FEDERAL PIONEER

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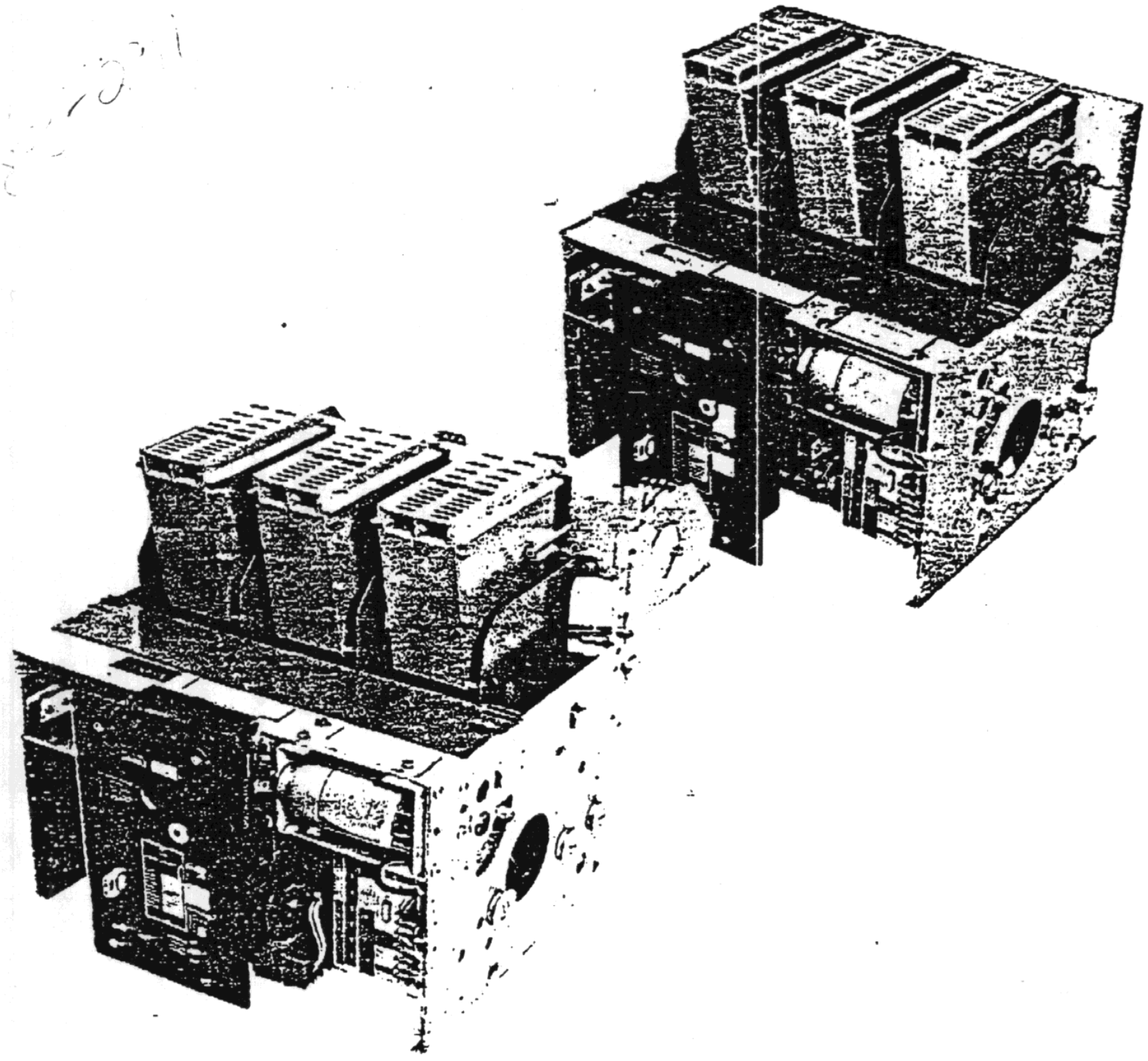
INSTRUCTIONS
FOR THE CARE AND MAINTENANCE OF

H-3 AND HL-3 CIRCUIT BREAKERS



This manual applies to H-3 and HL-3 breakers.

For H-2 and HL-2 breakers, consult the following instruction manuals:

For breakers with serial numbers BH consult Instruction Manual C-3-221-1 dated September 1979.

For breakers with serial numbers TH consult Instruction Manual C-3-221-1 dated March 1976.

For breakers with serial numbers T consult Instruction Manual C-3-414 dated August 1966.

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Before placing in service read this Instruction Manual completely and perform the pre-service inspection (see page 4).

GENERAL

Type H-3 and HL-3 power Air Circuit Breakers are suitable for controlling and protecting low voltage power circuits up to 250 volts dc and 600 volts ac. They are a means of safely switching loads and automatically clearing circuits when abnormal conditions occur such as undervoltage, sustained overloads, and short circuits.

The proper INSTALLATION, MAINTENANCE and OPERATION of these breakers is a prime safety consideration for the protection of personnel and equipment. Reference to this manual and adherence to its recommendations will enhance the performance of these breakers under all conditions.

This manual does not purport to cover all details or variations of equipment nor to provide for every possible contingency to be met in connection with receiving, storage, installation, maintenance or operation. Should further information be required or particular problems arise which are not covered sufficiently, please refer to Federal Pioneer Limited.

BASIC BREAKER TYPES

Type H-3 breakers are available mounted in a drawout cradle with disconnecting primary power and secondary control contacts. Alternatively a stationary fixed mounting in a suitable enclosure can be provided.

These breakers are provided with either a manually operated handle or an electric motor for compressing the closing spring.

HL-3 type breakers are available in the drawout version only, either manually or electrically operated. HL-3 type breakers are similar to the H-3 type but in addition have high rupturing capacity fuses mounted on the line side on a frame extension at the rear of the unit.

BREAKER DESCRIPTION

The three main functional components of a breaker are its mechanism, the conductive members and the interrupting devices.

The mechanism unit is designed to receive energy, store it, and deliver it to close the breaker contacts when required. Upon activation of the trip device, the mechanism must allow the contacts to open regardless of the state of the mechanism, that is the breaker mechanism is "TRIP FREE".

The conductive members are assembled on a moulded base of fiberglass reinforced polyester. Individual pole pieces carefully interlocked together and supported by a steel frame provide the mechanical support and insulating structure required. The conductive members comprise the main power contacts (drawout mounting) or lugs (fixed mounting), the main fixed contacts and the main moving bridge contacts.

The interrupting devices are the fixed and moving arcing contacts and the arc chutes.

In addition to these main functional components the breaker is available with overload protection and other accessories and interlocking devices.

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, arc chutes, or 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.

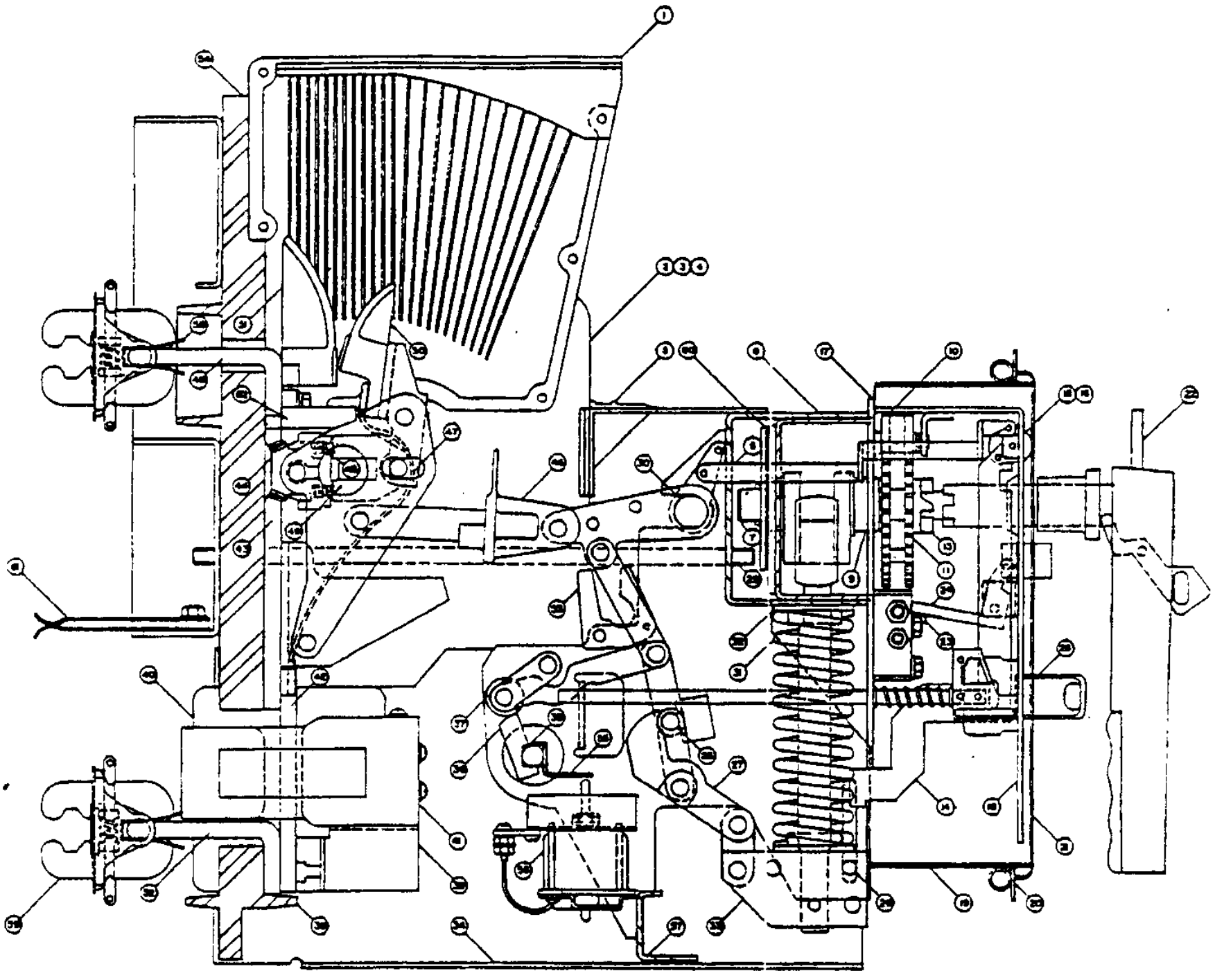
Further turns of the racking handle will move the unit to the "disconnected" position. It is then free to be pulled manually forward to the end of the tracks. Two lifting lugs are provided on each side of the unit so that it can be lifted clear of the tracks. Lifting yokes are available from the manufacturer. (Fig. 32).

Grounding continuity is established $^1/_8$ inch (3.2 mm) before the secondary control contacts are energized. It is maintained throughout breaker positioning in the enclosure until the secondary control contacts have been de-energized by $^1/_8$ inch (3.2 mm). Grounding continuity is established when the moving ground contact on the breaker mates with the stationary ground contact located on the frame of the breaker enclosure.

PART NUMBERS AIR CIRCUIT BREAKERS (DRAWOUT)

FIGURE 1 SECTION OF H-3 BREAKER	Type 30H-3 600 and 800 Amp	Type 50H-3 1600 Amp	Type 50H-3 2000 Amp	Type 50 and 75H-3 3000 and 3200 Amp	Type 100H-3 4000 Amp
1. Arc Chute Assembly	41A-504D	41A-504D	41A-504D	41A-504D	41A-504D
2. Interphase Barrier	13A-574C	13A-574C	13A-574C	13A-578C	13A-578C
3. R. H. End Barrier	13A-575C	13A-575C	13A-575C	13A-172A-1	13A-172A-1
4. L. H. End Barrier	13A-576C	13A-576C	13A-576C	13A-172A-1	13A-172A-1
5. Front Flash Shield	182A-542B	182A-542B	182A-542B	182A-40A-1 (-41A-1)	182A-40A-1 (-41A-1)
6. Closed-Open Link	170A-585	170A-585	170A-585	170A-585	170A-585
7. Crank Assembly	54C-507	54C-507	54C-507	54C-507	54C-507
8. Crank Box	24A-15A-2	24A-15A-2	24A-15A-2	24A-15A-2	24A-15A-2
9. Crank Box Bearings	29B-514	29B-514	29B-514	29B-514	29B-514
10. Holding Pawl	210A-505	210A-505	210A-505	210A-505	210A-505
11. Ratchet Wheel	35A-508	35A-508	35A-508	35A-508	35A-508
12. Oscillating Lever	168B-592	168B-592	168B-592	168B-592	168B-592
13. Clutch	45A-8	45A-8	45A-8	45A-8	45A-8
14. Charged-Discharged Link	168B-580	168B-580	168B-580	168B-580	168B-580
15. Closed-Open Button	182A-567B	182A-567B	182A-567B	182A-567B	182A-567B
16. Charged-Discharged Button	182A-568B	182A-568B	182A-568B	182A-568B	182A-568B
17. Front Plate	53M-65A-3	53M-65A-3	53M-65A-3	53M-65A-3	53M-65A-3
18. Indicator Plate	53M-64A-3	53M-64A-3	53M-64A-3	53M-64A-3	53M-64A-3
19. Faceplate Box Assembly	24A-8	24A-8	24A-8	24A-8	24A-8
20. Floating Trim	267A-1	267A-1	267A-1	267A-1	267A-1
21. Faceplate Assembly	84A-10C-2	84A-10C-2	84A-10C-2	84A-10C-2	84A-10C-2
22. Handle Assembly	115G-500	115G-500	115G-501	115G-501	115G-501
23. Close Lever	168B-39A-3	168B-39A-3	168B-39A-3	168B-39A-3	168B-39A-3
24. Close Latch	35A-509	35A-509	35A-509	35A-509	35A-509
25. Trip Rod Assembly	224B-124A-1	224B-124A-1	224B-124A-1	224B-124A-1	224B-124A-1
26. Spring Guide Pin	201B-88	201B-88	201B-88	201B-88	201B-88
27. Closing Casting	168A-3	168A-3	168A-3	168A-3	168A-3
28. Closing Pin	201B-72	201B-72	201B-72	201B-72	201B-72
29. Tie Rod Assembly	235D-17	235D-17	235D-17	235D-17	235D-17
30. Closing Shaft	170A-590	170A-590	170A-590	170A-593	170A-593
31. Main Spring	242A-510	242A-511	242A-511	242A-512	242A-512
32. Guide Bushings	29B-512	29B-512	29B-512	29B-512	29B-512
33. Clamp Assembly	42B-500	42B-500	42B-500	42B-500	42B-500
34. Breaker Frame	81A-566	81A-566	81A-566	81A-567	81A-567
35. Trip Shaft	235B-26	235B-26	235B-26	235B-26	235B-26
36. Trip Latch	168B-96	168B-96	168B-96	168B-96	168B-96
37. Latch Bearing	16A-9	16A-9	16A-9	16A-9	16A-9
38. Lower Moulding	182A-509D	182A-509D	182A-509D	14C-543	14C-543-1
39. Sensor Mounting Bracket	26G-606	26G-606	26G-606	26G-627	26G-627
40. Barrier	182A-24(-25)	182A-24(-25)	182A-24(-25)	182A-24(-25)	182A-24(-25)
41. Sensor	CSD-6(-8)	CSD-16	CSD-20	CUD-30(-32)	CUD-40
42. Jumper	147B-511	147D-503	147D-503	147D-510	147D-510
43. Centre Stationary Main Contact	49E-577	49E-550	49E-550	49E-550	49E-550
44. Main Moving Contact (Wafer Assy)	49E-575	49E-575	49E-575	49E-575	49E-575
45. Upper Stationary Main Contact	49E-554	49E-548	49E-549	49E-548	49E-549
46. Closing Link Assembly	170A-589	170A-589	170A-589	170A-589	170A-589
47. Braid	27A-500	27A-500	27A-500	27A-500	27A-500
48. Wafer Contact Spring	242A-521	242A-520	242A-520	242A-521	242A-521
49. Spring Holder	55B-502	55B-502	55B-502	55B-502	55B-502
50. Moving Arcing Contact	49E-552	49E-552	49E-552	49E-552	49E-552
51. Stationary Arcing Contact	49E-551	49E-551	49E-551	49E-551	49E-551
52. Load Terminal	271A-584	271A-507	271A-506	271A-507	271A-506
53. Anti-Bounce Plate	53L-545	53L-545	53L-545	53L-545	53L-545
54. Base Moulding	182A-548D	182A-548D	182A-548D	182A-548D	182A-548D
55. Trip Flipper	79A-517	79A-517	79A-517	79A-517	79A-517
56. Trip Coil Assembly	240A-514	240A-514	240A-514	240A-514	240A-514
57. Lower Channel	39A-530	39A-530	39A-530	39A-531	39A-531
58. Finger Spacer	26H-78	26H-503		26H-503	
59. Drawout Contact Assembly	49E-130	49E-519	49E-572(-573)	49E-519	49E-574
60. SLS Cam	35A-512	35A-512	35A-512	35A-512	35A-512
61. Ground Stab	49C-513	49C-513	49C-513	49C-513	49B-274A-1
62. Lower Flash Shield	13A-566B	13A-566B	13A-566B	13A-566B	13A-566B
(FIXED) 45. Upper Stationary Main Contact	49E-555	49E-549	49E-549	49E-549	49E-549

FIGURE 1



SECTION OF H-3 BREAKER

SPRING COMPRESSES UP

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

FIXED MOUNTED BREAKERS

H-3 and HL-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 operations, without any distortion and undue vibration of the mechanism.

POWER TERMINAL CONNECTIONS

The H-3 and HL-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. 27).

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 undervoltage trip unit is attached hold it down 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, spring discharge lever Fig. 9, shunt trip Fig. 11 and 12, and undervoltage trip Fig. 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.

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 of this 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 until 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.

