INSTRUCTIONS

DIRECTIONAL GROUND RELAYS

TYPES

CFCP11A

CFCP12A

CFCP13A

CFCP14A

IN

UNIVERSAL AND DRAWOUT CASES

Switchgear

GENERAL ELECTRIC

SCHENECTADY, N.Y.

DIRECTIONAL GROUND RELAYS

TYPES CFCP11A, CFCP12A, CFCP13A & CFCP14A

These relays are directional ground relays for polarization from a current transformer in the power transformer neutral. The pick-up of each relay is adjustable over a range, depending on the rating, by means of a calibrating spring.

The Type CFCP11A relay has single-throw, single circuit-closing contacts. The Type CFCP12A relay has single circuit-closing and single circuit-opening contacts. Internal connections for the two types are in Fig. 3.

The Type CFCP13A relay has two circuit-closing and single circuit-opening contacts. Internal connections are shown in Fig. 9.

The Type CFCP14A relay has two electrically separate circuit-closing contacts. Internal connections are shown in Fig. 10.

The outline and panel drilling dimensions for the above types are shown in Fig. 1 for models in the drawout case, and in Fig. 2 for models in the universal case.

When mounted in the drawout case, the circuit-opening contacts of the Type CFCP12A and CFCP13A relays have short-circuiting bars like those described below for the current circuits. If the shorting bar is not desired, it is easily removed by removing one screw.

These instructions are intended to assist in installing and testing the relays. If further information is desired, please refer to the nearest office of the General Electric Company.

DRAWOUT CASE

This instruction book is written to cover the above type relays mounted in the drawout case. The drawout cases are made in three major sizes each of which has studs for external connections at both ends or at the bottom only. These are respectively referred to as "double-end" and "single-end" cases. In either construction, the electrical connections between the relay units and the case are made through stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer block attached to the case has the studs for external connections and the inner block has terminals for the internal connections.

The above type relays are mounted in small size single-end case.

The relay mechanism is mounted in the steel framework called the cradle and is a complete unit with all leads being terminated at the inner block. This cradle

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

is held firmly in the case with a latch at both top and bottom and by a guide pin at the back of the case. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is drawn to the cradle by thumbscrews, holds the connecting plug in place.

To draw out the cradle, the cover must first be removed. Then, the connecting plug can be drawn out. In so doing, the trip circuit is first opened, then the current transformer circuits are shorted, and finally the voltage circuits are opened. After the plug has been removed, the latch can be released and the cradle easily drawn out. To replace the cradle, the reverse order is followed.

NOTE: Care must be taken to insert the connecting plug slowly on relays that have contacts which are closed when de-energized but open under normal operating conditions.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel either from its own source of current and voltage, or from other sources. Or, the cradle can be drawn out and replaced by another which has been tested in the laboratory.

INSTALLATION

The relay should be installed in a location which is clean and dry, free from excessive vibration, and well lighted to facilitate inspection and testing. It should be mounted on a vertical surface by means of the mounting studs or screws. Connect one of these studs or screws to ground with a conductor equivalent to No. 12 B&S gauge copper wire, or larger.

The outline and panel drilling dimensions are shown on Figs. 1 and 2. The internal connections are shown in Fig. 3. A typical external wiring diagram is shown on Figs. 5 and 6; for corresponding current and contact circuits refer to internal connections.

Before the relay is placed in service be certain to inspect the moving parts for any evidence of damage in shipment. The movement should be very free and the spring should promptly return the contact arm when it is displaced manually from its de-energized position.

Contact Ratings

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying ratings are limited by the two different ratings of target and holding coils as indicated in the following table:-

Function	1 Amp. (0.25 Ohm) Tar. & Hold. Coil	0.2 Amp. (7 Ohm) Tar. & Hold. Coil
Tripping Duty	30	5
Carry Continuously	2.5	0.5

The 0.2-ampere coil is for use with trip coils that operate on currents ranging from 0.2 up to 1.0 ampere at the minimum control voltage. If this coil is used with trip coils that take 1.0 ampere or more, there is a possibility that the 7 ohms resistance will reduce the current to so low a value that the breaker will not be tripped. This coil can safely carry currents as high as 5 amperes.

The 1.0-ampere coil should be used with trip coils that take 1.0 ampere or more at the minimum control voltage, provided the current does not exceed 30 amperes at the maximum control voltage. If the current exceeds 30 amperes, an auxiliary relay must be used to control the trip coil circuit, the connections being such that the current does not pass through the contacts or the target and holding coil of the protective relay.

When it is desirable to adopt one type of relay as standard to be used anywhere on a system, relays with the 1.0-ampere coil should be chosen. These relays should also be used when it is impossible to obtain trip coil data, but attention is called to the fact that the target may not operate if used with trip coils taking less than 1.0 ampere.

Installation Tests

Upon installing the relay, it is necessary to know (1) that the currents go to the proper relay terminals, and (2) that none of the current coils are open-circuited.

Test (1) should be made, if possible, by introducing a single-phase current in one phase of the primary circuits in such a way that current flows through both the transformer neutral current transformer and one of the line current transformers. If this cannot be done, a careful wiring check must suffice.

Test (2) can be checked by means of testing diagram (Fig. 7). Polarity and minimum operating currents may be checked also by means of the same testing circuit.

OPERATION

These relays are induction-cylinder devices for alternating current circuits. The principle by which torque is developed is the same as that employed in an induction-disk relay with a watt-hour meter element, though in arrangement of parts they are more like split-phase induction motors.

The stator has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. All poles are fitted with current coils. In the annular air gap between the poles and central core is the cylindrical part of the cup-like aluminum rotor, which turns freely in the air gap. The central core is fixed to the stator frame; the rotor alone turns.

This construction provides higher torque and lower rotor inertia than the induction-disk construction, making these relays faster and more sensitive.

They are well suited as units for carrier-current pilot relay equipments and similar uses. When one of these relays is used in conjunction with an overcurrent relay, and when the overcurrent relay can close its contacts during a fault in the

non-protected direction, directional control of the overcurrent relay should be provided if the direction of power can change while the overcurrent relay contacts are still closed. If the normally closed contact of the directional relay is being used, directional control should be provided even though there is no power reversal since sufficient energy can be stored in one contact to close the other contact when the fault is removed. If the normally closed contact is not being used, directional control may be avoided (if no power reversal is possible) by removing the normally closed contact and reversing it so as to provide a solid stop.

