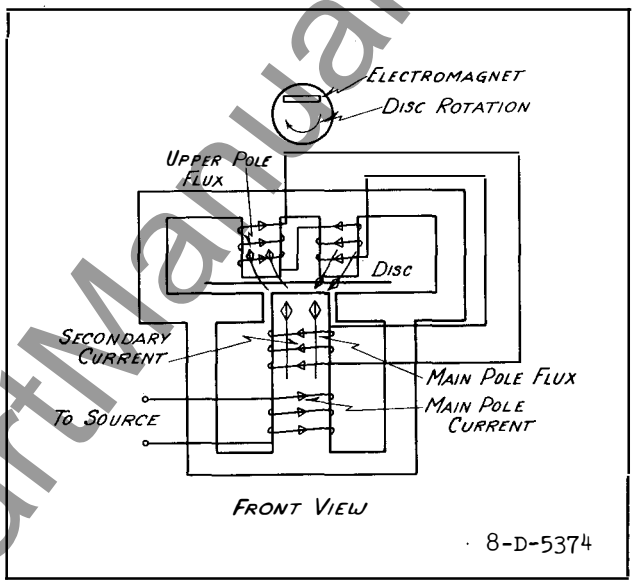

Fig. 1—Flux And Current Relations In The Induction Type Relay Element.

The moving contact is a small silver hemisphere fastened on the end of an arm. The other end of this arm is clamped to an insulated shaft geared to the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other, to a slotted spring adjuster disc which in turn fastens to the moulded block mounted on the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf spring, This spring is fastened to the moulded block. A small set screw provides adjustment of the contact follow.

The disc is rotated by an electromagnet in

* Denotes change from superseded issue.

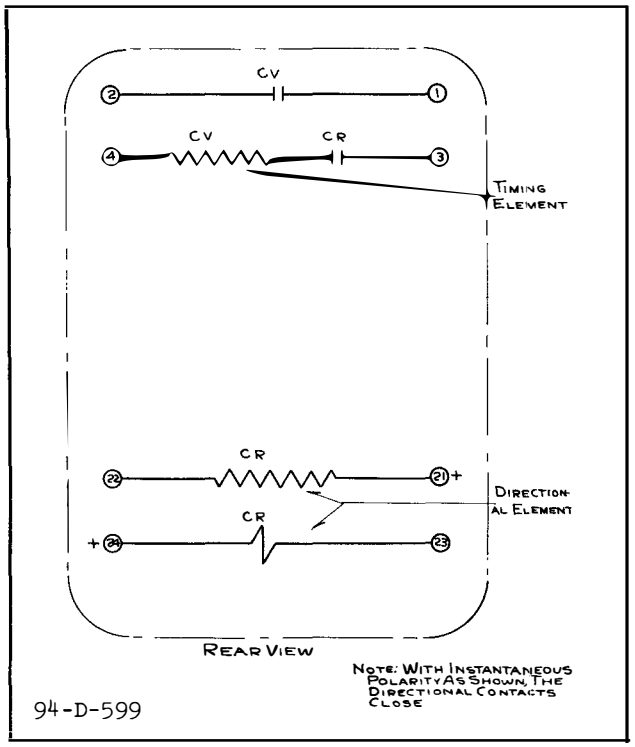

Fig. 2—Internal Schematic Connections Of The Type CRN Relay.

the rear and damped by a permanent magnet in front. The permanent magnet is mounted on the movement frame by means of four mounting screws--two at the front and two at the side. Above the two side screws and between the magnet bracket and the movement frame, are two adjusting hex-head screws. With the mounting screws loose, the hex-head screws are adjusted so that the disc rides midway in the air gap. The locking nuts are screwed down first and then the four mounting screws securely tightened.

The magnetic shunt in the center of the permanent magnet assembly can be rotated up or down to calibrate the timer element. It is locked in place by a small set screw.