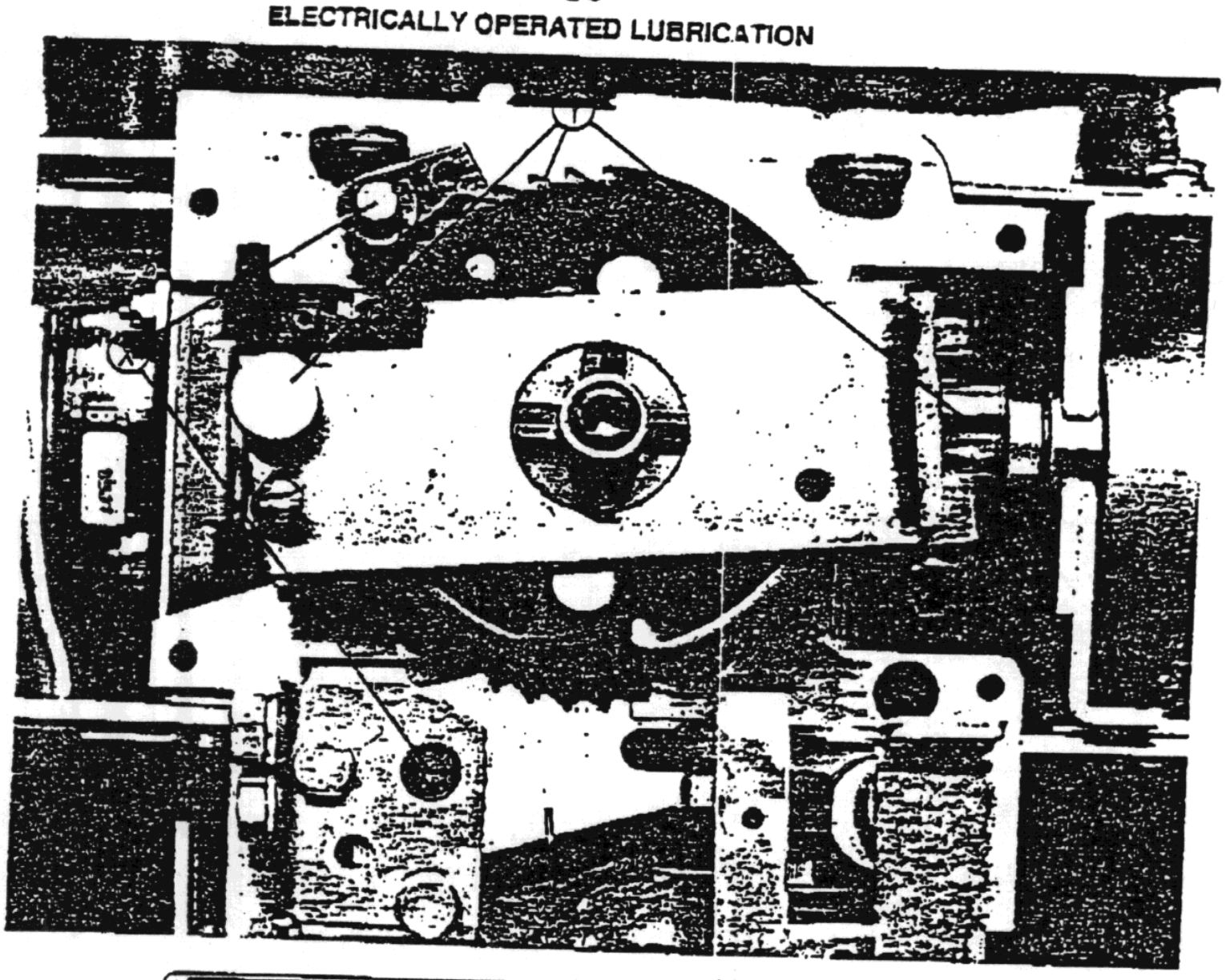
BREAKER MAINTENANCE

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-3 or HL-3 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.

FIGURE 3
ELECTRICALLY OPERATED LUBRICATION



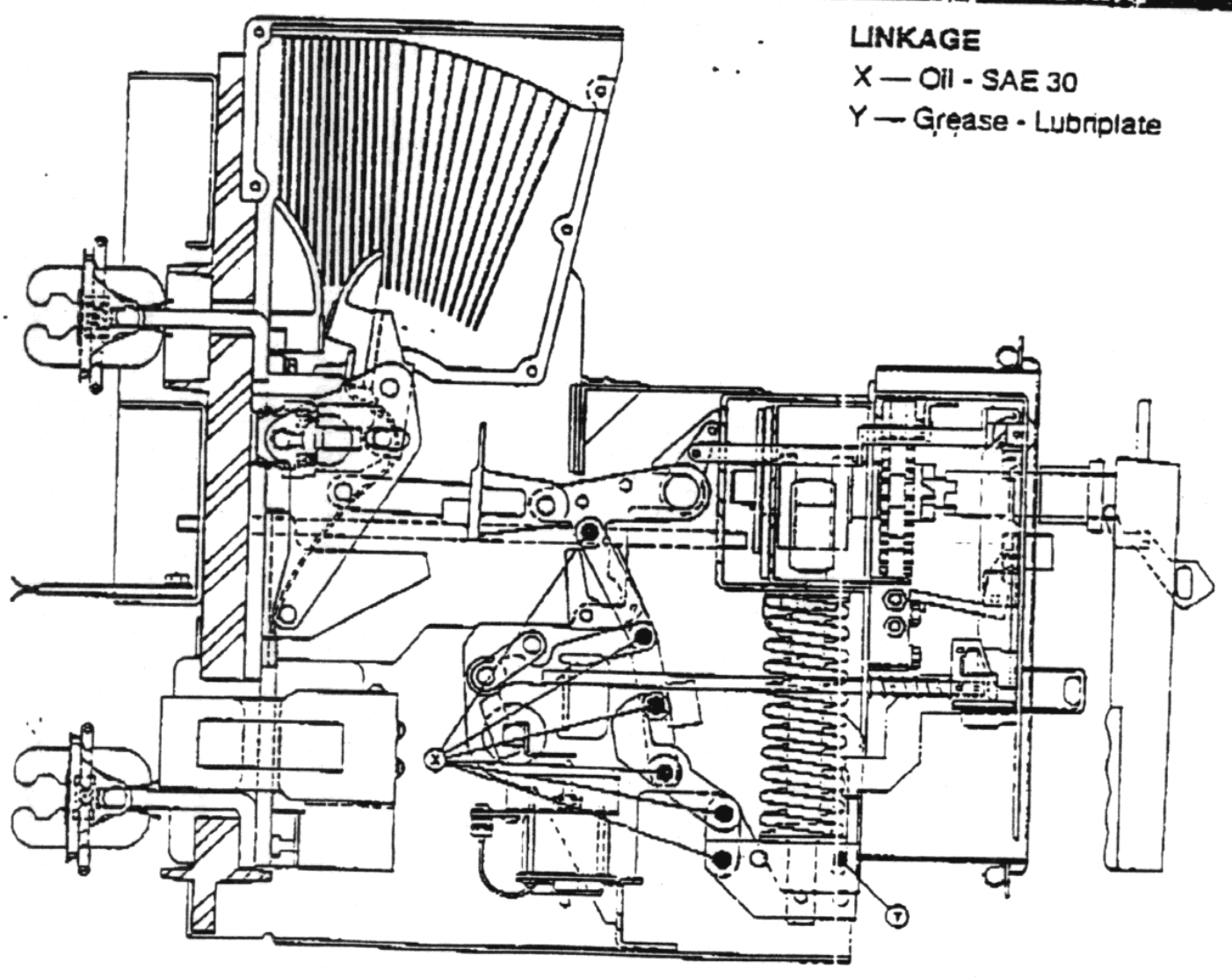
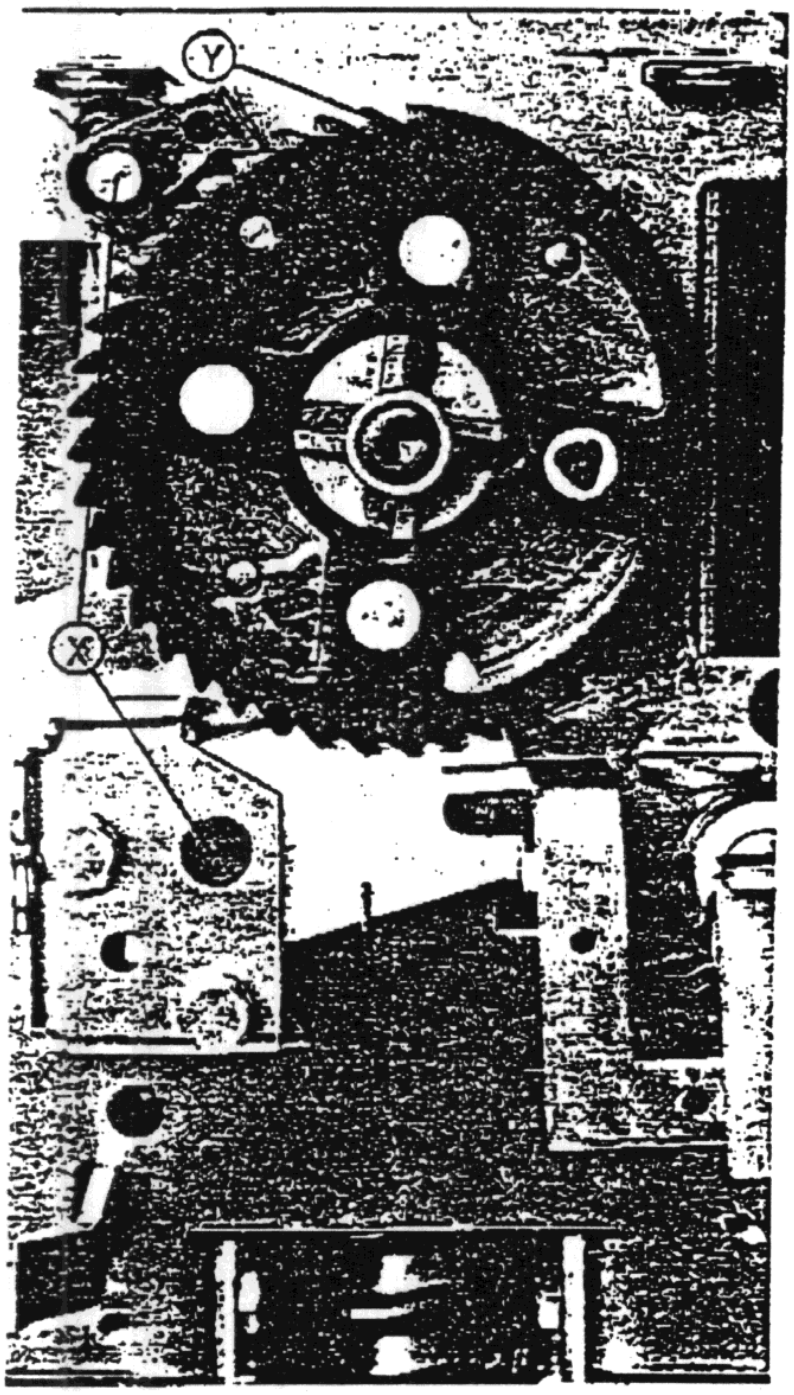


FIGURE 3
MANUALLY OPERATED
LUBRICATION



LINKAGE
X — Oil - SAE 30
Y — Grease - Lubriplate

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

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.)

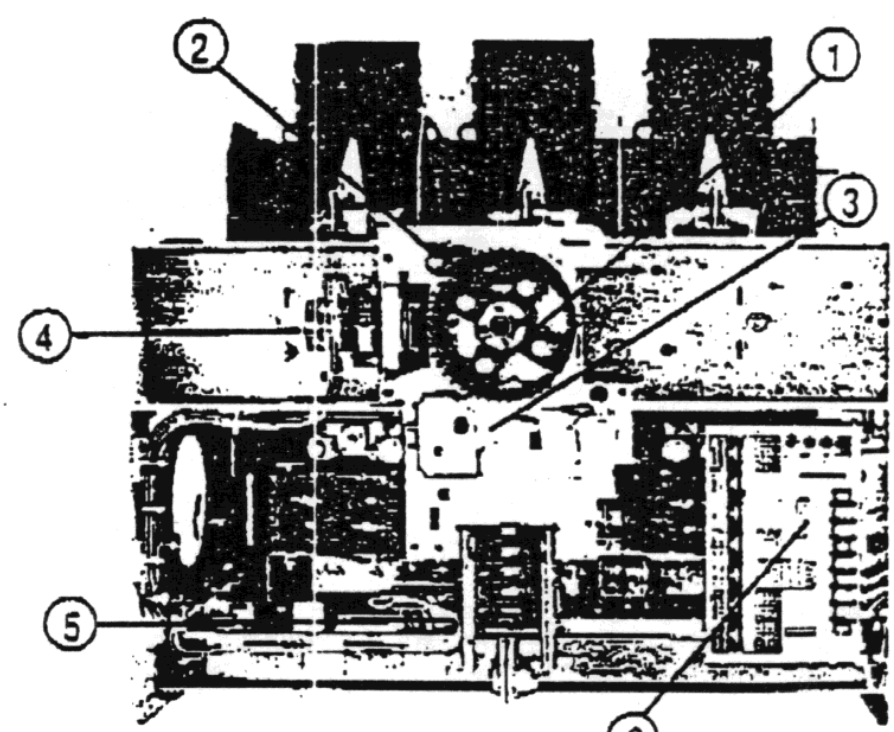
CLOSE LATCH ADJUSTMENT (Figs. 6(A) and 6(B))

The function of the close latch is to arrest or hold the ratchet wheel at a point 13 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(A), the adjustment procedure for the upper stopscrew 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 close latch (Item 2). Loosen locknut (Item 3). Turning the stopscrew (Item 4) counter-clockwise adjusts the close latch up. Adjust the close latch height until there is approximately $^1/_{32}$ inch (0.8 mm) clearance between the spacer and the nose of the close latch. Tighten the locknut securely.

Referring to figure 6(B), the adjustment procedure for the lower stopscrew is as follows. Be sure that the main spring is discharged and that the main contacts are open. Loosen locknut (Item 5). Manually depress the close latch (Item 2) until it stops on the lower stopscrew (Item 6). Adjust the close latch height until there is approximately $^1/_{32}$ inch (0.8 mm) clearance between the bottom of the teeth on the ratchet wheel and nose of the close latch. Tighten the locknut securely.



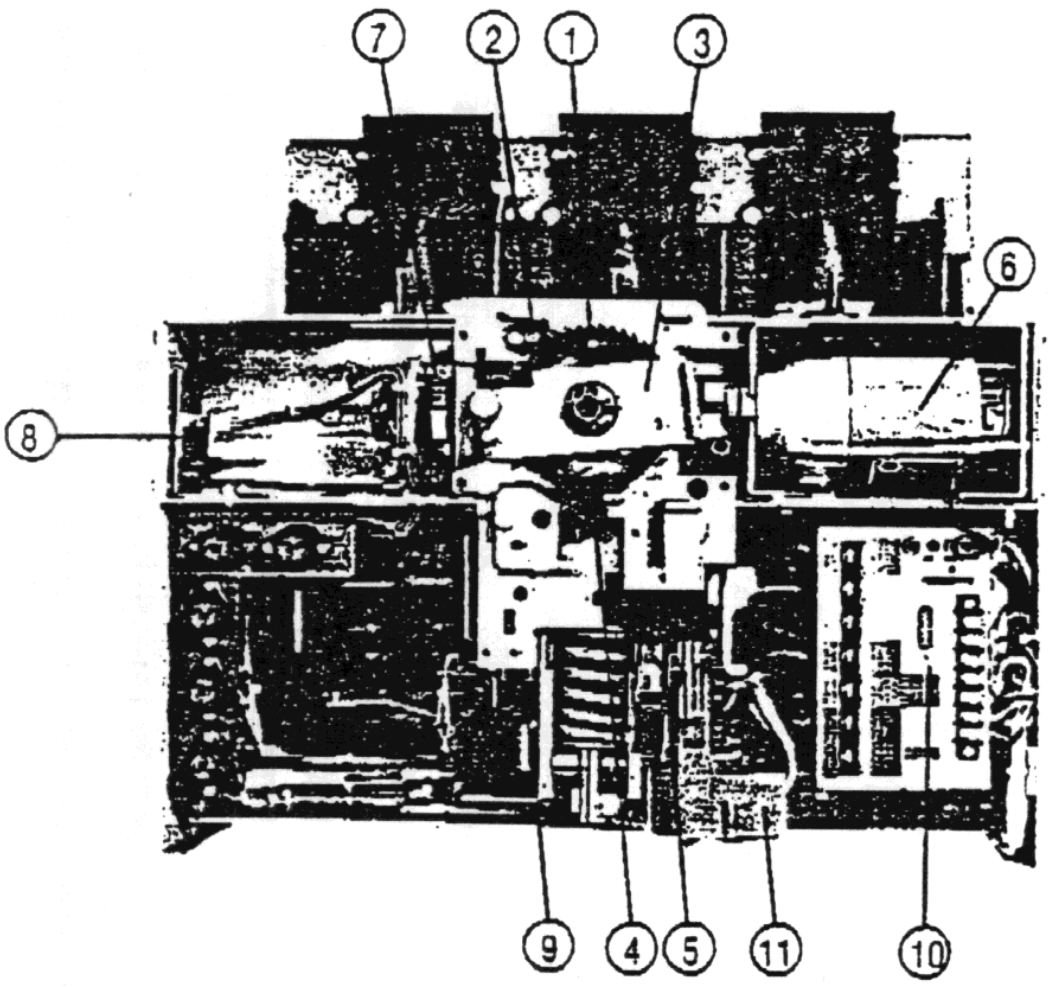


FIGURE 5
ELECTRICALLY OPERATED

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 and Blown Fuse Indicator

FIGURE 6(A)

