



INSTRUCTIONS

35

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NORTHEAST ELECTRICAL TESTING

DIRECTIONAL GROUND RELAY

Type CFPC16A

LOW VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL  ELECTRIC

PHILADELPHIA, PA.

DIRECTIONAL GROUND RELAY TYPE CFPC16A

INTRODUCTION

The Type **CFPC16A** relay can be used as an instantaneous overcurrent relay or as a current polarized directional ground relay. This is made possible by having two separate current circuits which can either be left separate for directional relays or connected in series for a "overcurrent relay."

Two of these relays may be used together to produce a directional controlled **overcurrent** relay combination by having the directional unit contacts control the floating circuit of the overcurrent unit.

RATINGS

CONTACTS

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 listed in the following table:

	Target and Holding Coil	
	1 Amp (0.25 Ohm)	0.2 Amp (7 Ohms)
Tripping Duty	30	5
Carry Continuously	2.5	0.5

TARGET AND SEAL-IN COILS

The 0.2 amperes coil is for use with trip coils that operate on currents ranging from 0.2 up to 1 ampere at the minimum control voltage. If this coil is used with trip coils that take 1 ampere or more, there is a possibility that the 7 ohms resistance will

reducethe current to so low a &that the breaker will not be tripped. This coil can safely carry currents as high as 5 amperes.

The 1 ampere coil should be used with trip coils that take 1 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, a "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 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 ampere.

BURDEN

The following table gives the burden of the current coils at 5 amperes and 60 cycles.

Current Range in Amps	Watts		Volt- amps	
	5-6 Oper.	1-8 Pol.	5-6 Oper.	1-8 Pol.
0.5 - 2	7.02	11.7	18.25	12.0
1 - 4	1.74	2.92	4.55	2.99
2 - 8	0.443	0.73	1.15	0.75
4 - 16	0.138	0.21	0.283	0.21
10 - 40	0.012	0.049	0.017	0.049

The burden at 50 cycles is slightly lower.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of the relay, a "examination should be made for any damage sustained during shipment. If injury or damage resulting from rough handling is evident, a claim should be filed at once with the transportation company and the nearest Sales Office of the General Electric Company notified promptly.

Reasonable care should be exercised in unpack-

ing the relay in order that "one of the parts are injured or the adjustments disturbed.

If the relays are not **to be** installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust, and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

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.

DESCRIPTION

DIRECTIONAL UNIT

This unit is an induction cylinder device 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, through an arrangement of parts, it is more like a split phase induction motor.

The **stator** has eight laminated magnetic poles projecting inward and arranged symmetrically around a central magnetic core. 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 gap. The central core is fixed to the **stator** frame; the rotor alone turns.

All eight poles have current windings. There are two groups of four coils connected in series. The four corner coils have an additional winding which consists of many turns of fine wire. A capacitor is connected across these four coils in series to produce a phase shift in the flux so as to produce torque. This floating circuit is brought out to two studs so that the relay can be controlled by another device if desired. When used as a directional relay, maximum torque is obtained when the current in studs 5-6 leads the current in studs 7-8 by approximately twenty degrees.

This construction provides higher torque and lower rotor inertia than the induction disk con-

struction, making these relays faster and more sensitive.

CONTACTS

The contacts are especially constructed to suppress bouncing. The **stationary contact (G, Fig. 1)** 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.

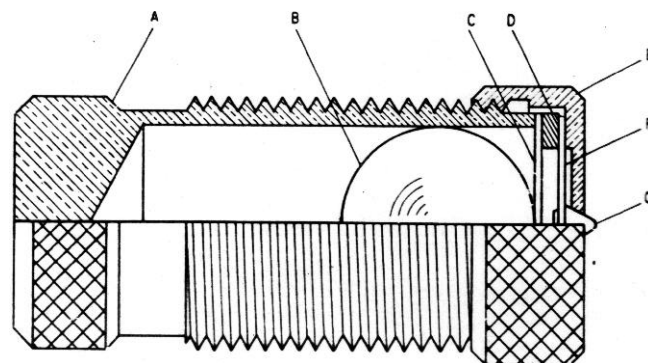


Fig. 1 Stationary Contact Assembly

INSTALLATION

LOCATION

The **location** should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel mounting diagram is shown in Fig. 2.

