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July, 1971
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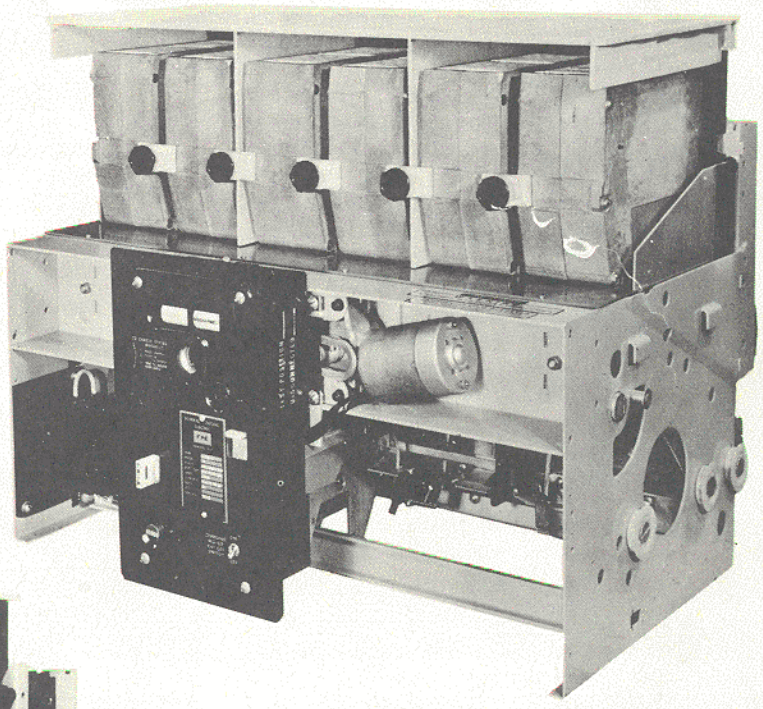
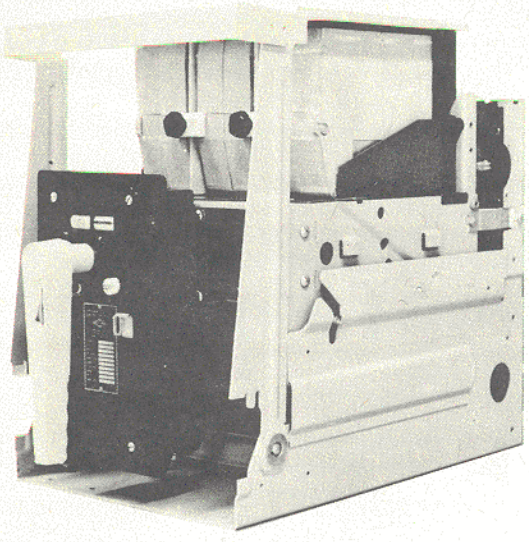
INSTRUCTIONS

FOR THE CARE AND MAINTENANCE OF

TYPE H-2
AIR CIRCUIT BREAKERS





FPE FEDERAL PIONEER

FEDERAL PIONEER LIMITED

MAINTENANCE INSTRUCTIONS

FOR

TYPE H-2 CIRCUIT BREAKERS

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INTRODUCTION

FPE Type H-2 low voltage power circuit breakers are designed to provide many years of reliable service even under severe conditions. The mechanism design employs high throw-off toggles to ensure tripping even after long periods of inactivity. Current carrying parts are designed for low current densities and the extremely efficient tripping relays do not require high current density coils thus realizing a low temperature rise even when the circuit breaker is loaded to its full rating.

Normal maintenance and replacement of arc control parts can be made without special tools or resetting factory adjustments and thus maintenance shut down periods can be very short.

SHIPMENT

Each circuit breaker is carefully inspected and tested before leaving the factory and then packed by workmen experienced in the proper handling and packaging of electrical equipment. Every circuit breaker should be examined immediately on receipt for any damage sustained enroute. If damage is evident or if indication of rough handling is visible, a claim should be filed immediately with the transportation company. FPE should be notified immediately if replacement parts are required.

STORAGE

Air circuit breakers should be stored in their shipping crates in the upright position in a clean dry area. Should the breaker 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.

UNPACKING

Crates used for domestic shipment of air circuit breakers are of open lattice work construction so that the breaker may be readily uncrated without damage. The breaker is bolted into the crate using its normal mounting holes so it is preferable to first remove top, front and sides of the crate. The breaker may then be unbolted and removed from the remaining crate. Do not lift the breaker by the rear connecting terminals or the operating handle. Lift on the steel channel at the front and hold the base to keep the breaker steady. The steel side plates will support the breaker but care should be taken to set the breaker on a level surface to avoid damage to the relays or the interlock linkage on draw out type breakers. Check the breaker thoroughly to see that no part of the breaker has been damaged or forced out of alignment during shipment.

LOCATION

Unless the circuit breaker enclosure is specifically designed for outdoor or unusual service conditions, circuit breakers should be installed in a clean dry place which is free from atmospheric contaminants and where good ventilation can be secured. Sufficient space should be provided to make connections and so that the breaker is readily accessible for operation and maintenance. Reference should be made to local code regulations.

MOUNTING

Circuit breakers should be enclosed in sheet steel cases in accordance with recommended dimensions and in general these cases provide the mounting for the breaker.

Fixed mounted breakers are mounted with bolts through the base, while drawout type breakers will roll in or out on rails which are fixed to the cradle. A crank lever on each side of the breaker engages in a slot in the cradle to pull the breaker either on or off the disconnecting contracts.

The mounting support should be a rigid structure able to withstand the impact of breaker closing and tripping.

CONNECTIONS

Before making any electrical connections to the circuit breaker, every precaution must be taken to ensure that all cables which are to be connected to the circuit breaker are safely de-energized. Breaker terminals are silver plated for maximum joint efficiency and cable connectors should be clean and free from dents or burns and bolted securely to the breaker terminals. Poor joints lead to breaker overheating and subsequent contact deterioration and eventual breaker failure so that considerable care should be exercised in making these primary connections. Cables or bus connections should be properly supported so that the circuit breaker terminals are not subjected to unnecessary weight or strain. Any strain which at first has no apparent affect, may cause poor contact alignment after prolonged periods of vibration or shock from normal breaker operations.

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

Control circuit wiring where applicable should be made in strict accordance with detailed wiring diagrams. Wiring connections are made to terminal blocks or to secondary drawout contracts and should be run in a supported and protected manner such that control wires cannot come into contact with primary connections.

INSPECTION

Read this instruction book completely before proceeding with inspection.
Before line side cables are energized, the breaker should be thoroughly checked and operated to ensure trouble free operation when it is placed in service. The following points should be specifically checked:

1. Make visible inspection after installation to ensure no parts have been damaged or forced out of alignment.
2. The door interlock is optional, but when fitted check for freedom of movement and block in depressed position. This will allow normal breaker operation with door open.

3. On drawout breakers check the drawout mechanism to see that the breaker rolls freely on the rails and pulls the breaker completely home on the contacts. There should be approximately 1/8" clearance between the male stab and the contact finger spacer.

4. On drawout breakers, check the drawout interlock. The gate must be fully up to cover the opening for the drawout crank. See fig. 1.

5. Check contacts to see that they are clean and free of foreign material.

6. Check any control wiring to ensure it has not been damaged during installation.

7. Check overload relays. Push on armature to ensure that the relay will trip the breaker. If moderate force is used the relay armature will move slowly because of the delay characteristics.

   A heavier force will extend the instantaneous springs and should trip the breaker immediately. Note that a small amount of oil seepage may occur during shipment if the breaker has not been in the upright position but the relay design employs sufficient cavities to trap ample amounts of oil for relay operation.

8. Close and trip the breaker several times to ensure correct operation. Note that interlocks should be voided or in normal released position so that the spring closing mechanism will pick up the contacts and thus avoid discharging the mechanism without its normal load. **Discharging the spring closing mechanism without load imposes severe stresses on the linkage and should be avoided.**

CLOSING THE BREAKER

As these breakers are complete stored energy as opposed to spring assisted closing, the energy for closing must be stored in the main spring before the breaker can be closed.