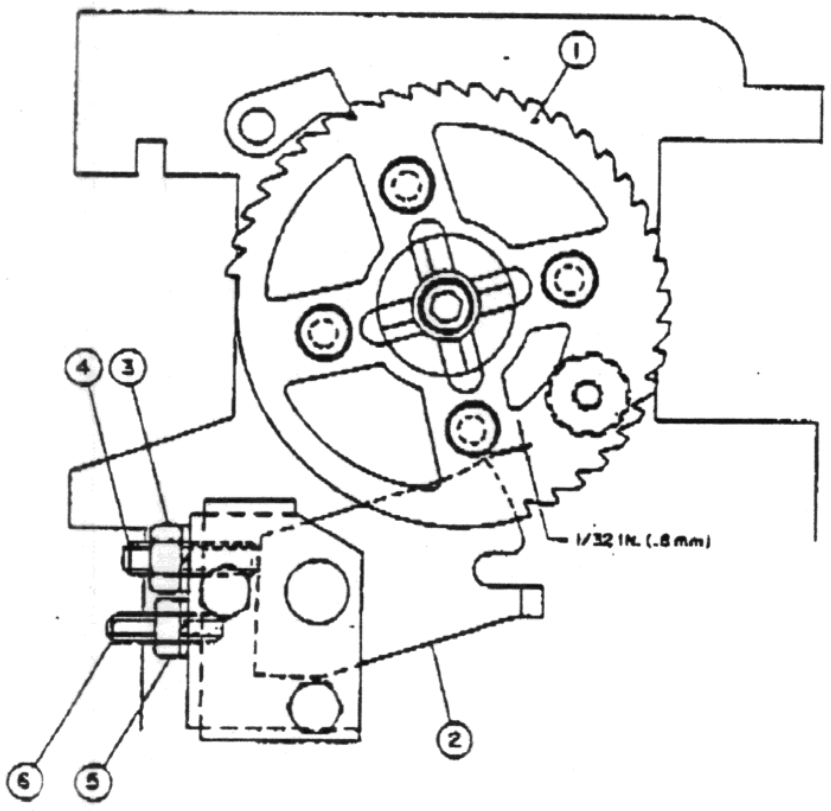
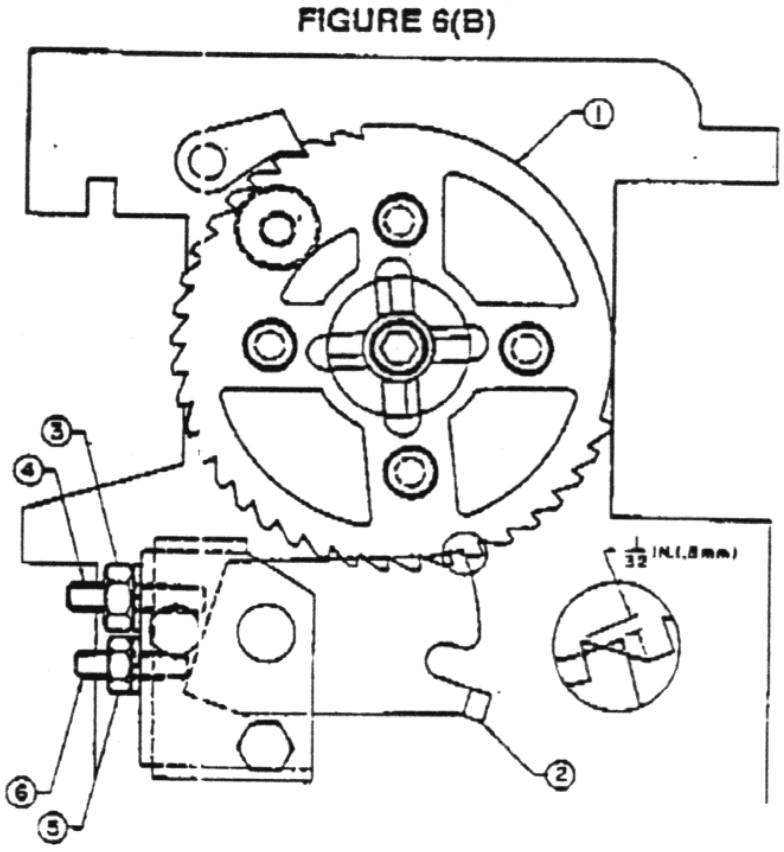


FIGURE 6(B)



CLOSE LATCH ADJUSTMENT

1. Ratchet Wheel
2. Close 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 will prevent latching with the same result as above. This adjustment controls the engagement of the trip roller with the trip shaft, and also the position of the toggle pin when the main contacts are in the closed position.

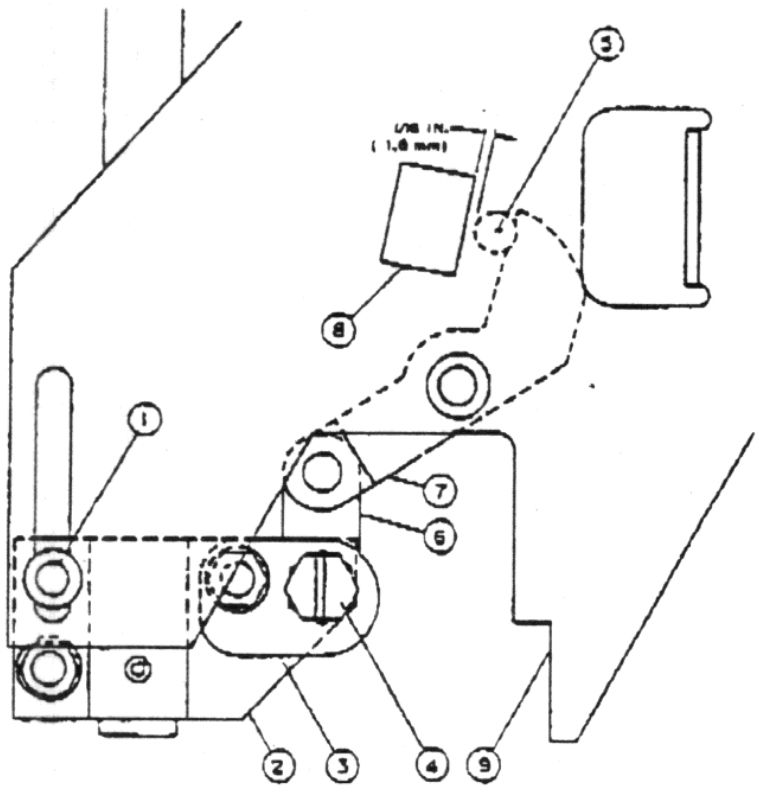
C) Insufficient overlap of the latch roller with the trip cam secured to the trip shaft. This condition will cause the moving contacts to pick up slightly and drop back to fully open position when the closing spring is discharged.

To correct A — Push manual reset lever. (Fig. 2).

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

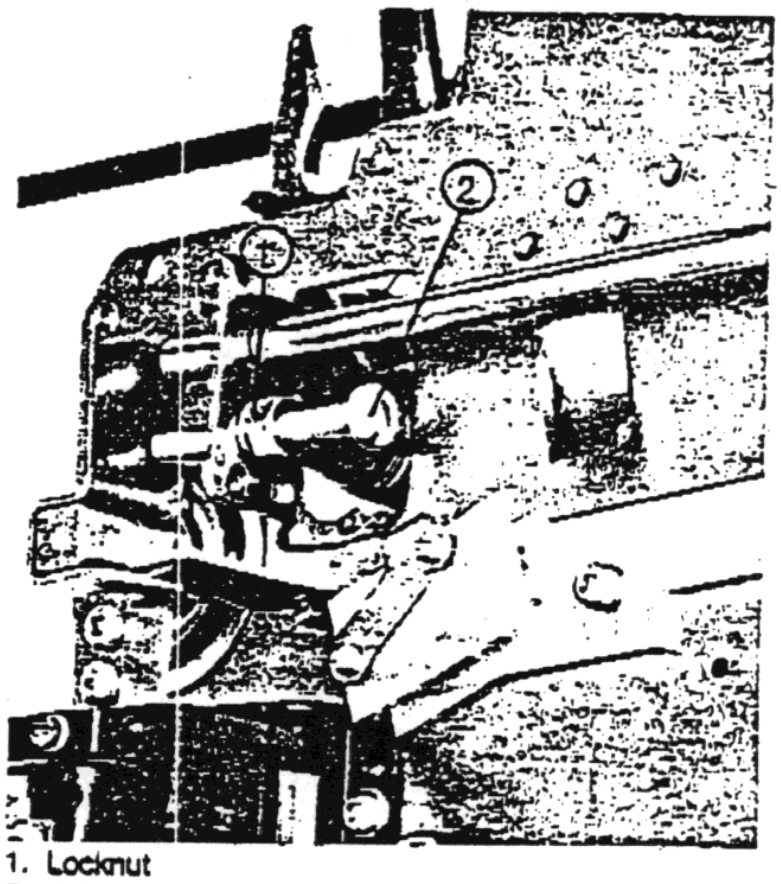
This adjustment is accomplished by means of an eccentric bolt accessible from the right hand side of the mechanism compartment. This eccentric moves the toggle pin (Item 5) relative to the stop in the sides of the mechanism compartment.

FIGURE 7
LINKAGE ECCENTRIC ADJUSTMENT



1. Spring Guide Pin
2. Main Spring Clamp
3. Locking Plate
4. Eccentric
5. Toggle Pin
6. Connecting Link
7. Closing Casting
8. Stop in Mechanism Sideplates
9. Mechanism Sideplate

FIGURE 8
TRIP SHAFT ADJUSTMENT



1. Locknut
2. Adjusting Screw

To proceed, isolate the breaker for servicing. Remove the arc chutes, front flash shield, interphase barriers, faceplate assembly, and faceplate box assembly. Be sure the main contacts are open and the main spring is discharged.

To ensure the main spring is completely discharged, a manual charging handle must be used to remove any spring force on the holding pawl, and driving pawl in the case of electrically operated breakers. Lift the holding and driving pawl away from the ratchet wheel. Releasing the manual charging handle now allows the main spring to completely discharge, with the crank assembly going to the bottom dead centre position, and the spring guide to its lowest point of travel.

Next remove the eccentric locking plate (Item 3). Rotate the eccentric bolt clockwise until the closing casting (Item 7) pushes the closing pin to within 1/16 inch (1.6 mm) away from the stops in the mechanism sideplates. This can be seen by viewing the mechanism sideplates from above. The locking plate should now be replaced, locating it to the nearest notch. Tighten the retainer nut firmly. 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.

To check the adjustment, close the main contacts. The closing pin should be against the stops in the mechanism sideplate. If it is not, proceed as follows.

With the main spring discharged and the main contacts open, remove the eccentric locking plate. Rotate the eccentric bolt clockwise an amount required to locate it in the next notch of the locking plate. The locking plate should now be replaced and the retainer nut firmly tightened. Return to the checking procedure above.

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.

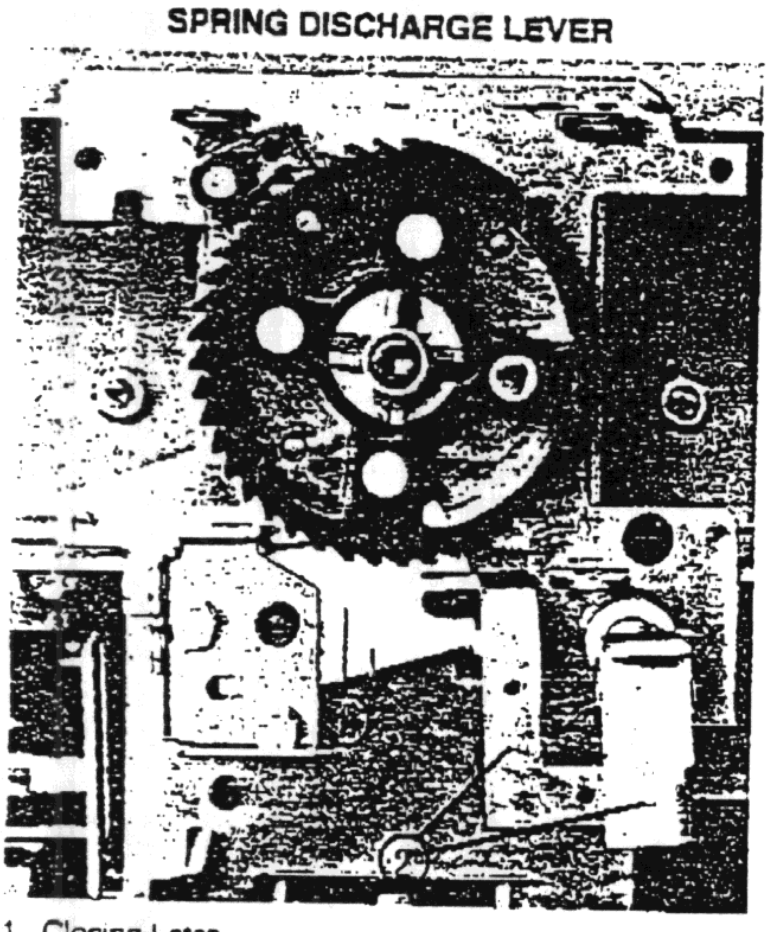
1. Latch Check Switch setting on electrically operated breakers (Fig. 16).
2. Shunt Trip Type B striker rod adjustment (Fig. 12).
3. Undervoltage trip striker adjustment (Fig. 13).
4. Drawout gate interlock lever eccentric adjustment on drawout breakers (Fig. 10).

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.

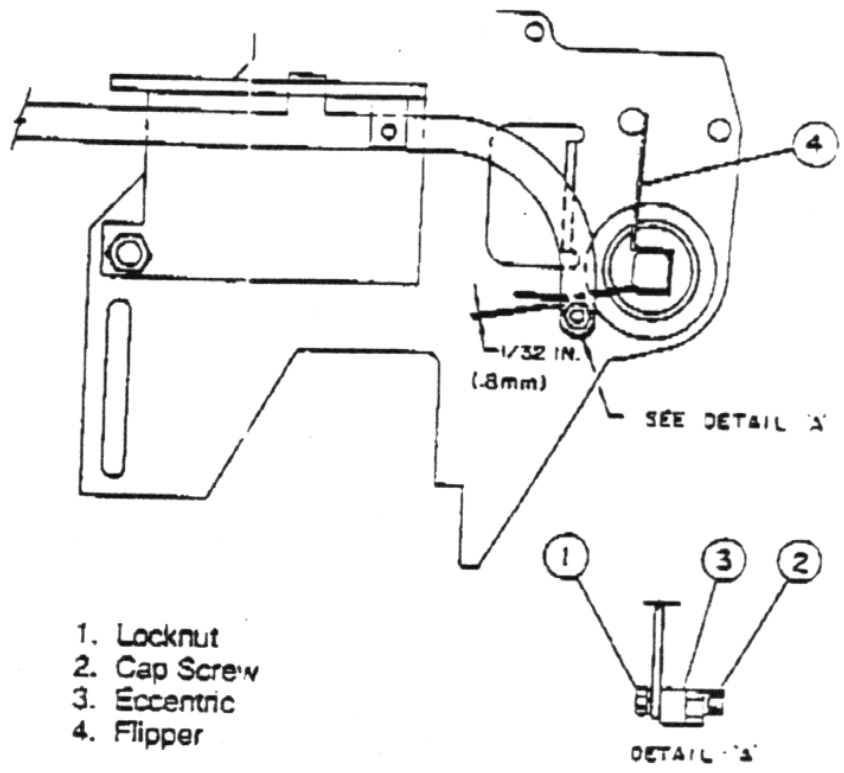
It should be noted that "empty" discharges of the closing spring stress the mechanism to a slightly greater extent than on normal closure. For this reason it is advisable to avoid additional intentional discharges to those which occur when the breaker is withdrawn and the spring is still charged.

FIGURE 9
SPRING DISCHARGE LEVER



1. Closing Latch
2. Spring Discharge Interlock Lever

FIGURE 10
ECCENTRIC ADJUSTMENT



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

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 right hand flipper (Item 4) on the trip shaft is approximately 1/32 inch (0.8 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.

SHUNT TRIP

Two types of shunt trip units are available for use on all H-3 and HL-3 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.

Type B (Fig.12)

This is a cylindrical solenoid mounted within the mechanism compartment 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.

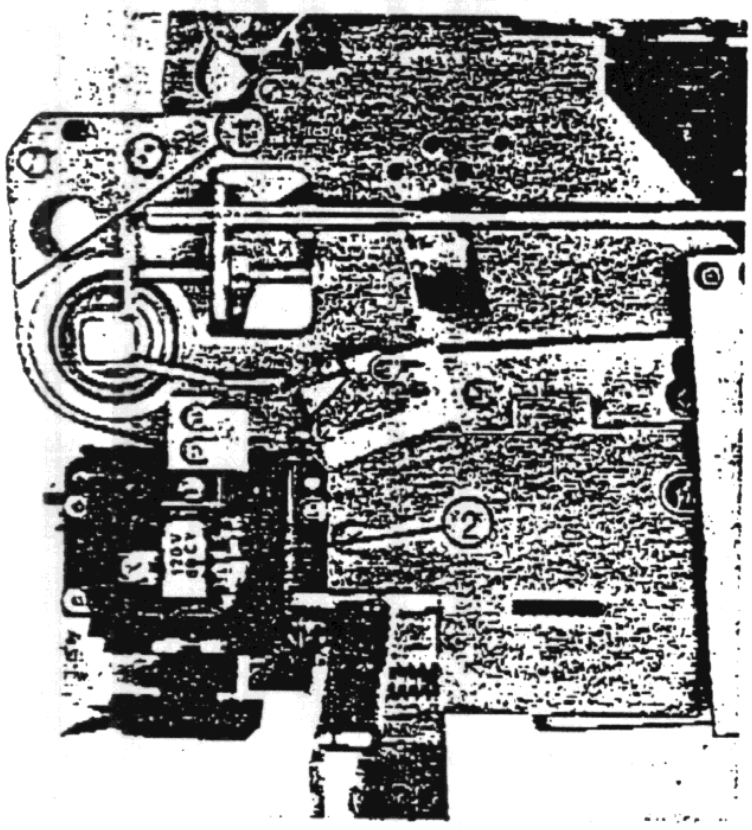
If adjustment is required, loosen the 8-32 socket head screw located at the bottom end of the plunger and turn the striker rod within the plunger as required. Retighten the set screw. If trip shaft adjustment (Fig. 8) is altered at any time, this striker rod adjustment should be checked.