To reverse the normally closed contact, remove the contact barrel and clamping ring as a complete unit after loosening the screws at the front of the contact block. Remove the clamping ring from the contact barrel and place it in the contact block with the flange against the inner side of the block. Then screw barrel into the clamping ring with the back end toward the movable contact arm. Tighten screws at the front of the contact block.

Operating Characteristics

The time-current curve characteristic is shown on Fig. 8.

Burdens

		Current Coil Burdens at 5 Amperes and Rated Frequency		
Relay	Current Range in Amps.	Freq.	Watts	Volt-amperes
CFCP11A & CFCP12A	0.5-2	60	20	52 (A)
			20	21 (B)
		25	13	26 (A)
			13	13.4 (B)
	1-4	60	5	13 (A)
			5	5.25 (B)
		25	3.25	6.5 (A)
			3.25	3.35 (B)
	2-8	60	1.15	3 (A)
			1.15	1.21 (B)
		25	.75	1.5 (A)
			.75	.77 (B)

(A) Burden of operating coils
(B) Burden of current polarizing coil.

ADJUSTMENT AND CARE

The relay was properly adjusted at the factory to obtain the desired characteristics, and it is advisable not to disturb these adjustments. If for any reason, the adjustments have to be disturbed, the following points should be observed when restoring them.

Assembly of Elements

After disconnecting the leads and removing unit intact with its mounting plate,

the rotors may be removed as follows (be sure to tag the leads so that they may be reconnected to the proper terminals):

Remove the top (flat head) screw holding the unit to the mounting plate. Then avoiding any disturbance to the top bearing plate, remove the entire top structure from the stator assembly by removal of the four corner screws. This will give access to the cup and stator assembly. In this way all parts will again be aligned by the pins when replaced.

Use care in handling the rotor while it is out of the relay and see that the air gap and rotor are kept clean.

In reassembly, the rotor will go into the air gap easily without forcing if the parts are held in proper alignment.

Bearings

The lower jewel bearing should be screwed all the way in until its head engages the end of the threaded core. The upper bearing should be adjusted to allow about 1/64" end play of the shaft.

Press down on the contact arm near the shaft to check the clearness between the iron core and the inside of the rotor cup and thus depress the spring-mounted jewel until the cup strikes the iron--the shaft should move about 1/64".

Examination under a microscope is preferable when checking the lower jewel for fractures. However, if a microscope is not available, satisfactory results generally can be obtained by exploring the jewel surface with a fine needle.

Contacts

If the contacts become dirty or pitted slightly they should be cleaned by scraping the surfaces lightly with a sharp knife or by using a fine, clean file. Under no circumstances should emery or crocus cloth be used on fine-silver relay contacts. Finish by wiping the contacts with a clean cloth and avoid touching them with the fingers. Contacts cleaned in this manner will remain in good condition for many months under ordinary conditions of service.

The contacts of the relay (Fig. 4) are specially constructed to suppress bouncing. The stationary contact (G) is mounted on a flat spiral spring (F) backed up by a thin diaphragm (C). These are both mounted in a slightly inclined tube (A). A stainless steel ball (B) is placed in the tube before the diaphragm is assembled. When the moving contact hits the stationary contact, the energy of the former is imparted to the latter and thence to the ball, which is free to roll up the inclined tube. Thus, the moving contact comes to rest with substantially no rebound or vibration. To change the stationary contact brush, remove the contact barrel and sleeve as a complete

unit after loosening the screw at the front of the contact block. Unscrew the cap (E). The contact and its flat spiral mounting spring may then be removed.

The contact gap may be adjusted by loosening slightly the same screw at the front of the contact block. The screw should be loose enough only to allow the contact barrel to rotate in its sleeve.

The stop screw fastened with a locknut should hold the moving contact arm in a neutral position, i.e., with it pointing directly forward. Then bring the stationary contact up until it just touches the moving contact by rotating the contact barrel. Next, back it away 2/3 turn to obtain approximately 0.020" contact gap. Last, tighten the screw which secures the barrel.

The moving contact brush may be removed by loosening the screw which secures it to the contact arm and sliding it from under the screw head.

Holding Coils

The location of each holding coil may be adjusted by loosening the mounting screw and sliding the coil either to the left or right in a groove provided for that purpose. The holding coils are located at the factory so that there is a gap of about 0.050" between the pole pieces and the armature. A gap of 0.040" is equivalent to 1-1/4 turns of the contact barrel. The holding coil gap must be adjusted appreciably below 0.040".

TESTING

Laboratory

In addition to the tests mentioned under 'INSTALLATION TESTS', time tests may be desired. Because of the speed of the relay, mechanical timers are unsatisfactory, and it is necessary to use an oscillograph or an electronic timer.

Upon leaving the factory, the relay is adjusted to close its contacts at the low point of the pick-up range unless otherwise requested.

Readjustment of the pick-up to another value within its pick-up range can be obtained readily by turning the upper spring adjusting ring. This can be accomplished after loosening the hexagonal head-locking screw at the top of the relay. The spring adjusting ring must be locked after the proper pick-up is obtained.

The clutch is adjusted at the factory to slip at approximately 10 amperes.

This adjustment is varied by means of the threaded sleeve with screw driver slot located on the right-hand side of the moving contact arm near the shaft.

Periodic Testing

An operation test and inspection of the relay at least once every six months is recommended. Regarding tests, it is believed that a check of the minimum operating current is sufficient.

RENEWAL PARTS

When ordering renewal parts describe the part in detail and give the model number and rating of the relay as they appear on the nameplate.