The operating torque is obtained by the electromagnet construction shown in Figure 1. The main pole coil of the element is energized by line voltage. This coil acts as a primary of a transformer and induces a voltage in a secondary coil. Current from this secondary coil flows through the upper pole coils and thus produces torque on the disc by the reaction between the fluxes of the upper and lower poles.

The timer element cannot be energized unless the power flow is in the tripping direction, because its potential coil is connected in series with the contacts of the directional element. Hence, the relay is directionally controlled.

Directional Element

This element is similar to the timing element, except that the quantities used to rotate the disc and the contact assembly are different. The two upper poles of the electromagnet are energized by line current, and the lower pole by polarizing voltage. The fluxes produced by these two electrical quantities cause rotation of the disc in a direction depending on the phase angle between the current and voltage. As power reverses, the current in the relay reverses, while the polarizing voltage remains fixed. Thus, a directional torque is obtained.

The contact assembly and permanent magnet construction are the same as for the timer element. The moving element is non-geared and the bearings are the same as for the timer element disc shaft.

Mechanical Balance

The moving elements of the Type CRN relay are balanced in the factory. This is provided for to insure proper operation of the relay in tilted positions up to 45 degrees from the vertical position.

CHARACTERISTICS

The timer element is rated at 115 volts, 60 cycles. The minimum trip value is 65 volts, or 57 percent of rated voltage. The continuous rating is 127 volts, or 110 percent of rated voltage. The characteristic time curves are shown in Figure 3 for various voltage and time-lever settings.

The directional element has a watt characteristic with maximum torque when current and

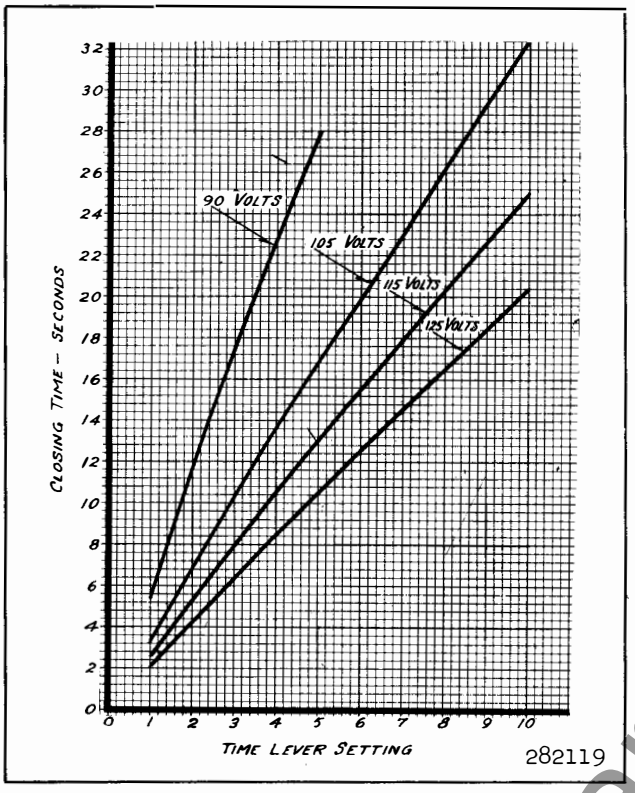

Fig. 3—Typical Time Curves Of The Timer Element Of The Type CRN Relay.