***CAUTION:** Every circuit in the drawout case has an auxiliary brush, this is the short one in the case (not on the cradle) which the connection plug or test plug should engage first. On every current circuit or other circuit with a shorting bar, make sure these auxiliary brushes are bent high enough to engage the connection plug or test plug before the main brushes in the case do, as otherwise the CT secondary circuit may be opened (where one brush

touches the shorting bar) before the circuit is completed from the plug to the other main brush

CONNECTIONS

The internal connection diagram is shown in Fig. 3.

Typical external wiring diagrams are shown in Figs. 4 and 5.

When using the relay with external control, remove the jumper from studs 3-4 and connect these studs across the contacts of the controlling device. Thus when the contacts of the controlling device close, the floating circuit is now closed and torque is developed.

One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gags copper wire or its equivalent.

ADJUSTMENTS

The relays are adjusted at the factory and it is advisable not to disturb the adjustments. If, for any reason, they have been disturbed, the following points should be followed in restoring them.

PICK-UP

The pick-up current is adjustable over a range which depends on the relay rating. Adjustment is

Fig. 2 (K-6209271)

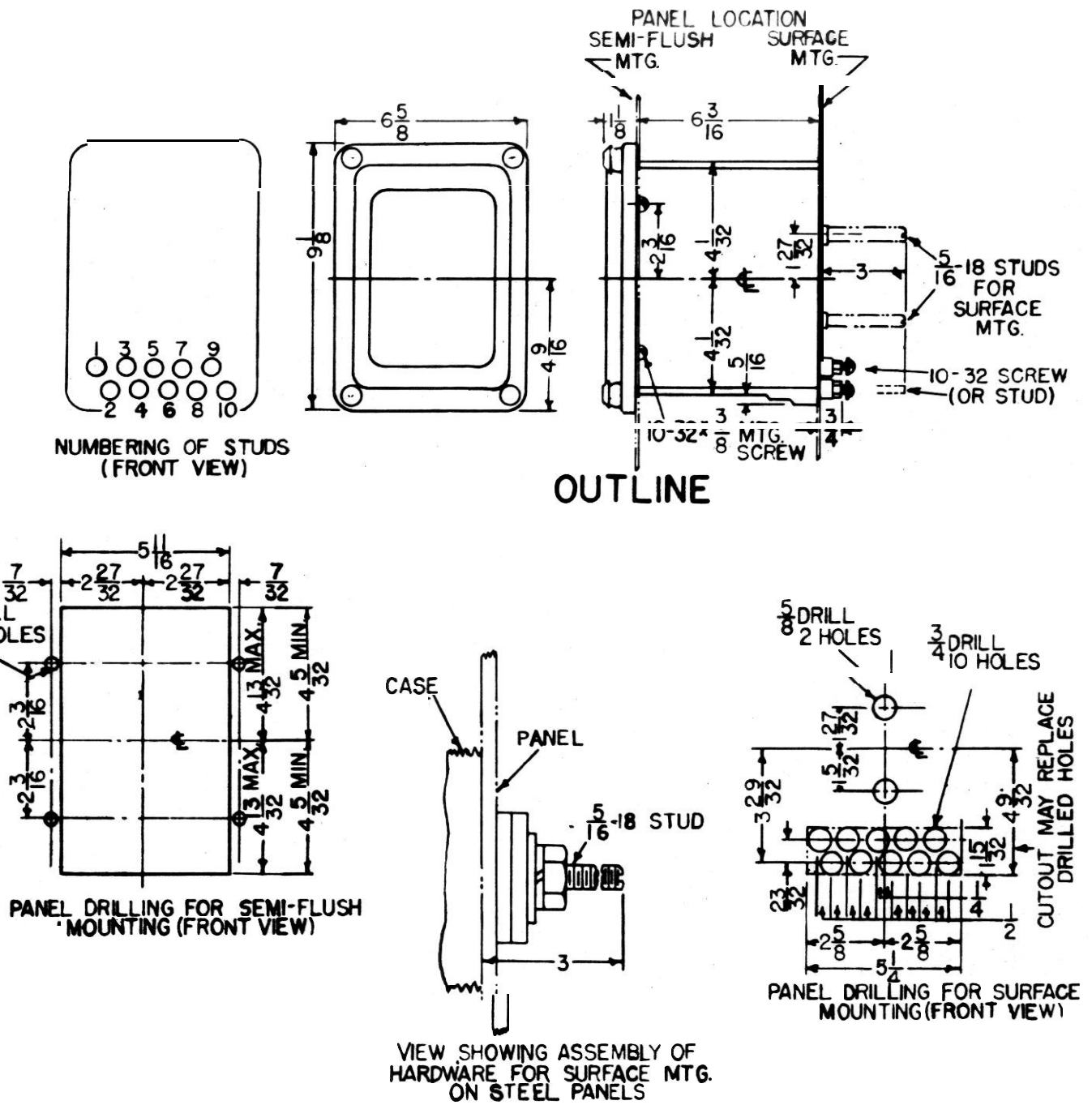


Fig. 2 Outline And Panel Drilling For Type CFPC16A Relay

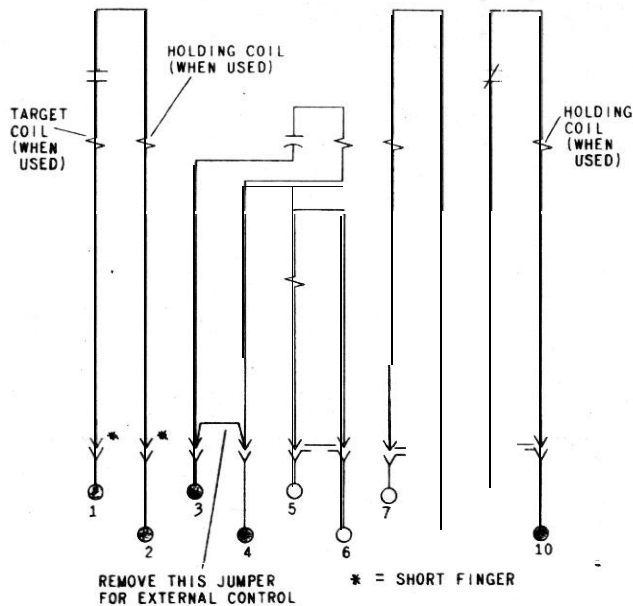


Fig. 3 Internal Connections For Type CFPC16A Relay

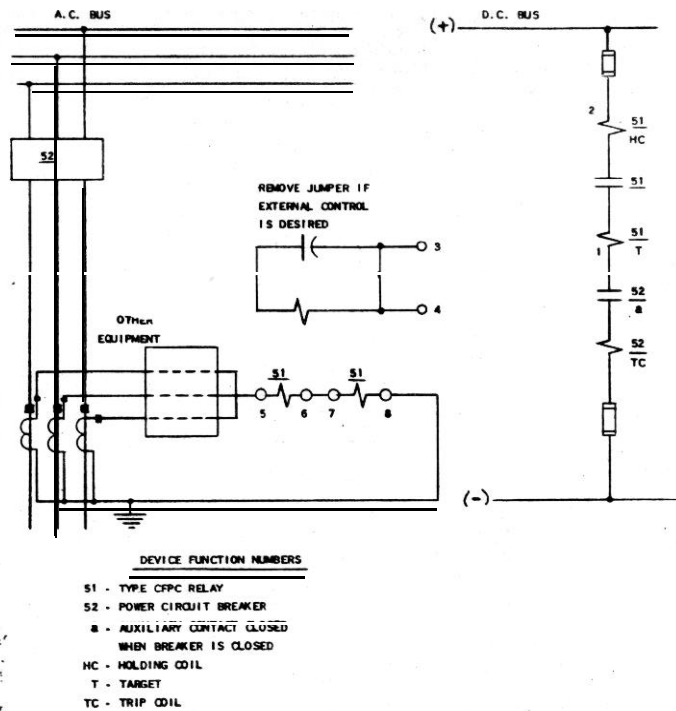


Fig. 4 External Connections Of Type CFPC16A Relay For Overcurrent Ground Protection

