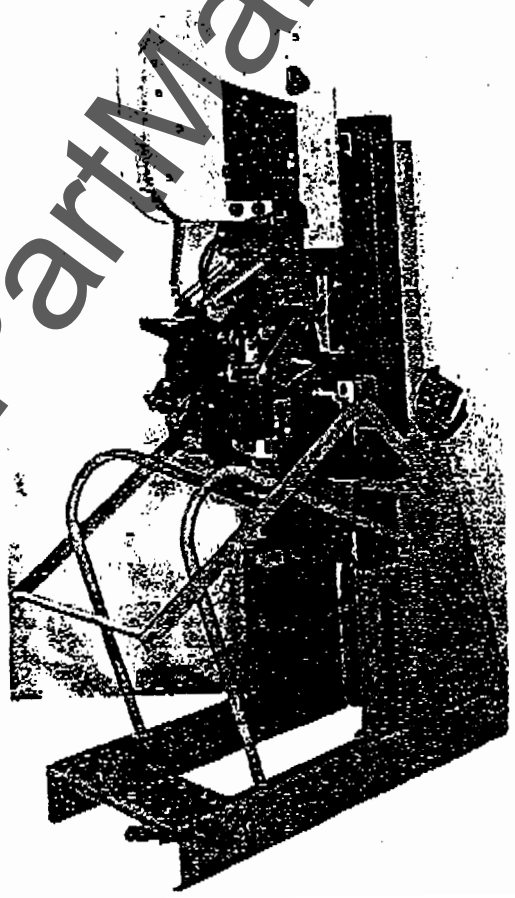
INSTRUCTIONS

GEH-1803B

SUPERSEDES GEH-1803A

POWER CIRCUIT BREAKER

Types
MC-5 MC-6,
MC-6A and MC-6B



GENERAL ELECTRIC

CONTENTS

POWER CIRCUIT BREAKER
TYPE MC-5, MC-6, MC-6A AND MC-6B

INTRODUCTION

Before installing or attempting to operate these power circuit breakers, this instruction book should be read thoroughly and carefully.

RATINGS

CURRENT RATINGS

2,000 to 4,000 amperes.
6,000 to 12,000 ampres.

VOLTAGE RATINGS

Up to and including 750 volts d-c.
751 to 1000 Volts d-c.

APPLICATION

Type MC-5, MC-6 and MC-6A power circuit breakers are designed for general use on d-c circuits providing an efficient means of controlling and protecting various types of d-c electrical apparatus and power circuits. These breakers are particularly applicable where service conditions are severe, operations frequent and the available short circuit current is high.

The MC-6B breaker is designed primarily for use as a load break disconnecting switch. It can be distinguished from the MC-6 breaker by its smaller arc chute and the elimination of the rebound hook assembly. It is not furnished with any of the automatic overcurrent trip devices, therefore, its application is limited accordingly.

RECEIVING, HANDLING AND STORAGE

RECEIVING

Immediately upon receipt of the breakers, an examination should be made for any damage or loss sustained in transit. If injury or rough handling is evident, a damage claim should be filed at once with the transportation company and the nearest General Electric Sales Office should be promptly notified.

HANDLING

The breakers should be unpacked as soon as possible after being received, as difficulty may be experienced in making claim for damage not evident upon receipt, if delayed. Care should be used in unpacking in order to avoid damaging any of the breaker parts. Be sure that no loose parts are missing or left in the packing material. Blow out any dirt or particles of packing material that may be accumulated on the breaker parts.

STORAGE

If the breakers are not to be mounted in their permanent location at once, they should be stored in a clean dry place and preferably placed in a vertical position. They should be supported to prevent bending of studs or damage to the breaker parts. It is best not to cover the breakers with any packing or other material that is apt to absorb moisture which may cause corrosion of breaker parts. A covering of paper will prevent dust from settling on the breaker parts.