MANUAL CLOSING

The handle is rotated counter-clockwise to the upright position to engage the spring charging cam. Rotating the handle through 180° will then completely charge the springs. A ratchet mechanism allows several short strokes instead of one 180° single stroke if preferred and also prevents any spring fly back during the charging stroke. The springs can be charged when the breaker is closed which will allow one immediate reclosure. Pressing a mechanical push button on the face plate releases the energy in the compression springs to close the breaker.

ELECTRICAL CLOSING

A universal ac/dc 120 volt ¼ H.P. motor is used to wind the spring closing mechanism and a shunt close releases the stored energy to close the breaker. Upon supplying control power with the breaker open, the motor will automatically charge the spring (time 2-4 seconds). Pressing a close button either on the face plate or at a remote location will then close the breaker. When the breaker is tripped the motor will immediately rewind the mechanism to charge the spring ready for the next close operation. An emergency closing handle is supplied which can be used in the event of control power failure. The handle is inserted into the faceplate connection and is used in the same manner as for manual closing to store the energy in the spring. To close the breaker insert the opposite end of the handle in the small hole to the lower right as illustrated, figure 1, page 5.

MAINTENANCE

The breakers have been manufactured and tested in accordance with NEMA standard SG-3 and BSS specification 3659-1963 and to ensure the safety and the successful functioning of connected apparatus which depends upon the proper operation of the circuit breaker, the circuit breaker must have regular, systematic care and inspection.

1. Be sure that the circuit breaker and its mechanism are disconnected from all electric power, both high voltage and control circuit. Also be sure that the main closing spring is discharged before being inspected or repaired.

2. Inspect the operating mechanism periodically and keep it clean. Lubricate sparingly all moving parts readily accessible with a heavy duty light grade machine oil (SAE-10). Wipe excess to prevent collecting dust and make sure oil does not get on electrical control contacts. Interior mechanisms are lubricated with grease as detailed later.

3. Examine the contacts frequently, see that they are aligned and that contact surfaces bear with firm uniform pressure. Replace badly pitted or burned contacts before they are burned away sufficiently to cause damage to other parts of the apparatus.

4. 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 type H-2 Air Circuit Breakers 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.

5. See that bolts, nuts, washers, clips and all terminal connections are in place and tight.

6. Clean the circuit breaker at regular intervals where abnormal conditions such as salt deposits, cement dust or acid fumes prevail to avoid flashovers as a result of the accumulation of foreign substances on the surface of the circuit breaker.
7. Always check for loose nuts and bolts after any maintenance work has been completed.
8. Adjustments. During the course of manufacture, each circuit breaker is operated up to 50 times. All adjustments are set and locked and should not require adjustment in the field. However, refer to adjustments for the latch and holding cam.
9. The maintenance intervals will vary depending on the duty imposed on the circuit breaker. However, the maximum number of operations between service intervals should not exceed 500 and where severe switching duty is encountered, frequent inspection is recommended. The service interval should be set accordingly.

REMOVING THE FACEPLATE

The faceplate assembly consists of three parts: (1) the front plate, (2) the frame and (3) the floating trim and it is mounted to the cross channel of the mechanism bracket. To disassemble, first remove the 4 oval head screws in each corner of the front plate. The floating trim will then be free to be removed. Note that one side of the trim is bevelled to correspond with the hingeing of the front cover and it must be replaced correctly to ensure smooth action as the door closes over the faceplate.

The manual handle is captive in the front plate and may be removed by drawing out the ¼" rolpin holding the clutch to the shaft.

CIRCUIT BREAKER FACEPLATE

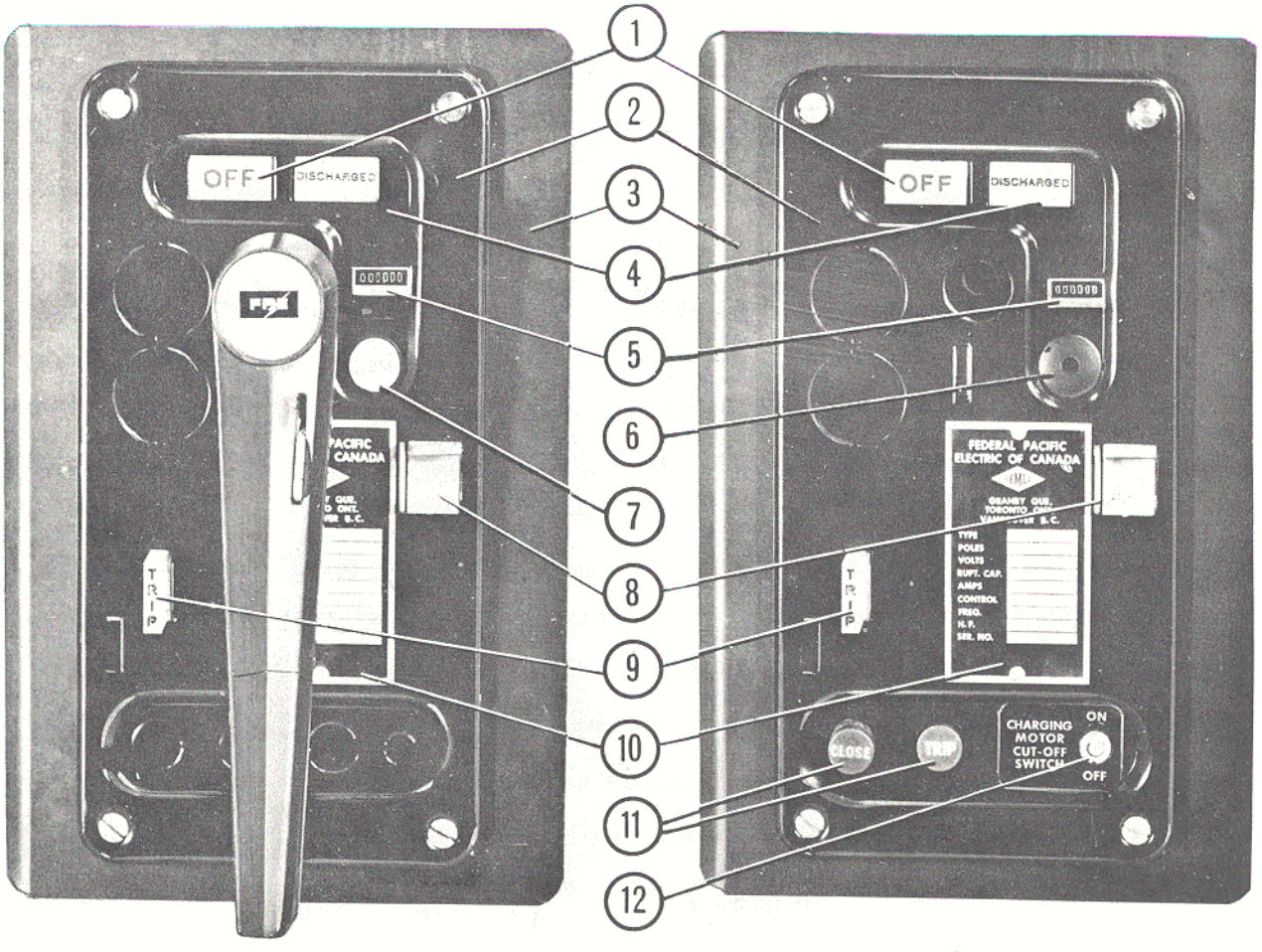


Figure 1 — **CIRCUIT BREAKER FACEPLATES**

MANUAL

1. On-Off indicator
2. Front plate
5. Operations counter
6. Emergency manual close
9. Manual trip
10. Rating plate

ELECTRICAL

3. Floating trim
4. Spring charge indicator
7. Close button
8. Gate for draw out crank
11. Electrical control buttons
12. Motor cut-off switch

SPRING CHARGE INDICATOR

The spring charge indicator is mounted on the front plate and consists of a spring loaded mechanism operated by the spring holding cam assembly. When replacing the front plate hold the indicator in the "discharged" position by a thumb for easy reassembly.