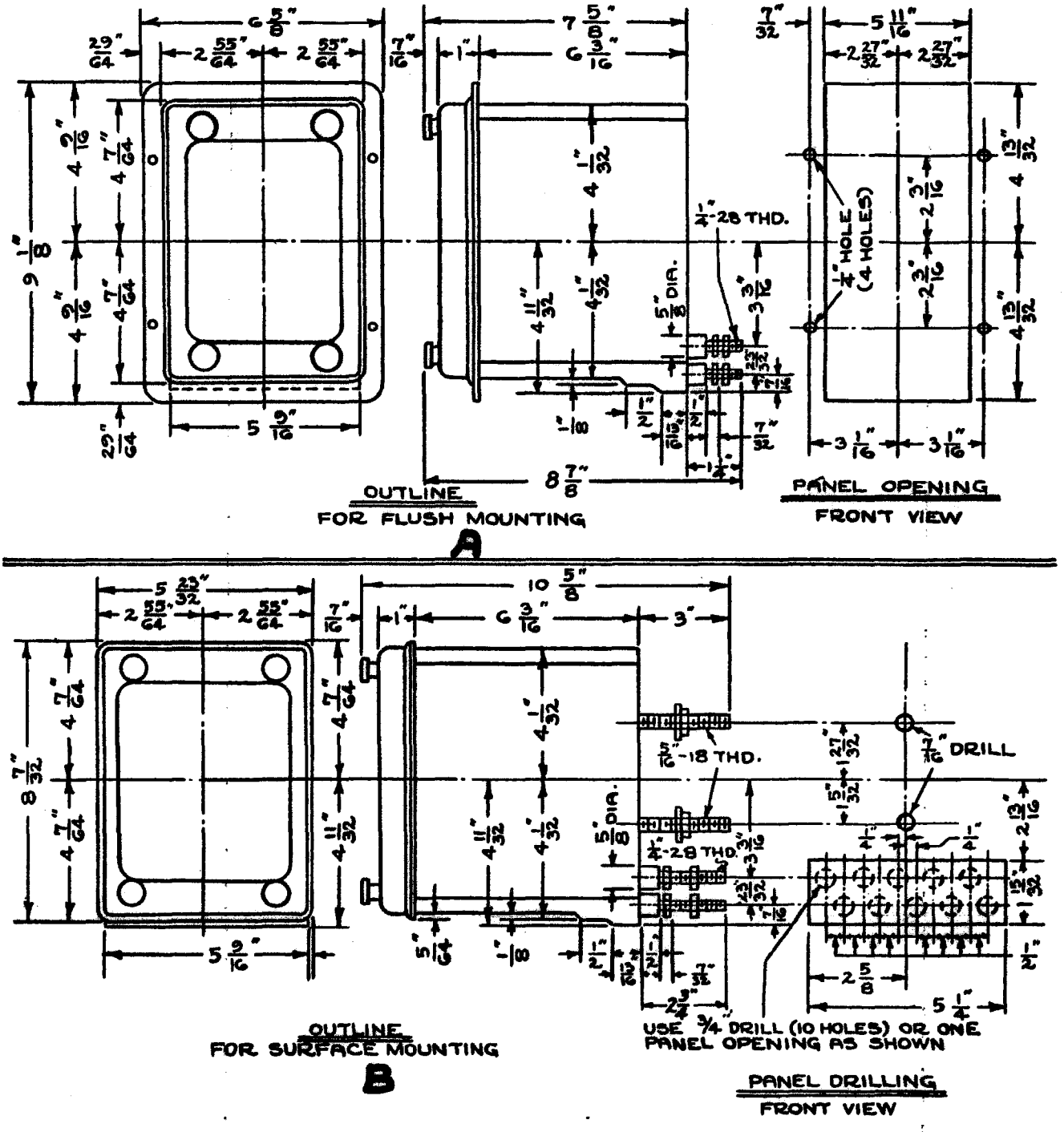
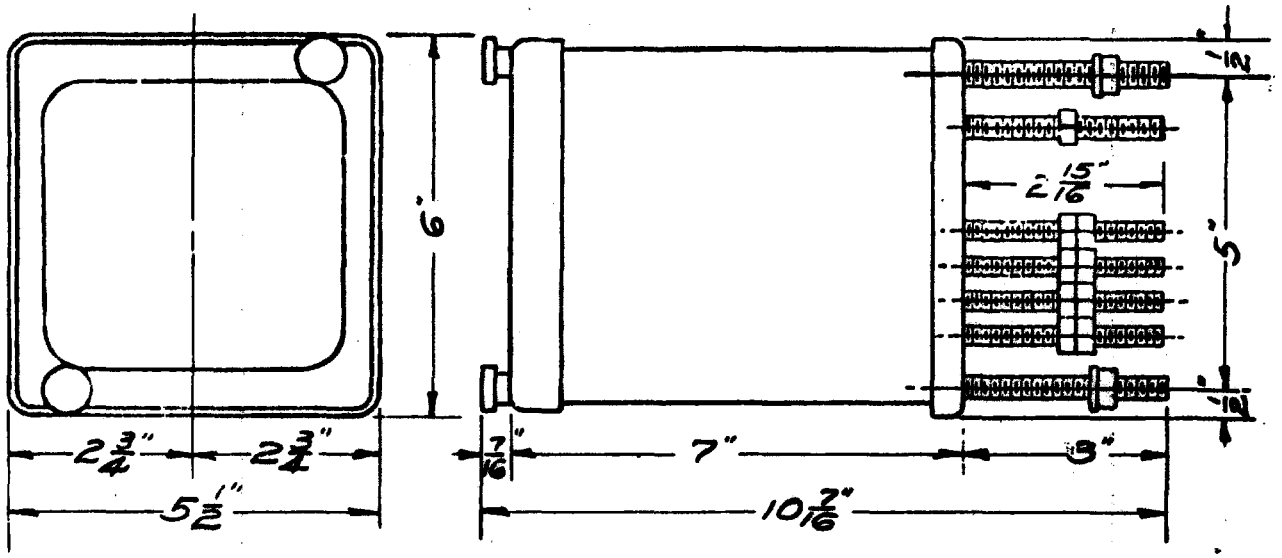
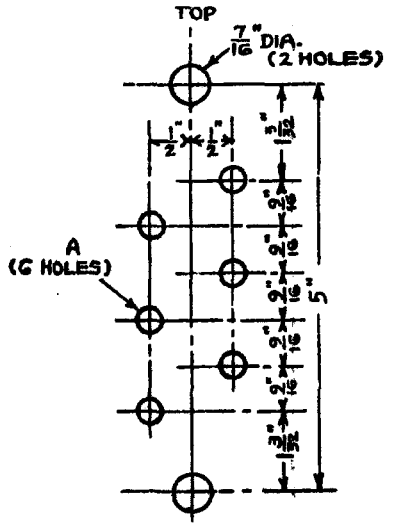