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:

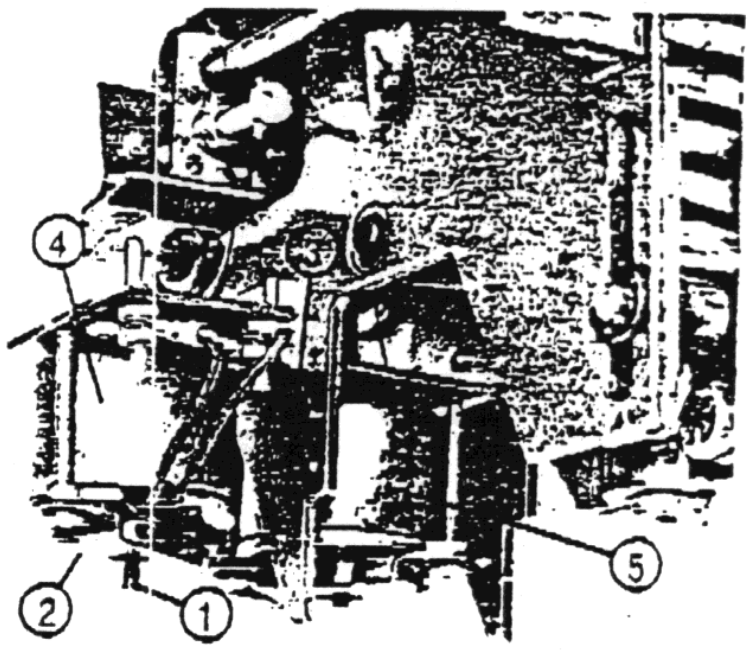
1. A Type B is used where only a separate trip coil is required.

FIGURE 11
SHUNT TRIP TYPE A



1. Mechanism Sideplate
2. Shunt Trip Type A

FIGURE 12
SHUNT TRIP TYPE B



1. Plunger
2. Stop Plate
3. Mechanism Sideplate
4. Shunt Trip (Separate Trip Source)
5. Shunt Trip (USD Relay Trip Source)

2. With USD 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 USD relay can both be used on the same unit.

UNDERVOLTAGE TRIP (Fig. 13)

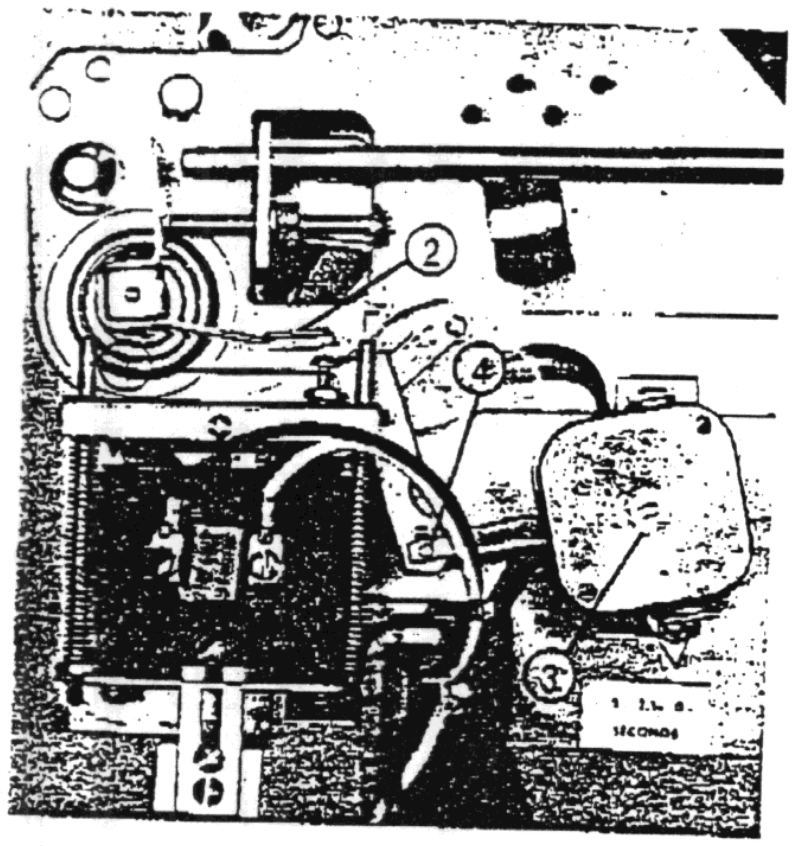
The Undervoltage Trip is a spring operated unit mounted on the left hand side of the main mechanism compartment and acting directly on the trip shaft. In operation two springs are held in compression by a rectangular solenoid.

Normally supplied in the 120 volt ac rating, the solenoid has a holding current of 340 milliamperes, with an inrush of 2.45 amperes. A mechanical escapement time delay attachment is available which provides a delay adjustable from 0 to 5 seconds.

An adjustable striker (Item 1) is provided to control the engagement of the solenoid plunger to the trip shaft. With the solenoid energized and the plunger seated, adjust the striker as required to provide a gap of 5/16 inch (8 mm) between the striker and the trip shaft lever. Tighten locknut firmly. If at any time the trip shaft adjustment (Fig. 8) has been altered the undervoltage striker adjustment should be checked.

A vernier time adjustment in the form of an eccentric is provided for fine adjustment, independent of the scale setting. If trimming is required, loosen the locknut located on the inside of the lever and turn the eccentric counter-clockwise to increase time, and clockwise to shorten time. The locknut must be firmly tightened each time the eccentric is moved.

FIGURE 13
UNDERVOLTAGE TRIP



1. Striker
2. Trip Shaft Lever
3. Timer
4. Vernier Time Adjustment

In operation, the undervoltage trip has a dropout of 35% of rated voltage for 120 V. a.c. and 46% of rated voltage for 240 V. a.c. Both have a pull-in of 85% rated voltage and are identified on the wiring diagram by the symbol "27".

SHUNT CLOSE (Fig. 14)

This accessory is supplied on 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 independent 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".

CLOSING SPRING CHARGING MOTOR

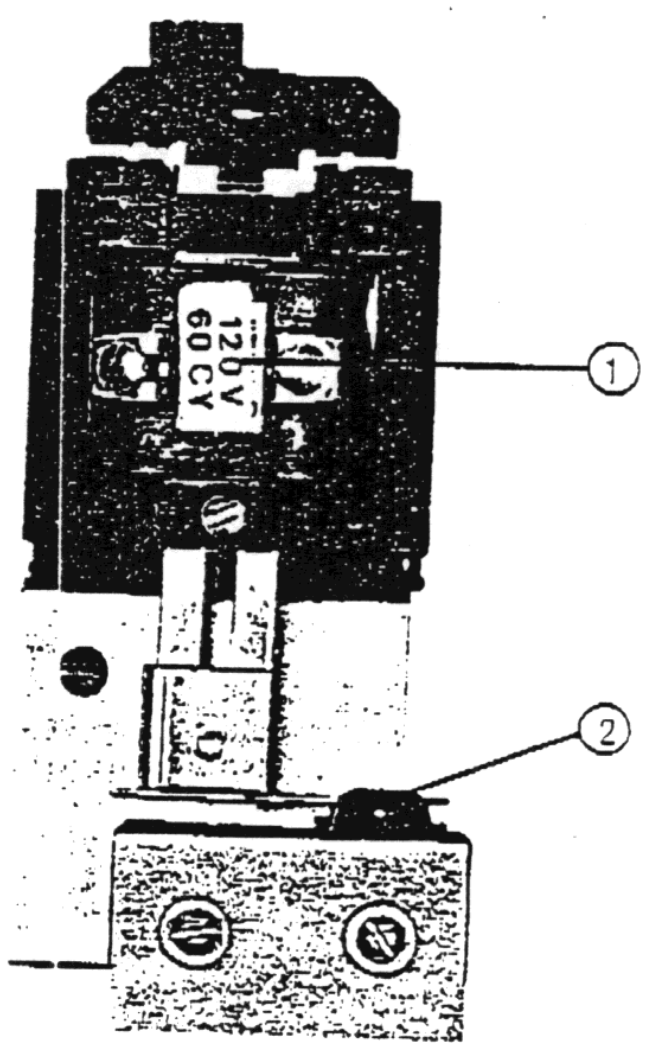
All electrically operated units employ a series-wound gear motor, suitable for operation on alternating or direct current. The reduction gear compartment is sealed and lubricated for life and the armature bearing similarly requires no maintenance lubrication. The basic motor is available in voltage ratings 48, 120, 250 dc and 120, 240 ac. In all alternating current applications above 240V a step down control transformer is used in conjunction with the 120 volt motor.

A toggle switch mounted in the faceplate permits the motor to be de-energized during maintenance or inspection. (Fig. 2).

Preferred control circuitry permits spring charging to take place after the breaker has tripped only. While a unit can be supplied to charge after close, this should be used only in applications requiring high speed reclosing. Unless otherwise specified all units are supplied to operate in the "charge after trip" sequence.

The charging motor is identified on the wiring diagram by the symbol "M".

FIGURE 14
SHUNT CLOSE



1. Shunt Close Coil
2. Independent Normally Closed Limit Switch

To remove the motor, first remove the bracket assembly from the frame channel, noting the number of shims at the top and bottom faces of the motor bracket. The drive cam and outboard bearing should then be removed. The drive cam is threaded to the motor output shaft and can be readily released by a light tap in the counter-clockwise direction. Remove the hex head bolt holding the front bracket to the motor. Next, remove the mounting screws at the end opposite to the drive and motor housing can be withdrawn from the rear bracket. When replacing the motor bracket assembly in the channel, replace the shims as originally installed. Do not tighten the hex head bolt holding the front bracket to the motor until the screws holding the motor brackets in the front channel have been tightened securely.

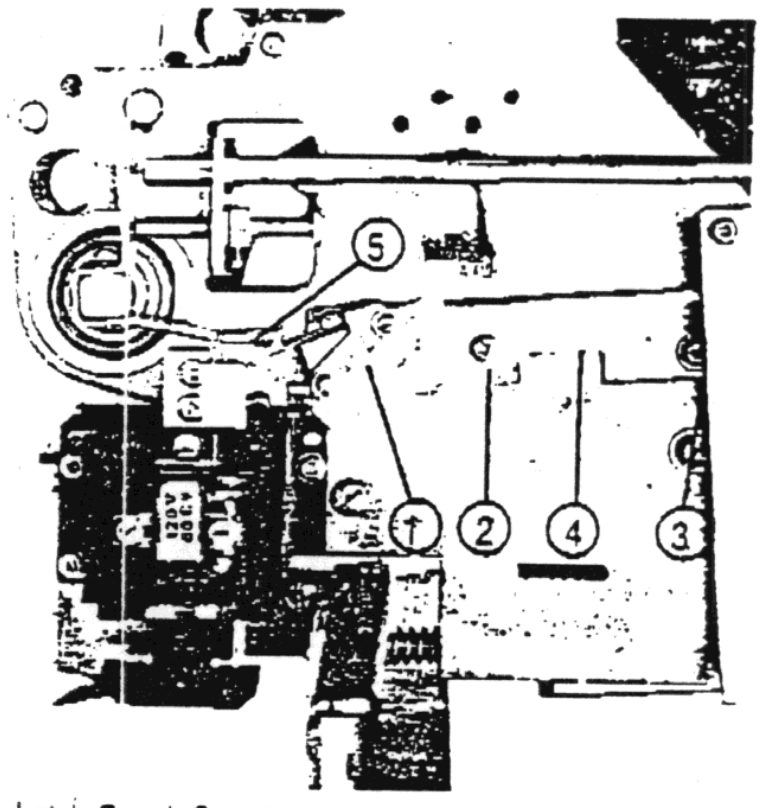
MOTOR CLOSING SPRING LIMIT SWITCH (Fig. 15)

All electrically operated H-3 and HL-3 units are equipped with a limit switch which stops the motor at the end of the charging stroke. The switch is mounted in the left hand end of the front channel. The switch is coupled with a lever actuator to a cam located on the rear of the crank assembly. As the crank passes through top-dead-centre and the ratchet wheel bearing approaches the close latch, the lever actuator moves to operate the switch and de-energize the motor. The lever actuator is reset when the main spring discharges. No adjustment is required for the motor closing spring limit switch.

LATCH CHECK SWITCH (Fig. 16)

The latch check switch is provided on electrically operated units to prevent any attempted electrical close until the trip shaft is completely reset and seated in readiness to close. The switch is connected in series with the shunt close solenoid and prevents operation of the solenoid until the trip shaft is fully seated. Failure of the trip shaft to be completely reset at the beginning of the close stroke will result in a trip free operation. This malfunction can occur in transfer switch installations where one circuit breaker is mechanically interlocked with its companion, and a signal to close enters before the trip shaft has fully returned to its stop. A key interlock or any form of mechanical lockout presents the same set of conditions.

FIGURE 16
LATCH CHECK SWITCH



1. Latch Check Switch
2. Pivot Screw
3. Lock Screw
4. Mounting Plate
5. Trip Shaft Lever

With reference to Fig. 16, adjustment of the latch check switch is performed as follows: With the circuit breaker open, loosen pivot screw (Item 2) and lock screw (Item 3). By lowering mounting plate (Item 4) at the front end, engage the switch roller to trip shaft lever (Item 5) until the lever just begins to lift. From this reference point, raise the front end of the mounting plate 1/16 inch (1.6 mm) and tighten both pivot and lock screws firmly.

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".

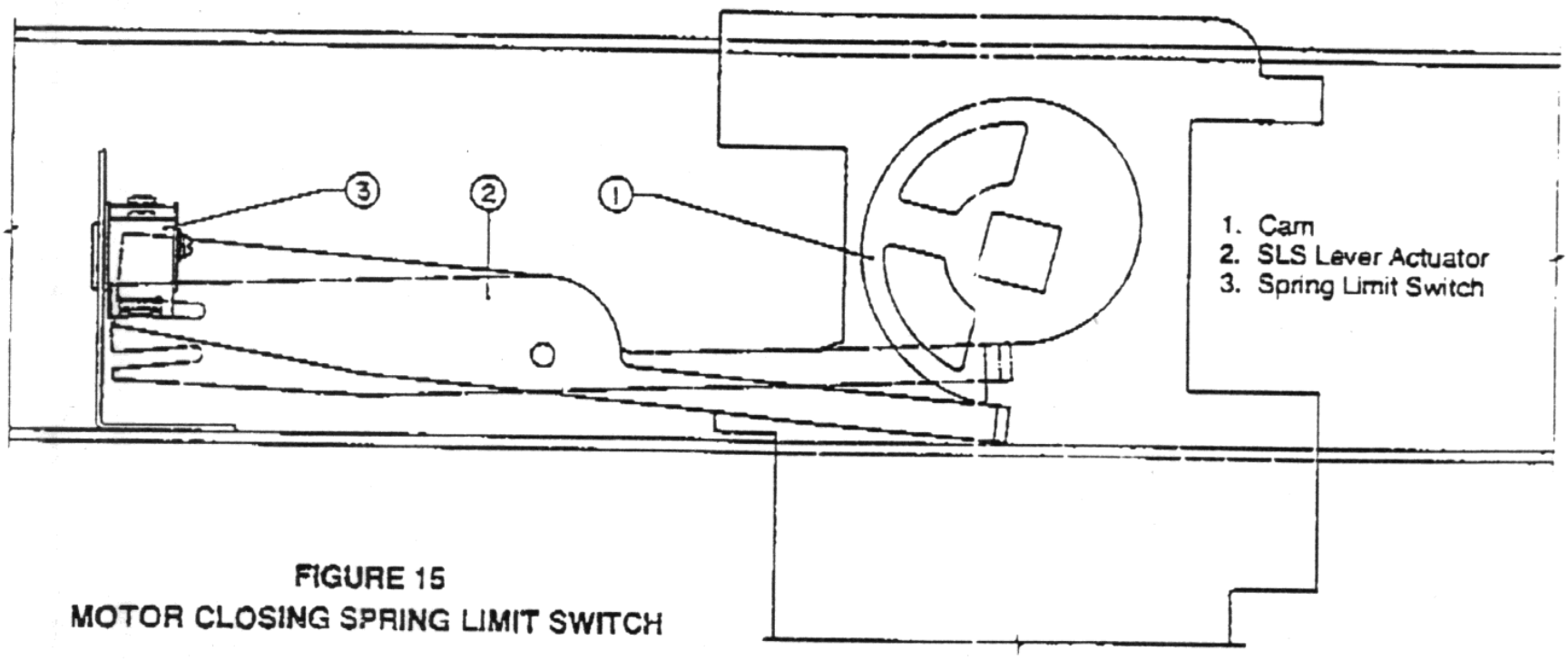


FIGURE 15
MOTOR CLOSING SPRING LIMIT SWITCH

CONTACT MAINTENANCE

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.

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 overheating and subsequent failure of the device. The alloy contacts of the type H-3 and HL-3 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.

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

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 and 18)

At intervals as recommended by ANSI standards (see paragraph on Lubrication), the differential between the main and arcing contacts should be checked. The differential should be maintained between the limits of 0.050 to 0.065 inches (1.3 to 1.6 mm). Using the slow close device (Fig. 18 (A)) close the contacts until the moving arcing contact touches the stationary arcing contact (Fig. 18 (B)). A gap of 0.050 to 0.065 inches (1.3 to 1.6 mm) between the main moving wafer contacts and the main upper fixed contact should exist. The gap is checked using a feeler gauge. If adjustment is necessary, shims (Fig. 17, Item 4) are placed between the stationary arcing contacts 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).

Note that it is not important nor necessary that the arcing contacts touch simultaneously. The differential should be measured on each pole by closing the contacts until the arcing contacts touch on the pole being measured.

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

MAIN MOVING CONTACT DEFLECTION

At intervals as recommended by ANSI standards (see paragraph on Lubrication), the deflection of the main moving contacts should be checked. The deflection should be maintained between the limits of 3/64 to 4/64 inches (1.2 to 1.6 mm) for 600, 800, 1600, and 2000 ampere frame sizes, and 2/64 to 3/64 inches (0.8 to 1.2 mm) for 3000, 3200, and 4000 ampere frame sizes. A gauge is available for measuring purposes which carries a scale graduated in 1/64 inch (0.4 mm) divisions. For the 1600 amp and larger frames use Gauge Number 96A-500, and for the 600 and 800 amp frame use Gauge Number 96A-501.