INSTALLATION

LOCATION

MC breakers should be installed in a clean dry location which is accessible for proper operation, inspection and maintenance. Sufficient space for electrical clearance should be provided in accordance with the specific outline drawing furnished for the breaker.

STATIONARY BREAKERS

Most MC breakers are shipped on permanent bases or panel sections designed for live-front stationary mounting, and installation consists of bolting the breaker base to the supporting framework or structure. These breakers are usually shipped with the arc chute assembled on the breaker. Before energizing the breaker, the 1/8" minimum clearance, "C" Fig. 5, between the arc runner and the movable arcing contact, should be checked and reobtained, if necessary. If the breaker is over 48" high, the arc chute will be removed for shipment and should be installed before energizing the breaker, as described under the "Arc Chute Mounting" section of the instructions.

NOTE: If the breaker is mounted in its permanent location and not put in service immediately, it should be covered with a moisture resistant material which will not absorb moisture and cause corrosion of breaker parts. A covering of paper will prevent dust from settling on breaker parts.

DRAWOUT BREAKERS Fig. 1

MC drawout breakers are designed for dead front mounting in drawout cubicles or switchgear equipments. These breakers are mounted on a truck (7) which facilitates the insertion and withdrawal of the breaker from its compartment. The insulated breaker base (15) is mounted to the truck framework. The truck is furnished with a test position stop and foot release (6), thus allowing the breaker to be operated when in the "test position".

Many drawout breakers are shipped with the arc chute removed, and must therefore be mounted on the breaker before installation. See section entitled "ARC CHUTE MOUNTING".

RACKING MECHANISM - Fig. 1

All drawout breakers are provided with a racking mechanism which consists of a racking handle (5), racking cams (11), cam locking arm (12), and pawl (10). The racking mechanism facilitates that part of inserting or withdrawing the breaker when the movable primary disconnects engage or disengage the stationary primary disconnects. The cam locking arm (12) prevents operation of the racking mechanism unless the breaker is inserted into the compartment.

DRAWOUT TRIP INTERLOCK - Fig. 1

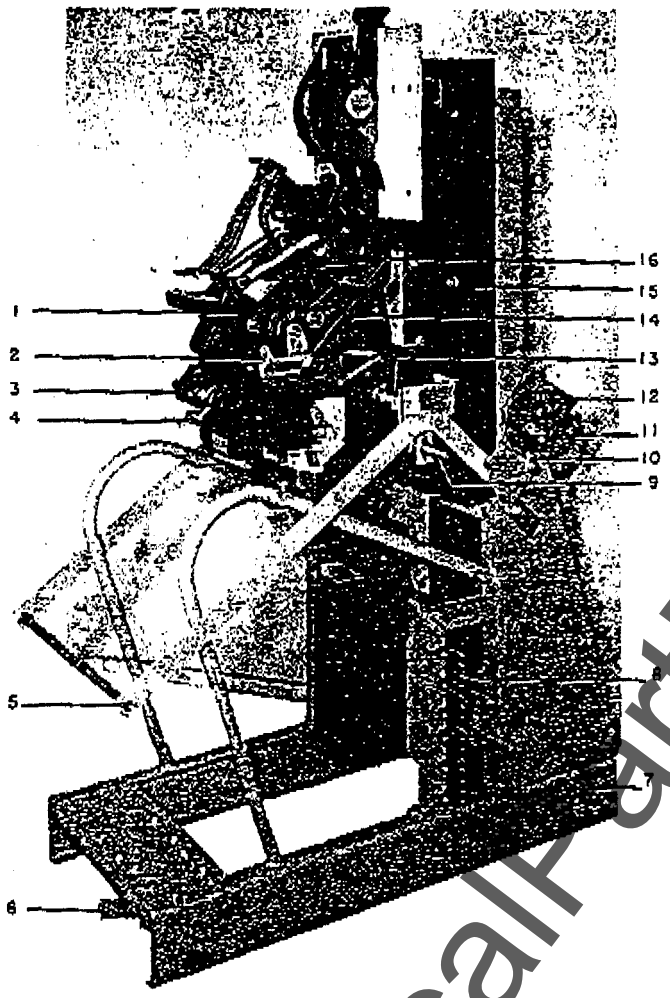
All drawout breakers are furnished with a trip interlock feature, which when coordinated with the trip interlock components of the compartment, provided a door trip interlock. When the breaker is in the operating position, the door trip interlock assures that the breaker is tripped before it's compartment door is opened and the door is latched closed before the breaker is closed.