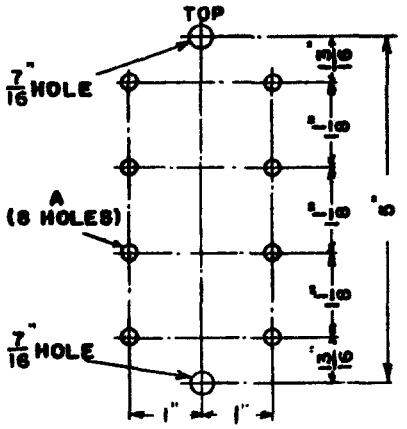
FIG. 1 - OUTLINE & PANEL DRILLING FOR DRAWOUT CASE. ONE-UNIT, SINGLE-END.
(K- 6174671)



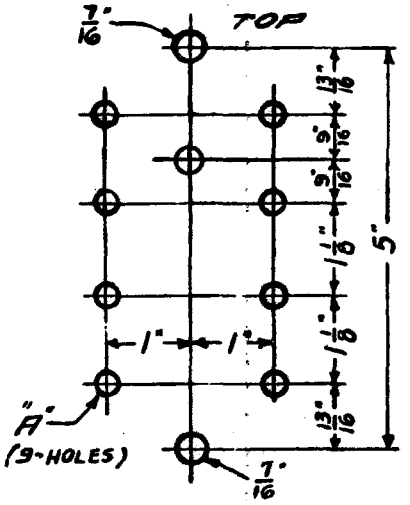
A - OUTLINE (K-6154816)



B - TYPE CFCP11A RELAY FRONT VIEW. (K-6154816)



C - TYPE CFCP12A AND CFCP14A RELAYS. (K-6178568)

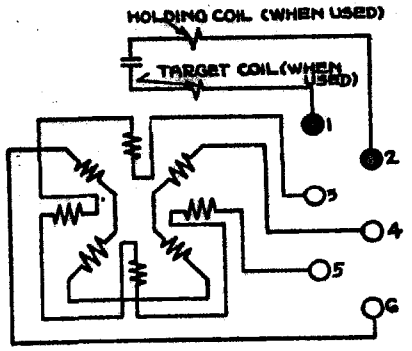


D - TYPE CFCP13A RELAY (K-6178864)

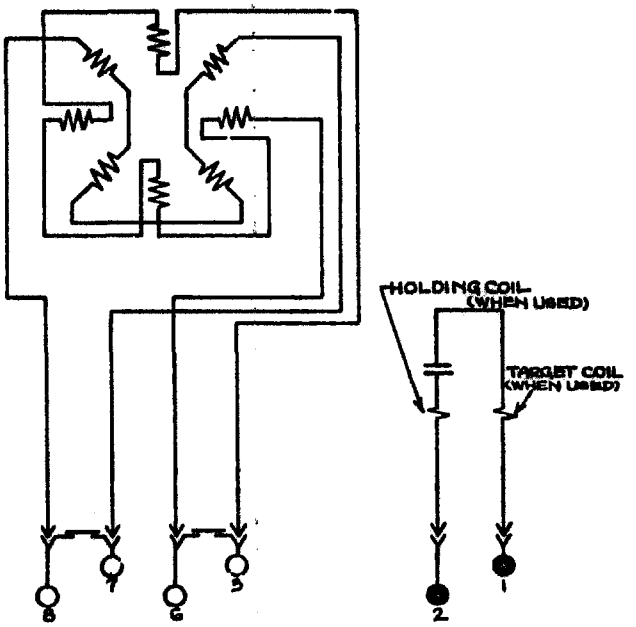
PANEL DRILLING
FRONT VIEW

A	TYPE OF PANEL
5/16"	INSULATING
9/16"	STEEL

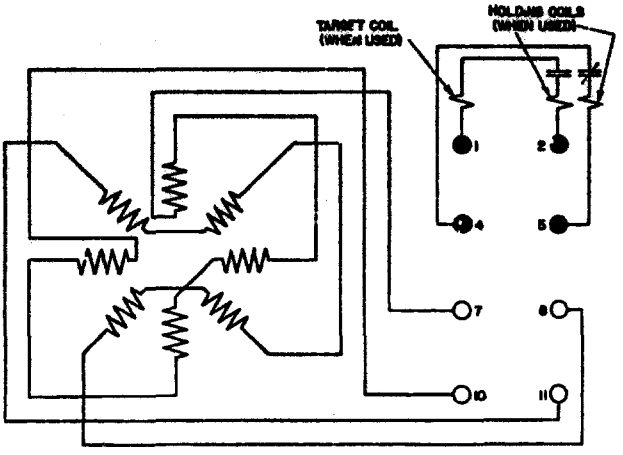
FIG. 2 - OUTLINE DIMENSION AND PANEL DRILLING FOR UNIVERSAL CASE.



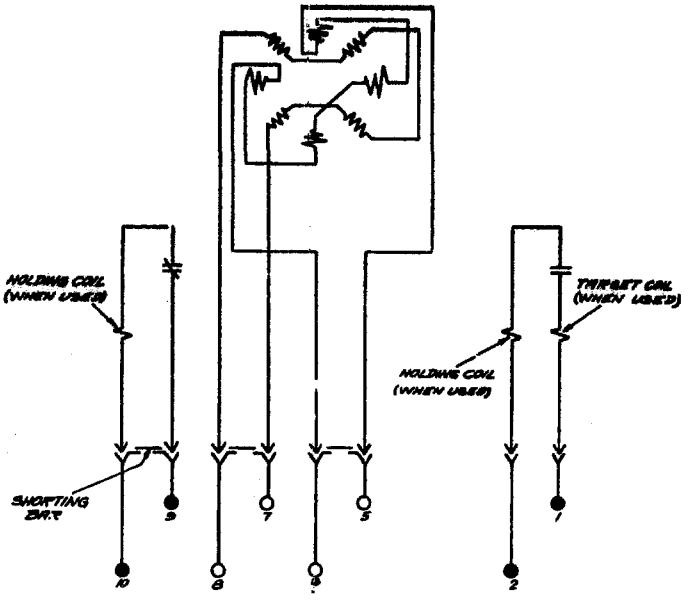
A - TYPE CFCP11A RELAY IN UNIVERSAL CASE
(K-6154816)