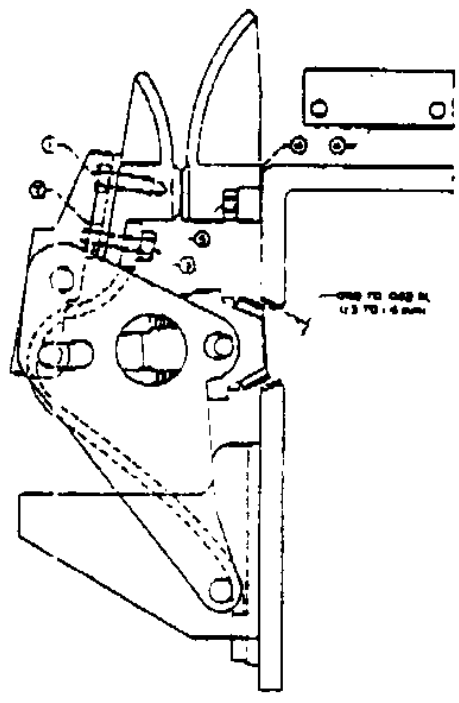
With the circuit breaker open establish the starting or "zero" point for each main moving contact assembly. Apply the gauge to the left hand side as shown in Figure 20 (A) and note the position of the pointer. To assist in positioning the gauge the pointer should be moved forward or "up scale" then released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

With the circuit breaker closed again apply the gauge as shown in Figure 20(B), 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 21. 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.

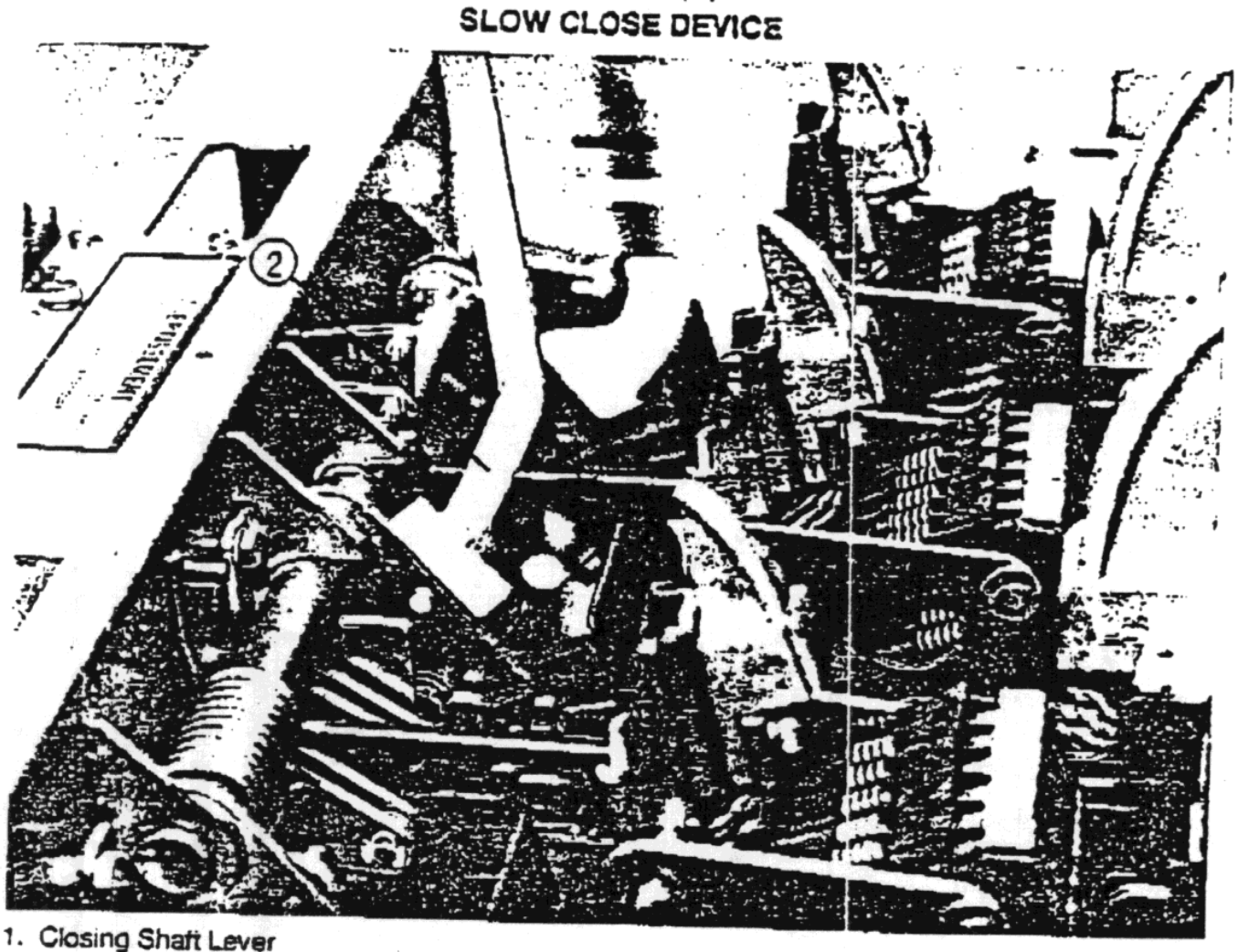
A supply of shims is included with the gauges.

FIGURE 17
CONTACT DIFFERENTIAL ADJUSTMENT



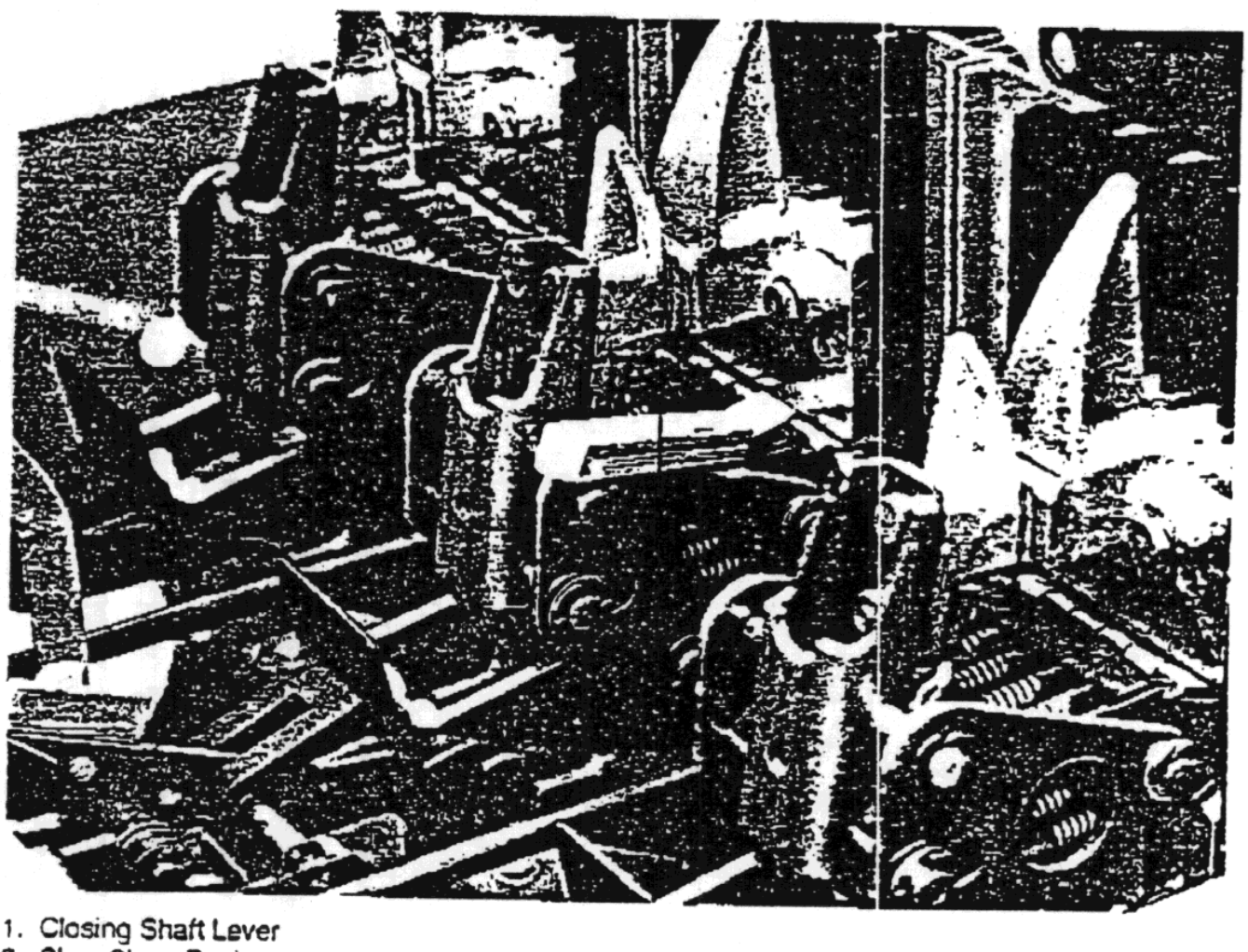
1. 1/4-20 x 3/4 Inch Long Hex Bolt and Lockwasher
2. 1/4-20 Hex Nut and Lockwasher
3. 1/4-20 x 1 Inch Long Hex Bolt and Lockwasher
4. Shim
5. 1/4-20 x 3/4 Inch Long Hex Bolt and Lockwasher

FIGURE 18(A)
SLOW CLOSE DEVICE



1. Closing Shaft Lever
2. Slow Close Device

FIGURE 18(B)
SLOW CLOSE DEVICE



1. Closing Shaft Lever
2. Slow Close Device
3. Feeler Gauge

SLOW CLOSE DEVICE

A slow close maintenance device is available which can be attached to the circuit breaker to permit slow operation of the contacts and closing mechanism. The device is available from the manufacturer, FPE Part No. 11SG-514. As shown in Figures 18 (A) and 18 (B) 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.

ARCING CONTACTS (Fig. 17)

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 (Item 5) 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 the lower hex-head screw (Item 3). Remove the nut and lockwasher (Item 2) at the rear of the assembly first before removing this lower screw. When replacing, tighten the lower screw (Item 3) firmly to attach the braid to the moving arcing contact before replacing the lockwasher and nut (Item 2) at the rear of the assembly.

When replacing arcing contacts, be sure to retrieve all hardware items and assemble as originally installed. Whenever replacing arcing contacts inspect the braids and replace them if they are discoloured or strands are broken.

ARC CHUTES

The arc chutes are made of fiberglass reinforced polyester material. They may be removed individually by removing the two 1/4-20 hex-head bolts on each side of the chute. The chutes mate with the upper base and can be lifted clear to expose the arcing contacts. A lower flash shield mounted to the upper stationary main contact below the stationary contact can also be removed to expose the silver contact surfaces of the main contacts. This shield protects the main contacts during arc interruption.

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.

OVERLOAD PROTECTION (Fig. 22)

Type H-3 and HL-3 breakers are normally supplied with solid state overload protection. The solid state overcurrent trip system protects low voltage power systems against damage caused by overloads and faults. The types of protection offered are overload, short circuit and ground fault. Zone selective instantaneous protection (ZSIP) is also available.

The trip unit operates to open a low voltage circuit breaker in accordance with a set of programmable time-current characteristics. Tripping energy for the operation of the circuit breaker is obtained solely from the circuit being protected. Other power sources are not required, except for fault indication.

The complete solid state overcurrent trip system consists of the primary current sensors, the overload relay, and the direct acting shunt trip solenoid. 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. When the sensor tap settings are altered, the sensor tap setting indication on the breaker faceplate (Fig. 2) should also be changed. Turning the screw to the right of the indication rotates a dial behind the rating plate until the correct tap setting indication is given.

The direct acting shunt trip solenoid is a Type B shunt trip, mounted between the mechanism side-

FIGURE 19
MOVING CONTACT DEFLECTION

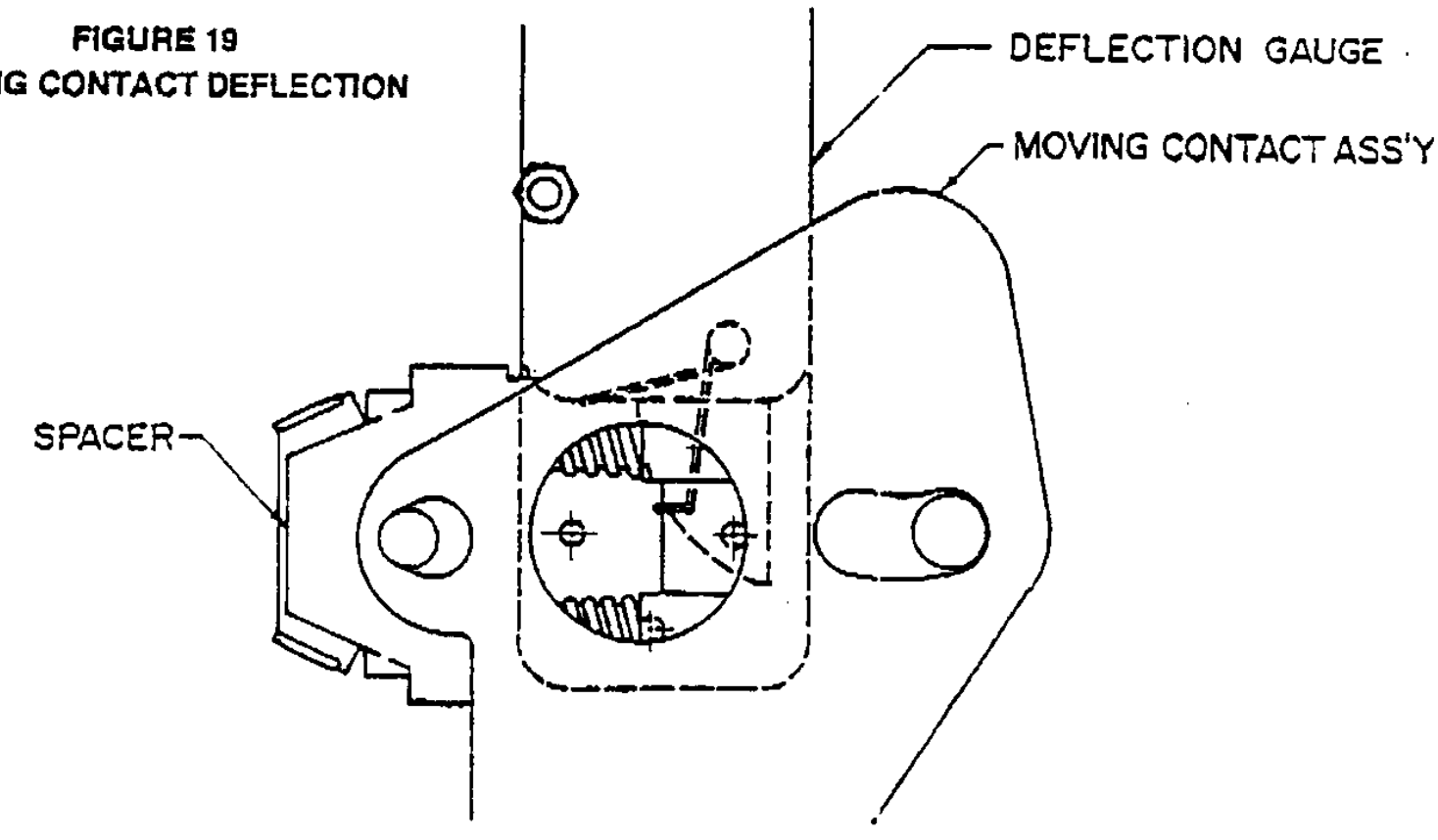


FIGURE 20(A)
MOVING CONTACT DEFLECTION

1. Moving Contact in Open Position
2. Deflection Gauge

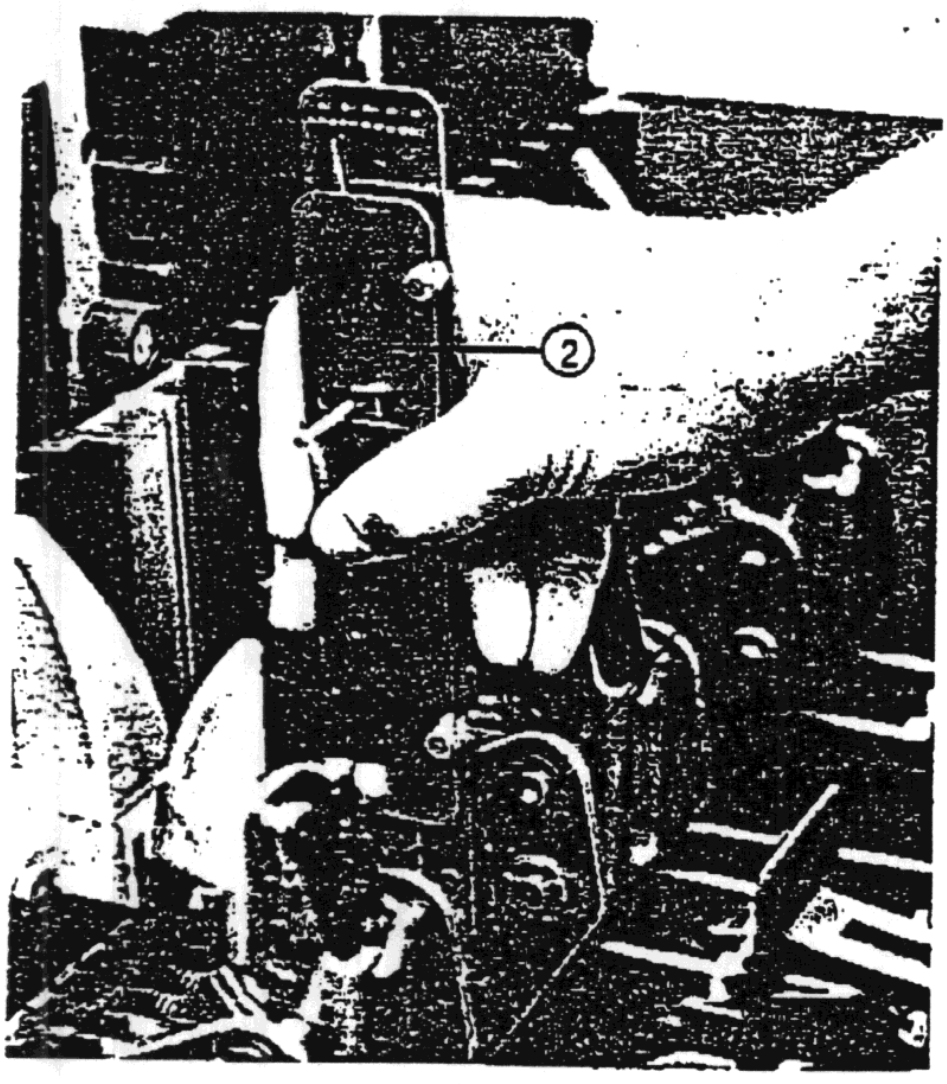
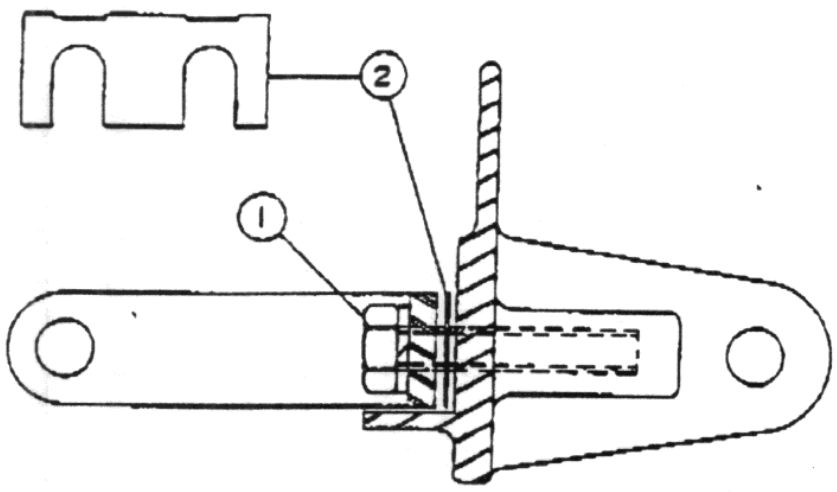