NOTE: When the breaker is in the "test position", the interlock does not engage the trip pin (9) on the breaker, thus allowing breaker to be operated with its compartment door open or closed.

If the breaker is closed and moved from the "test position" toward the fully racked-in position, the trip pin (9), coupled to the breaker trip shaft (13), engages a cam on the compartment door shaft, thus tripping the breaker and holding it trip-free until the subsequent racking operation is complete and the compartment door is latched closed.

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

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.



1. Manual Release Lever
2. Lever
3. Position Indicator
4. Operation Counter
5. Racking Handle
6. Foot Release
7. Truck
8. Secondary Disconnect
9. Trip Interlock Pin
10. Pawl
11. Racking Cam
12. Cam Locking Arm
13. Trip Shaft
14. Rebound Hook
15. Breaker Base
16. Pin (Rebound Hook)

Fig. 1 Drawout Breaker Type MC-6A (Arc Chute Removed)

BREAKER TRUCK INTERFERENCE INTERLOCK

The breaker truck interference interlock prevents the insertion of a breaker truck into a breaker compartment of different current rating from that of the breaker.

An interference bolt is mounted on one side of the breaker truck and a stop bolt is mounted on one side of the compartment. When the breaker and compartment are of like current ratings, the stop and interference bolts are located on opposite sides, which allows the breaker truck to enter the compartment. When breaker and compartment are of different current ratings, the stop and interference bolts are located on the same side, thus preventing the truck from entering the compartment.

INSERTING THE BREAKER - Fig. 1

Before installing the breaker a fresh coat of G.E. lubricant D50H47 should be applied to the silvered portion of the primary disconnects. Then proceed as follows:

1. Roll the truck into the compartment until the test position stop engages. This is the "test position" where the secondary disconnecting devices (8) are engaged but the primary disconnects are safely parted. In this position, the truck and compartment ground connection is also engaged.

2. On initial installation, it is advisable to operate the breaker several times while in the "test position".

3. Push down on the position stop foot release (6) and roll the breaker into the compartment until the racking cams (11) engage the racking pins on the compartment. In so doing, the cam locking arm (12) has been lifted, thus allowing the racking handle to be operated.

4. Operate the racking handle (5) five complete upward and downward strokes, thus racking the breaker to the fully-in position.

5. After the fifth racking stroke has been performed, raise the racking handle part way and allow it to drop to its normal position. This reverses the pawl (10), which engages the teeth of the racking cam (11), and thereby readies the mechanism for a withdrawal operation.

NOTE: Further operation of the racking handle will initiate the withdrawal operation and may render the breaker trip-free by virtue of the trip interlock.

6. Close and latch the compartment door releasing the door trip interlock.

7. The breaker may now be operated.

WITHDRAWING THE BREAKER - Fig. 1

1. Trip the breaker by the control switch and turn the door handle to unlatch the door. If the breaker is not tripped, operating the door handle will trip it.

2. Rack the breaker all the way out by performing five complete racking strokes.

3. Pull the breaker out of its compartment until it engages the position stop and holds the breaker in the "test position". In this position the breaker may be inspected and operated, with the primary disconnects safely parted, while the compartment door is either open or closed.

