F PE 1600 AMP
FP-75

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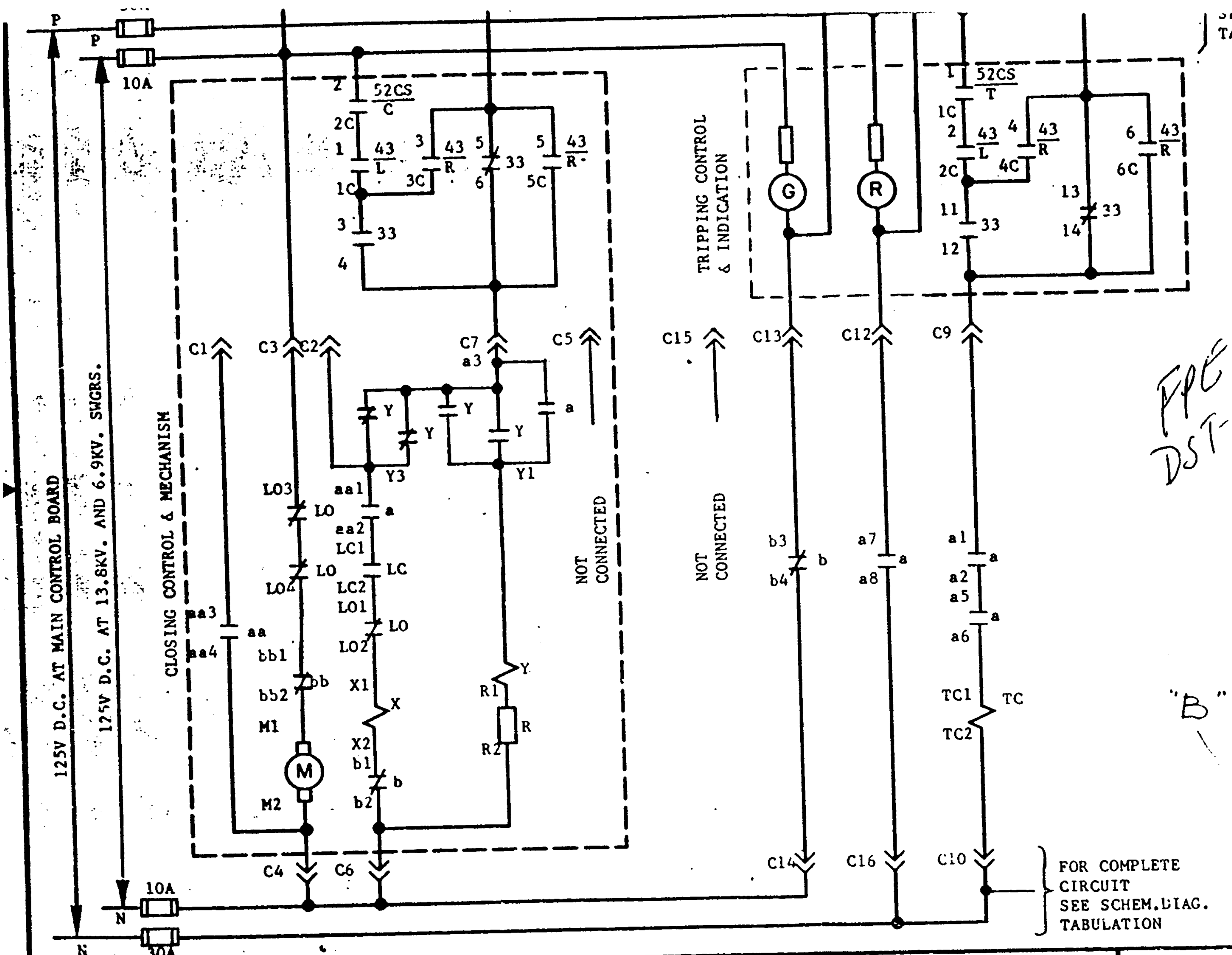


13.8KV. BUS SOUTH
13.8KV. BUS NORTH
6.9KV. BUS 14S M
6.9KV. BUS 14S R
6.9KV. FEED TO 6
6.9KV. BUS 14N
6.9KV. FEED TO 6

REVISIONS

A	8-9-74	J.J.C.	RELEASED FOR FPE INSTALL. SPEC.
B	8-20-?	J.J.C.	MISC. REVISIONS

DRAWN V. KING CHECKED M. LOPEZ
ENGINEER J.D. KUECK DATE Aug. 8, '74
APPROVED DATE

13.8KV. & 6.9KV. SWGRS. A.C.
SCHEMA
ROLLIN M.S
U
NO. INDIANA
WHEATF

SARGENT & LUNDY

F PE 1600 AMP

FP-75

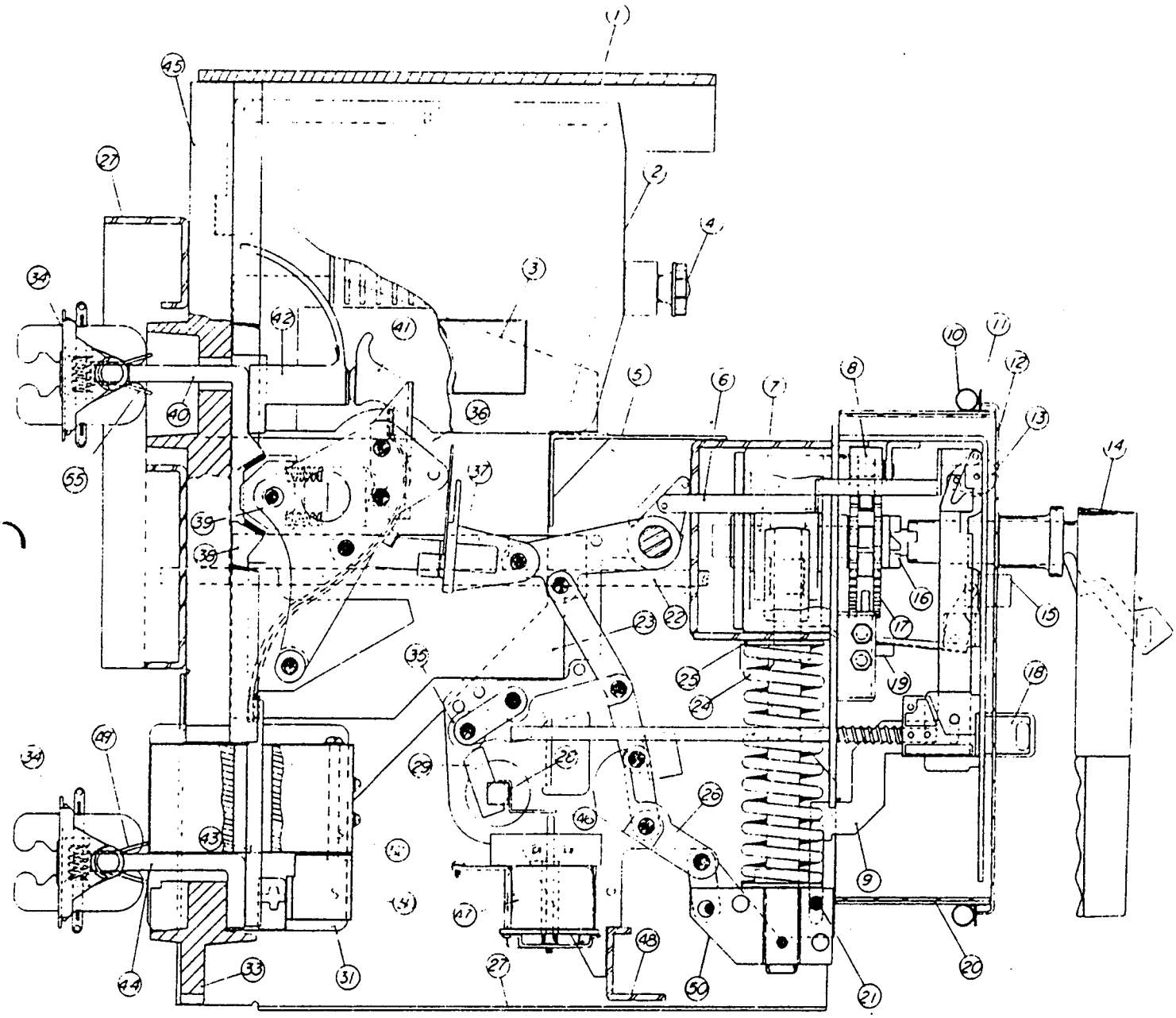


FIGURE 1

RECEIVING, HANDLING AND STORAGE

Receiving

Immediately upon receipt of the breaker an examination should be made for damage sustained in transit. If damage has occurred or there is evidence of rough handling a claim should be filed immediately with the transportation company and Federal Pioneer Limited should be notified. Check all parts against the packing list to make sure all the correct items have been received.

Handling and Storage

Lift the breaker by the steel channels at the front and back. Do not lift by the connecting terminals or the asbestos hoods and arc chutes, or by the operating handle. Check the unit thoroughly to see that no parts were damaged or forced out of alignment during shipment. If replacement parts are required, the manufacturer should be notified promptly. The breaker should be installed in a clean dry ventilated area, which is free from atmospheric contaminants.

Each circuit breaker should be stored in its shipping crate in an upright position in a clean dry area. Should the unit get wet, it must be thoroughly dried out using forced warm air over an extended period until "infinite" readings are obtained using a 600 volt megger.

BREAKER OPERATION

DRAWOUT MOUNTED BREAKERS

Switchgear assemblies for drawout mounted breakers are provided with supporting rails, main power contacts and secondary contacts to mate with those on the breakers when it is racked into position.

Drawout Racking Mechanism

An interlock is provided which will ensure that the unit is open and the main spring is discharged when it is either engaging or disengaging the main disconnecting contacts. A block is provided on the racking mechanism which operates in conjunction with the gate interlock lever over the racking opening. Before withdrawing electrically operated breakers, turn off the motor isolating switch on the faceplate. To withdraw the unit, move the gate over the crank opening down so as to expose the socket end of the drawout racking shaft. This action will first open the unit if it is closed and then discharge the main spring if it is charged. The racking handle may now be inserted in the racking shaft socket and by counter-clockwise rotation the unit will move outward.

At the "test" position the main contacts are withdrawn but the auxiliary contacts remain engaged in the test position.

Further turns of the racking handle will move the unit to the "disconnected" position and it is then free to be pulled manually forward to the end of the tracks. Two lifting lugs are provided on each side of the unit so that it can be lifted clear of the tracks.

Except for the mounting the following instructions for fixed mounted breakers equally apply to drawout mounted breakers.

FIXED MOUNTED BREAKERS

H-2 and H-3 circuit breakers should be mounted in sheet steel enclosures in accordance with recommended dimensions. The mounting support should be a rigid structure able to withstand the impact caused by the switching operation without any deflection of the frame which may cause misalignment and undue vibration of the mechanism.

POWER TERMINAL CONNECTIONS

The H-2 and H-3 terminals are silver plated for maximum joint efficiency and cable connectors must be clean and free from dents or burrs, and bolted securely to the terminals. Poor joints lead to over-heating and subsequent contact deterioration, and an eventual failure. Cables or bus connections should be properly supported so as not to transfer any unnecessary mechanical or short circuit stress to the terminals. Any strain which may have no apparent effect initially, may, after prolonged periods of vibration and shock from normal operation, cause poor contact alignment.

Meter shunts, resistors, and similar devices which operate at relatively high temperature should be mounted away from the circuit breaker so they do not contribute to the heating of the unit.

SECONDARY CONTROL CIRCUITS

Control circuit wiring, where applicable, should be made in strict accordance with detailed wiring diagrams. Wiring connections, which are made to terminal blocks should be run in a supported and protected manner, so control wiring cannot come into contact with the primary connections.

PRE-SERVICE INSPECTION

Read this instruction manual completely and inspect and check the unit in accordance with this manual.

The following items should be specifically checked.