B - TYPE CFCP11A RELAY IN DRAWOUT CASE
(K-6154817)



C - TYPE CFCP12A RELAY IN UNIVERSAL CASE
(K-6178568)



D - TYPE CFCP12A RELAY IN DRAWOUT CASE
(K-6209139)

FIG. 3 - INTERNAL CONNECTIONS (BACK VIEW)

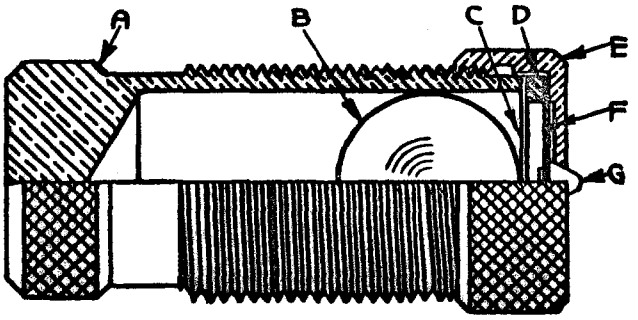


FIG. 4 - CONTACT ASSEMBLY FOR INDUCTION CUP RELAYS.
(K-6077069)

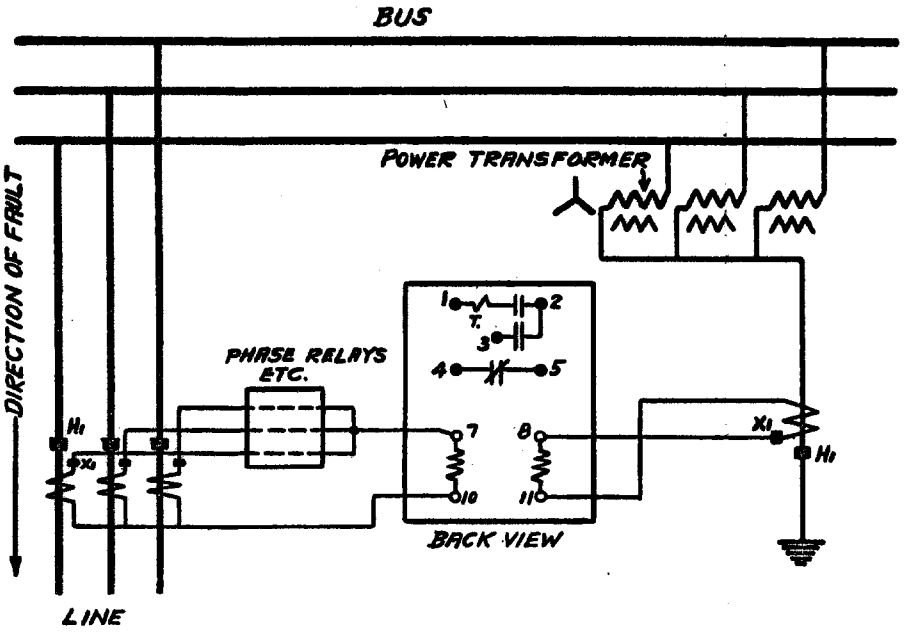


FIG. 5 - EXTERNAL CONNECTIONS FOR A DIRECTIONAL GROUND RELAY IN UNIVERSAL CASE (K-6178954)

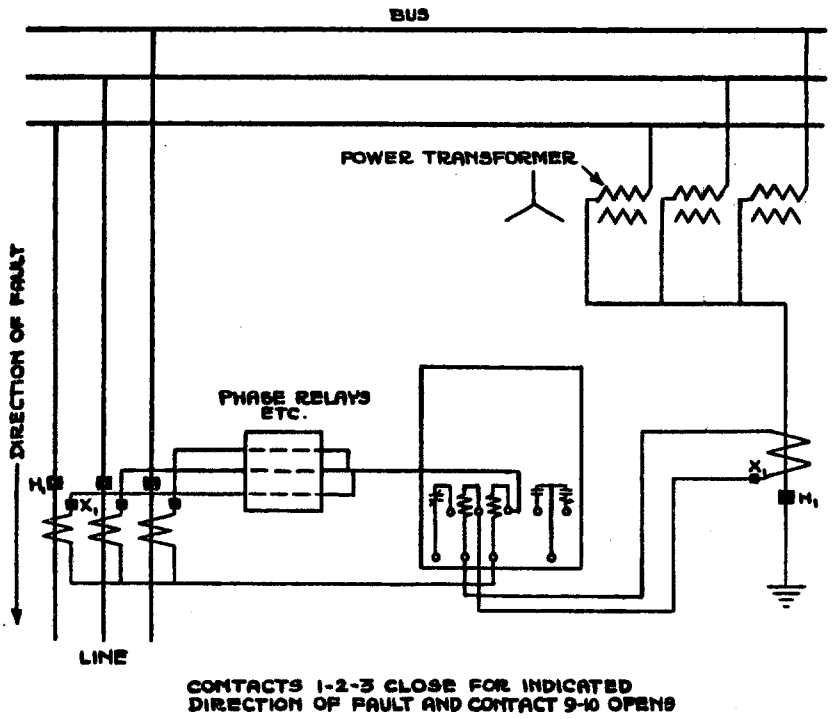
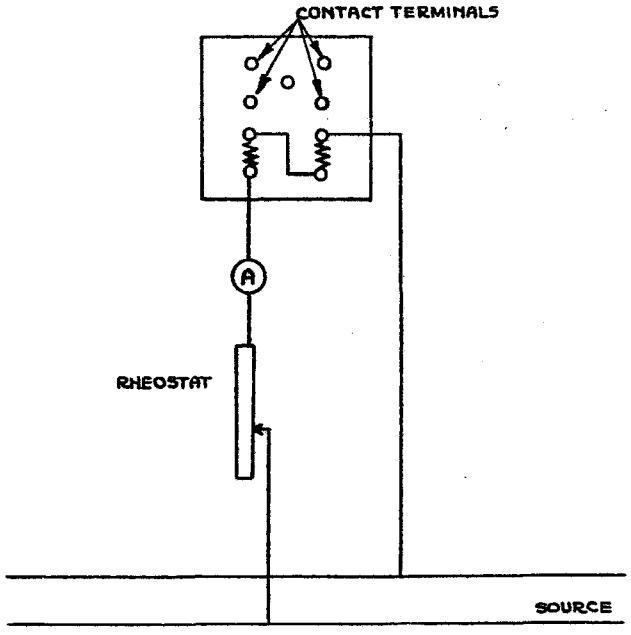
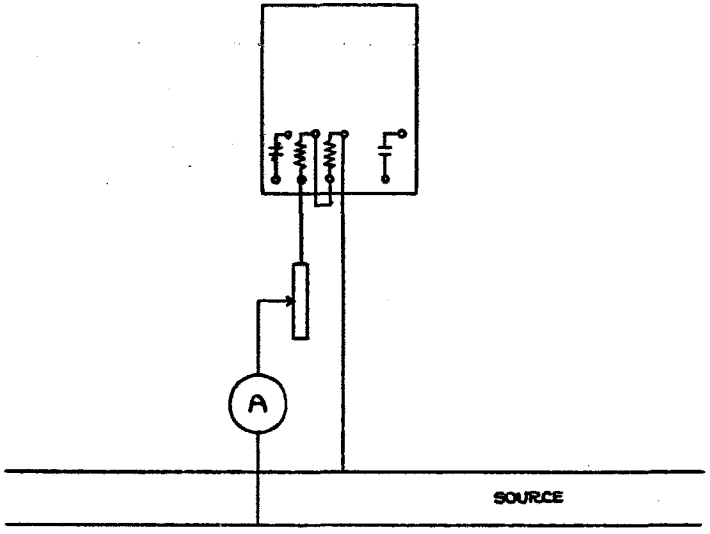