4. For complete removal trip the breaker, release the test position stop and pull the breaker free of its compartment.

CONNECTIONS

Before connecting current-carrying bus bars, cables or secondary control wiring, every precaution must be taken to be sure that all leads to be connected to the breaker, are de-energized.

The connections to the breaker studs should be clean, flat and free from burrs to assure full contact area, and should be firmly clamped or bolted in place to prevent excessive heating. The connecting cables or bus bars should have adequate current-carrying capacity, otherwise heat will be conducted from them to the breaker, thereby causing excessive temperature rise when carrying normal current. Connecting bus bars or cables should be supported so that the breaker studs will not be subjected to unnecessary strain.

Under no circumstances should the bolts holding the connecting studs to the panel be loosened to facilitate the assembling of the connections to the breaker studs. To do so may cause misalignment of the contacts resulting in improper contact pressure, overheating and faulty breaker operation.

Fig. 1 (8027378)

OPERATION

MANUAL

CLOSING - Fig. 3

To close the breaker manually, lift the manual release lever (2) and insert the manual operating handle (15), Fig. 9. This causes lever (3) to rotate the rebound hook (13) off pin (14), thus allowing the mechanism to complete the closing operation.

(Refer to Fig. 9) With the rebound hook released, push downward on the operating handle forcing the mechanism upward until the catch toggle link (19) and trip latch (27), engage their respective catch plates (25), thus holding the mechanism in the closed position. The mechanism is then propped in the closed position by the prop (13) which is supported against stop stud (3) and against the heavy springs (1) Fig. 3.

TRIPPING - Fig. 13

The breaker may be tripped manually by pushing upwards on the trip button (10), thus moving the trip lever (11) downward against the top of the trip latch (13) and disengaging it from its catch plate (25) Fig. 9. This allows the mechanism to collapse as roller (21) Fig. 9 moves against the main toggle prop (13) Fig. 9, releasing the prop from the stop stud (3) Fig. 9, allowing the mechanism to drop to the open position where stop stud (3) Fig. 9 engages the top catch position of the prop (13) Fig. 9. NOTE: Be sure to remove the operating handle after operating the breaker manually, otherwise the mechanism will not be self resetting.

ELECTRICAL - Fig. 2

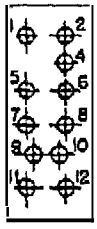
CLOSING

MC breakers are closed electrically whenever the closing solenoid is energized, thus causing an upward movement of the solenoid armature and initiating the subsequent mechanical closing action. The closing signal may be given by either a remote switch or relay, depending on the external closing circuit.

NOTE - If the breaker is equipped with a reverse current tripping device, its potential coil must be energized before the breaker can be closed.

A typical wiring diagram for the control circuit of electrically operated breakers is shown in Fig. 2. The function and sequence of operation of the control circuit components may be observed by coordinating the following text with the wiring diagram:

When a closing signal is given the X relay is energized through the normally close contact K10-K12 of the Y relay and is sealed-in by its own contact K5-K7. When the X relay is energized its contact K1-K2 closes, energizing the closing solenoid G1-G2, thus causing the solenoid armature to move upward, forcing the mechanism upward where it is latched and propped closed as described under "Manual Operation".



CLOSING RELAY STUD LOCATIONS (BACK VIEW)

LEGEND

G - SOLENOID CLOSING COIL
F - (AA) CUT-OFF SWITCH
L - AUXILIARY SWITCH
K - CLOSING RELAY TYPE HKA
(X) CLOSING CONTACTOR
(Y) ANTI-PUMP PERMISSIVE RELAY.
M - SHUNT TRIP (T.C.)