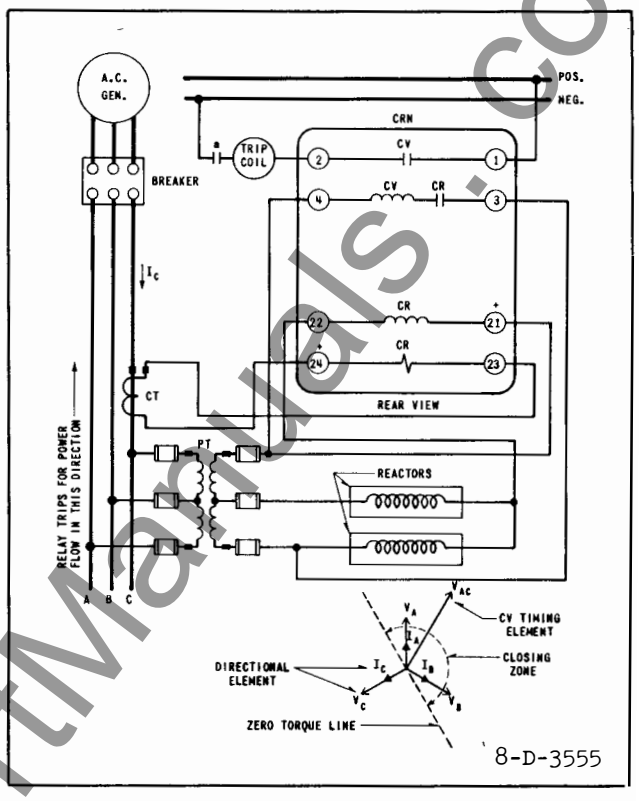

Fig. 4—External Connections Of The Type CRN Relay Using Open Delta Potential Transformer And External Reactors.

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INSTALLATION

The relays should be mounted on switchboard panels, or their equivalent, in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes at top and bottom of the case flange. One of the mounting screws may be utilized for grounding the relay case. The electrical connections may be made direct to the terminals by means of screws.

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Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d.c., and will safely carry this current long enough to trip a breaker.

The time for the main contacts to break after operation can be decreased by eliminating the follow. This is done by screwing in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the moulded support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero.

SETTINGS

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External Reactors

Connect the potential coil of the type CRN directional element in series with the two reactors. Apply three times rated voltage to the combination (220 volts for 70-volt relays). Using a high resistance voltmeter, check the voltage across each reactor and across the directional element potential coil. All three voltages should be equal within ± two volts. Adjustments may be made by varying the air gap in the reactor iron.

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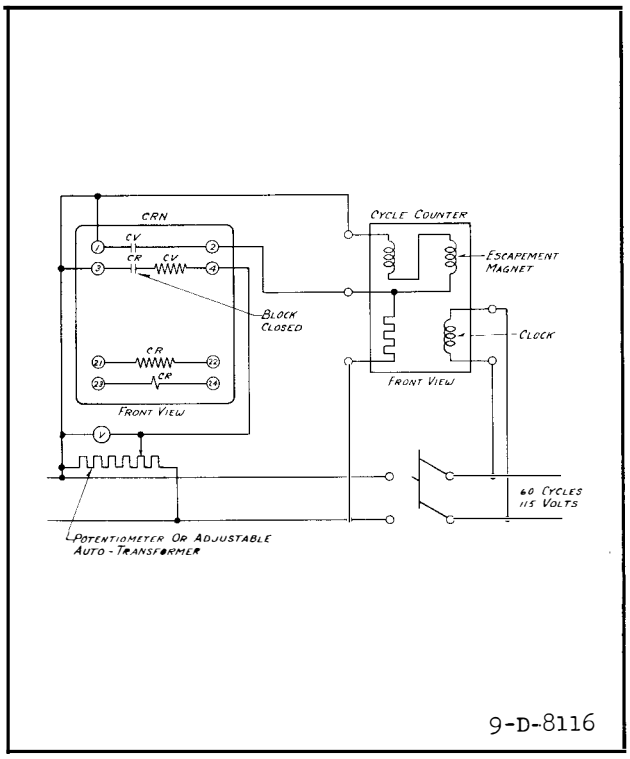

Fig. 5—Test Connections For The Timer Element Of The Type CRN Relay.