FIG. 6 - EXTERNAL CONNECTIONS FOR DIRECTIONAL GROUND RELAY IN DRAWOUT CASE (BACK VIEW) (K-6154238)



NOTE : WITH THE ABOVE CONNECTIONS, THE RELAY SHOULD CLOSE THE LEFT-HAND CONTACTS (FRONT VIEW).

A - TESTING OF UNIVERSAL CASE RELAY (H-6086260)



NOTE : WITH THE ABOVE CONNECTIONS, THE RELAY SHOULD CLOSE THE LEFT-HAND CONTACT (FRONT VIEW).

B - TESTING OF DRAWOUT CASE RELAY (K-6154243)

FIG. 7 - TESTING CONNECTIONS FOR A DIRECTIONAL GROUND RELAY (BACK VIEW)

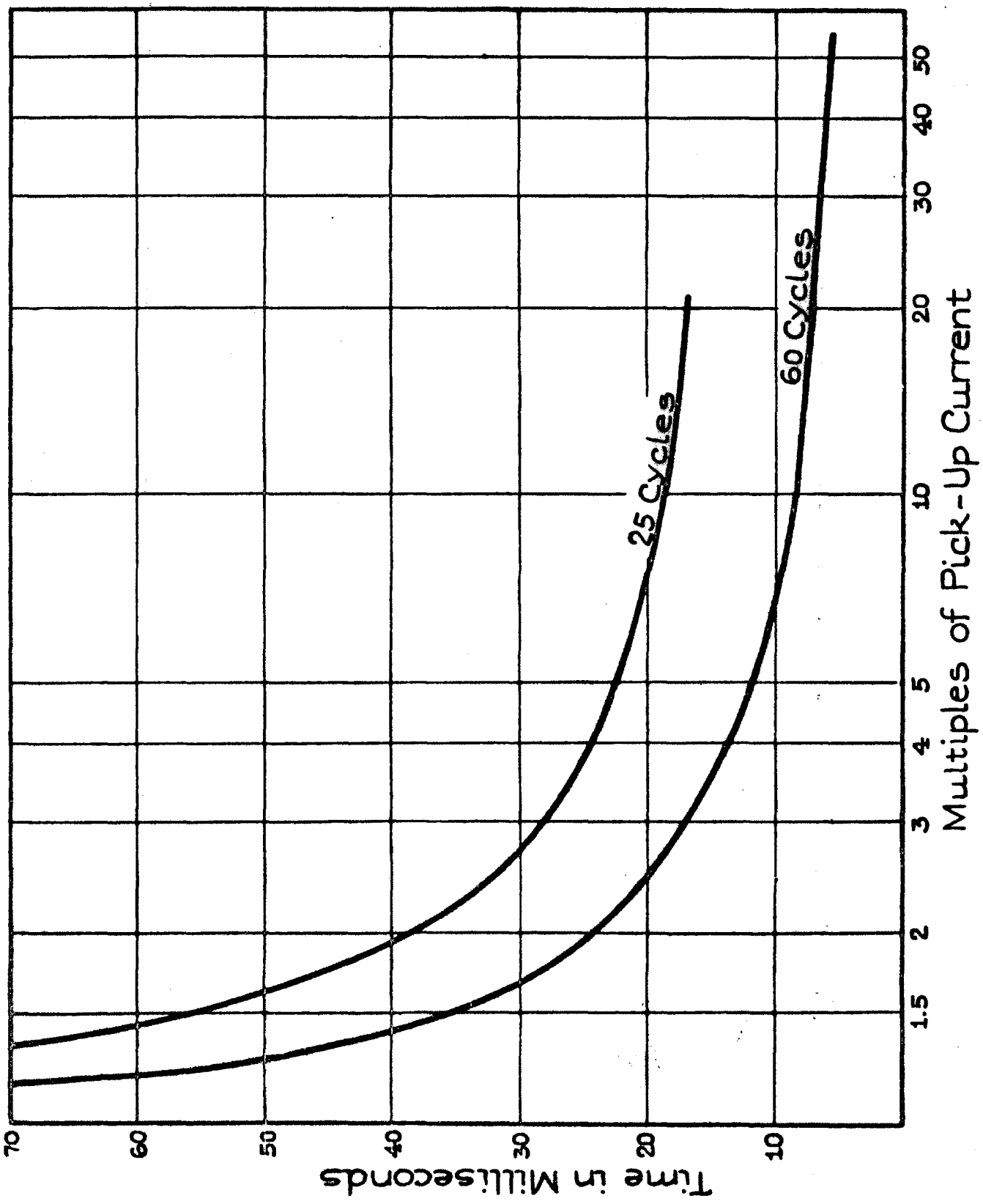
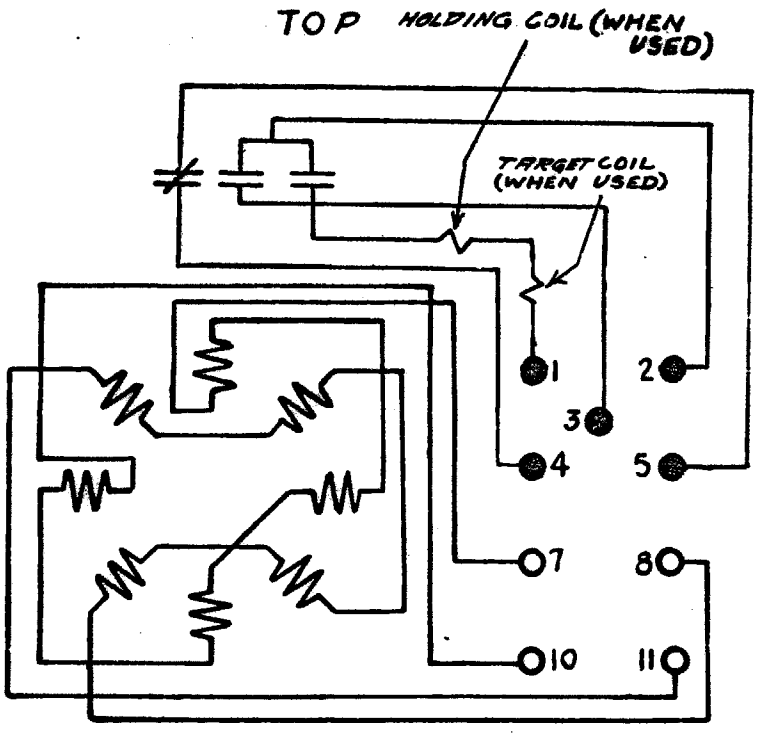
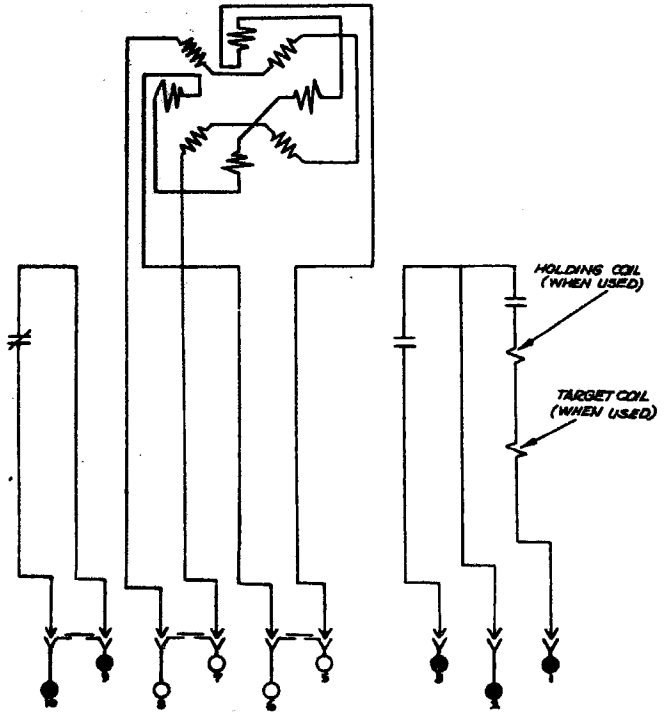


FIG. 8 - TIME-CURRENT CURVE FOR TYPE CFCP RELAY WITH OPERATING AND POLARIZING COILS IN SERIES.
(H-6280173)