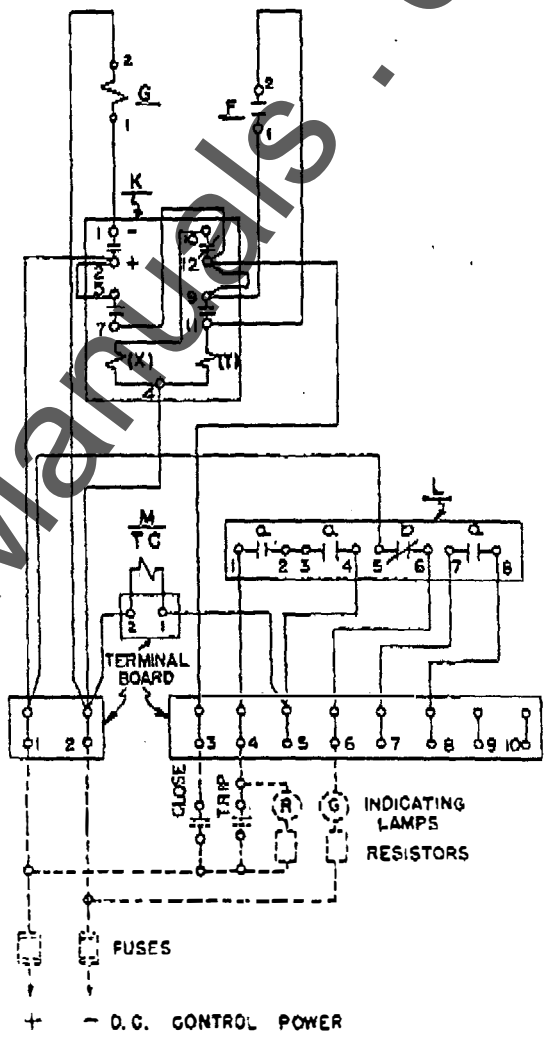


Fig. 2 Typical Wiring Diagram

Near the top of the armature closing stroke the cutoff switch F1-F2 is mechanically operated, closing its contact and energizing the Y relay. With the Y relay energized its contact K10-K12 opens de-energizing the X relay, thus de-energizing the solenoid G1-G2 and allowing the solenoid armature to reset to its normal position, while the closing mechanism remains latched and propped in the closed position. When the solenoid armature resets to its normal position, the cutoff switch is also reset to its normal open position, thereby readying the circuit for a subsequent closing operation.

If contact is maintained at the closing switch, the Y relay remains energized, independent of the cutoff switch, through its now closed contact K9-K11, thereby holding the X relay circuit open by Y relay contact K12-K10. This provides the anti-pump feature.

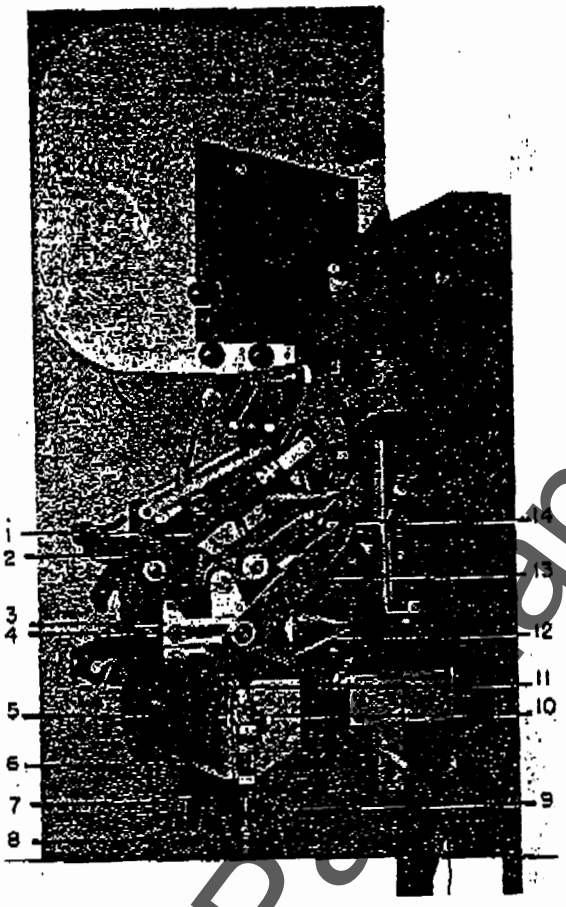
TRIPPING - Fig. 2

The breaker may be tripped electrically by any of the automatic protective tripping devices described in these instructions. All of these initiate tripping in a similar manner, when the trip lever (11) Fig. 13 of the device moves against the trip latch (13) Fig. 13, disengaging the latch from its catch plate (25) Fig. 9, and causing the mechanism to collapse.