STORED ENERGY MECHANISM

Before close inspection of the stored energy mechanism extreme care should be taken to ensure the spring is discharged. Tripping the circuit breakers DOES NOT discharge the spring. On electrically operated breakers the motor cut off switch must be used to prevent the motor from recharging the spring automatically. If the face plate indicator shows "CHARGED" closing the breaker will discharge the spring.

With the front plate and frame removed the complete mechanism is exposed and inspection and lubrication of moving parts is readily accomplished. Use a very light good quality machine grease such as lubraplate on the ratchet assembly. A light machine oil can be used on parts where grease cannot be applied.

SPRING RELEASE MECHANISM

The spring release mechanism is located behind the front-plate and below the holding cam assembly.

When the spring is fully charged the needle bearing of the holding cam assembly is stopped by the release cam. When the manual close button is pressed or when the shunt close is actuated, the release cam is rotated clockwise releasing the spring holding cam assembly.

If the spring holding cam does not reset properly, it may be jarred when the closing spring is charged and as a result, the breaker will attempt to close without pressing the "close" button or operating the shunt close device. To adjust the holding cam itself, release the locknut on the top screw and turn counter clockwise one quarter of a turn and relock. This increases the loading on the cam so that it is important that the adjustment be made carefully to ensure that the resultant load will not be too heavy for the shunt close device. The lower screw is an over travel stop and does not need adjustment.

Figure 2

SPRING RELEASE MECHANISM

1. Holding cam adjusting screw and lock nut
2. Over-travel stop
3. Release cam
4. Holding pawl
5. Spring holding cam assembly and ratchet wheel

HOLDING CAM ADJUSTMENT

If the spring holding cam does not reset properly, it may be jarred when the closing spring is charged and as a result, the breaker will attempt to close without pressing the "close" button or operating the shunt close device.

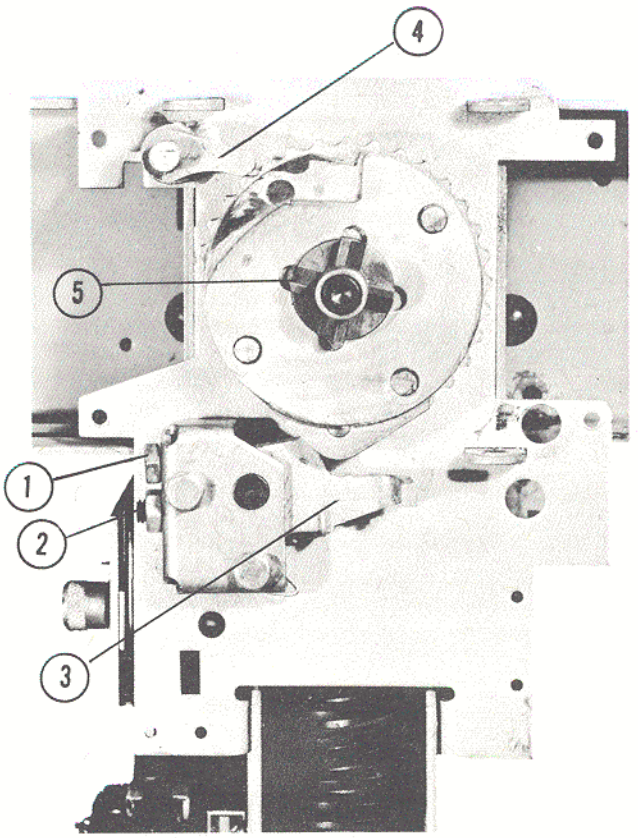
To adjust the holding cam itself, release the lock-nut on the top screw and turn counter clockwise one quarter of a turn and relock. This increases the loading on the cam so that it is important that the adjustment be made carefully to ensure that the resultant load will not be too heavy for the shunt close device. The lower screw is an over travel stop and does not need adjustment.

SLOW CLOSE DEVICE

A slow-close maintenance device is available, which can be attached to the breaker to allow slow operation of the mechanism.

To install the slow-close device, slip it over the spring assembly and charge the spring manually almost completely. The mounting holes will line-up just before the spring mechanism goes over toggle.

Push the close button and re-engage the manual handle which will then operate the mechanism directly.



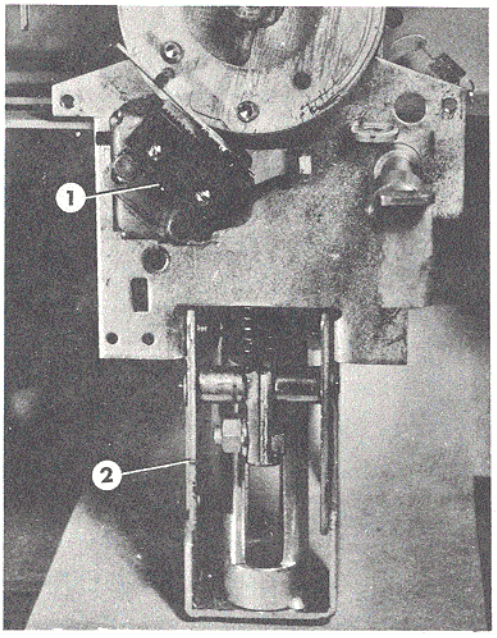


Figure 3

SLOW CLOSE DEVICE

1. Motor stop switch
2. Slow close device

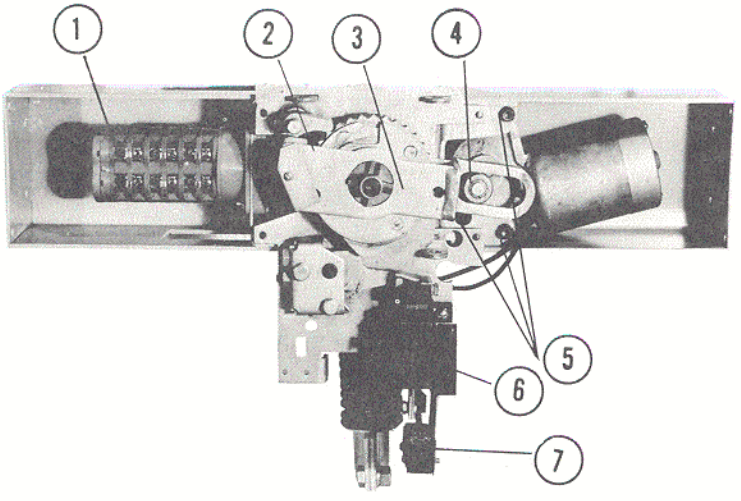


Figure 4 — **ELECTRICAL MECHANISM**

1. Auxliary Switch
2. Holding Pawl
3. Oscillating Lever
4. Needle Bearing
5. Motor Mounting Bolts
6. Shunt Close
7. Closing Coil Switch

CONTROL RATINGS

The following table lists the standard ratings of motors. Note that for ac applications 115 volt motor is used throughout and a control transformer is supplied for voltages other than 115V.

RATED CONTROL VOLTAGE	CLOSING VOLTAGE RANGE	MAXIMUM MOTOR CURRENT AMPS	SHUNT CLOSE AMPS	TRIPPING VOLTAGE RANGE VOLTS	SHUNT TRIP AMPS
125V dc	90 - 130	11	0.8	70 - 140	0.8
250V dc	180 - 260	6	0.2	140 - 280	0.2
115V ac	95 - 125			95 - 125	
230V ac	190 - 250	Inrush 12	1.4	190 - 250	1.4
460V ac	380 - 500	Full load 6		380 - 500	
575V ac	475 - 630			475 - 630	

ELECTRICAL OPERATING MECHANISM

The motor mechanism consists of a ¼ h.p. universal motor with a worm gear reduction. An eccentric lever is mounted on the end of the worm gear reduction and drives the oscillating lever. The driving pawl is mounted on the oscillating lever and with each stroke of the lever drives the ratchet around one tooth at a time until the spring is charged and the limit switch is actuated to cut off the motor.

To remove the motor mechanism, remove the three ¼ - 20 Allen Head screws. Tilt the motor in slightly and disengage it from the oscillating lever and remove the assembly from the breaker. The eccentric driving lever is threaded onto the end of the worm gear reduction of the motor and may be removed by tapping lightly in a counter clockwise direction. The spring limit switch mounts on the holding cam assembly and is readily replaced by removing the 6-32 mounting screws. See Fig. 3.