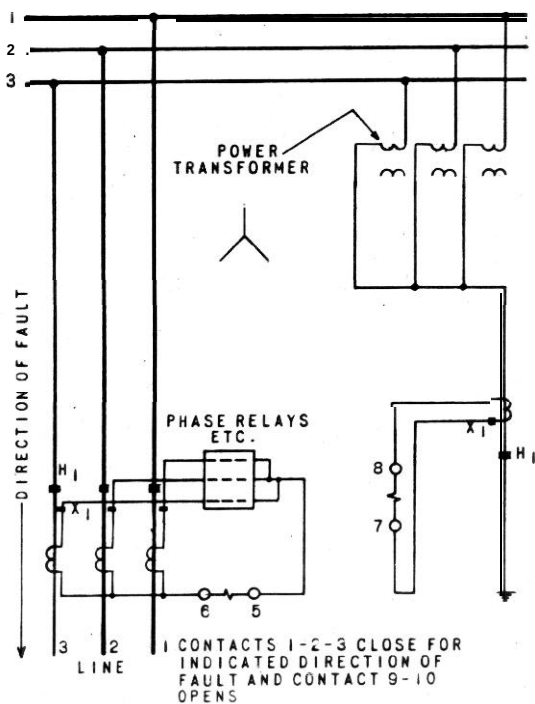


Fig. 5 External Connections Of Type CFPC16A Relay For Directional Ground Protection

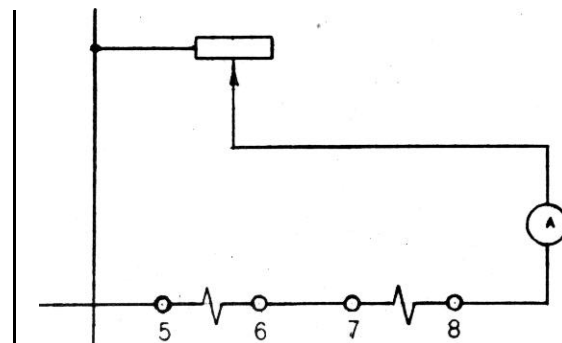


Fig. 6 Test Connections For Type CFPC16A Relay

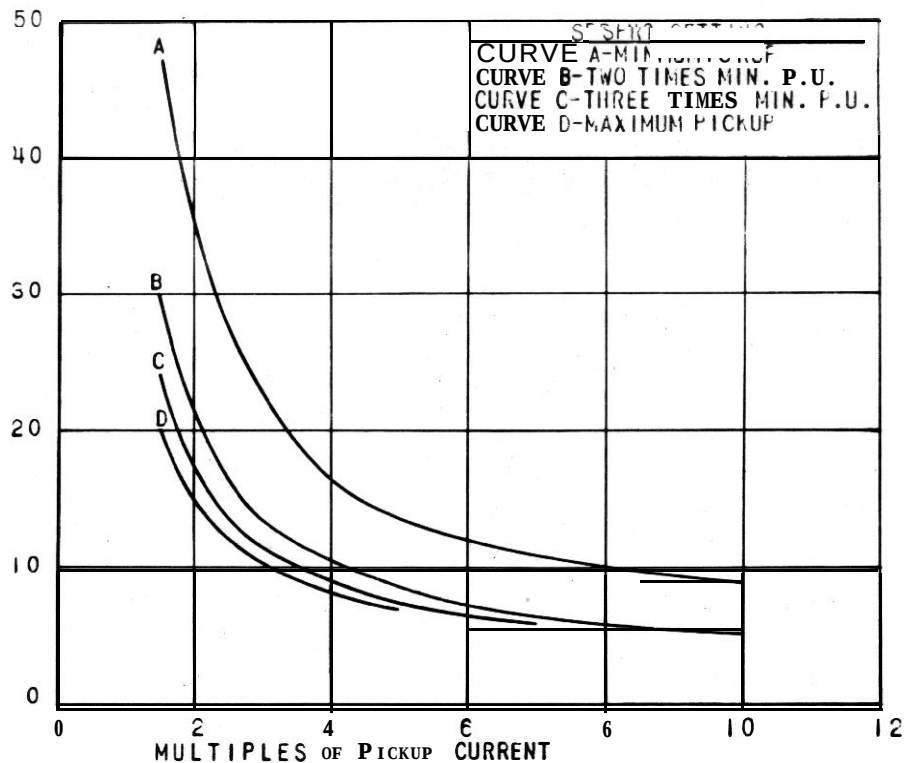


Fig. 7 Time-Current Characteristics Of Type CFPC16A Relay

made by controlling the restraining torque of the upper control spring. To change the level of pick-up current, loosen the hexagonal-head locking screw located **toward** the rear of the adjusting ring guide at the top of the relay. Moving the adjusting ring clockwise (as viewed from the top) decreases the spring restraining torque, and hence lowers the pick-up current. When the desired pick-up is obtained, the locking screw should be tightened.