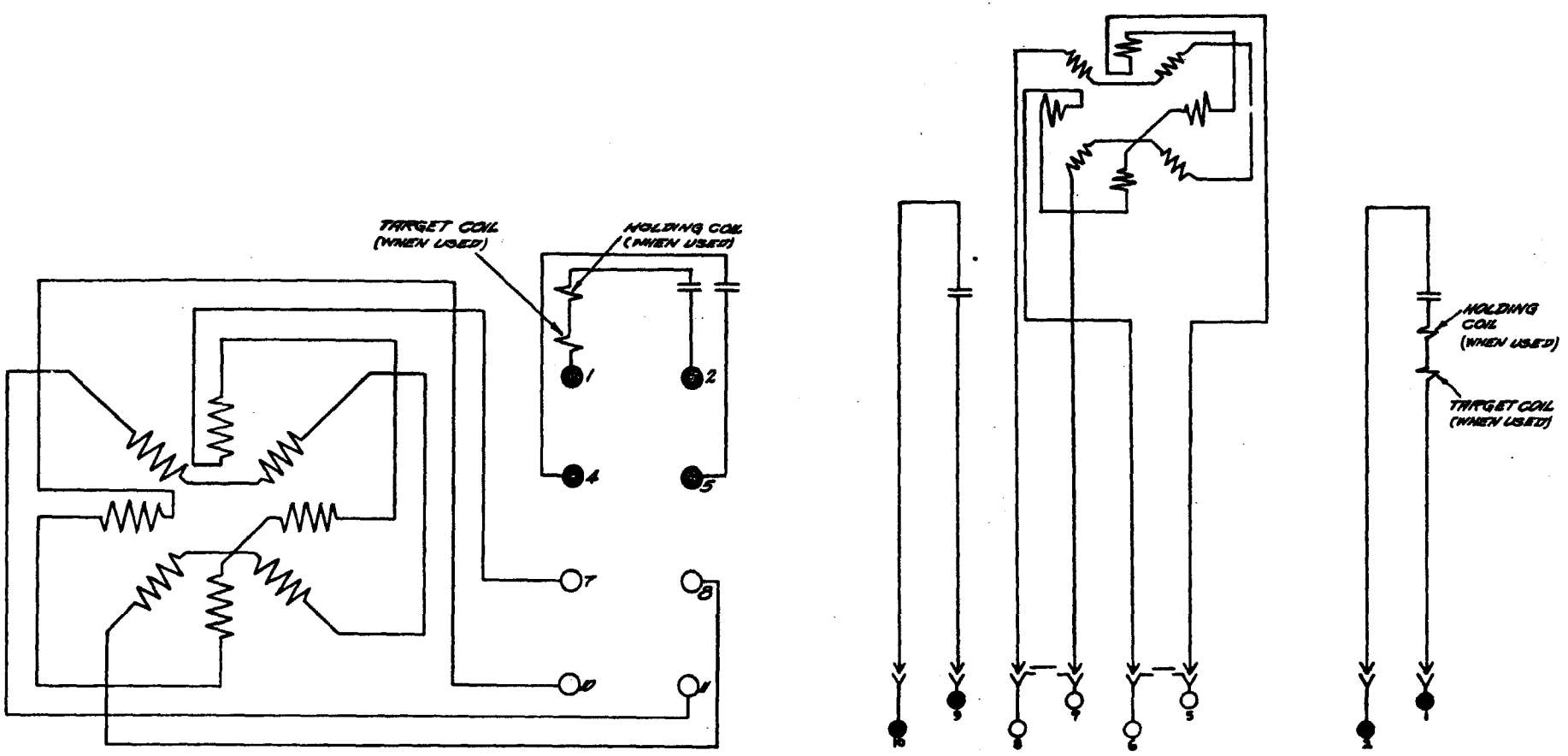


A - UNIVERSAL CASE (K-6178884)



B - DRAWOUT CASE (K-6209579)

FIG. 9 - INTERNAL CONNECTIONS OF TYPE CFCP13A, RELAY BACK VIEW.



A - UNIVERSAL CASE (K-6209600)

B - DRAWOUT CASE (K-6209601)

FIG. 10 - INTERNAL CONNECTIONS OF TYPE CFCP14A RELAY - BACK VIEW

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*† Sacramento 95816 ..... 2407 "J" St.
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*†‡§ San Francisco 94106 ..... 235 Montgomery St.
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*†‡ Hartford 06105 ..... 764 Asylum Ave.

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*† Jacksonville 32202 ..... 1901 Hill St.
† Miami 33134 ..... 4100 West Flagler St.
† Pensacola 32503 ..... First Bank Bldg.
†‡ Tampa 33609 ... Henderson Blvd. at Lois Ave.
* Tampa 33609 ..... 2106 S. Lois Ave.

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* Macon 31202 ..... 682 Cherry St.
*† Savannah 31405 ..... 5002 Paulsen St.

IDAHO
*† Boise 83706 ..... 1524 Idaho St.

ILLINOIS
*†‡§ Chicago 60680 ..... 840 S. Canal St.
*† Peoria 61603 ..... 2008 N.E. Perry Ave.
* Rockford 61105 ..... 4223 East State St.
† Springfield 62701 ..... 607 E. Adams St.

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*†‡ Evansville 47714 ..... 2709 Washington Ave.
‡ Fort Wayne 46807 ..... 1635 Broadway
*† Fort Wayne 46806 ..... 3606 S. Calhoun St.
*†‡ Indianapolis 46207 ..... 3750 N. Meridian St.
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* Lake Charles ..... 1424 Ryan St.
*† § New Orleans 70112 ..... 837 Gravier St.
* New Orleans 70125 ..... 4747 Earhart Blvd.
*† Shreveport 71101 ..... 400 Travis St.

MAINE
† Augusta ..... 152 State St.
* Bangor 04402 ..... 77 Central St.

MARYLAND
*†‡ Baltimore 21201 ..... 1 North Charles
† Hagerstown ..... 49 East Franklin St.

MASSACHUSETTS
*†‡§ Boston 02117 ..... 31 St. James Ave.
* Springfield 01103 ..... 120 Maple St.
* Worcester 01605 ..... 288 Grove St.

MICHIGAN
*†‡ Detroit 48202 ..... 700 Antoinette St.
* Flint 48503 ..... 316½ W. Court St.
*‡ Grand Rapids 49508 2821 Madison Ave., S.E.
*† Jackson 49201 ..... 210 W. Franklin St.
* Kalamazoo ..... 927 S. Burdick St.
† Lansing 48901 ... 501 Bank of Lansing Bldg.
* Saginaw 48607 Second National Bank Bldg.

MINNESOTA
*† Duluth 55802 ..... 14 W. Superior St.
† Fergus Falls 56537 ..... 106 E. Washington St.
*†‡ Minneapolis 55402 ..... 12 S. Sixth St.

MISSISSIPPI
† Gulfport 39502 ..... P.O. Box 33
† Jackson 39201 ..... 210 S. Lamar St.

MISSOURI
* Joplin 64802 ..... 212½ W. Fifth St.
*†‡ Kansas City 64105 ..... 106 W. Fourteenth St.
*‡ St. Louis 63101 ..... 1015 Locust St.

MONTANA
*† Billings 59101 ..... 303 N. Broadway
*† Butte 59701 ..... 103 N. Wyoming St.

NEBRASKA
*† Omaha 68102 ..... 409 S. Seventeenth St.

NEVADA
† Las Vegas 89106 ..... 1711 S. 8th St.

NEW HAMPSHIRE
† Manchester 03104 ..... 1662 Elm St.

NEW JERSEY
*†‡ East Orange 07017 ..... 26 Washington St.

NEW MEXICO
*† Albuquerque 87108 120 Madeira Drive, N.E.

NEW YORK
*† § Albany 12203 ..... 8 Colvin Ave.
† Binghamton 13902 ..... 19 Chenango St.
*†‡ Buffalo 14202 ..... 625 Delaware Ave.
*† § New York 10022 ..... 570 Lexington Ave.
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