A special grease is used in the worm gear reduction assembly and should not require replacement. If necessary use only Led-Plate compound 250.

AUXILIARY SWITCH

The auxiliary switch is mounted in the channel to the left of the face plate and is held by four 8-32 round head machine screws, two on the top and two on the bottom. The driving link protrudes back through the mounting channel and is connected to the main drive link provided on all breakers. No adjustment is necessary. Although access is provided to the switch terminals, it is easier to pre-wire the switch before mounting. See Fig. 4.

SHUNT CLOSE

The shunt close mounts on the right side of the spring compartment plate and engages the holding cam release lever. Two 10-32 screws are used to mount this assembly which includes the closing coil switch. No adjustments are necessary. Check to see that the solenoid moves freely and that the holding cam release lever returns to its normal position. See also "Holding Cam Adjustment".

SHUNT TRIP

The shunt trip is supplied on an accessory mounting plate which mounts on the left side of the main mechanism compartment. This plate has provision for mounting the no-volt relay and an additional auxiliary switch when required. Three 10-32 tapped holes are provided to hold the assembly. Check the operation to ensure the shunt trip relay engages the horizontal trip shaft tab.

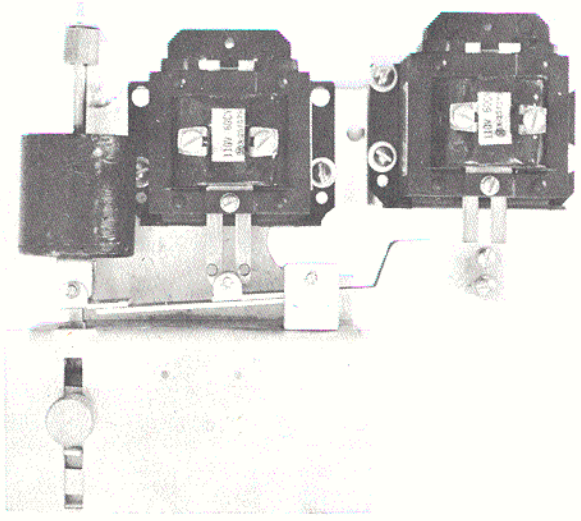


Figure 5 — **SHUNT TRIP AND NO-VOLT TRIP**

NO-VOLT TRIP

The no-volt trip relay mounts on the accessory mounting plate in front of the shunt trip. It can be supplied with a time delay device adjustable from 1-5 seconds. Tripping is actuated by the weight of the solenoid plunger and no adjustment is necessary. Check the operation to ensure the lever engages the horizontal trip shaft tab.

CONTROL TRANSFORMER

An auxilliary bracket is provided, which mounts between the two outer frame side plates at the bottom front and a fused control transformer is supplied on the left side. If fuses blow check electrical circuits to determine cause and replace fuses using the same rating as supplied and shown on wiring diagrams. 100VA is standard.

THERMAL RELAY

When required, a thermal relay is supplied mounted on the right side of the auxiliary bracket. A three element relay is supplied as standard, but relays of customers choice can be supplied if they do not exceed the space requirements.

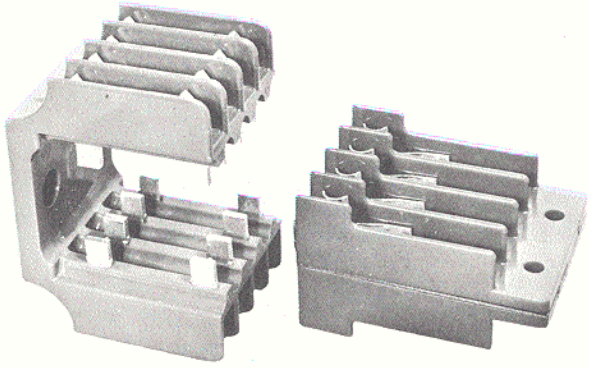


Figure 6

SECONDARY DRAWOUT CONTACTS

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

The contacts are supplied in sets of 8 in one contact block with power supply always on the left side viewed from the front. Control power supply terminals are separated from other control circuits by a blank terminal thus providing double arc gap and creepage distances at these points. A maximum of 32 contacts can be supplied.

The continuous current carrying capacity of the contacts is conservatively rated at 30 amps continuous and is suitable for voltages up to 600 volts.

Contacts are formed copper, cadmium plated and mounted in a polycarbonate moulding. The moulding is designed with high barriers between contacts and the disconnecting parts shrouded so that contacts cannot be made until they are aligned. If contacts are added or replaced check carefully to see they are properly aligned.

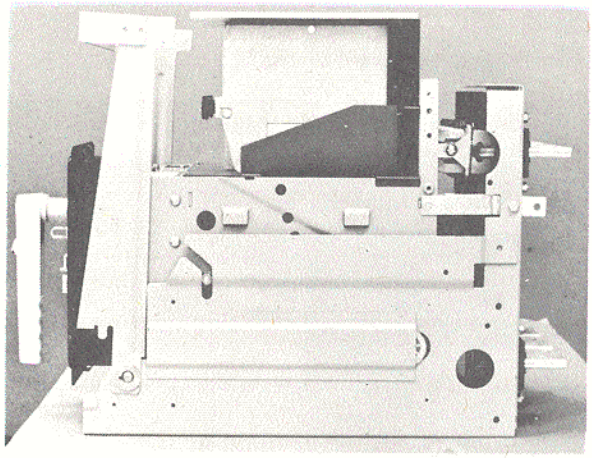


Figure 7

BREAKER MECHANISM

As the spring is charged, the mechanism linkage is lifted and the latch bearing set on the latch. When the spring is discharged, the closing casting is rotated and because the linkage is prevented from collapsing by the latch, the toggle links force the contacts into the closed position. The breaker is tripped by rotating the ground steel cam backwards which releases the latch bearing allowing the linkage to collapse.

When the breaker is open and the spring charged ready for closing, the latch bearing will have a clearance of 1/64″ to 1/16″ above the ground steel cam. Fig. 8.

If there is not sufficient clearance between the cam and the latch bearing the cam cannot return to its proper position and the breaker will not latch. After one attempt, the vibration may assist the cam to its proper location and the breaker will then close.

If the clearance is excessive, the latch bearing may bounce off the ground steel cam and the breaker will not close.