FIGURE 20(B)
MOVING CONTACT DEFLECTION

1. Moving Contact in Closed Position
2. Deflection Gauge

FIGURE 21
MOVING CONTACT ADJUSTMENT



1. 5/16-18 x 1 Inch Long Hex Bolt
2. Shim

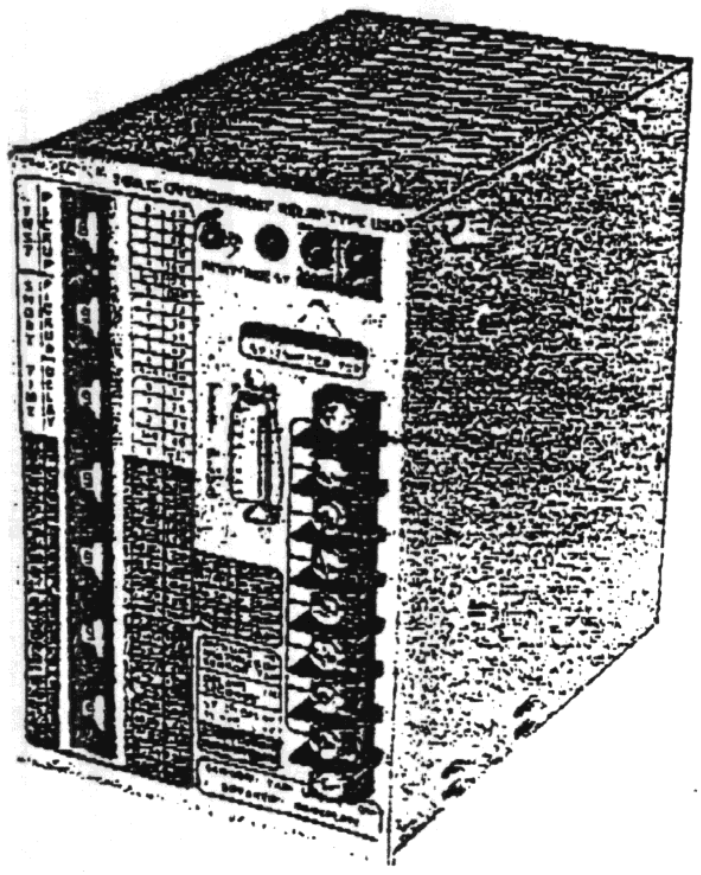
plates. One adjustment is provided to give a space of 1/16 inch (1.6 mm) between the end of the plunger and the stop plate on the trip shaft. If adjustment is required, refer to the section entitled Shunt Trip, Type B (Fig. 12).

Many H-3 and HL-3 type breakers have been supplied with the SD type solid state relay. This relay has been replaced in manufacturing by the USD type solid state relay. The USD relay is an improved design incorporating many features not available on the SD relay.

For complete details of the SD relay refer to instruction manual C-3-216-2.

For complete details of the USD relay refer to instruction manual C-3-217-2.

FIGURE 22
TYPE USD SOLID STATE RELAY



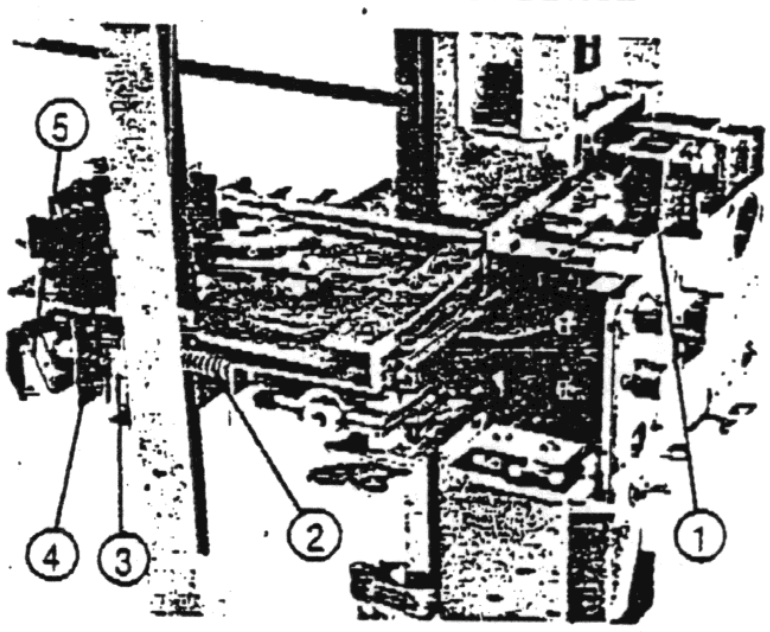
OVERLOAD LOCKOUT DEVICE (Fig. 23)

The overload lockout device prevents reclosing of the breaker either manually or electrically after the breaker has been tripped by the overload relay, until this device is manually reset. Two micro switches with normally open contacts are also available to act as overload alarm contacts.

The direct acting shunt trip solenoid plunger mechanically holds the closing mechanism in the trip-free position thus preventing closing of the main contacts. The latch check switch wired in series with the closing coil is open in this position, preventing any attempted electrical operation of the closing coil.

The device is reset by pushing the manual overload lockout reset button on the breaker faceplate (Fig. 2). This reset button is spring loaded and returns to its normal position.

FIGURE 23
OVERLOAD LOCKOUT DEVICE



1. Overload Lockout Reset
2. Reset Spring
3. Shunt Trip (USD Relay Trip Source)
4. Overload Lockout Flipper
5. Overload Alarm Contacts

FUSE MOUNTING — HL-3 ONLY

All HL-3 circuit breakers in frame sizes up to and including 4000 amps have provision for mounting NEMA HRC fuses, mounted on the line side on a frame extension at the rear of the unit. As an option, in ratings of 3000 and 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.

HL-3 Frame Rating (Amperes)	Relay Rating (Amperes)	Maximum Fuse Rating (Amperes)
600	600	800 NEMA L
800	800	1200 NEMA L
1600	1600	2000 NEMA L
2000	2000	3000 NEMA L
3000	3000	4000 NEMA L
4000	4000	6000 NEMA L

ANTI-SINGLE PHASE DEVICE AND BLOWN FUSE INDICATOR — HL-3 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. Fig. 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 achieved. An electrical test may be performed by means of a single phase variable ac source, 250 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.

SECONDARY CONTROL CONTACTS (Fig. 34)

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 48 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).

AUXILIARY SWITCH (Fig. 5)

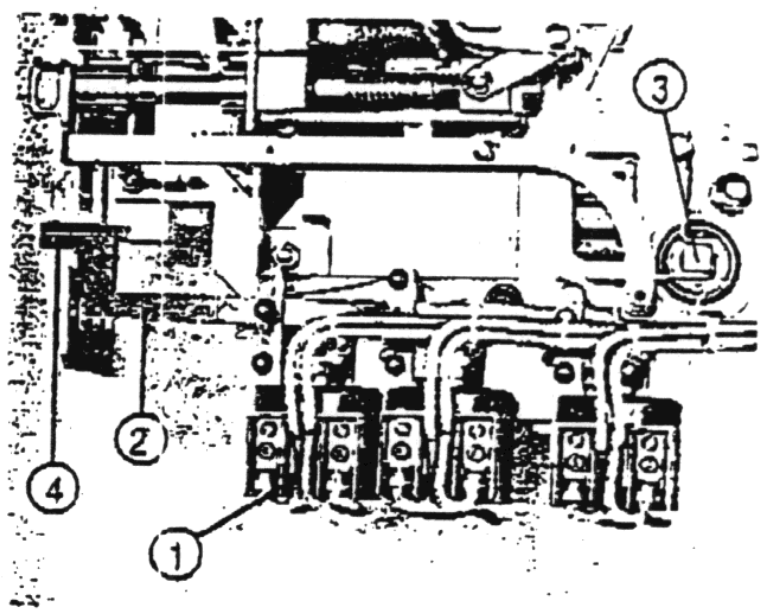
On all H-3 and HL-3 units a multi-section rotary switch is used. It is coupled directly to the closing shaft and operates on a snap-action principle which provides quick break switching. No adjustment is required and the switch is available in the following contact arrangements.

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.
16-pole, providing 8 normally open and 8 normally closed.
20-pole, providing 10 normally open and 10 normally closed.

The following contact ratings apply.

10 amperes up to 254 V.a.c.
1 ampere at 250 V.d.c.
2 amperes at 125 V.d.c.

FIGURE 24
ANTI-SINGLE PHASE DEVICE



1. Solenoid
2. Slide
3. Trip Shaft
4. Blown Fuse Indicator

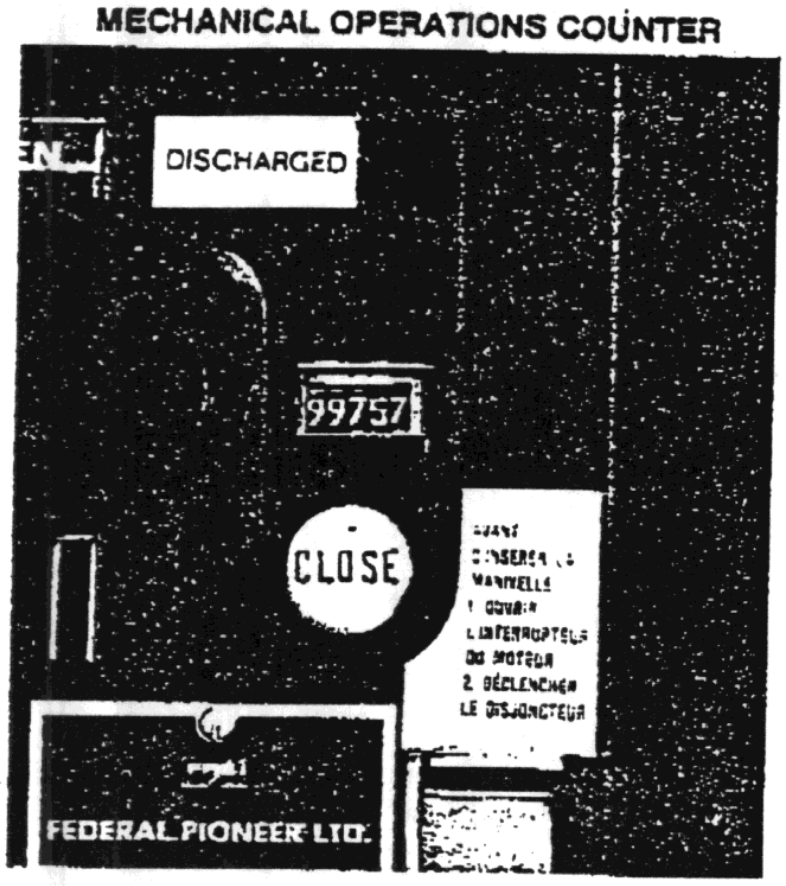
MECHANICAL OPERATIONS COUNTER (Fig. 25)

A five digit mechanical counter can be supplied. It is mounted in the faceplate of the breaker (Fig. 2).

This device is mechanically driven by the "charged-discharged" indicator. The counter operates once for each charging of the breaker main spring. No adjustment or maintenance is required for successful counter operation.

Operations counters are recommended where breakers will be subjected to frequent operations as an indicator of the recommended maintenance intervals.

FIGURE 25
MECHANICAL OPERATIONS COUNTER



MECHANICAL INTERLOCK (Fig. 26)

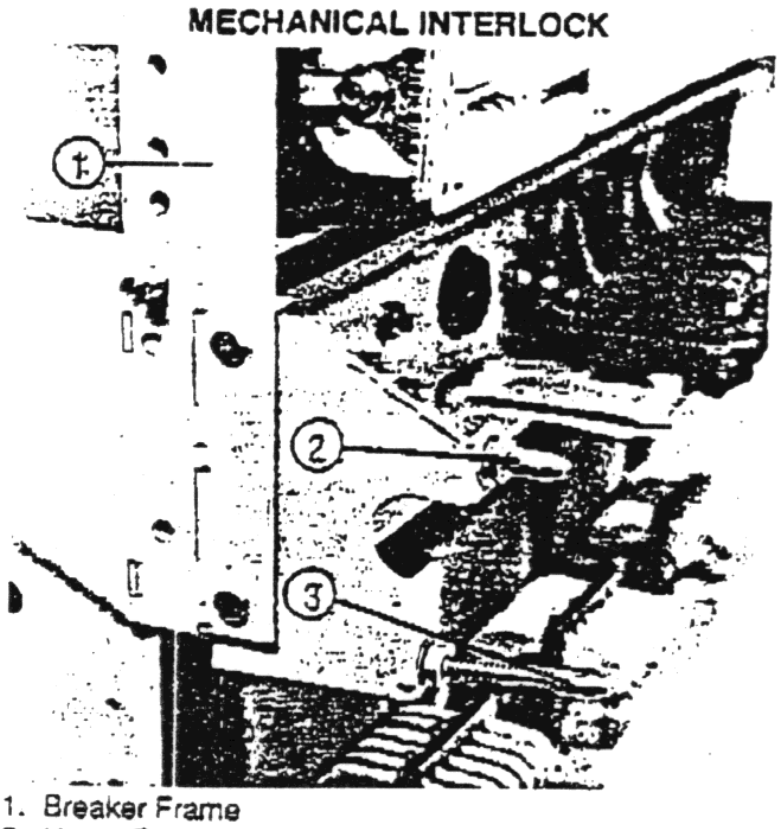
Mechanical interlocks are available on all H-3 and HL-3 breaker frame sizes. They are used to mechanically interlock breakers in a two or three breaker transfer scheme. In the case of a two breaker transfer scheme, mechanical interlocks ensure only one breaker is closed while the other is held in a trip free position. In a three breaker transfer scheme, mechanical interlocks ensure only two breakers are closed while the third is held in a trip free position.

Mechanical interlocks connect with flexible cable the closing shaft of one breaker to the trip shaft of a second breaker, and vice versa. If one breaker is closed, the other breaker is held in a trip free position. Drawout breakers are interlocked by cable connections between the two cradles. There are no permanent connections between the breaker and matching cradle when interlocking is supplied, so the breaker can be freely withdrawn from the cell. Mechanical interlocks are operable only when the breaker is in the connected position. When withdrawn to the test position, breakers are not interlocked and can be test operated in the normal manner.

Mechanical interlocks are preset at the factory and require no adjustment. The plungers at the rear of the breaker should be checked for freedom of movement at intervals as recommended by ANSI standards (see paragraph on Lubrication).

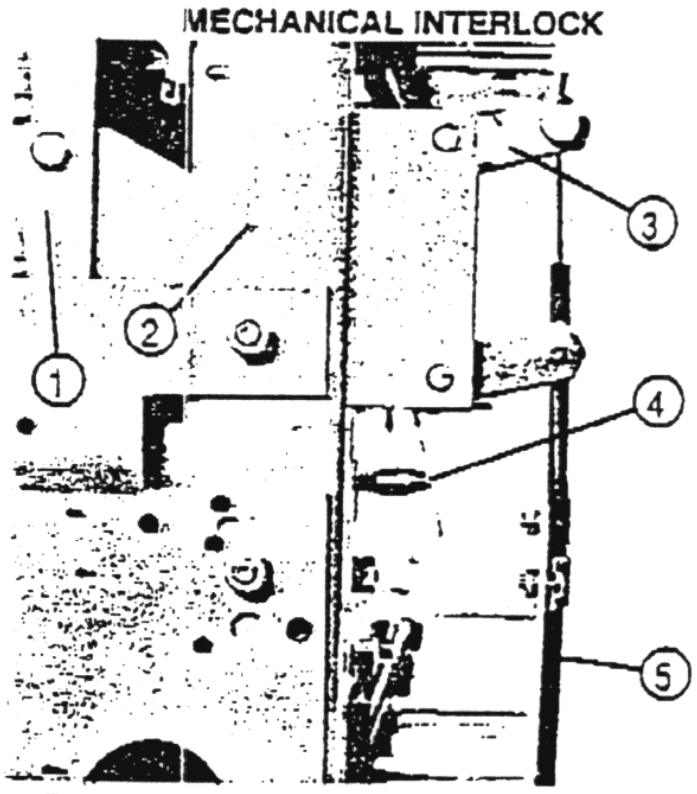
With the breaker removed from the cell, manually close the main contacts using the slow close device (Fig. 18). With reference to figure 26 (a), the top plunger at the rear of the breaker connected by cable to the closing shaft should move freely with movement of the closing shaft. Next, charge the main spring and close the breaker. Pushing in on the lower plunger at the rear of the breaker should open the main contacts. If the plungers do not move freely, the cable must be removed from the sheath and cleaned to restore free movement.