The breaker may also be tripped electrically by the shunt trip coil M1-M2, which is energized through two normally open contacts L1-L2, L3-L4 of the auxiliary switch, when a tripping signal is given from a remote switch or relay.

The closing and tripping coils of these devices are designed for intermittent service and should not be operated repeatedly for any extended period of time.

Fig. 2 (K-6303815)



1. Heavy Springs
2. Manual Release Lever
3. Lever
4. Pivot Pin
5. Cutoff Switch
6. Switch Plunger
7. Adjusting Screw
8. Operating Lever
9. Rod
10. Pawl
11. Stud (Rebound Hook)
12. Springs
13. Rebound Hook
14. Pin

Fig. 3 Side View MC-6A Breaker - For Drawout Mounting

MAINTENANCE

BEFORE INSPECTING OR REPAIRING, BE SURE THE BREAKER AND ACCESSORIES ARE DISCONNECTED FROM ALL ELECTRICAL POWER, BOTH PRIMARY AND CONTROL VOLTAGES.

PERIODIC INSPECTION

Periodic inspection of the breaker is recommended at least once a year or more frequently if load conditions, dust and moisture are very severe. An inspection of contacts and arc runners should always be made after the breaker has opened a severe short circuit. If the breaker remains open or closed for a long period of time, arrangements should be made to open and close it several times in succession. Clean and lubricate the breaker where necessary, to keep the moving parts and contacts in good working condition.

The breaker should be closed and opened manually and electrically a few times as described under "Operation" to be sure that it operates freely.

If overheating, not caused by overcurrent, is observed, look for loose connections, damaged contacts or flexible connection.

Periodic inspection and maintenance of the breaker should include care of the silver contacts. Check line contact and make contact adjustments as described in the section of these instructions entitled "Contacts".

LUBRICATION

In general, the Type MC circuit breaker require little lubrication. Bearing points and latch surfaces should be lubricated at the regular inspection period with a thin film of light grease with a sodium base, suitable for extreme pressure, similar to Atlantic grease #62A or G-E Lubricant #D50H15. Hardened grease and dirt should be removed by using kerosene. When the breakers are shipped, the latch surfaces are covered with grease to protect them during shipment. Excess grease should be removed to avoid the possibility of latches failing to hold under shock due to solenoid operation, and to prevent the accumulation of dirt on these surfaces.

At each maintenance period, all silver to silver friction points, such as primary disconnects, should be cleaned and given a fresh coat of G.E. lubricant No. D50H47.

TROUBLE SHOOTING

The "trouble shoot" chart lists typical symptoms of breaker malfunction, together with their causes and remedies. If, at any time, these symptoms are observed, their cause should be determined and the necessary corrective action should be taken.