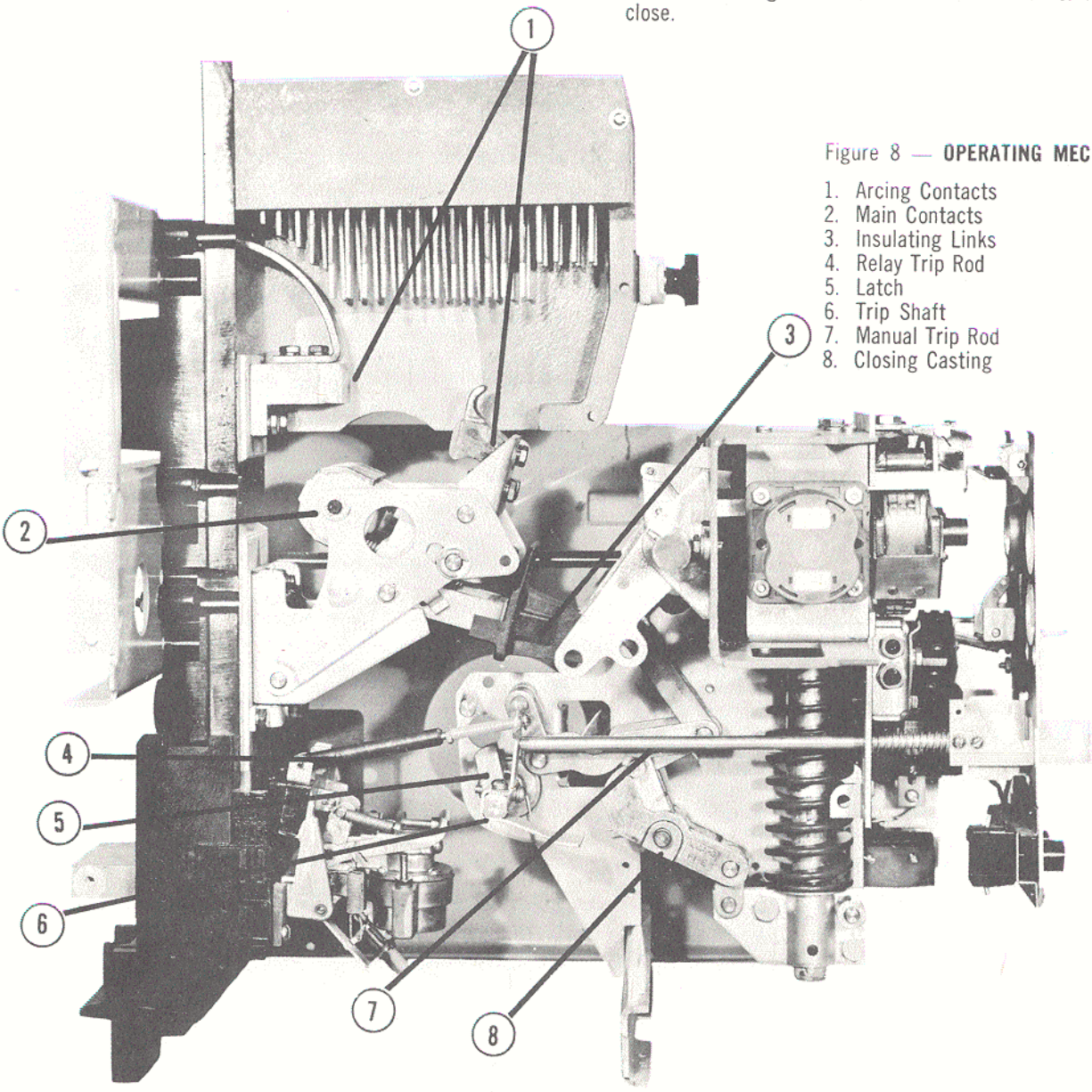


Figure 8 — **OPERATING MECHANISM**

1. Arcing Contacts
2. Main Contacts
3. Insulating Links
4. Relay Trip Rod
5. Latch
6. Trip Shaft
7. Manual Trip Rod
8. Closing Casting

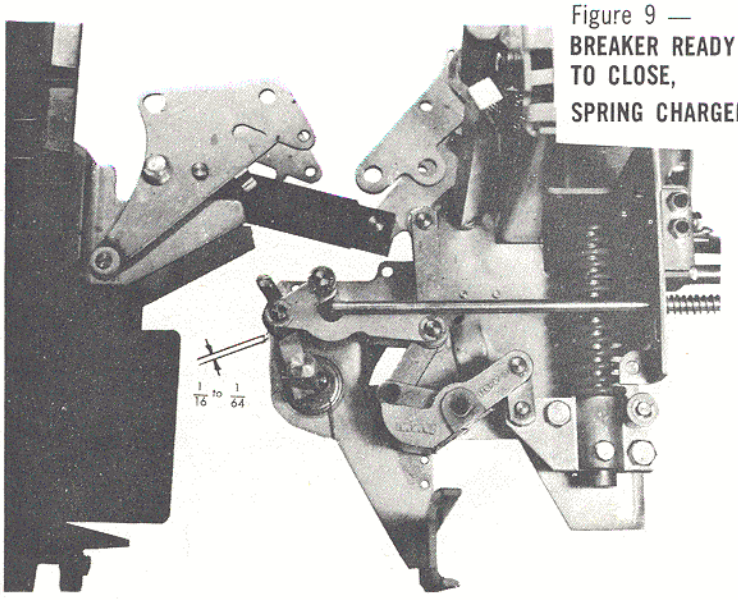


Figure 9 — **BREAKER READY TO CLOSE, SPRING CHARGED**

LATCH ADJUSTMENT

When the breaker fails to latch the spring mechanism discharges without carrying the contact assembly to the closed position. Without the inertia of the contact assembly to absorb the energy from the closing spring, severe stress is imposed on the closing mechanism and damage will result if this process is repeated.

To adjust the latch first loosen the locknut (1). Turn the adjusting screw (2) counter-clockwise two or three turns to ensure proper latching. Close the breaker and then turn the adjusting screw clockwise slowly until the breaker trips. Then turn the adjusting screw back counter-clockwise one and one quarter turn and lock with locknut (1). If the breaker is subjected to severe vibration which results in nuisance tripping more latch travel is needed and one and a half turns can be used.

OVERLOAD RELAYS

All type H breakers are supplied with the new type PA direct acting overcurrent relay. These relays are dual magnetic type consisting of a long delay element and an instantaneous element.

A series coil is used on breaker rated 600 amperes and below, while a single conductor provides sufficient magnetic lux for all ratings over 600 amperes. The very efficient magnetic design permits operation of the relay at very low ampere turn values and thus the coil normally associated with air circuit breaker relays is completely eliminated for all ratings of 600 amperes and over. In addition, coils use on the lower ratings employ much lower current densities than usual for this type of device and thus will operate at much lower temperatures.

For breakers with series coils, the coils also must be disconnected from the breaker. Coils are mounted using Allen screws, two at each terminal. The yoke around which the coil is wound is mounted by two 10-32 flat head screws which may be removed using a short screw driver at the top front of the yoke. Reverse this procedure to install new relays.

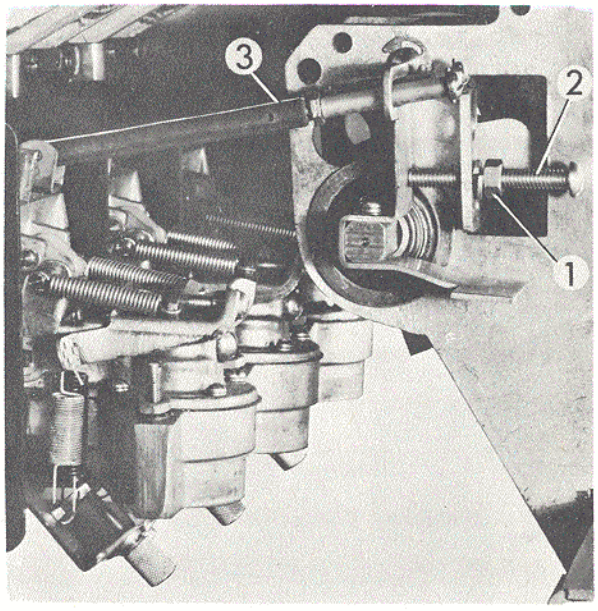


Figure 10 — **LATCH ADJUSTMENT**

1. Locknut
2. Adjusting screw
3. Relay connecting link

P.A. OVERLOAD RELAY COILS
For Type H-2 Air Circuit Breakers

Part Number	Current Range	No. of Turns	Maximum 100% Calibration	Minimum 100% Calibration
46E-47	30 Amp	30	30	30
46E-51	35 Amp	25	35	35
46E-52	50 Amp	19	50	50
46E-53	60 Amp	16	60	60
46E-54	70 - 75 Amp	13	75	70
46E-55	90 Amp	9	90	90
46E-43	100 - 149 Amp	8	149	100
46E-42	150 - 249 Amp	6	249	150
46E-38A-1	250 - 400 Amp	4	400	250
46E-38	401 - 500 Amp	3	500	401
46E-44	501 - 600 Amp	2	600	501

NOTES:

1. The minimum for Std. calibration is 800 ampere turns.
2. The minimum for selective calibration is 950 ampere turns.
3. Ampere turns = F/L current x No. of turns.
4. Short time pickup (selective) should have 1 pickup point between 4 & 10 X.
5. Short time Delay (selective) should have 1 delay band 5, 15 or 25 cycles.

LONG DELAY CALIBRATION

The relays are calibrated at the factory at 80%, 100% and 160% of trip coil rating and may be adjusted in the field to these calibrated marks.

INSTANTANEOUS CALIBRATION

The relays are calibrated at the factory at 10 times the trip coil rating as standard. A calibrated mark at 8, 10, or 15 times is provided and the setting can be altered in the field if necessary.