FIGURE 26(A)
MECHANICAL INTERLOCK



1. Breaker Frame
2. Upper Plunger (Connected to Closing Shaft)
3. Lower Plunger (Connected to Trip Shaft)

FIGURE 26(B)
MECHANICAL INTERLOCK

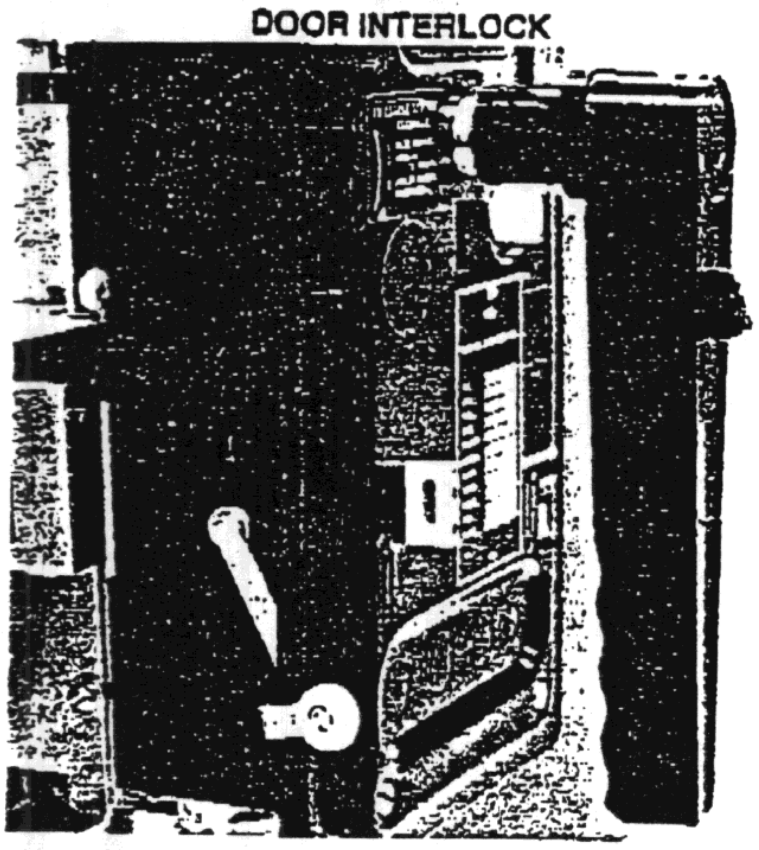


1. Breaker Frame
2. Cradle Frame
3. Upper Flipper
4. Lower Flipper
5. Cable Connections to Lower Cradle

DOOR INTERLOCK (Fig. 27)

All H-3 and HL-3 circuit breakers may be fitted with a device which acts to trip the unit when the cell door is opened. In operation, the door lever acts internally on the mechanical trip button causing it to move in towards the faceplate. This interlock may be defeated by arresting 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.

FIGURE 27
DOOR INTERLOCK



KEY INTERLOCKS (Fig. 28)

Type VF key interlocks single or double lock with 3/8 inch (9.5 mm) projection can be provided. They mount with 3/8-16 screws behind the breaker faceplate. Key interlocks can be installed in the factory. Provision is made for key interlocks on all frame sizes.

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 closing of the main contacts. For electrically operated units an auxiliary switch contact is provided to operate in conjunction with the interlock to isolate the closing circuit.

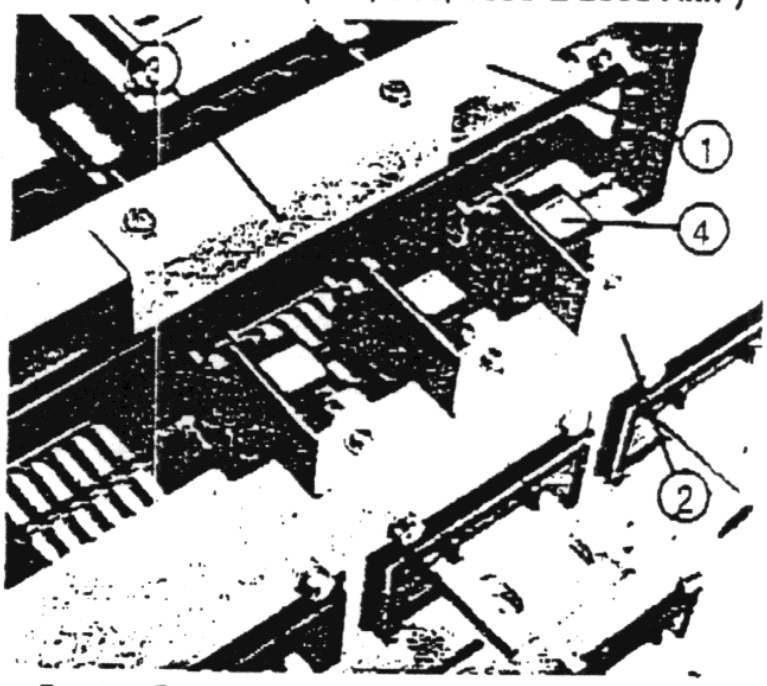
FIGURE 28
KEY INTERLOCK

CELL SWITCHES (Fig. 29)

Cell switches mounted in the cradle can be provided when required to serve as position indicators or external electrical interlocks. The switches are operated when the breaker is moved from the test to operating position in the enclosure.

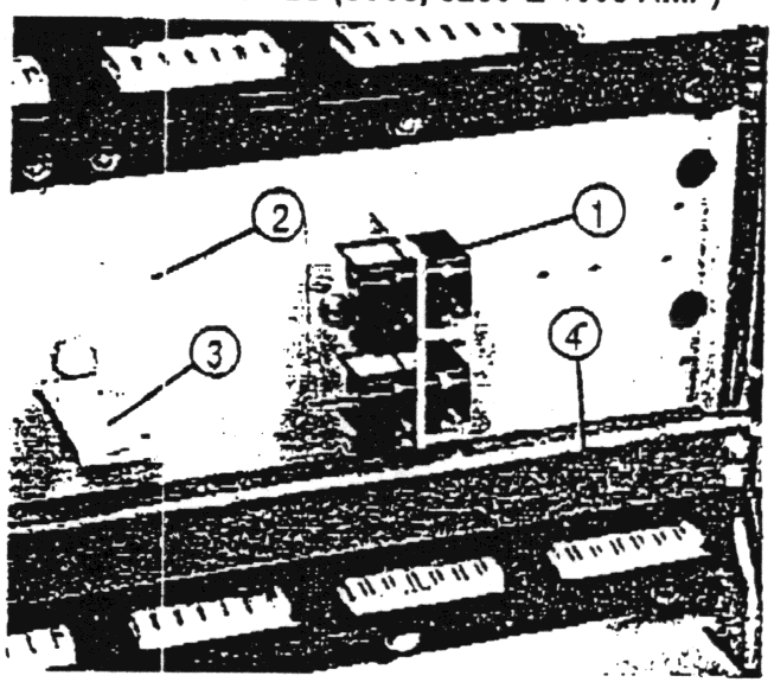
Each switch contains one normally closed and one normally open contact. A total of six switches can be supplied. These contacts are rated 10 amperes up to 300 V.a.c.

FIGURE 29(A)
CELL SWITCHES (600, 800, 1600 & 2000 AMP)



1. Breaker Frame
2. Cradle Frame
3. Operating Bracket
4. Cell Switches

FIGURE 29(B)
CELL SWITCHES (3000, 3200 & 4000 AMP)



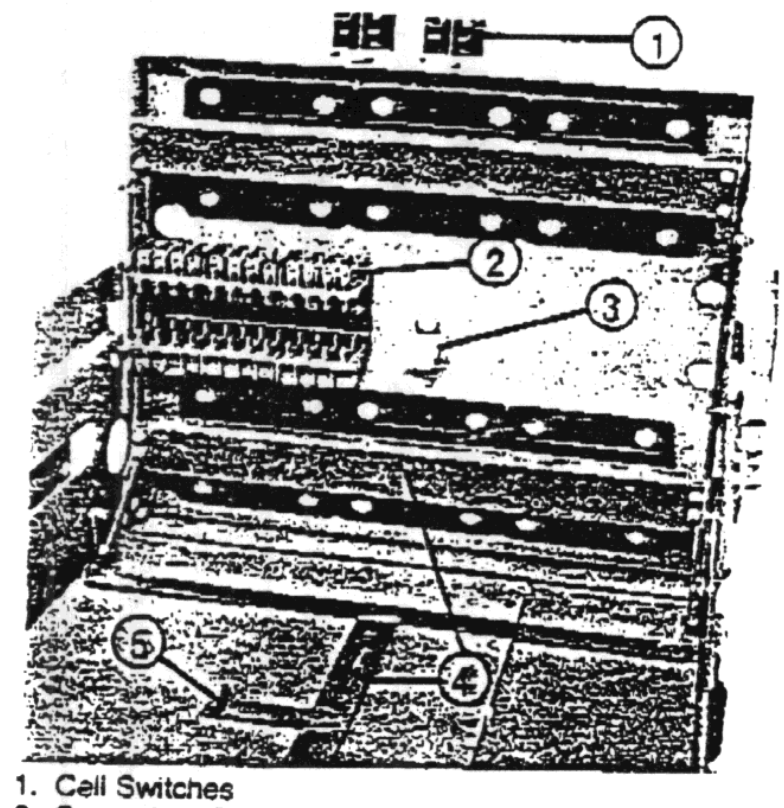
1. Cell Switches
2. Cradle Bus Pan
3. Ground Stab
4. Shutter (In Open Position)

SHUTTERS (Fig. 30)

Shutters are available for all frame sizes up to and including 3200 amperes for both line and load side main plug-in contact stabs.

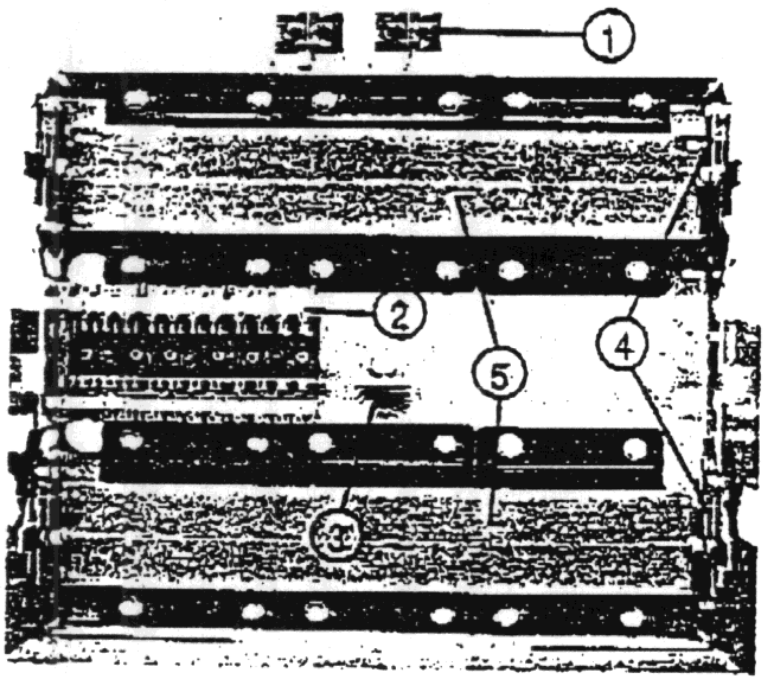
For the 600, 800, 1600, 3000, and 3200 ampere H-3 frame sizes, shutters are of the lifting type shown in figure 30 (A). They have a padlock bracket in the bottom of the enclosure for locking in the down position. When the breaker moves from the test to operating position, shutter bolts on the frame of the breaker lift the shutter to expose the main plug-in contacts.

FIGURE 30(A) SHUTTERS



1. Cell Switches
2. Secondary Control Contacts
3. Ground Stab
4. Shutter Mechanism
5. Padlock Bracket

FIGURE 30(B) SHUTTERS



1. Cell Switches
2. Secondary Control Contacts
3. Ground Stab
4. Shutter Mechanism
5. Shutter

For the 2000 ampere H-3 and for the 600, 800, 1600 and 2000 ampere HL-3 shutters are of the splitting type shown in figure 30 (B). When the breaker moves from the test to operating position, shutter bolts on the frame of the breaker open the shutter to expose the main plug-in contacts.

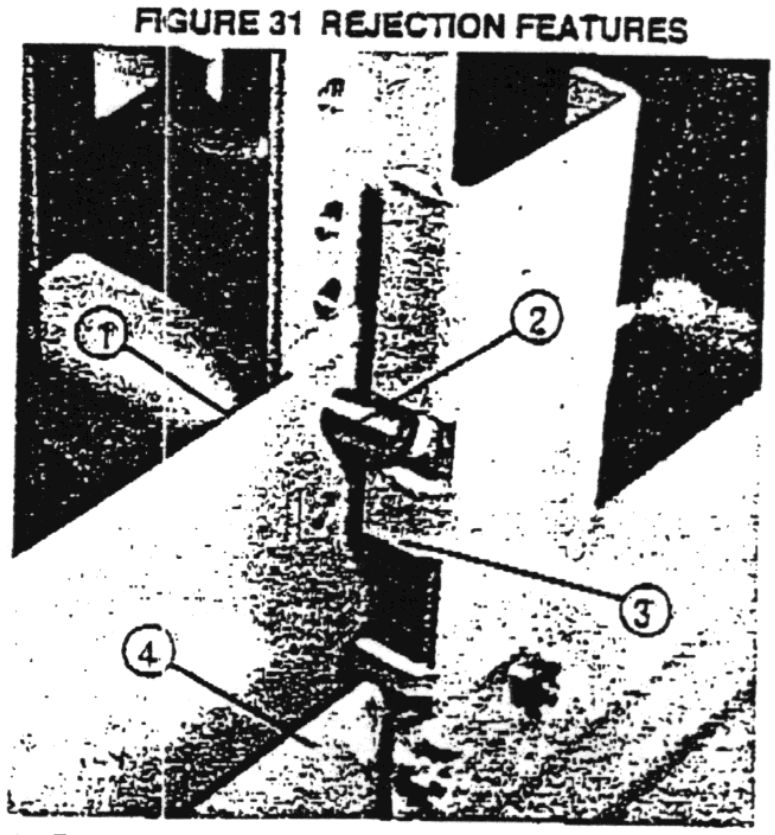
The shutters do not require field maintenance.

REJECTION FEATURES (Fig. 31)

Rejection features are provided on all frame sizes. The rejection feature prevents entry of a breaker into an enclosure of a different frame size. Pins on both sides of the breaker frame match slots cut in brackets mounted on both sides of the cradle.

If the cradle is a different frame size than the breaker, the breaker pins will not match the slots cut in the cradle brackets. Entry of the breaker into the wrong frame size enclosure is then prevented.

FIGURE 31 REJECTION FEATURES



1. Breaker Frame
2. Rejection Pin
3. Rejection Bracket
4. Cradle Sideplate

LIFTING DEVICE (Fig. 32)

A lifting device is available from the manufacturer for all frame size breakers. The lifting device is a one-piece yoke which fits into lugs on the breaker sideplates. This permits safe removal of the breaker from the enclosure drawout tracks. Lifting yokes are ordered as follows:

Part Number 26G-542 for 600, 800, 1600 and 2000 ampere H-3's.

Part Number 26G-151 for 3000, 3200 and 4000 ampere H-3's.

Part Number 26G-601 for 600, 800, 1600 and 2000 ampere HL-3's.

Part Number 26G-603 for 3000 and 4000 ampere HL-3's.