1. Make a visual inspection after installation to ensure that no parts have been damaged or forced out of alignment.

2. Check the door interlock lever for freedom of movement, when supplied. (Fig. 25).

3. Check the main and drawout contacts to see that they are clean and free from foreign material.

4. Check all the control wiring to ensure that it has not been damaged or moved during the installation.

5. ~~Check the single phase protection (when supplied) by manually raising each tripping plunger in turn on the three tripping coils, Fig. 24. If the unit is closed, it should trip and the correct indicator should show on the faceplate. (Fig. 2).~~

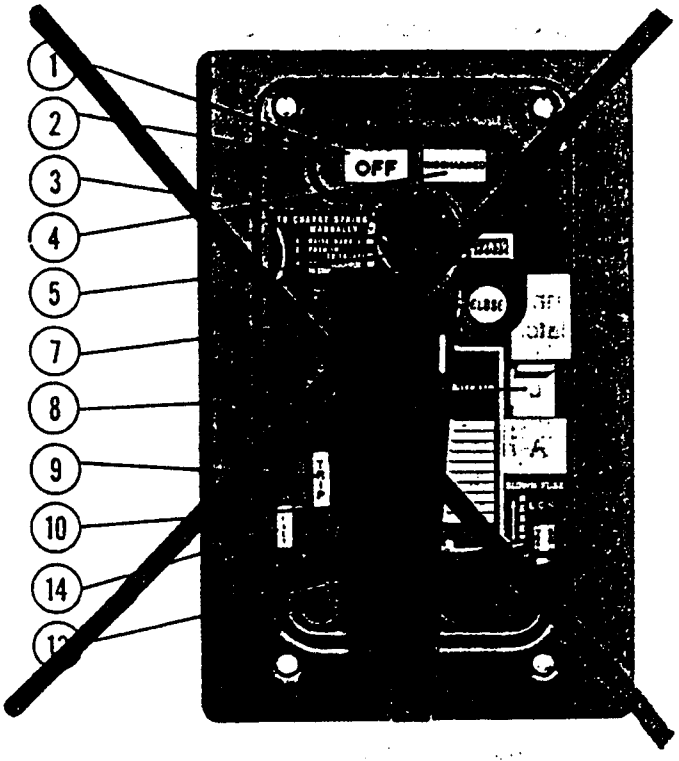
6. Close and open the unit several times to ensure correct operation. Interlocks should be defeated or be in normal release position. If an under voltage trip unit is attached hold it up manually, so the spring

closing mechanism will pick up the contacts, and thus avoid discharging the mechanism without its normal contact spring load.

7. Manually activate the tripping devices to establish that they are operable. These devices include manual trip Fig. 2, shunt trip Figs. 11, 12 and under-voltage trip Figs. 11, 13.

8. Check all cable connections to ensure that they are tight.

9. The electrical operation of drawout breakers should be checked in the 'test' position.



LEGEND

1. On-off indicator
2. Front plate
3. Floating trim
4. Spring charge-discharge indicator
~~5. Operations counter~~
6. Emergency manual close
7. Close button
8. Gate for drawout crank
9. Manual trip
10. Rating plate
11. Electrical control buttons
12. Motor cut-off switch
~~13. Single phase indicator and reset~~
14. Overload lockout reset

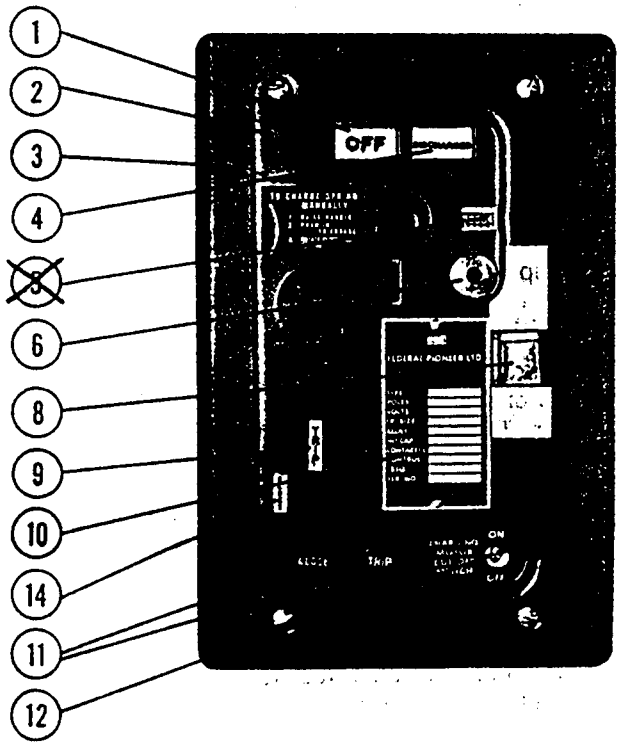


FIGURE 2(B)
FACEPLATE FOR ELECTRICALLY OPERATED

Manual Closing

The closing mechanism compresses a main spring which is held compressed until released. The handle is rotated counter-clockwise to the vertical position and pushed in to engage the clutch. Rotating the handle 180° clockwise fully charges the spring and as the internal crank passes through top-dead-centre, rotation is stopped and held by the close release latch. Operation releases latch by means of the close push button Fig. 2 in the faceplate releases the spring energy to close the breaker. A multi-tooth ratchet wheel prevents recoil and permits the spring charging to be performed in several short strokes if desired. On frame sizes 1600 amperes and above, the handle is a pull-out extension type for ease of operation.

Electrical Closing

On all electrically operated units the motor charges the spring unit the close release latch engages. The close latch is operated by a solenoid energized from the push button in the faceplate, Fig. 2 or by a remote button. The closing stroke then follows in a similar manner to that of the manual type described above. A removable handle is provided to permit manual charging of the spring. A mechanical close button similar to that on the manually operated unit is not included. Emergency operation of the close release latch is accomplished by insertion of a pin through a small aperture in the faceplate, Fig. 2. A suitable pin is provided in the upper end of the manual charging handle.

BREAKER MAINTENANCE

The safe and successful operation of connected apparatus depends upon the proper operation of the circuit breaker. Therefore, it must have regular, systematic care and inspection. The following points require special attention.

1. Before inspecting or repairing the H-2 ~~or HE-2~~ be sure it is disconnected from any electric power, either high voltage or control voltage. Also check that the main spring is discharged. If the breaker is electrically operated, turn the motor isolating switch on the faceplate to the 'off' position before tripping the unit to prevent the motor from recharging the spring. (Fig. 2).

2. Inspect the operating mechanism periodically and keep it clean.

REMOVING THE FACEPLATE (Fig. 2)

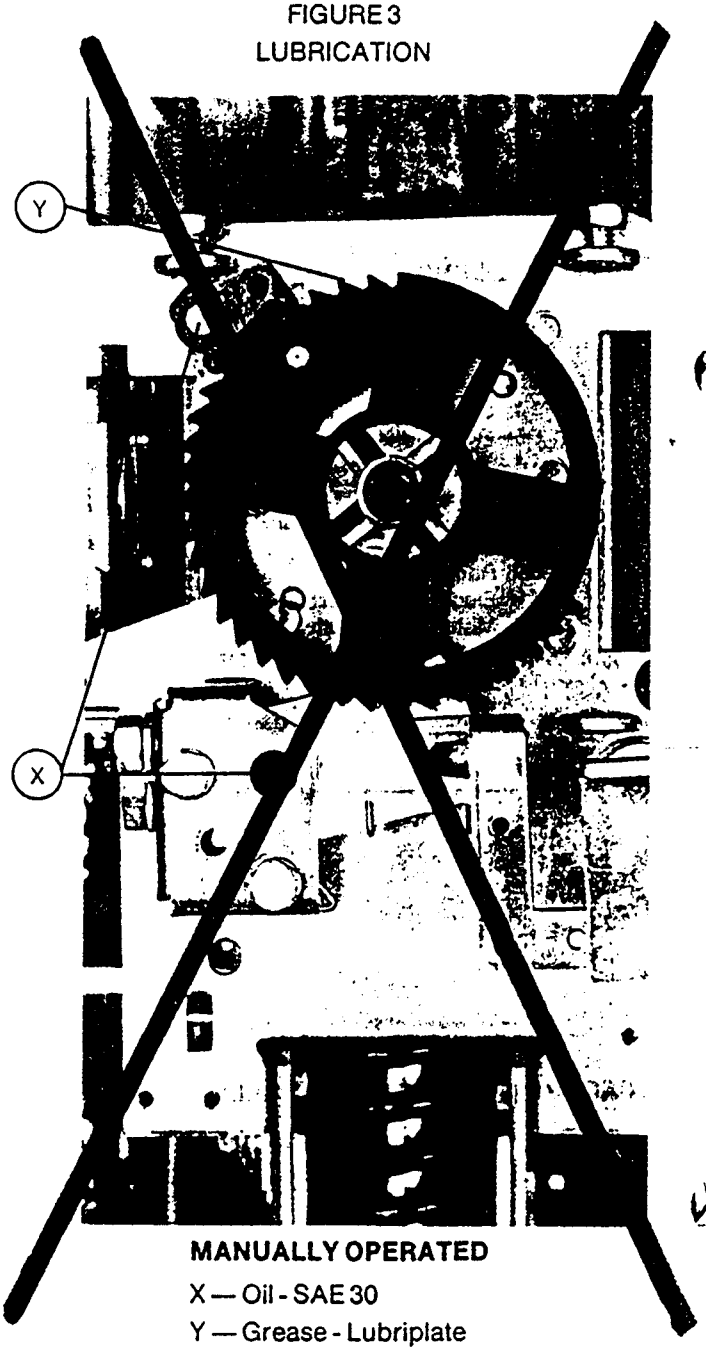
First remove the four oval head screws located at the corners of the faceplate and remove the faceplate and trim. The four mounting screws located at the base of the enclosure may now be removed and the enclosure withdrawn. When replacing the faceplate and trim it is important that the bevelled edge of the trim be positioned on the side nearest the enclosure door hinge.

LUBRICATION

H-2 breakers have been tested for mechanical endurance to the prescribed number of operations by ANSI standards without lubrication during the tests. No seizing of the mechanism occurred and the breakers were still operational. In service it is possible to encounter dusk, corrosive atmospheres and other adverse conditions which may impair proper operation. Therefore we consider it prudent to lubricate and clean breakers periodically. ANSI standards recommend lubrication and servicing to be carried out at the following periods.

In frame sizes up to and including 2000 amps, this interval is 500 operations, and in sizes 3000 amps and above, 250 operations. The following points should receive attention:-