RELAY REPLACEMENT

Relays are mounted by two 12-24 screws one on each side at the bottom. For breakers without series coil, simply remove the two mounting screws and replace relays and the mounting screws.

OIL FILLER HOLE

The relays are shipped from the factory filled with oil and should not require servicing. If the relays are disassembled they should be thoroughly cleaned with carbon tetrachloride and reassembled with care to ensure they are completely free of dirt or lint. Refill the relay with 20 cc of the replacement silicon oil using a squirt type oil can.

CHECK RELAY OPERATION

Push on both sides of moving armature with gentle pressure. The armature will move slowly as the delay piston retards the movement. At a point before the armature meets the yoke, the delay action ceases abruptly and the armature should travel freely to meet the yoke. In so doing the insulated pull rod connected to the armature should pull the lever on the trip rod to trip the breaker. Adjust the screw at the trip shaft end of the pull rod if necessary to ensure the breaker trips.

This procedure may be repeated with more severe pressure which will extend the instantaneous springs and allow the armature to touch the yoke and trip the breaker.

Reference should be made to the time current characteristic curves for proper settings to suit load conditions.

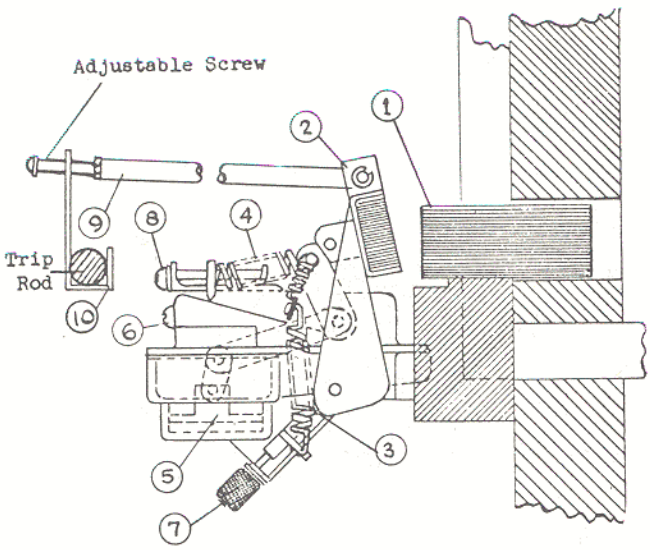


Figure 11 — **RELAY ADJUSTMENT**

1. Fixed yoke
2. Moving armature
3. Long delay springs
4. Instantaneous springs
5. Delay mechanism
6. Oil filler hole
7. Long delay adjustments
8. Instantaneous adjustments
9. Relay connecting link

SELECTIVE TRIPPING ATTACHMENT

When a short delay is required under short circuit conditions a delay device is introduced to prevent the instantaneous action of the relay. Three calibrated delays of 5, 15 or 25 cycles at 6 times the instanteous pickup are available.

A mechanical escapement device is mounted on the moving armature of the relay to prevent its movement under short circuit conditions. The timing adjustment is made by the amount of extension of the escapement spindle. Release the locknut on the side and adjust to one of the calibrated marks.

MAIN CONTACTS

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

If main contacts are severely damaged careful inspection of all current carrying parts should be made. Supporting pins, linkage and especially springs should be examined for damage due to excess heat. Annealed or distorted parts should be replaced.

To change main moving contacts disconnect the insulating links to the other two poles and close the breaker. The slow close maintenance device can be used to assist this procedure. When the pole is closed, the main contact pin should be free and can be removed. Care should be used to avoid dropping the insulating spacer washers down into the mechanism. Reassemble with new contacts.

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 is held firmly in position by the arc chute rods projecting from the base. The hood is an asbestos type material and will break if subjected to undue shocks, therefore, care should be used in handling.

ARC CHUTES

The arc chutes are a ceramic 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 a knob on the interphase barrier and can be lifted clear to expose the arcing contacts. The arc chute may discolor from arc interruption but will not need replacement unless heavy deposits of arc contact material are present or unless parts are distorted or cracked.

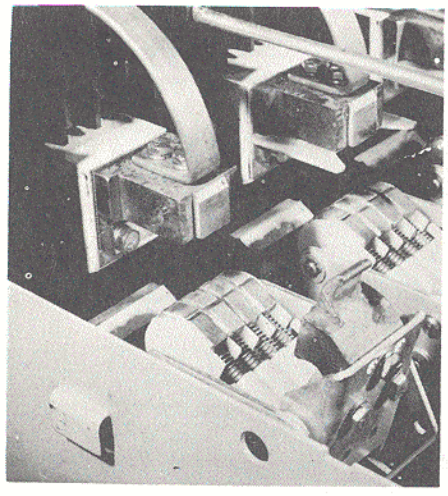
ARCING CONTACTS

Arcing contacts are subjected to burning every time the circuit breaker interrupts the current and should be inspected at regular intervals if the circuit breaker 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 burning.

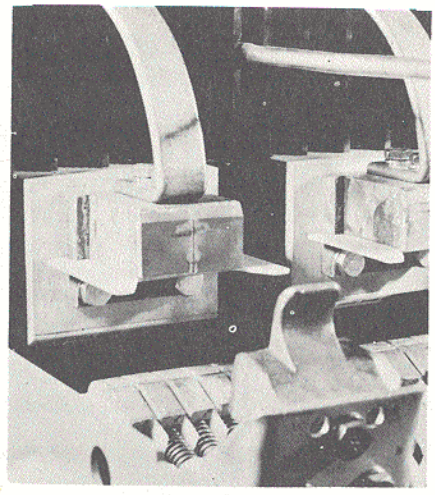
To remove the fixed arcing contacts from the breaker take out the two hex-head machine screws at the base of each fixed contact. It is not necessary to remove the arcing horns separately because new arcing horns are supplied with each new set of arcing contacts.

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 lock washer when removing the contact and do not omit the lock washer when connecting the braid to the new contact.

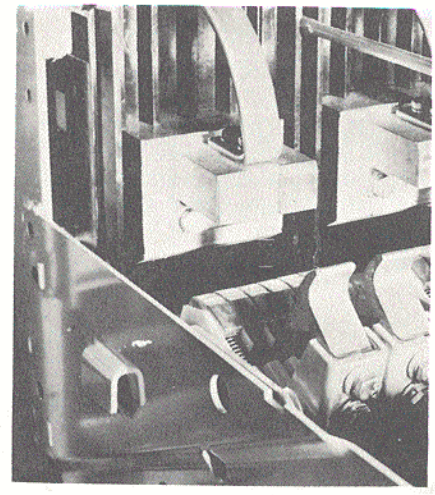
Whenever replacing arcing contacts inspect the braids and replace them if necessary.



25H-2 600A



50H-2, 1600A - 3000A
75H-2, 2000A - 4000 A



100H-2 2000A - 4000A

Figure 12 — **ARCING CONTACTS**

DRAWOUT CIRCUIT BREAKERS

All drawout circuit breakers are mounted on a three position carriage so that the breaker may be moved to any of its positions, connected, tested and withdrawn without opening the door.