FIGURE 32
LIFTING DEVICE

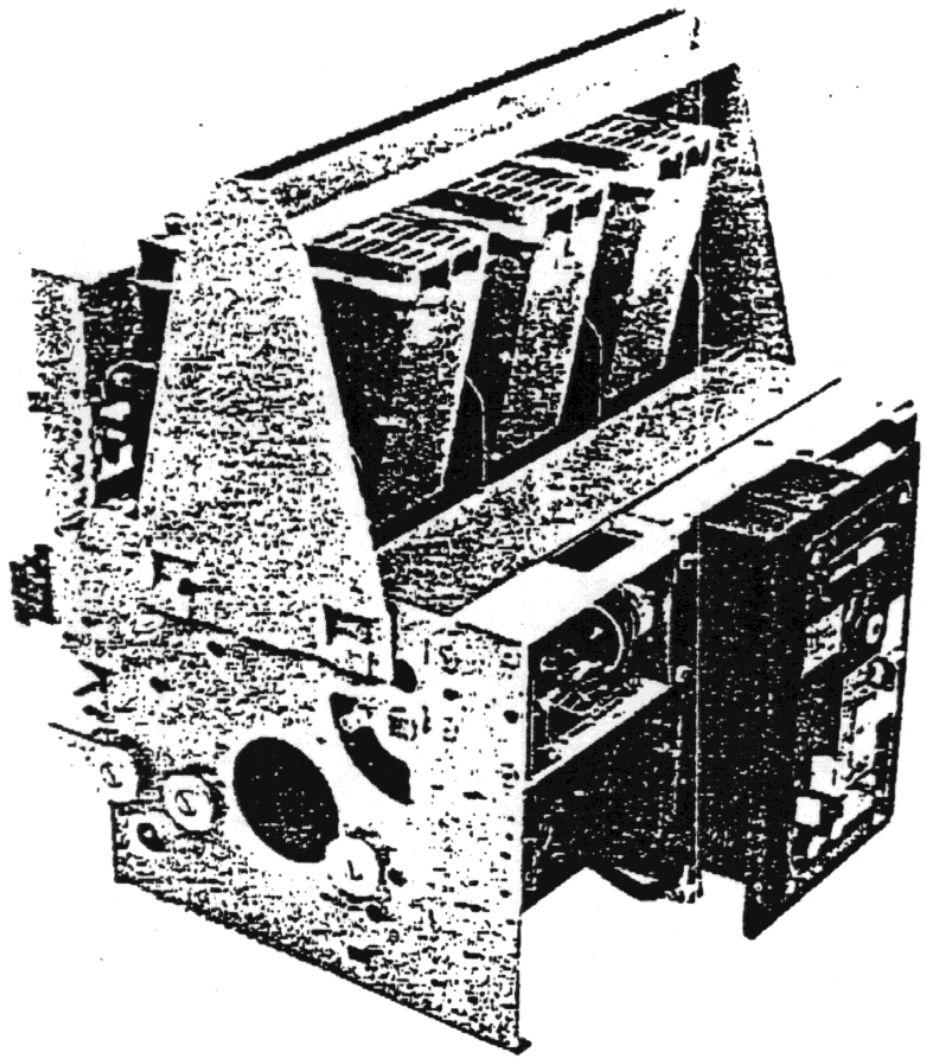


FIGURE 33
COIL DATA

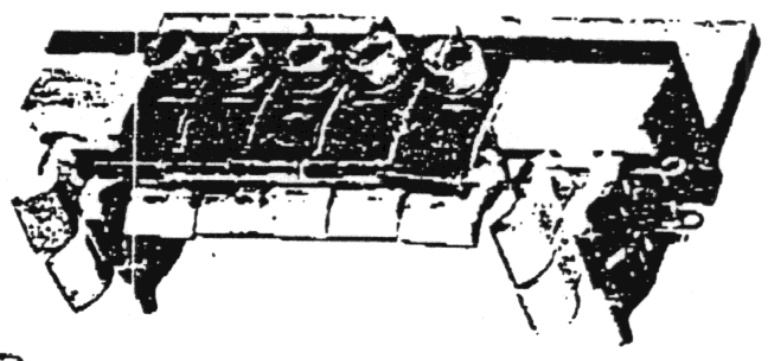
	Rated Control Voltage	Minimum Operating Voltage	D.C. OHMS	Amperes	
				Inrush	Sealed
Shunt Trip Type A	120 AC	75	30.0	2.45	0.34
	240 AC	150	312.0	1.5	0.15
	48 DC	40	6.0	8.0	0.2
	125 DC	40	50.0	2.2	0.2
	250 DC	70	312.0	0.8	0.1
Shunt Trip Type B	120 AC	60	13.0	1.4	
	240 AC	120	50.0	1.0	
	48 DC	40	13.0	2.0	
	125 DC	40	86.0	2.5	
	250 DC	70	215.0	1.25	
Shunt Close	120 AC	90	30.0	2.45	0.34
	240 AC	180	312.0	1.5	0.15
	48 DC	40	6.0	8.0	0.2
	125 DC	60	50.0	2.2	0.2
	250 DC	150	312.0	0.8	0.1
Undervoltage Trip	120 AC	96	23.0	2.45	0.34
	240 AC	190	312.0	0.8	0.1
Anti-Single Phase Device	240 AC	90	13.0	2.8	
	480 AC	120	50.0	1.8	
	600 AC	120	50.0	2.3	
Charging Motor	120 AC	85		4	
	240 AC	190		2.5	
	48 DC	40		7	
	125 DC	85		4	
	250 DC	190		2.5	

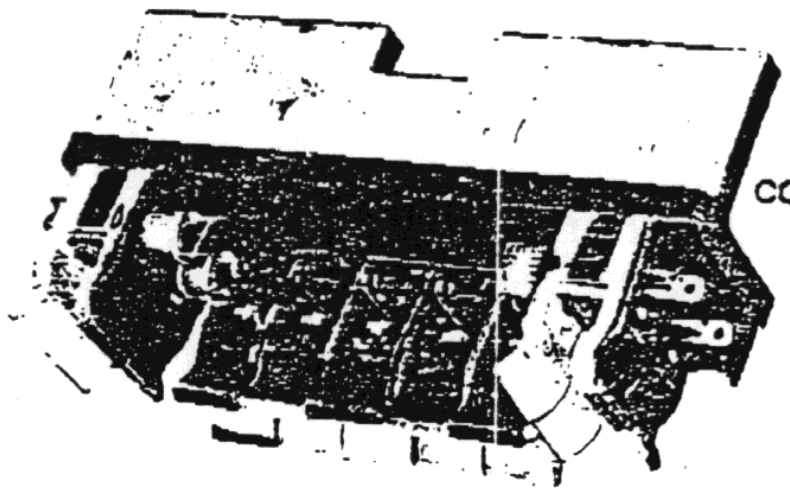
SPARE PARTS (Fig. 34)

By the nature of its application and its switching capability spare parts for the circuit breaker should normally 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, the complete nameplate data, especially the breaker serial number, should be provided to ensure that the correct parts are supplied.

FIGURE 34
SPARE PARTS

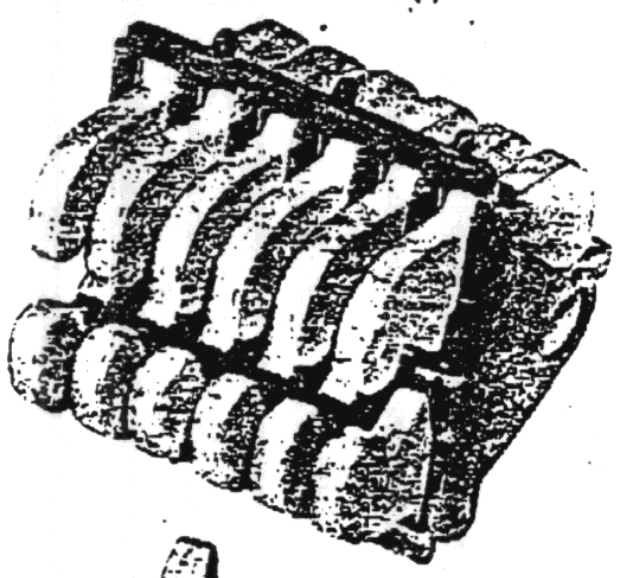
MAIN DRAWOUT CONTACT ASSEMBLY (600 & 800 Amp)

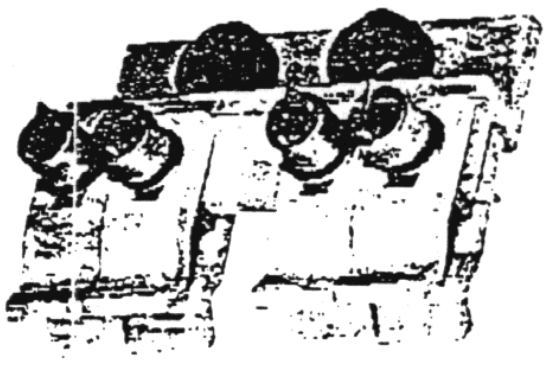




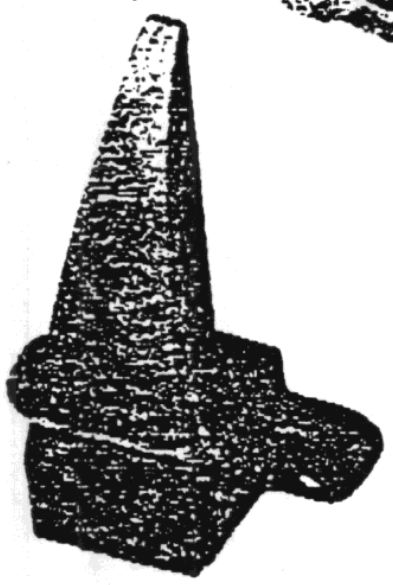
MAIN DRAWOUT CONTACT ASSEMBLY (4000 Amp)

MAIN DRAWOUT CONTACT ASSEMBLY (1600, 3000 & 3200 Amp)

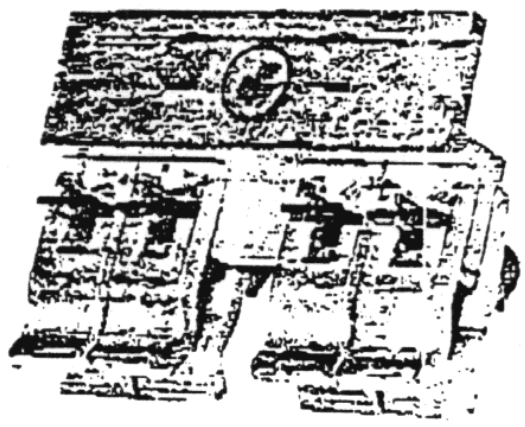




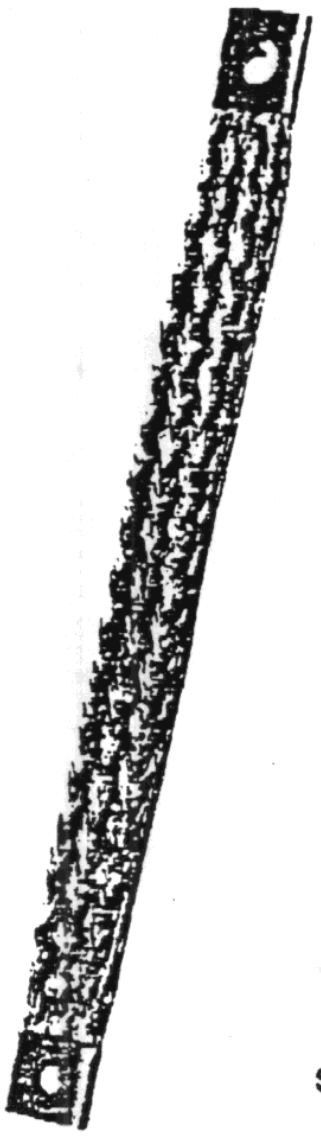
MAIN DRAWOUT CONTACT ASSEMBLY (2000 Amp)



STATIONARY ARCING CONTACT ASSEMBLY



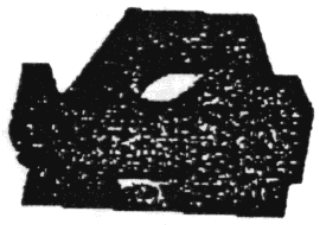
MOVING ARCING CONTACT ASSEMBLY



MAIN
BRAIDS

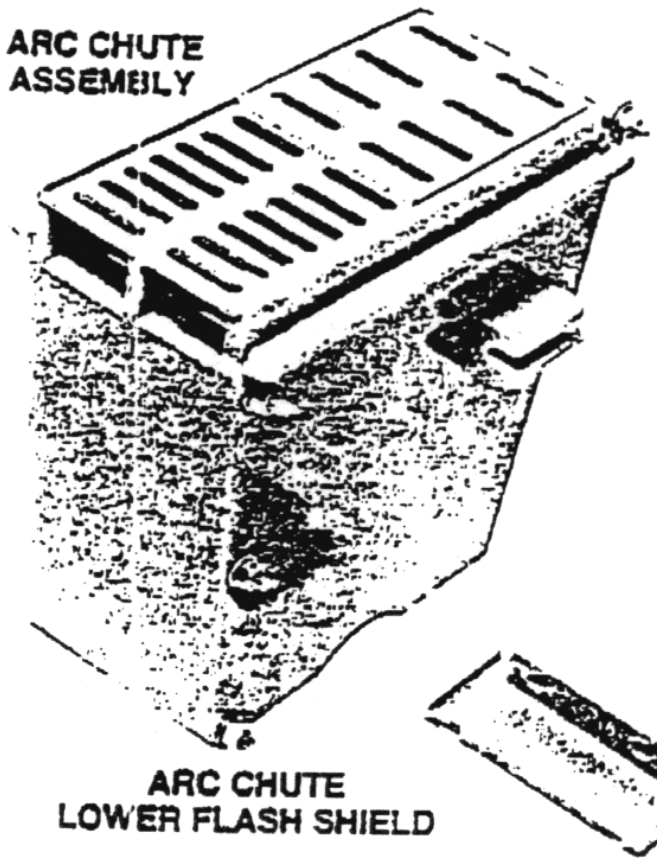
MAIN MOVING CONTACT
(WAFER ASSEMBLY)

SPACER FOR WAFER
ASSEMBLY (OUTER)



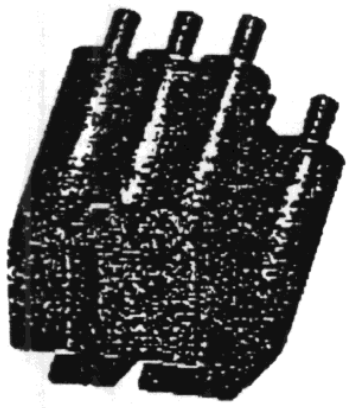
SPACER FOR WAFER
ASSEMBLY (INNER)

MAIN MOVING
CONTACT SPRING



ARC CHUTE
ASSEMBLY

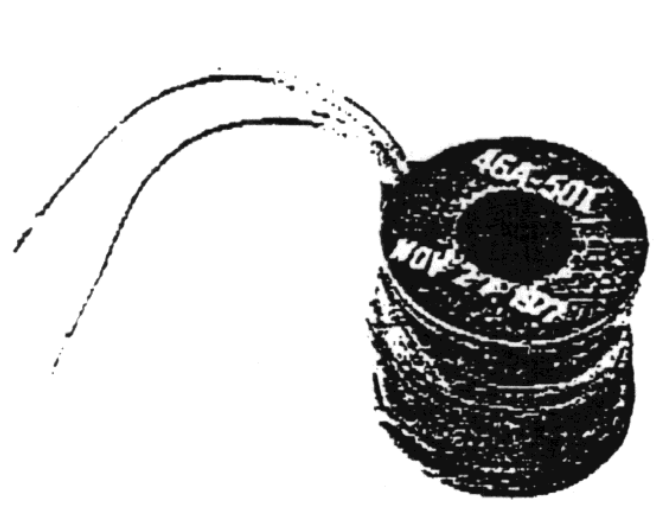
ARC CHUTE
LOWER FLASH SHIELD



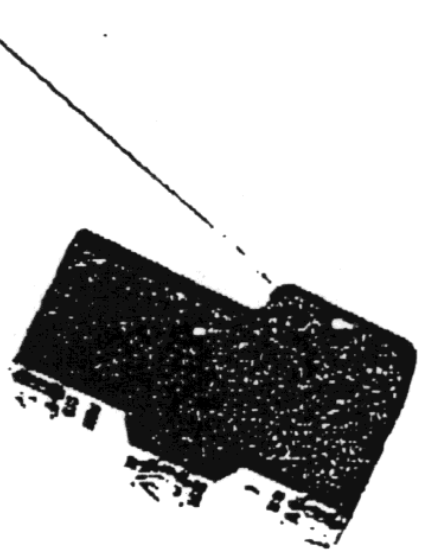
MAIN MOVING
CONTACT SPRING GUIDE

CHARGING MOTOR

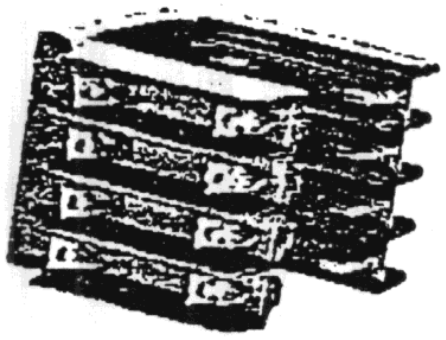
SOLENOID COIL
SHUNT TRIP TYPE A
UNDERVOLTAGE TRIP
SHUNT CLOSE

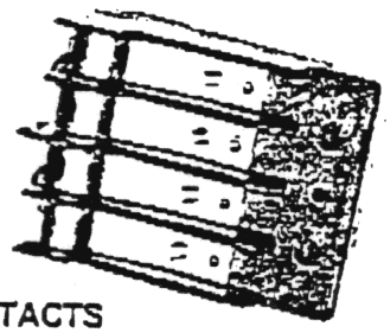


SOLENOID COIL
SHUNT TRIP TYPE B
ANTI-SINGLE PHASE DEVICE

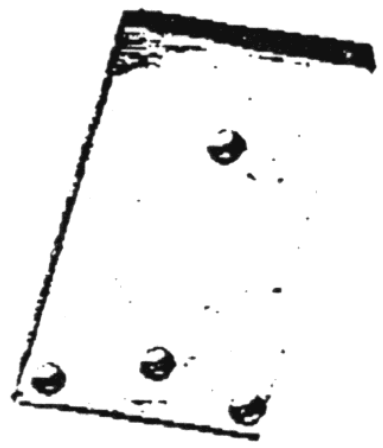


LIMIT SWITCH





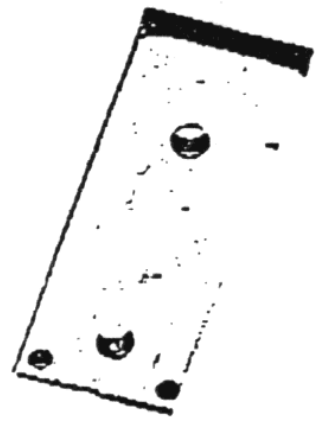
SECONDARY CONTROL CONTACTS



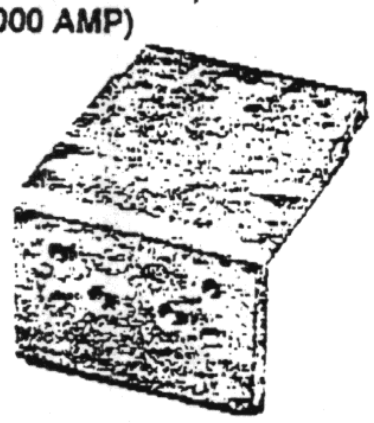
CENTRE STATIONARY MAIN CONTACT
(1600, 2000, 3000, 3200 & 4000 AMP)

UPPER STATIONARY MAIN CONTACT
(1600, 3000 & 3200 AMP FIXED,
ALL 2000 & 4000 AMP)

UPPER STATIONARY MAIN CONTACT
(1600, 3000 & 3200 AMP DRAWOUT)



CENTRE STATIONARY MAIN CONTACT
(600 & 800 AMP)



UPPER STATIONARY MAIN CONTACT
(600 & 800 AMP DRAWOUT)

UPPER STATIONARY MAIN CONTACT
(600 & 800 AMP FIXED)

FEDERAL PIONEER LIMITED

Offices in principal cities across Canada