FIGURE 3
LUBRICATION



MANUALLY OPERATED

X — Oil - SAE 30

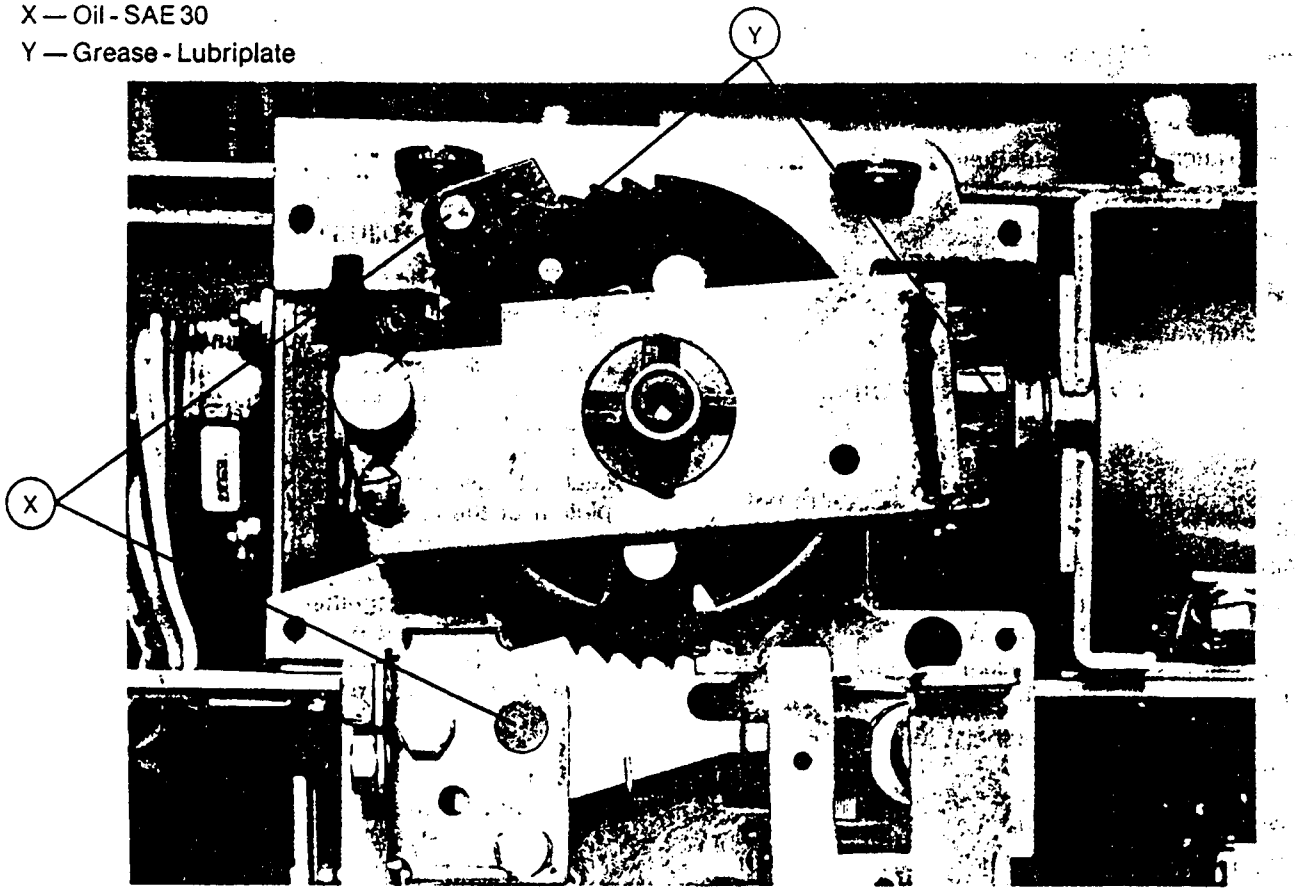
Y — Grease - Lubriplate

FIGURE 3
LUBRICATION

ELECTRICALLY OPERATED

X — Oil - SAE 30

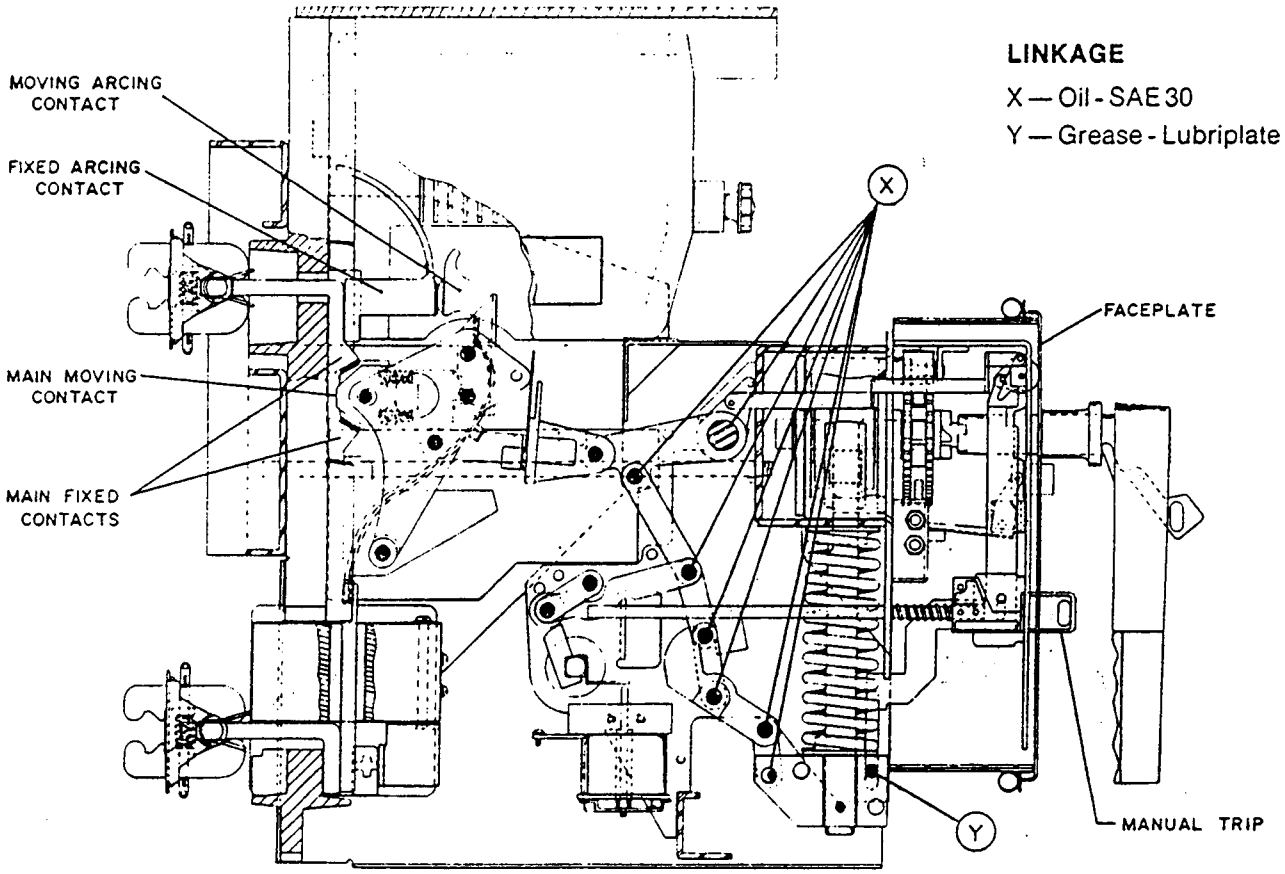
Y — Grease - Lubriplate



LINKAGE

X — Oil - SAE 30

Y — Grease - Lubriplate



MANUALLY OPERATED MECHANISM
(Ref. Fig. 3).

Oil - SAE 30

1. All linkage pivots within the mechanism compartment.
2. All closing shaft bearings.
3. Holding pawl pivot (located within the faceplate enclosure - upper left hand corner).
4. Close latch pivot (located below the main ratchet wheel).

Grease - Lubriplate Lo-Temp.

1. Spring guide pin (located at the lower end of the closing spring).
2. Ratchet wheel teeth.

ELECTRICALLY OPERATED MECHANISM
(Ref. Fig. 3).

Oil - SAE 30

1. All linkage pivots within the mechanism compartment.
2. All closing shaft bearings.
3. Holding pawl pivot (located within the faceplate enclosure - upper left hand corner).
4. Motor limit switch lever pivot (located within the front channel - left hand corner).
5. Close latch pivot (located below the main ratchet wheel).

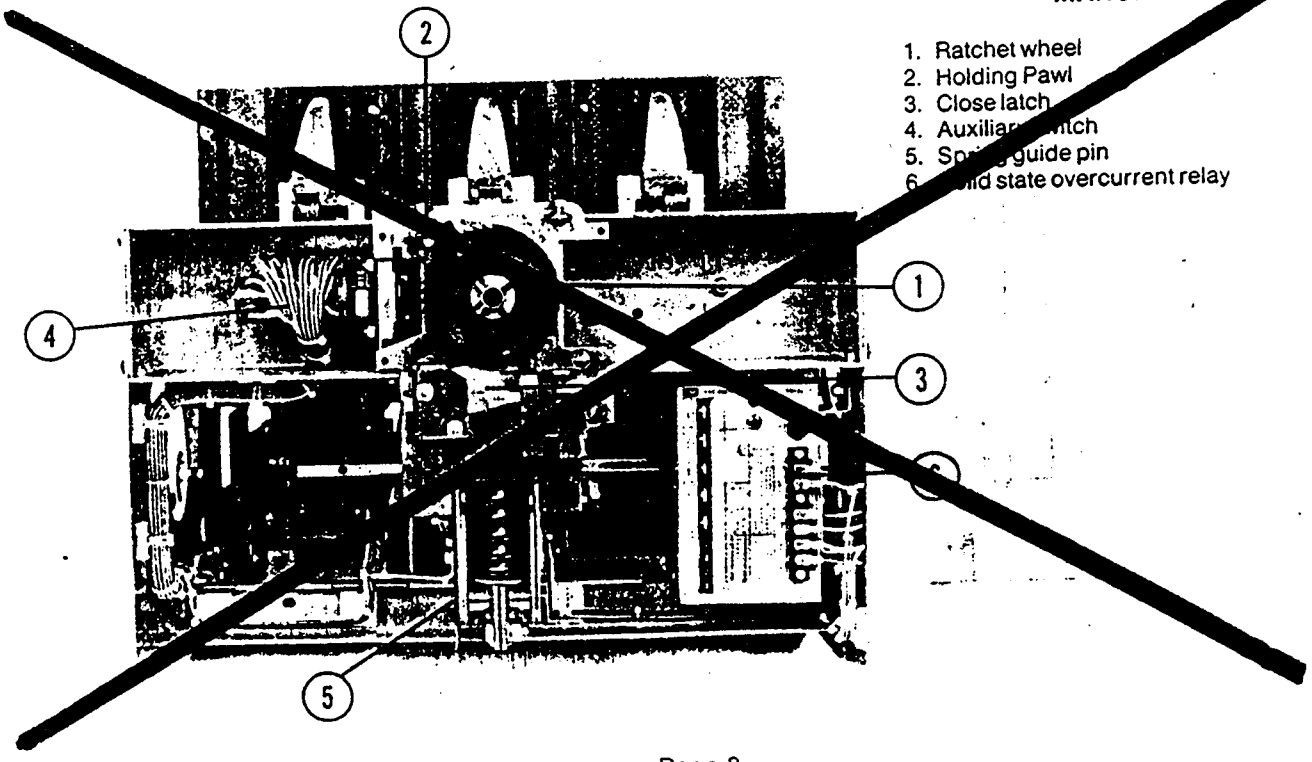
Grease - Lubriplate Lo-Temp.

1. Spring guide pin (located at the lower end of the closing spring).
2. Ratchet wheel teeth.
3. Front face of the ratchet wheel.
4. Oscillating lever - right hand end (at the motor drive cam).
5. Driving pawl pivot and springs (located on left hand end of the closing spring).

CLOSE LATCH ADJUSTMENT (Fig. 6)

The function of the close latch is to arrest or hold the ratchet wheel at a point 12 degrees past top-dead-centre, with the spring fully charged in readiness to close. The closing stroke is initiated by release of the latch, either manually by means of the mechanical push button in the faceplate or electrically by means of the close solenoid. Insufficient engagement of the latch may allow the closing stroke to occur at completion of the charging of the spring. Referring to Figure 6, the adjustment procedure is as follows. The ratchet wheel assembly (Item 1) is made up of two plates riveted together. The two plates are held apart by spacers located between the plates on the four rivets. Rotate the ratchet wheel until one of the spacers on a rivet is directly above the nose of the cam latch (Item 2). Loosen locknut (Item 3). Turning the stop screw (Item 4) counter-clockwise adjusts the cam latch up. Adjust the cam latch height until there is approximately 1/32 inch (.8 mm) clearance between the spacer and the nose of the cam latch. Tighten the locknut securely.

FIGURE 4
MANUALLY OPERATED



1. Ratchet wheel
2. Holding Pawl
3. Close latch
4. Auxiliary switch
5. Spring guide pin
6. Solid state overcurrent relay

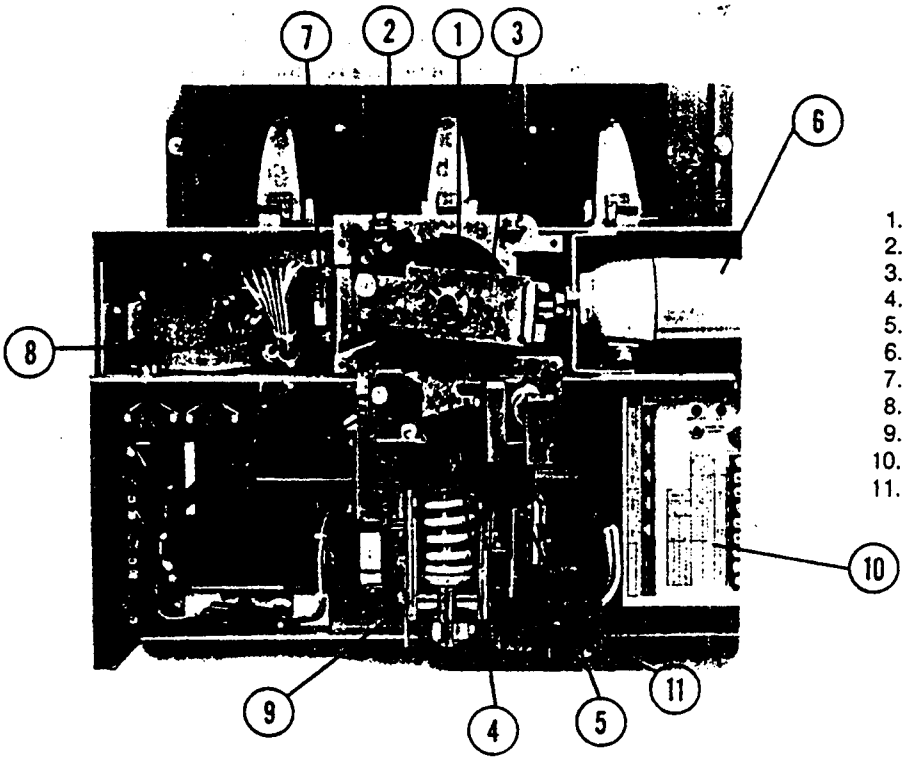
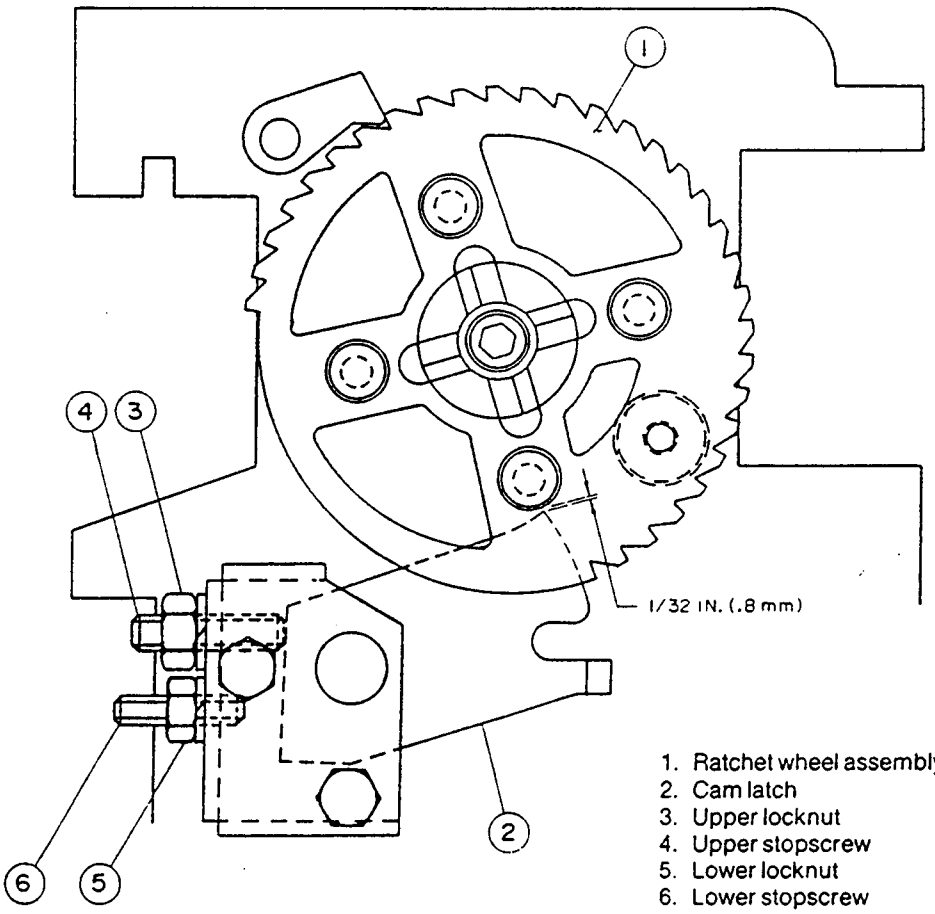