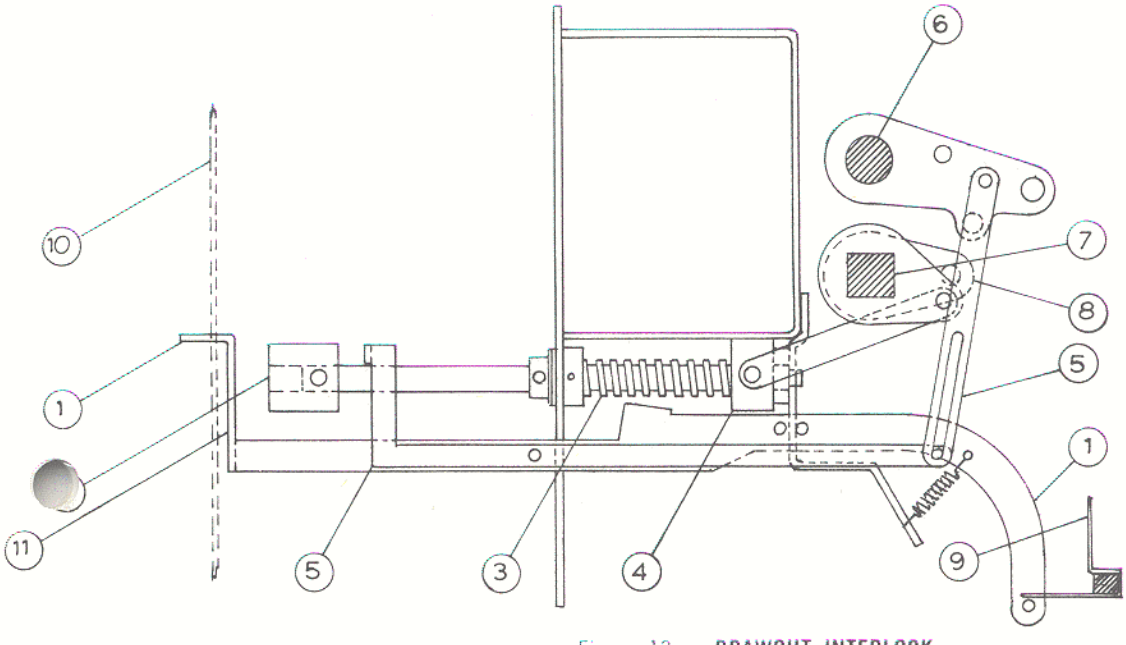
An interlock is provided which will ensure that the breaker is open when it is either engaging or disengaging the main contacts. A block is provided on the crank mechanism which operates in conjunction with the gate over the crank opening. See Fig. 13.

To withdraw the breaker first lower the drawout tracks to the horizontal position, then move the gate over the crank opening down so as to expose the socket end of the drawout crank shaft. The crank may now be inserted in the crank shaft socket and by counter clockwise rotation the breaker will move outward.

At the "test" position the main contacts are withdrawn but the auxiliary contacts become engaged with their test position connections.

A few more turns of the crank will move the breaker 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 breaker so that it can be lifted clear of the tracks with the handles supplied.



1. Interlock lever
2. Crank socket
3. Screw shaft
4. Interlock block
5. Lockout lever
6. Main closing shaft
7. Drawout lever shaft
8. Drawout levers
9. Trip shaft
10. Face plate
11. Gate

Figure 13 — **DRAWOUT INTERLOCK**

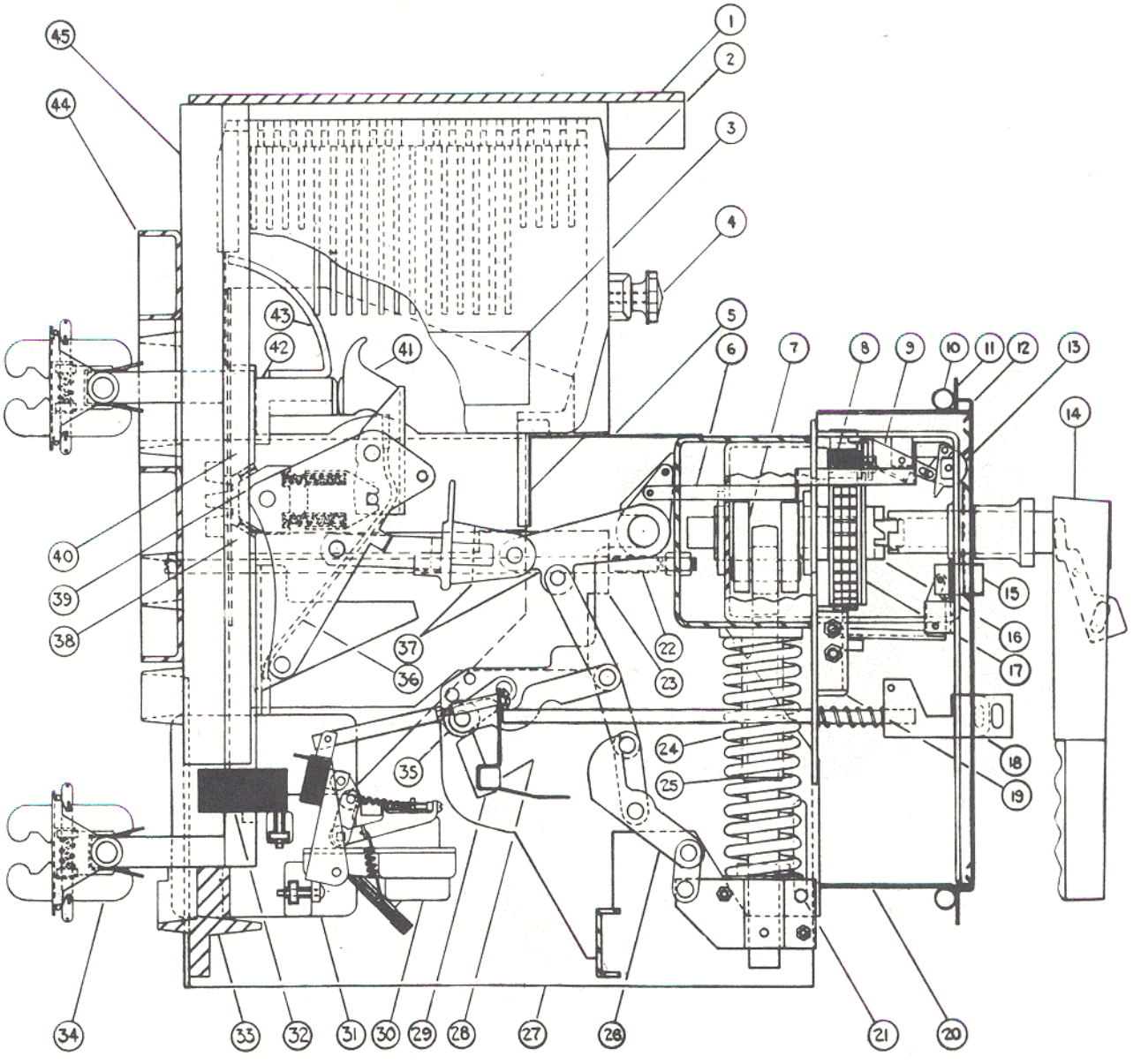


Figure 14 — **SECTION OF BREAKER**

1. Hood
2. Arc chutes
3. Side flash barriers
4. Arc chute mounting knobs
5. Front flash barrier
6. On-Off indicator link
7. Spring crank
8. Ratchet wheel holding pawl & spring
9. Charged-Discharged indicator link
10. Floating trim spring
11. Floating trim
12. Faceplate
13. On-Off and charged-discharge indicators
14. Manual handle with provision for lock-out
15. Closing button with lever
16. clutch
17. Ratchet wheel
18. Trip lever with provision for padlocking
19. Cam for spring holding assembly
20. Faceplate box
21. Spring guide pin
22. Tie rods
23. Interphase barrier
24. Main closing spring
25. Guide tube for spring
26. Closing casting
27. Breaker frame
28. Trip shaft
29. Ground steel trip latch
30. Dual magnetic overload relays
31. Relay mounting and barrier plate
32. Overload relay yoke
33. Lower base moulding
34. Main drawout contacts
35. Latch bearing
36. Braid
37. Main closing links
38. Main lower fixed contact
39. Main moving contacts
40. Main upper fixed contacts
41. Moving arcing contact
42. Stationary arcing contact
43. Arcing horn
44. Rear base pan
45. Upper base moulding