If a test of the pick-up time is desired, it is necessary to use an **oscilloscope** or an electronic timer because the speed of the relay is such that a mechanical timer is unsatisfactory. The **time-current** characteristics are shown in Fig. 7.

CONTACTS

To adjust the wipe of the stationary contact, 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, Fig. 1). The contact and its flat spiral mounting spring may then be removed. The spring should be **adjusted** so that a contact wipe of approximately 0.006 inch is **obtained** when fully assembled. This may be measured by **rotating** the contact barrel 45 to 90 degrees ($1/8$ to $1/4$ turn) after initial connection with the moving contact.

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 right stationary contact barrel or the stop screw fastened with a locknut, whichever is used, should hold the moving contact arm in a neutral position, i.e., with it pointing directly forward. Then bring the left 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 inch contact gap. Last, tighten the screw which secures the barrel. When a rear normally open contact is present, it should be adjusted to make at or just after the front left contacts have made, but before they have wiped in.

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

CLUTCH ADJUSTMENTS

Clutch adjustment is made with test connections shown in Fig. 6 with the adjustable resistor capable of controlling the current in the current coils **between** 5 and 35 amperes. A screw on the side of the moving contact arm controls the clutch pressure. Using rated frequency, the clutch should be **set** to slip at the proper current as shown in the table below:

Pick-up Amps Rating	Amps for Clutch to Slip
0.5-2.0	10
1-4	10
2-8	16
4-16	32
10-40	Must Not Slip At 30 Amps

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 0.055 inch between the pole pieces **and the armature**. A gap of 0.040 inch is equivalent to 1-1/4 turns of the contact barrel. The holding coil gap must not be

adjusted appreciably below 0.040 inch.

CONTACT CIRCUIT

The normally closed contact circuit of the Type **CFPC16A** relay is provided with a shorting bar which completes the external circuit when the **connecting** plug is removed. **If** this action is not desired, the shorting bar may be removed by **removal** of the mounting screw in the case.

MAINTENANCE

INDUCTION UNIT

If, for any reason, it becomes necessary to disassemble the induction unit, the following procedure should be followed:

(a) **Disconnect** the **leads** to the unit at the **terminals** in the base.

(b) **Remove** the unit **intact** with its mounting **plate from the base**.

(c) Remove the upper screw supporting the unit on the mounting plate.

(d) Avoiding any disturbance to the top bearing plate, remove the **entire** top molded structure and rotor assembly from the **stator assembly** by removing the four corner screws. This **will** give access to **both** the rotor and **stator** assemblies and all parts will be aligned by the dowel pins when **replaced**.

(e) To remove the rotor assembly from the **top** molded structure, remove the small pin from the groove at the upper end of the shaft and back off on the clutch **screw** located on the right side of the movable contact arm.

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 line properly.

BEARINGS

The lower jewel screw can be removed from the unit by means of an offset screw driver or an end wrench. The jewel may **be** tested for cracks by exploring its surface with the point of a fine needle. If it is necessary to replace the jewel a new

pivot should **be** screwed **into** the bottom of the shaft at the same time.

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 inch end play of the shaft**.

Press down on the contact arm **near** the shaft to check the clearance between the iron core **and the** inside of the rotor cop and thus depress the **spring** mounted jewel **until** the cup strikes the iron **the** shaft should move **about 1/16 inch**.

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures **the** cleaning of the actual points of contact.

Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. **Knives** or files may leave scratches which increase **arcing and** deterioration of the contacts. Abrasive paper or **cloth** may **leave** minute particles of **insulating** abrasive material in the contacts and thus prevent closing.

The burnishing tool described is included in the standard relay tool kit obtainable from the factory.

PERIODIC TESTING

An operation test and inspection of the relay at least **once** every six months are recommended. A check of minimum operating current **is** sufficient to insure correct operation. Inspection should include a check of contact conditions, a search for foreign matter, and a test of the freedom of movement of the moving contact arm.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried **in** stock to enable the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, **address the near-**

est Sales Office of the General Electric Company, specify quantity required, name of part wanted, and give complete nameplate data. Reference can be made to publication GEF-3925. **If** possible, **give** the General Electric Company requisition number on which the relay was furnished.