FIGURE 5
ELECTRICALLY OPERATED

1. Ratchet wheel
2. Holding pawl
3. Oscillating lever
4. Close latch
5. Shunt close
6. Motor
7. Auxiliary switch
8. Spring limit switch
9. Spring guide pin
10. Solid state overcurrent relay,
11. Anti single phase device

FIGURE 6
CLOSE LATCH ADJUSTMENT



1. Ratchet wheel assembly
2. Cam latch
3. Upper locknut
4. Upper stopscrew
5. Lower locknut
6. Lower stopscrew

MECHANISM LATCHING AND TRIP SHAFT ADJUSTMENT

Misadjustment of latching results in failure to close, but it does not prevent the closing spring from being compressed and discharged for closure.

There are 3 possible causes of improper latching:

A) On units equipped with an overload lockout or single phase device, failure to manually reset the device after it has operated, will prevent latching and the discharge of the closing spring will not move the main contacts.

B) Misadjustment of the main linkage (which governs travel of the latch roller) will prevent latching with the same result as above.

C) Insufficient overlap of the latch roller with the trip cam secured to the trip shaft. This condition will cause the moving contacts to pick up slightly and drop back to fully open position when the closing spring is discharged.

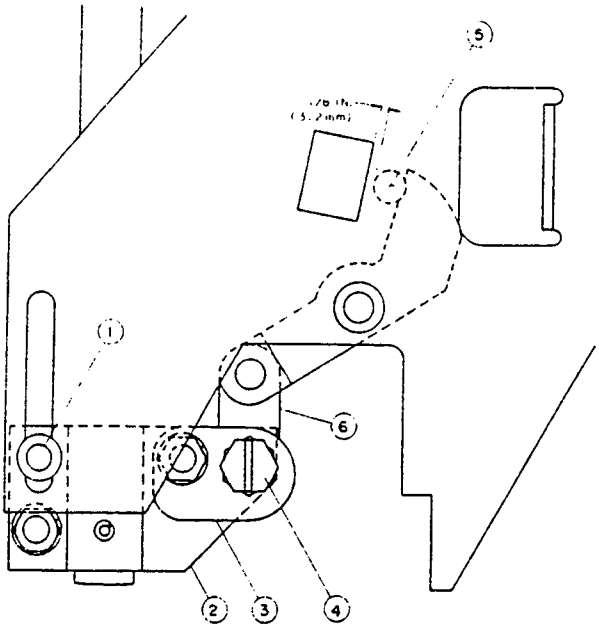
To correct A - push manual reset lever. (Fig.2)

To correct B - Linkage adjustment must be made (Ref. Fig. 7).

This adjustment is accomplished by means of an eccentric bolt accessible from the right hand side of the mechanism compartment. Where adjustment is correct, as the spring is charged, the trip roller is moved into position resting on the latch face of the trip shaft cam in readiness for the closing stroke. If insufficient travel is attained because of the improper setting of the eccentric, the roller will not be properly engaged and will result in a "trip-free" closing stroke.

FIGURE 7

LINKAGE ECCENTRIC ADJUSTMENT



1. Spring guide clamp pin
2. Main spring clamp
3. Locking plate
4. Eccentric
5. Toggle pin
6. Connecting link

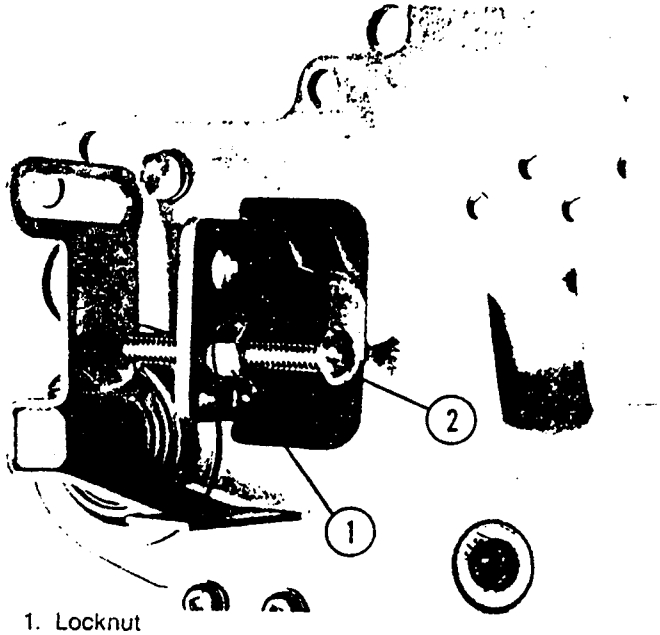
A visual check of the trip shaft position will confirm the condition being described. With the spring charged and the unit in readiness to close, the trip shaft lever will not be resting against the stop screw, as shown in Fig. 8.

To make the observation described below, the red flash shield, hood and arc chutes should be removed, and safety precautions will require that the unit be de-energized during this operation. With reference to Fig. 7 the following procedure should be used. With the circuit breaker open and the spring discharged, remove the eccentric locking plate (Item 3) and rotate the eccentric to its uppermost position. This can be readily observed in the movement of the connected linkage. Replace the locking plate temporarily, locating to the nearest notch. It is not necessary to tighten the holding nut at this point. Charge the spring and close the unit.

By viewing the mechanism compartment from above again remove the locking plate and adjust the eccentric by turning clockwise to position toggle pin (Item 5) at a point ⅛ in. (3.0 mm) from the stops located in the mechanism side plates. The locking plate should now be replaced and the retainer nut firmly tightened. In this operation, two wrenches should be used — one holding the head of the bolt at the left hand side — the other tightening the nut at the right hand side.

FIGURE 8

TRIP SHAFT ADJUSTMENT



1. Locknut
2. Adjusting Screw

The adjustment is checked by charging the main spring with the breaker closed. If the main contacts slowly open during charging, the eccentric must be adjusted to move the toggle pin closer to the stops located in the mechanism sideplates.

To correct C-Latch roller engagement adjustment must be made.

This adjustment, located on the left hand side of the mechanism compartment, controls the engagement of the trip shaft to the latch roller. If this engagement

is insufficient, the roller may release during the closing stroke, resulting in failure to close. The main contacts will appear to move but not complete the travel.

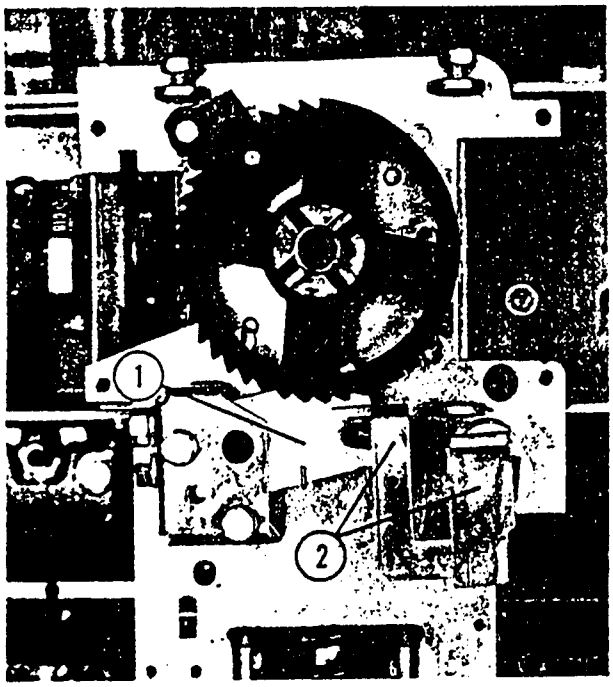
To adjust, the following procedure should be used. With reference to Fig. 8 loosen locknut (Item 1) and turn adjusting screw (Item 2) counter-clockwise two turns. Close the breaker and slowly turn the screw clockwise until the unit trips. Now turn the screw counter-clockwise one and one quarter turns and tighten the locknut.

NOTE: Whenever this adjustment is made the following should be checked if present on the breaker.

1. Latch Check Switch setting on electrically operated breakers (Page 15, Fig. 16).
2. Shunt Trip Type B striker rod adjustment (Page 12, Fig. 12).
3. No-Volt Trip Type B striker adjustment (Page 13, Fig. 13).
4. Drawout gate interlock lever eccentric adjustment on drawout breakers (Page 11, Fig. 10).

FIGURE 9

SPRING DISCHARGE LEVER



1. Closing latch
2. Drawout interlock/discharge lever

SPRING DISCHARGE INTERLOCK

Drawout mounted breakers are fitted with a gate interlock to prevent the breaker being withdrawn while the unit is closed or the main spring is charged. Depressing the gate interlock down to expose the drawout crank opening first trips the breaker then discharges the main closing spring.

It should be noted that 'empty' discharges of the closing spring stress the mechanism to a slightly greater extent than on normal closure. For this reason it is advisable to avoid additional intentional discharges to those which occur when the breaker is withdrawn and the spring is still charged.

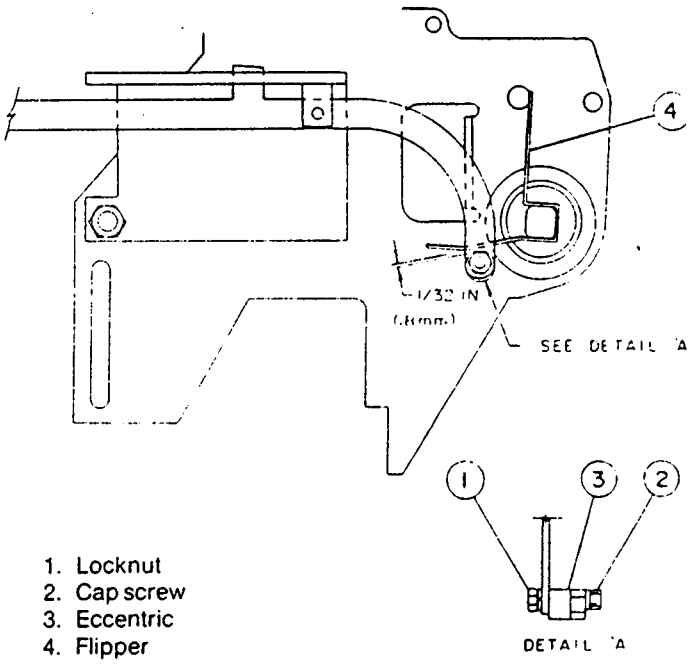
Adjustment of the drawout gate interlock lever is performed as follows. Be sure the trip shaft is rotated down so the left hand flipper is resting against the adjusting screw. Be sure the drawout lever is lifted to its upward position. With reference to Fig. 10 loosen locknut (Item 1) and allen head cap screw (Item 2). Using a wrench, rotate eccentric (Item 3) until the clearance between the eccentric and righthand flipper (Item 4) on the trip shaft is approximately 1/32 inch (.8 mm). Holding the eccentric in position with wrench, tighten allen screw securely. Tighten locknut securely.

Discharging the main spring is accomplished by the drawout lever acting on the close button lever, Fig. 9. The lever arrangement requires no adjustment. Depressing the drawout lever activates the closing latch which discharges the main spring. This action results in failure to close, but discharge of the main spring.