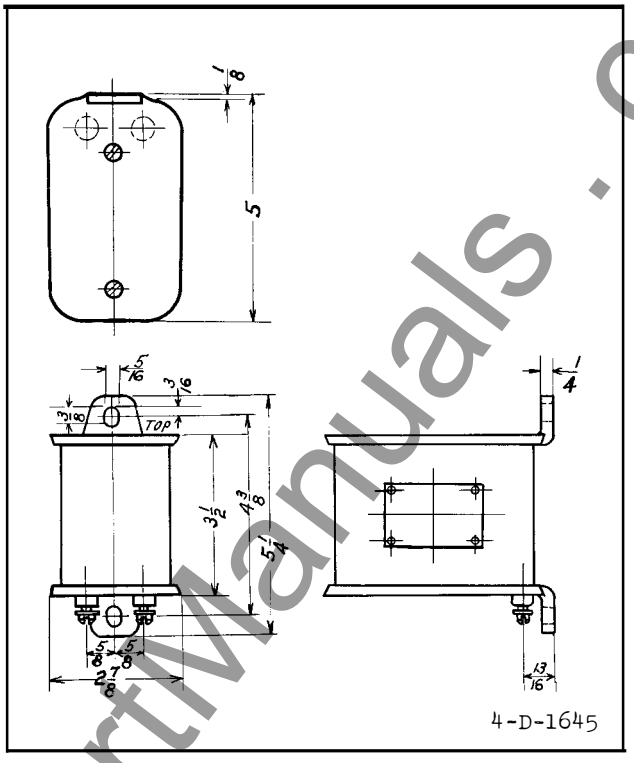

Fig. 6—Outline And Drilling Plan For The External Reactor. For Reference Only.

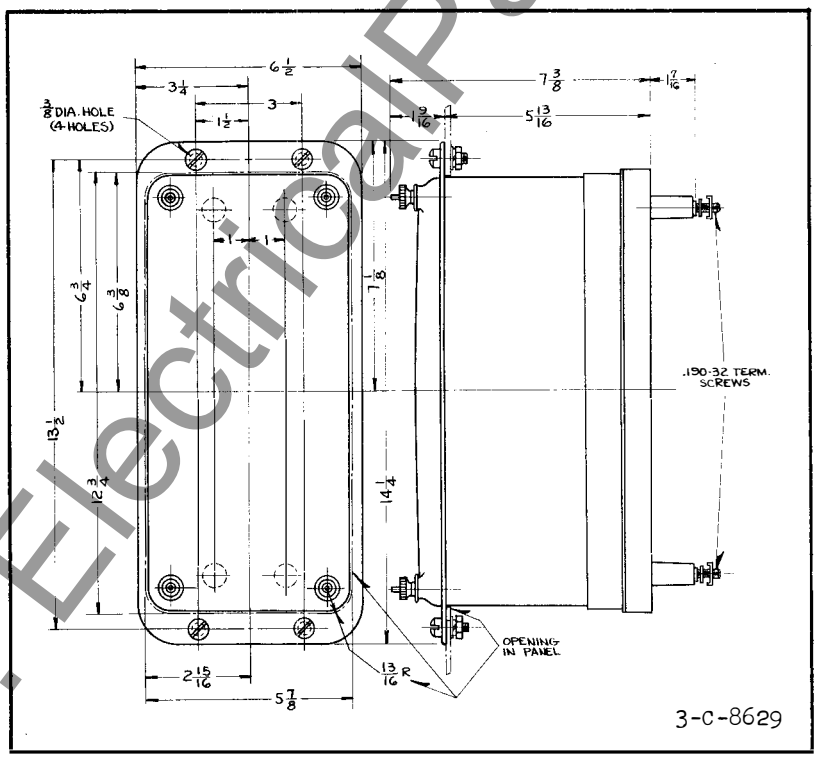

Fig. 7—Outline and Drilling Plan For The Type HI Shockproof Semi-Flush, Non-Detachable Type Case. For Reference Only.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY DEPARTMENT **NEWARK, N. J.**

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