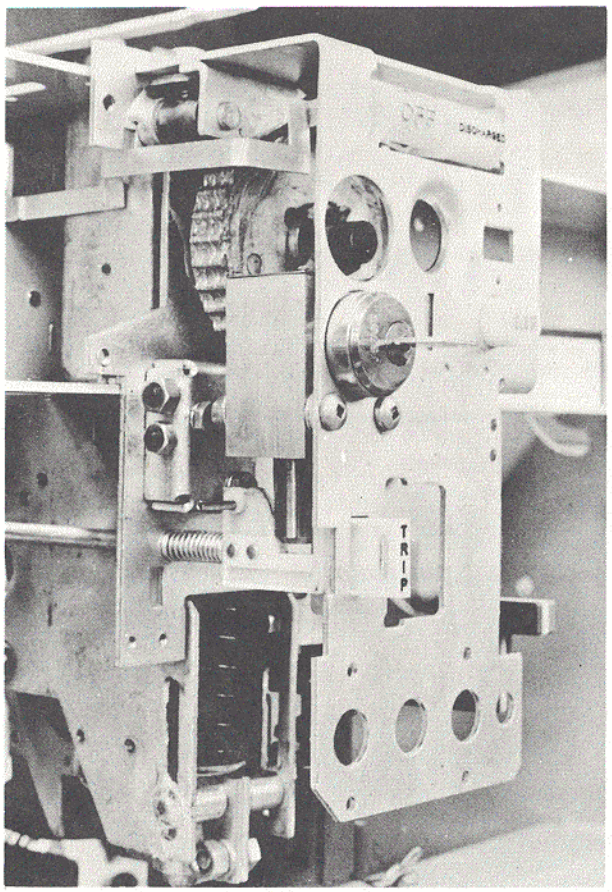


Figure 15 — **KEY INTERLOCK**

INTERLOCKS

Knock-outs are provided in the face plate to accept a type VF single or double interlock with ⅜" projection which mounts with ¼-20 screws behind the face plate. The lock plunger engages the tapered section of the manual trip shaft. No auxiliary mechanism is required. For electrically operated breakers an auxiliary contact can be provided to operate in conjunction with the interlock to isolate the closing circuit. Complete mounting details are provided with the unit.

SPARE PARTS

It is recommended that sufficient spare parts be carried in stock to enable the operators of circuit breakers to promptly replace any worn, broken or damaged parts. It will be readily appreciated that a stock of parts reduces delays in service and saves time and expense. The following spare parts are recommended as minimum requirements for a breaker installation.

SPARE PARTS (electrically operated breakers 600A TO 4000A

Description	Parts Req'd. Per Bkr.
Motor*	1
Closing coil*	1
Shunt trip coil*	1
No volt coil*	1
Limit switch (SLS)*	1
Limit switch (CC)*	1
Auxilliary relay* (2N02NC contacts)	1
Control transformer* 150VA	1
Auxilliary D/O contacts (fixed)	‡
Auxilliary D/O contacts (moving)	‡

*Specify voltage.

‡8 contacts per unit — check wiring diagram for number of units required.

SPARE PARTS (all breakers)

Description	PARTS REQUIRED PER BREAKER				
	600A-25H-2	1600A-50H-2	2000A-65H-2	3000A-75H-2	4000A-100H-2
Hood assembly	1	1	1	1	1
Arc chute	3	3	3	6	6
Moving arcing contact	3	3	3	6	12
Stationary arcing contact	3	3	3	6	6
Upper stationary main contact (fixed)	3	3	3	6	6
Upper stationary main contact (drawout)	3	3	3	6	6
Centre stationary main contact	3	—	—	—	—
Lower stationary main contact (fixed)	3	3	3	6	6
Lower stationary main contact (drawout)	3	3	3	6	6
Main moving contact	12	18	24	36	36
Main moving contact spacer—outer	3	3	3	6	6
Main moving contact spacer—inner	12	18	24	36	36
Main moving contact spring—light	—	—	16	6	24
Main moving contact spring—heavy	24	36	32	48	48
Main moving contact spring guide—inner	6	6	6	12	12
Main moving contact spring guide—outer	—	—	6	—	—
Main braids	3	3	3	6	6
Draw-out contacts	6	6	6	12	12
Relay oil (60 cc)	—	—	—	—	—

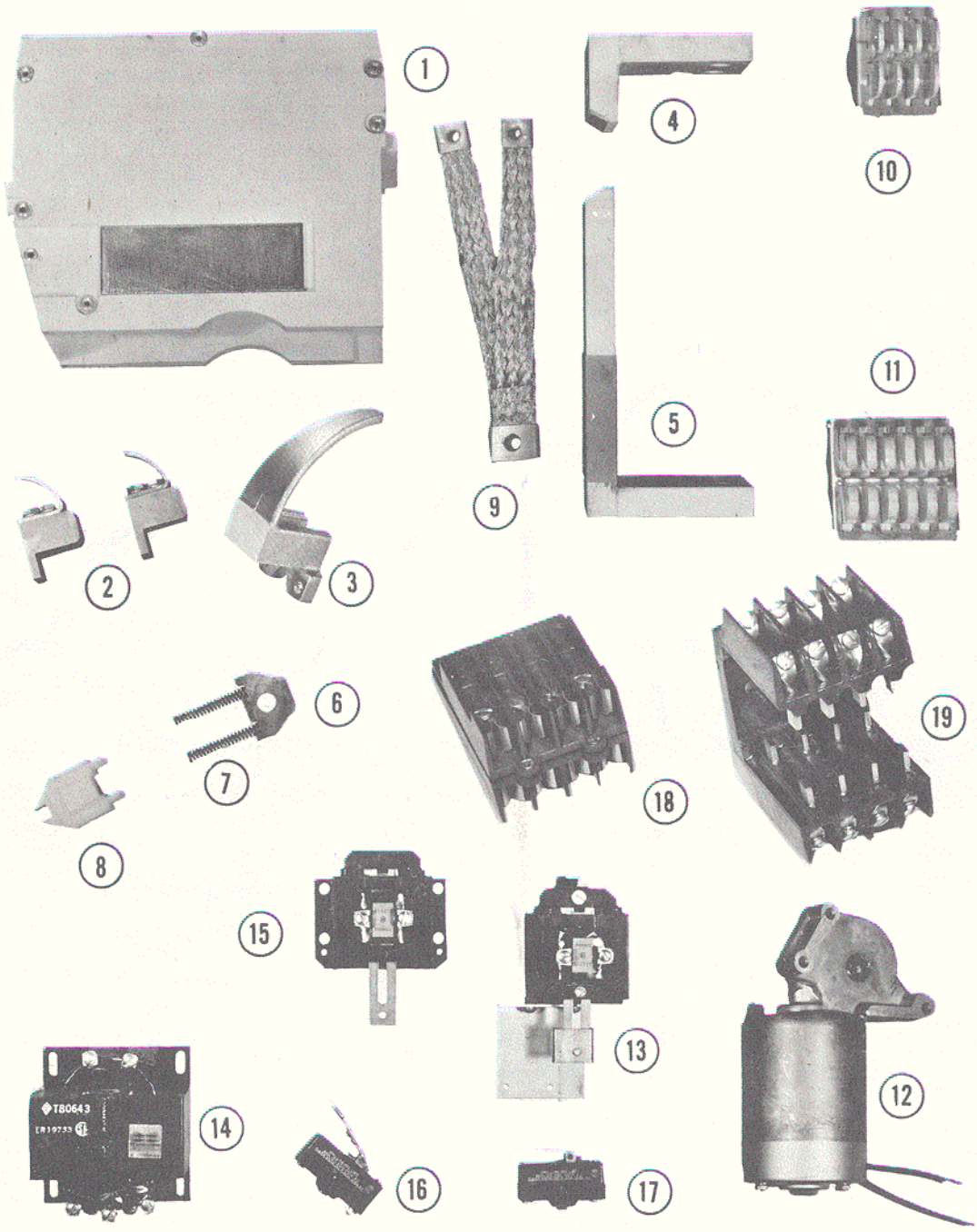


Figure 11 — **SPARE PARTS**

1. Arc chute
2. Moving arcing contacts
3. Stationary arcing contacts
4. Upper stationary main contact
5. Lower stationary main contact
6. Main moving contact
7. Main moving contact spring
8. Main moving contact spring guide
9. Main braids
10. Draw-out contacts, 600A.
11. Draw-out contacts, 1600A.
12. Motor
13. Closing coil assembly
14. Control transformer
15. No-volt trip coil assembly
16. Limit switch (SLS)
17. Limit switch (CC)
18. Auxiliary D/O contacts (moving)
19. Auxiliary D/O contacts (fixed)