Whenever trip shaft adjustment is performed (Fig. 8), the drawout gate interlock lever adjustment should be checked.

FIGURE 10

ECCENTRIC ADJUSTMENT



1. Locknut
2. Cap screw
3. Eccentric
4. Flipper

SHUNT TRIP

Two types of shunt trip units are available for use on all H-2 breakers each having specific performance features.

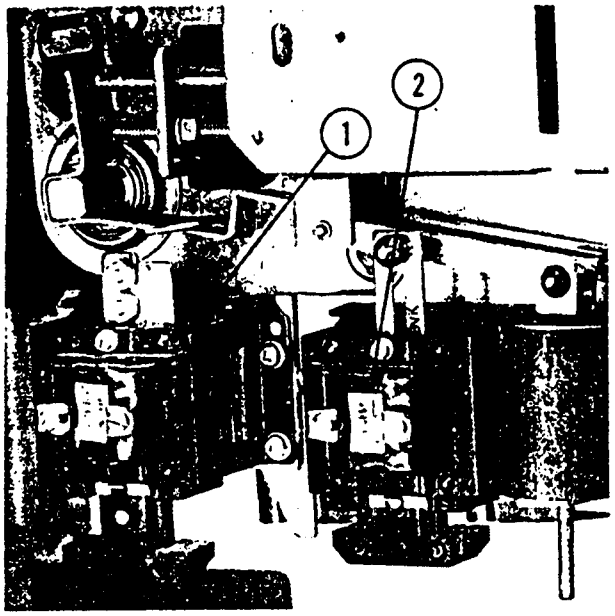
The two types are described as follows:-

Type A (Fig. 11)

This unit consists of a rectangular laminated solenoid frame, mounted on the left hand side of the mechanism and acting directly on the trip shaft. When used on typical 120 volt ac control, the coil has a continuous rating, with a holding current of only 340 milliamperes. This makes possible use of this trip unit without the conventional normally open auxiliary switch contact in series with the coil. When

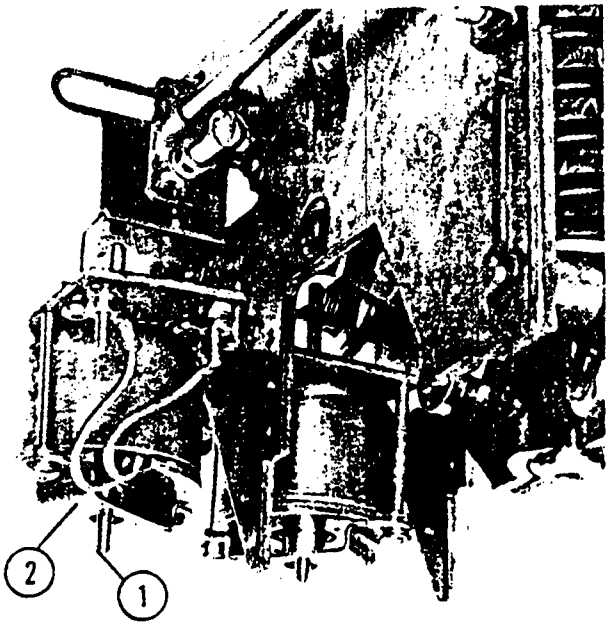
used in conjunction with a typical latching-type ground fault relay the breaker is locked out and will be totally trip-free until the relay has been reset. Any attempt to reclose the breaker before resetting the relay will preclude a restriking of the ground fault. No adjustment is required on this device and the only attention needed is that of ensuring that the plunger is free of any binding or friction. This unit is capable of tripping at 50% of the rated voltage.

FIGURE 11



1. Shunt trip type A
2. No-volt trip type A

FIGURE 12
SHUNT TRIP TYPE B



1. Plunger
2. Stop plate

Type B (Figure 12)

This is a cylindrical solenoid mounted within the mechanism comparment at the lower rear and acting directly on the trip shaft. Unlike the Type A unit, it is not continuously rated and for any application a normally open auxiliary switch contact must be used. In the 120 volt ac application the Type B unit is equivalent in performance to the Type A device (i.e. will operate at 50% of rated voltage) but in the 125 volt dc rating, tripping can be performed at levels as low as 25% of nominal rating. One adjustment is provided in the Type B trip unit to control the extent of free travel between the plunger and the trip shaft lever. By lifting the plunger until the striker rod is lightly touching the trip shaft lever a space of 1/16 inch (1.6 mm) should exist between the end of the plunger and the stop plate as shown in Figure 12.

If adjustment is required, loosen the 8-32 socket head screw located at the bottom end of the plunger, and turn the striker rod within the plunger as required. Retighten the set screw. If trip shaft adjustment (Fig. 8) is altered at any time, this striker rod adjustment should be checked.

The shunt trip is identified on the wiring diagram by the symbol "TC".

Both units can be installed on one breaker. With regard to use, the following rules are usually adhered to:

1. A Type B is used where only a separate trip coil is required.

2. With the SD relay, a Type B is used between the mechanism sideplates to operate with the relay, and possibly a Type B mounted outside the left hand mechanism sideplate to be used as a separate trip coil.

3. A Type A, mounted only outside the left hand mechanism sideplate, is used only when a continuous rated coil for a separate trip source is required.

4. Type A and Type B used in conjunction with the SD relay can both be used on the same unit.

UNDER VOLT TRIP-TYPE A (Fig. 11)

The Type A Under-Volt Trip is a gravity-operated device mounted on the left hand sideplate of the mechanism compartment and acting directly on the trip shaft. The operating solenoid is similar to the Type A shunt trip, and is supplied in the 120 volt ac rating, with a current of 340 milliamperes and a pull of 45 amperes. A mechanical escapement time delay attachment is available which provides a delay adjustable from 0 to 5 seconds. In operation the unit has a dropout of 50% of rated voltage and a pull in of 85% of rated and is identified on the wiring diagram by the symbol "27"

UNDER VOLT TRIP-TYPE B (Fig. 13)

Type B Under-Volt Trip is a spring-operated device mounted on the left hand sideplate of the main mechanism compartment and acting directly on the trip shaft. The operation two springs are compressed by a rectangular solenoid similar to the

Ty[illegible] A under-volt trip. Normally supplied in th[illegible] v[illegible] rating, the solenoid has a holding cu[illegible] of 340[illegible] amperes, with an inrush of 2.45 am[illegible]s. A mech[illegible] escapement time delay att[illegible]ent is availab[illegible]ch provides a delay adjus[illegible] from 0 to 5 secon[illegible]

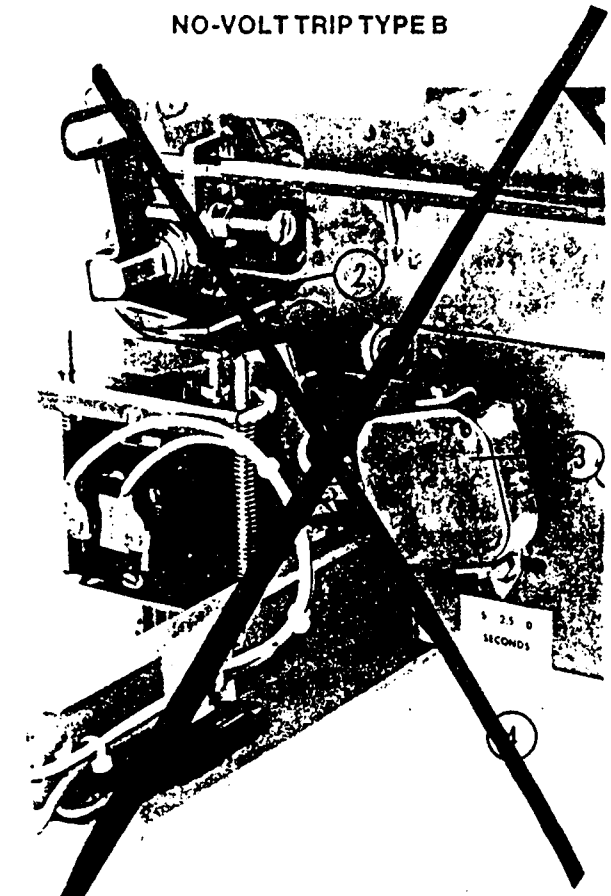
An adjustab[illegible]iker (Item 1) is pr[illegible]d to control the engageme[illegible] the solenoid[illegible]ger to the trip shaft. With the s[illegible]id energi[illegible]nd the plunger seated, adjust the[illegible]er as[illegible]red to provide a gap of 5/16 inch (8 m[illegible] et[illegible] the striker and the trip shaft lever. Tighte[illegible] firmly. If at any time the trip shaft adjustmen[illegible]) has been altered the under voltage striker [illegible]t should be checked.

A vernier time adj[illegible]ent in the [illegible] of an eccentric is provided for f[illegible]djustment, i[illegible]endent of the scale setting.[illegible]mming is requ[illegible] loosen the locknut loca[illegible] the inside of the lev[illegible]d turn the eccentric [illegible]ker-clockwise to increas[illegible]e, and clockwis[illegible]horten time. The locknut mu[illegible] firmly tight[illegible] each time the eccentric is move[illegible]

In o[illegible]ion, the Type B under voltage trip [illegible] dr[illegible] of 50% of rated voltage and a pull-in of [illegible] r[illegible] voltage, and is identified on the wiring diagram by the symbol "27".

FIGURE 13

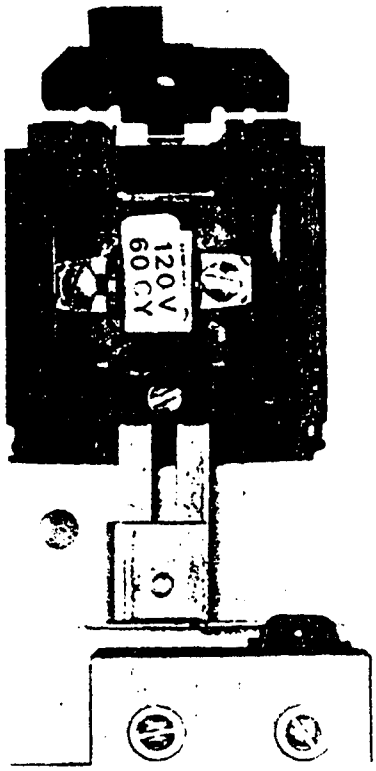
NO-VOLT TRIP TYPE B



1. S[illegible]ker
2. [illegible]p shaft lever
3. [illegible]imer
4. Vernier time adjustment

FIGURE 14

SHUNT CLOSE



SHUNT CLOSE (Fig. 14)

This accessory is supplied on the electrically operated circuit breakers and consists of a rectangular laminated solenoid frame, similar to the Type A shunt trip device. It is mounted within the front mechanism compartment, and its function is that of actuating the close latch to initiate the closing stroke. It may be energized by the normally open push button in the faceplate or by a remote push button. In ac ratings the coil is inherently continuously rated and in the typical 120 volt application the holding current is 340 milliamps, with an inrush of 2.45 amperes. For dc operation a holding resistor in conjunction with a plunger operated limit switch again provides a continuous rating.

The shunt close unit is fitted with an independant normally closed limit switch, operated by the solenoid plunger. This switch is connected in series with the spring charging motor and serves to render the motor inoperative while the solenoid is energized. Used in conjunction with the conventional "charge after trip" motor operation, this performs the duties of an anti-pump relay. The breaker will not reclose because the spring is retained in a discharged condition. Only when the close signal is removed will the motor operate to charge the spring.

No adjustment is required on this unit and the only attention needed is that of ensuring that the plunger is free of any binding or friction. The device is capable of operating at 75% of rated voltage.

The shunt close is identified on the wiring diagram by the symbol "CC".

In normal operation the latch check switch should require no readjustment, but if at any time the trip shaft adjustment (Fig. 8) is altered, the latch check switch setting should be checked as above. This device is identified on the wiring diagram by the symbol "LCS".

CONTACT MAINTENANCE

1. Examine the main breaker contacts (and disconnecting contacts on drawout mounting breakers) frequently to see that they are properly aligned and that the contact surfaces bear with firm uniform pressure.

2. The contact surfaces of all types of disconnecting or interrupting devices must be kept clean and bright to ensure maximum operating efficiency. Contact surfaces which are corroded by contaminated atmospheres will cause over-heating and subsequent failure of the device. The alloy contacts of the type H-2 and HL-2 will resist contamination to a great degree but in areas where sulphur is present or other chemicals which readily combine with silver, regular maintenance is required to ensure contact efficiency.

3. See that bolts, nuts, washers, clips and all terminal connections are in place and tight, especially after completion of any maintenance work.

4. When abnormal conditions exist, such as salt deposits, cement dust or acid fumes the breaker should be cleaned at regular intervals. This will prevent flashovers caused by the accumulation of foreign substances.

MAIN POWER CONTACTS

Main contacts are silver alloy and should be clean, bright and free from pitting. They may be gently sanded if necessary using a fine emery to remove pit marks. Avoid having particles fall into the mechanism, and wipe contacts clean with cloth after sanding.

If the main contacts are severely damaged make a careful inspection of all current carrying parts. Supporting pins, linkage, and especially springs should be examined for damage due to excess heat. Annealed or distorted parts should be replaced. Before attempting this, consult the manufacturer.

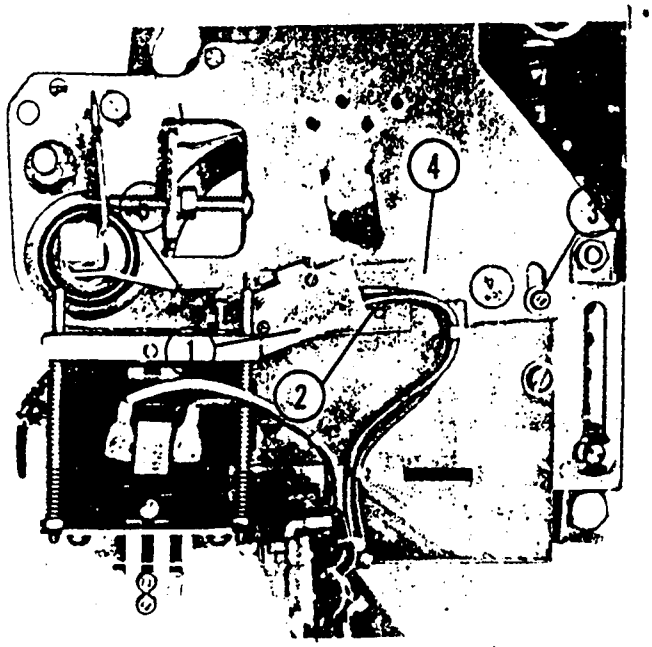
CONTACT DIFFERENTIAL (Fig. 17)

At intervals of 1000 operations, the differential between the main and arcing contacts should be checked, and maintained between the limits of .050 to .065 inches (1.3 to 1.6 mm). Using the slow close device (Fig. 18) close the contacts until the moving arcing contact touches the stationary arcing contact. A gap of .050 to .065 inches (1.3 to 1.6 mm) between the main moving wafer contacts and the main upper fixed contact should exist. This gap can be checked using a feeler gauge. If adjustment is necessary, shims are placed between the stationary arcing contact and the main upper fixed contact. This is done by removing the stationary arcing contacts. Shims are available from the manufacturer (Part Number 241A-500).

Contact differential should always be checked before main moving contact deflection.

FIGURE 16

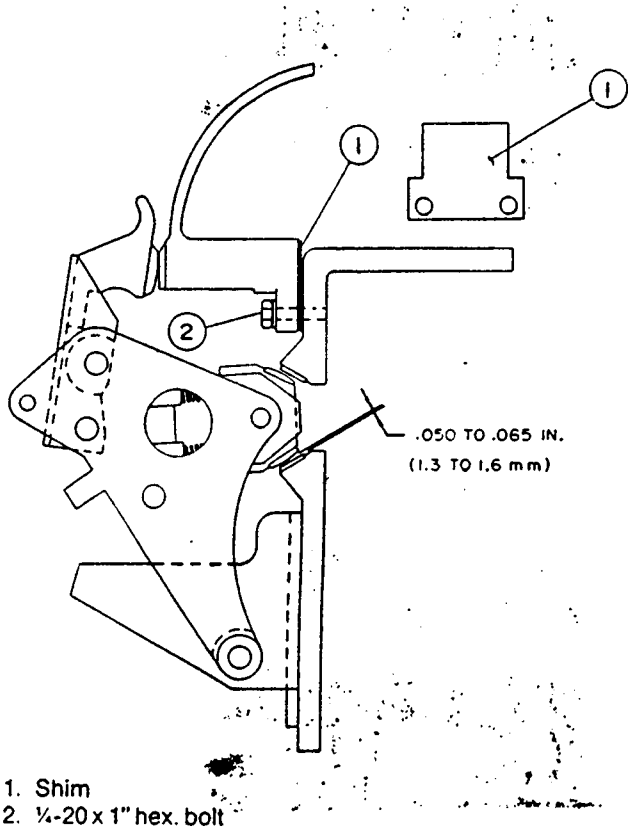
LATCH CHECK SWITCH



1. Latch check switch
2. Pivot screw
3. Lock screw
4. Mounting plate
5. Trip shaft lever

FIGURE 17

CONTACT DIFFERENTIAL ADJUSTMENT



1. Shim
2. ¼-20 x 1" hex. bolt

MAIN MOVING CONTACT DEFLECTION

At intervals of 1000 operations, deflection of the main moving contacts should be checked, and maintained between the limits of 3/64 to 5/64 inches (1.2 to 2.0 mm). A gauge is available for this purpose which carries a scale graduated in 1/64 inches (.4 mm) divisions. For the 1600 amp and larger frames use Gauge #96A-500, and for the 600 amp frame use Gauge #96A-501.

With the circuit breaker open establish the starting or "zero" point for each main moving contact assembly. Apply the gauge to the left hand side as shown in Figure 20 and note the position of the pointer. To assist in positioning the gauge the pointer should be moved forward or "up scale" then released to allow the indicator pins to locate as shown.

With the circuit breaker closed again apply the gauge as shown in Figure 21, and note the position of the pointer. The number of divisions the pointer has moved from "zero" position indicates the amount of main contact deflection, each division representing 1/64 inch (0.4 mm) deflection.

When adjustment is required, proceed as shown in Figure 22. Using any suitable blocking device, position the moving contact members toward the closed position as shown and loosen capscrews (Item 1). Shims (Item 2) are added as required to restore deflection to within the limits stated above. After shims are added, it is important that the capscrews be firmly tightened before closing the unit in the normal manner.

A supply of shims is included with the gauges.

ARCING CONTACTS

Arcing contacts are subjected to pitting every time the circuit breaker interrupts current and should be inspected at regular intervals if the unit is operated frequently. They should always be inspected after the breaker has interrupted a short circuit and should be replaced if they are showing serious pitting and loss of contact material. To remove the fixed arcing contacts from the circuit breaker take out the two hex-head machine screws at the base of each fixed contact.

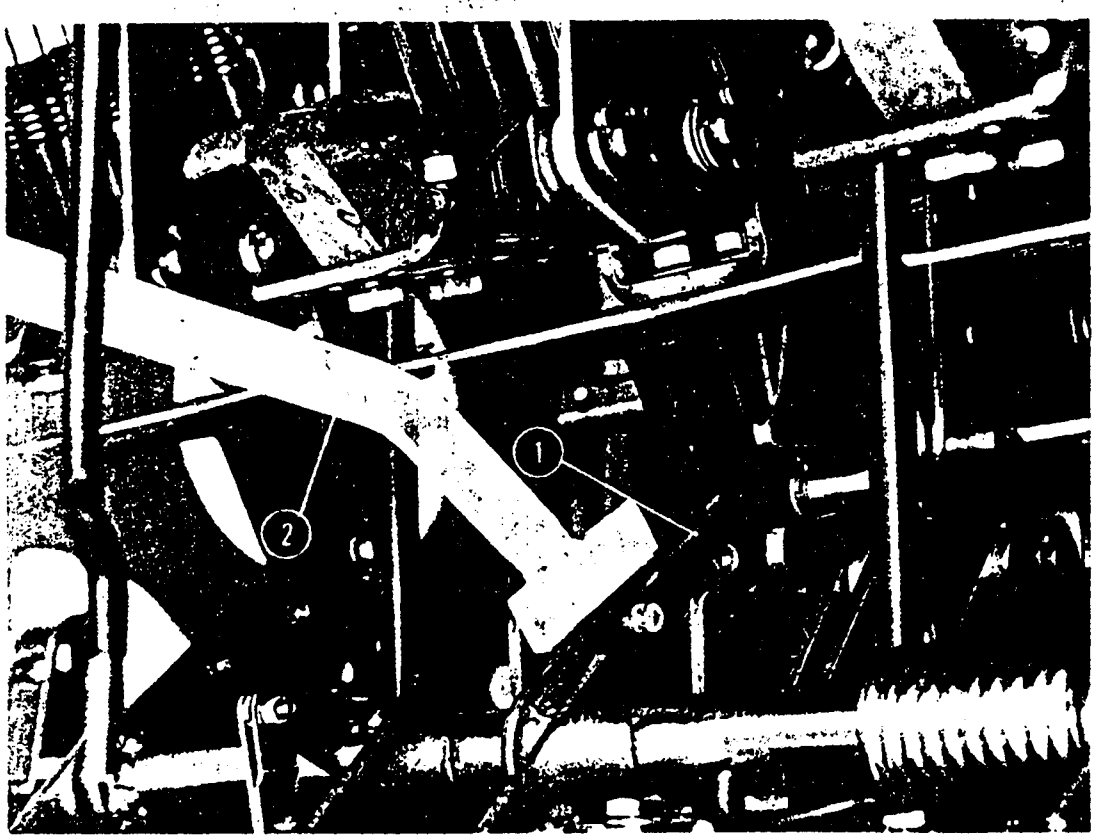
To remove the moving arcing contacts simply take out the two hex-head machine screws which hold each contact in the assembly. Note that the braid is attached to the contact by a nut on the lower, hex-head screw. Be sure to retrieve the nut and lockwasher when removing the contact and do not omit the lockwasher when connecting the braid to the new contact. Whenever replacing arcing contacts inspect the braids and replace them if they are discoloured or strands are broken.

SLOW CLOSE DEVICE

A slow close maintenance device is available which can be attached to the circuit breaker to permit slow operation of the mechanism, The device is available from the manufacturer, FPE Part No. 115G-514. As shown in Figure 18 the tool is attached to one of the lever arms of the closing shaft. The slow close device requires no attaching bolts and can be installed and removed with ease.

FIGURE 18

SLOW CLOSE DEVICE



1. Closing shaft lever
2. Slow close device

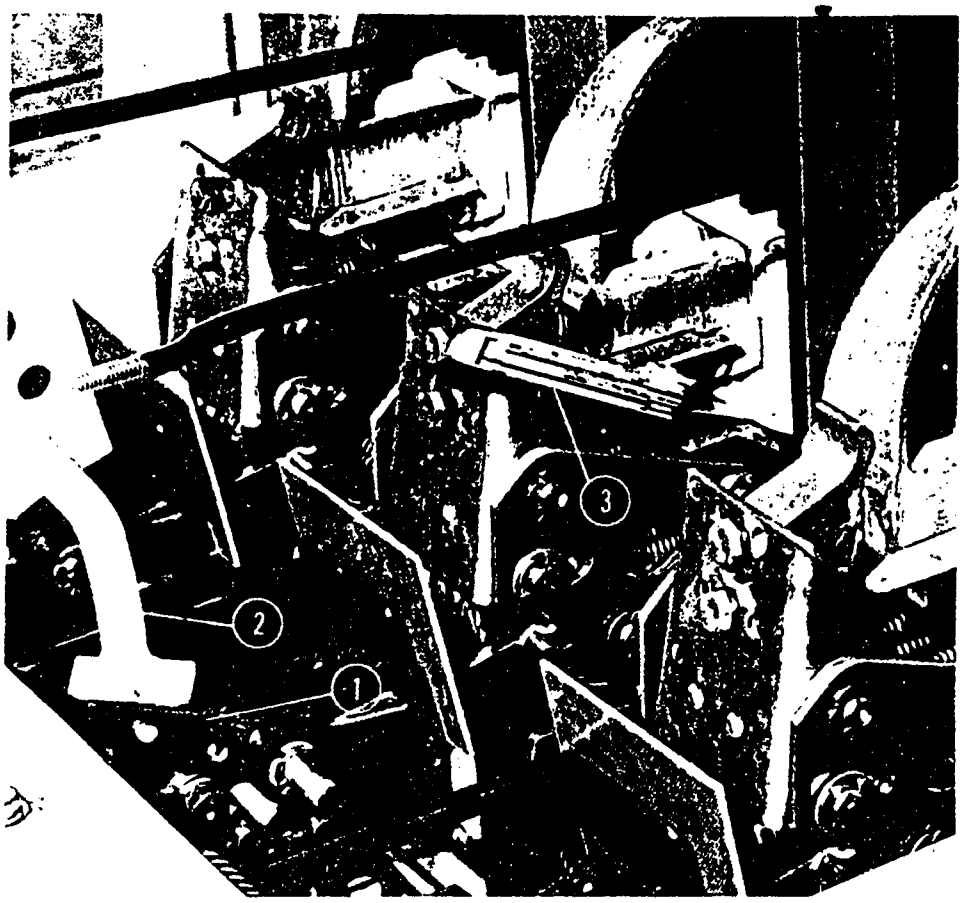
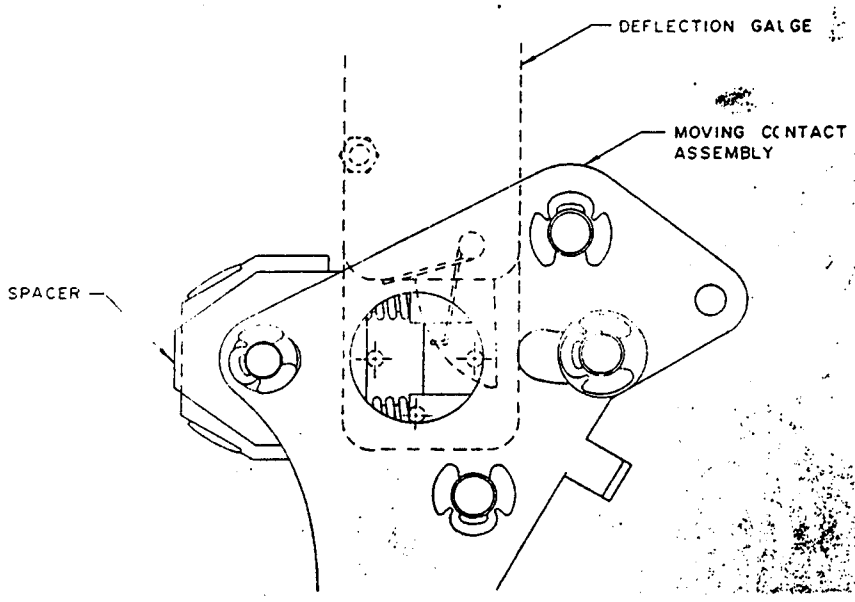


FIGURE 19
SLOW CLOSE DEVICE

1. Closing shaft lever
2. Slow close device
3. Feeler gauge

FIGURE 20
MOVING CONTACT DEFLECTION



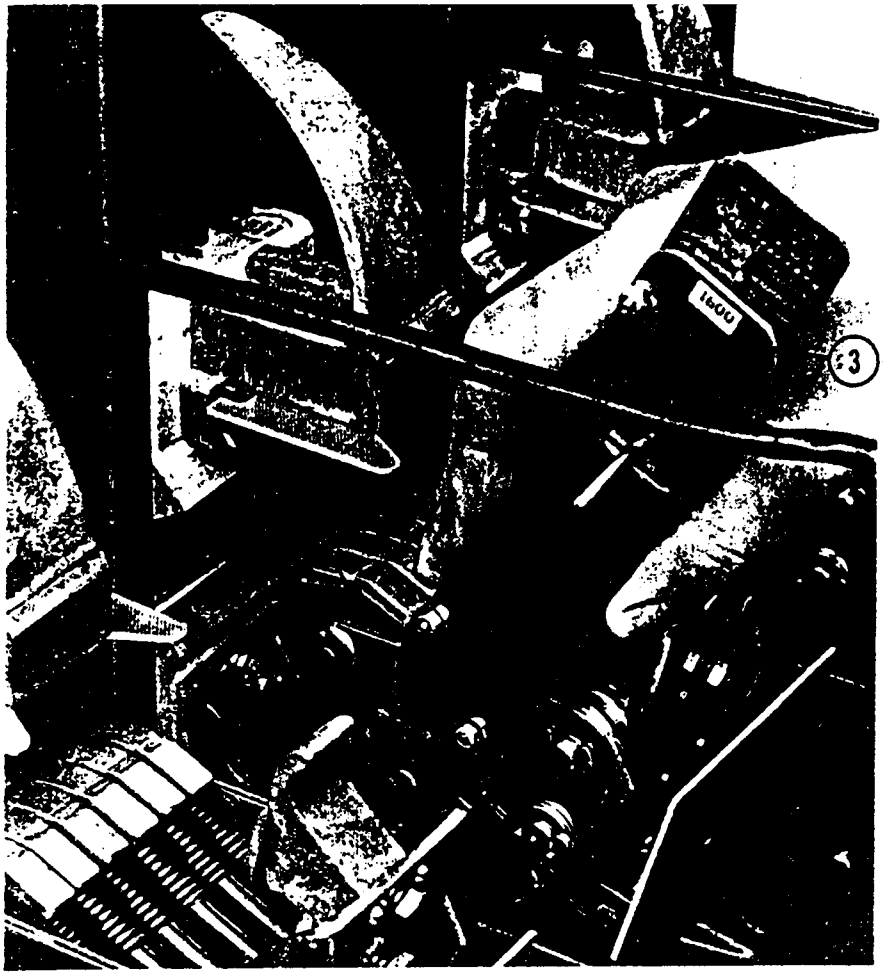


FIGURE 21
SLOW CLOSE DEVICE

1. Moving contact in open position
2. Moving contact in closed position
3. Deflection gauge

HZ ACB
F.P.C. 1600 Amp

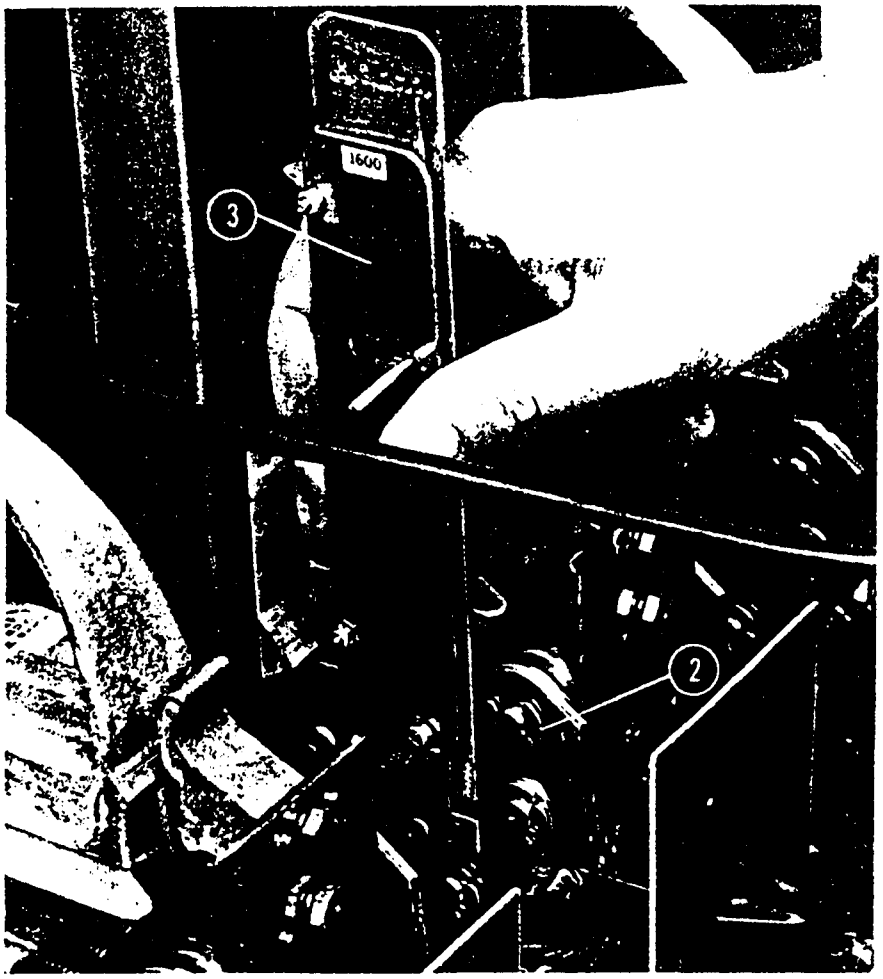
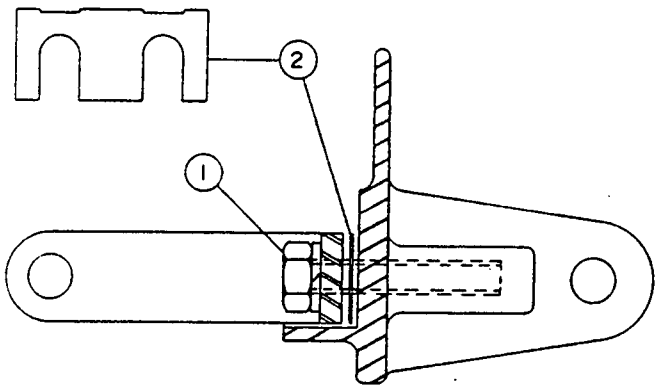


FIGURE 22

MOVING CONTACT ADJUSTMENT



1. 5/16-18 x 1 hex. bolt
2. Shim

FUSE MOUNTING — HL-2 ONLY

All HL-2 circuit breakers in frame sizes up to and including 4000 amps have provision for mounting NEMA ERC power fuses, mounted on the line side on a frame extension at the rear of the unit. As an option, in ratings of 3000 & 4000 amps, a separate fuse truck is available used in conjunction with a standard circuit breaker. Key interlocking is provided to ensure that the circuit breaker is open before the fuse unit is withdrawn. The fuse unit is equipped with a rejector feature which prevents entry of the fuse unit into the breaker cell.

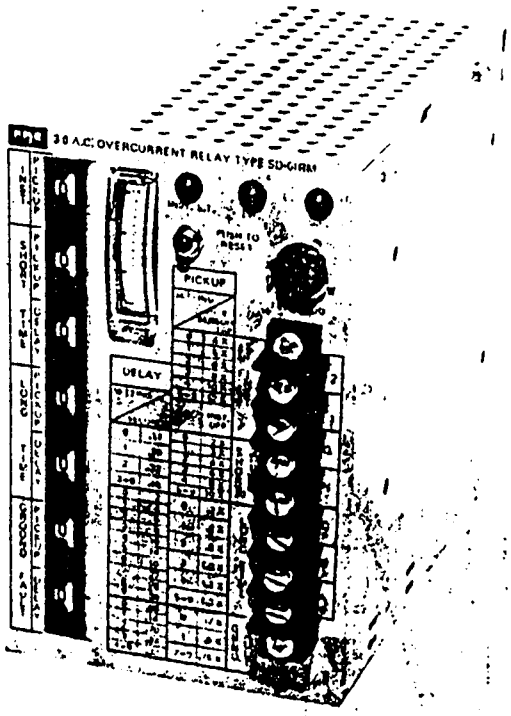
In all applications the circuit breaker is equipped with anti-single phase protection.

The following maximum fuse sizes may be used.

FRAME RATING	RELAY RATING	MAXIMUM FUSE RATING
600 amp	600 amp	800 amp NEMA L
1600 amp	1600 amp	2000 amp NEMA L
2000 amp	2000 amp	3000 amp NEMA L
3000 amp	3000 amp	4000 amp NEMA L
4000 amp	4000 amp	6000 amp NEMA L

FIGURE 23

TYPE SD SOLID STATE RELAY



ARC CHUTES

The arc chutes are an asbestos material and must be handled with care. They may be removed individually by removing the knob and short tie bar between the chutes. The chutes rest on lips on the base and can be lifted clear to expose the arcing contacts. The arc chute may discolour from arc interruption but will not need replacement unless heavy deposits of arc material are present or parts are distorted or cracked.

ARC CHUTE HOOD

The hood is provided to restrict ionized gases from direct access to the steel enclosure and in addition carries interphase barriers. The hood fits into grooves on the base and on top of the base moulding. It is held firmly in position by the arc chute clamping rods projecting from the base. Care should be used in handling the hood as it is an asbestos type material and will break if subjected to undue shocks.

OVERLOAD PROTECTION

H-2 and HL-2 breakers are provided with solid state overload protection which is completely self contained and requires no auxiliary control supply. The SD type solid state relay operates from current sensors mounted within the breaker and provides energy to a solenoid type shunt trip. Each sensor is available with changeable tap settings to suit the rating of the breaker.

Note — Sensor tap settings must not be changed while power is flowing through the breaker.

For complete details of the SD relay refer to Instruction Manual C-3-216-2. (Fig. 23).

ANTI-SINGLE PHASE DEVICE & BLOWN FUSE INDICATOR — HL-2 Breaker Only (Fig. 24)

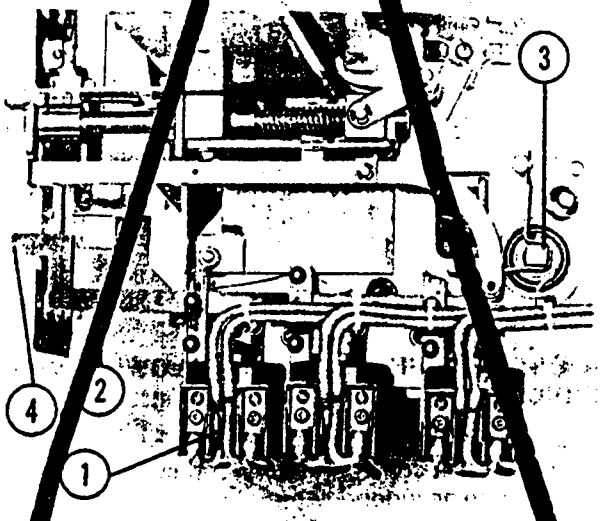
The anti-single phase device is supplied on all frame sizes. The unit consists of three trip solenoids each acting upon an independent slide, which in turn acts directly onto the trip mechanism. When activated by the solenoid, the slide moves forward and latches in this position thus locking the breaker in a trip-free state. Each solenoid coil is connected in parallel across the corresponding power fuse and in normal operation the trip coil is, in effect, shorted out.

The slides are colour coded, red, yellow and blue, and when tripped they protrude through an aperture in the faceplate (Ref. Figure 2), thus providing a blown fuse indicator. Red indicates the left hand phase, yellow centre and blue right hand. To reset, the slide is lifted and pushed in at the faceplate opening. The breaker cannot be reclosed until the anti-single phase device and blown fuse indicator is reset.

Two coil voltage ratings are available, one for system voltages 240 or less, and one for systems 480 to 600 volts. The coils are identified by colour coded leads — the 240 volt carries blue leads, the 600 volt rating is fitted with red leads.

A simple mechanical check of the unit can be made by raising each plunger by hand to observe movement of the corresponding slide and rotation of the trip shaft. The plunger must be raised firmly against the internal stop to ensure that full travel is attained. An electrical test may be performed by means of a single phase variable ac source, 25 va or larger. The test signal is applied directly to the trip coil terminals after first disconnecting one of the connecting leads. This is necessary to isolate the trip coil from the power fuse. The 240 volt coil should operate at approximately 50 volts and the 600 volt rating at approximately 100 volts. In this test it should be noted that these coils are short-time rated and in normal operation are de-energized the instant the breaker opens. A preset voltage and a momentary on-off switching action is recommended. Do not sustain the test power after the coil has operated.

FIGURE 2
ANTI SINGLE PHASE DEVICE



1. Solenoid
2. Slide
3. Trip shaft
4. Blown fuse indicator

SECONDARY CONTROL CONTACTS (Fig. 27)

Secondary control contacts are provided on drawout units to automatically connect or disconnect control circuits, as the circuit breaker moves through its positions in the cradle. The contacts are designed such that the control circuit can be energized or isolated in the test position. These connections can be altered in the field, when required, by means of jumpers between contacts of the stationary block.

Supplied in multiples of 8 contacts, a total of 40 can be provided, and each contact has a continuous current rating of 30 amperes. In applications where a control supply voltage in excess of 250 is to be used, the higher voltage contacts are double spaced (i.e. the adjoining contact is unused). Cell switches can be provided when required to serve as position indicators or external electrical interlocks. Operated by the movement of the carriage, each switch contains one normally closed and one normally open contact, electrically separate. These contacts are rated 10 amperes at 600 volts. A total of four such switches can be supplied.

AUXILIARY SWITCH (Fig. 5)

On all H-2 and HL-2 units a multi-section rotary switch is used. It is coupled directly to the closing shaft and operates on a snap-action principle which provides quick break switching. No adjustment is required and the switch is available in the following contact arrangements:-

4-pole—providing 2 normally open and 2 normally closed
8-pole—providing 4 normally open and 4 normally closed
12-pole—providing 6 normally open and 6 normally closed
20-pole—providing 10 normally open and 10 normally closed

The following contact ratings may be applied:-

20 amperes @ 600 volts ac

DOOR INTERLOCK (Fig. 25)

All H-2 and HL-2 circuit breakers may be fitted with a device which trips to trip the unit when the cell door is opened. In operation the door interlock acts internally on the mechanical trip button causing it to move in towards the faceplate. The interlock may be defeated by actuating the movement of the trip button. A screwdriver blade or similar tool inserted through the slot in the trip button will allow the door to be opened without tripping the circuit breaker.

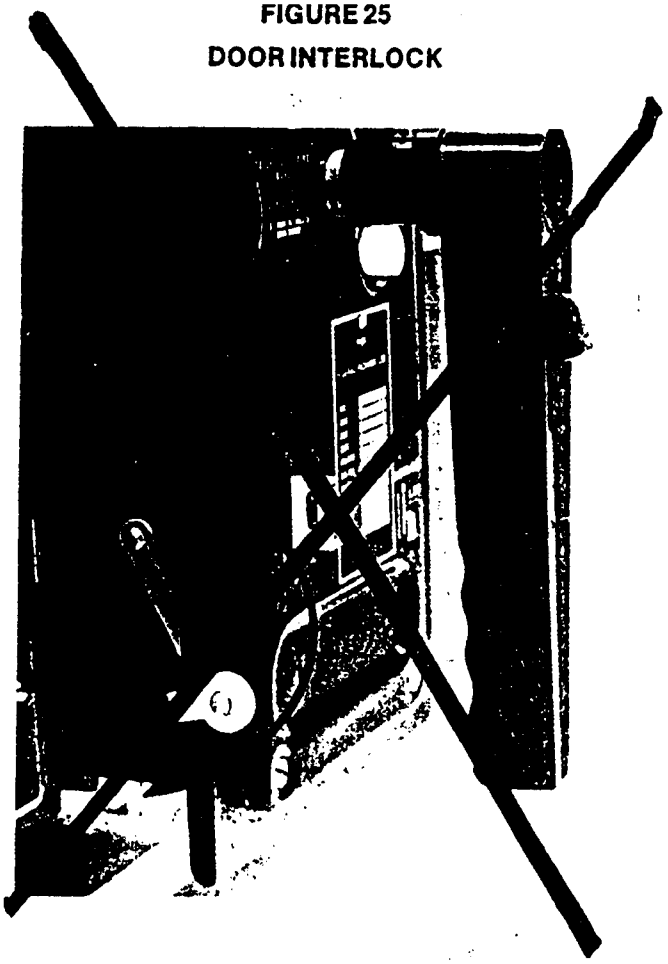
KEY INTERLOCKS (Fig. 26)

Key interlocks type VF single or double interlock with 3/8" (9.5 mm) projection which mount with ¼-20 screws behind the faceplate can be provided. Key interlocks can be installed in the factory or provision for key interlocks is available as an option.

The lock plunger engages the tapered section of the manual trip button when the key is removed. With the key removed the closing mechanism is completely trip free thus preventing movement of the main contacts. For electrically operated units an auxiliary contact is provided to operate in conjunction with the interlock to isolate the closing circuit.

FIGURE 25

DOOR INTERLOCK

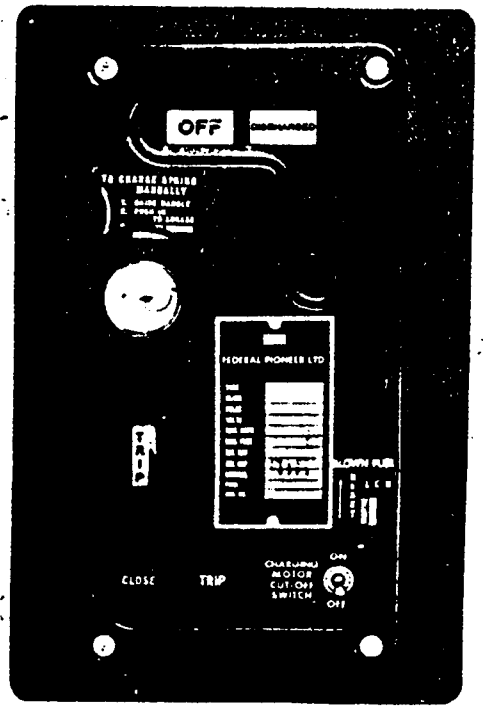


SPARE PARTS (Fig. 27)

By the nature of its application and its switching capability spare parts for the circuit breaker should generally not be required. If the unit is going to be used for frequent load switching, then the parts shown on the recommended spare parts list should be carried in stock. When ordering spare parts please provide complete nameplate data, especially the Serial No. to ensure that correct parts are supplied.

FIGURE 26

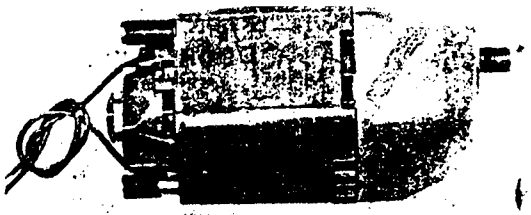
KEY INTERLOCK



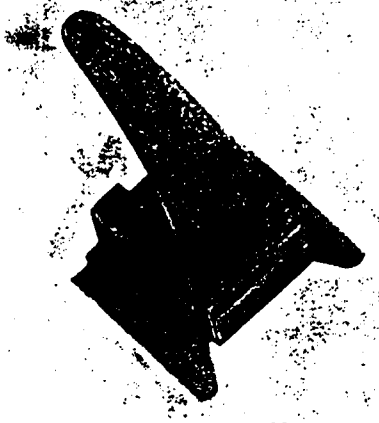
COIL DATA

	RATED CONTROL VOLTAGE	D.C. OHMS	AMPERES INRUSH	AMPERES SEALED
SHUNT TRIP TYPE A	~~24DC~~	~~3.0~~	~~4.0~~	
	~~48DC~~	~~6.0~~	~~4.0~~	
	120AC	30.5	2.45	0.34
	~~125DC~~	~~66.0~~	~~2.0~~	
	~~250DC~~	~~312.0~~	~~0.8~~	
SHUNT TRIP TYPE B	~~24DC~~	~~6.4~~	~~3.0~~	
	~~48DC~~	~~24.0~~	~~2.0~~	
	120AC	14.0	1.4	
	~~125DC~~	~~40.0~~	~~2.0~~	
	~~250DC~~	~~200.0~~	~~1.26~~	
SHUNT CLOSE	~~24DC~~	~~3.0~~	~~8.0~~	~~0.2~~
	~~48DC~~	~~6.0~~	~~8.0~~	~~0.15~~
	120AC	30.5	2.45	0.34
	~~125DC~~	~~33.0~~	~~2.0~~	~~0.2~~
	~~250DC~~	~~312.0~~	~~0.8~~	~~0.1~~
NO VOLT TRIP	120AC	30.5	2.45	0.34
	250DC	312.0	0.8	0.1
ANTI SINGLE PHASE TRIP	240	14.0	2.8	
	480	56	1.8	
	600	50.0	2.5	

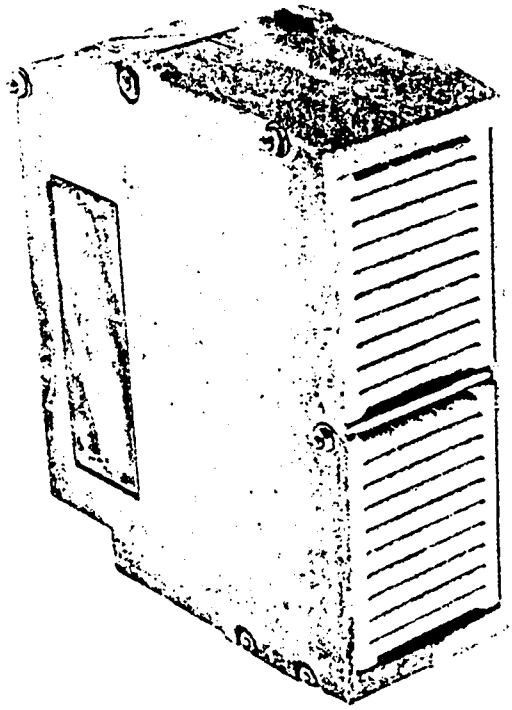
CHARGING MOTOR
48V DC - 7 AMPS
120 AC - 4 AMPS
125 DC - 4 AMPS
250 DC - 2.5 AMPS



CHARGING MOTOR



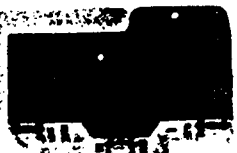
STATIONARY ARCING CONTACT



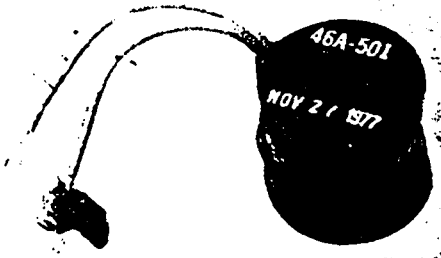
ARC CHUTE

BRAID

MOVING ARCING CONTACT

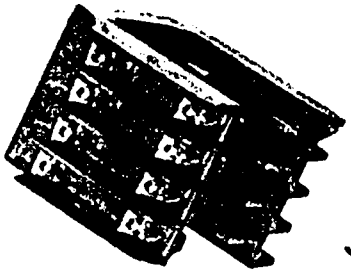


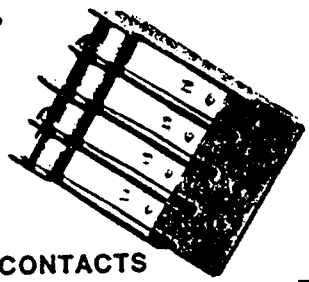
LIMIT SWITCH



SOLENOID COIL
SHUNT TRIP TYPE B
ANTI SINGLE PHASE TRIP

SOLENOID COIL
SHUNT TRIP TYPE A
NO-VOLT TRIP
SHUNT CLOSE





SECONDARY CONTROL CONTACTS

FIGURE 27
SPARE PARTS