TROUBLE SHOOTING CHART

TROUBLE	CAUSE	REMEDY
OVERHEATING	Misalignment of contacts.	Adjust contacts.
	Dirty or greasy contacts.	Clean contact surfaces.
	Inadequate external bus or cable capacity.	Increase size of bus or cables.
	Loose or dirty terminal connections.	Clean and tighten connections.
	Current in excess of breaker rating.	Check breaker application.
	Excessive ambient temperature.	Provide adequate ventilation.
	Contacts worn, burned or pitted.	Clean and dress-up contacts - replace if necessary.
	Damaged flexible connector.	Replace flexible connector.
BURNED CONTACTS	Improper bridging contact pressure.	Check pressure as described under "Contacts".
	Improper line contact.	Correct line contact.
	Dirty or greasy contacts.	Clean contact surfaces.
FAILURE TO TRIP	Main toggle link allowed to go to close to center when too much of stop surface is filed away.	Replace main toggle link.
	Insufficient positive trip of trip device lever. Worn or damaged trip device parts.	Re-adjust or replace trip device. Replace trip device.
FALSE TRIPPING	Overcurrent trip device pickup setting low.	Check device application.
	Bind in overcurrent trip device.	Relieve bind or replace device.
FAILURE OF MECHANISM TO CLOSE AND LATCH	Solenoid closing coil burned out.	Replace solenoid coil.
	Improper clearance between trip latch and catch lever.	Re-adjust toggle lever.
	Improper clearance between solenoid plunger and mechanism roller.	Re-adjust solenoid armature.
	Improper clearance between trip paddles and overcurrent device trip arms.	Re-adjust device trip arms.

BREAKER COMPONENTS

BLOWOUT COIL & ARC CHUTE

BLOWOUT COIL - Fig. 8

The magnetic blowout coil (44) consists of a few heavy edgewise turns connected at one end to the stationary arcing contact (1), and to the upper stud at the other end. The coil is insulated from it's frame (46), except at the stationary arcing contact end, by the insulation barrier (45), and the insulating support (43).

ARC CHUTE MOUNTING - Fig. 8

Arc chutes are provided for all MC breakers. If the arc chute is shipped separately, after the breaker has been mounted in its permanent location, the arc chute should then be mounted on bolts (40), in each end of the magnetic blowout coil core assembly. Slots are provided for this purpose in the metal sides of the arc chute.

The flexible braided connections for the arc chute should be assembled to the movable arcing contact (2) as shown, using the bolt (5) which holds the arcing tip to the secondary contact lever.

The blowout coil on which the arc chute mounts is lined up at the factory so that the arc chute will be centered on the breaker. This should prevent interference between the movable arcing contact (2) and the arc chute. This clearance, "C" Fig. 5, should be a minimum of 1/8 inch. In some cases however, there may be some interference caused by side play in the movable arcing contact supports. If side play is present, it can be eliminated by adding washers on supporting pin (13), thereby shifing the secondary contact lever (9) so that the contact will be centered in the arc chute opening.

CONTACTS - Fig. 8

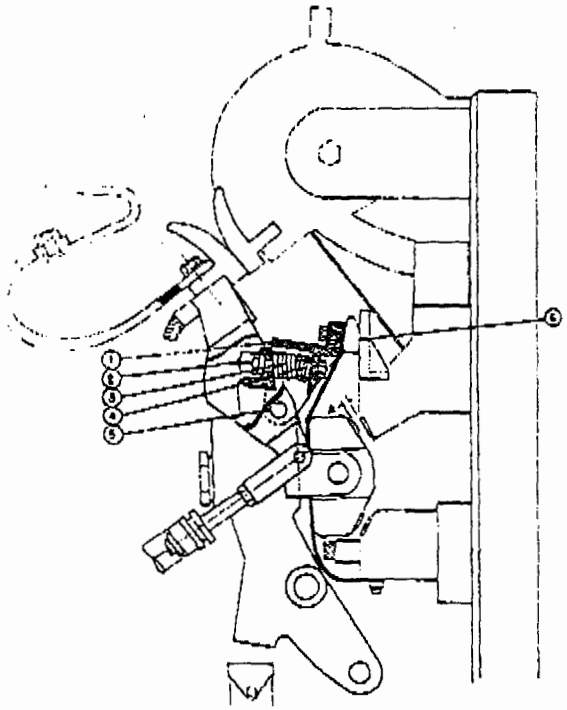
The current is carried by three types of contacts through the breaker, namely, main bridging, intermediate, and arcing contacts. Referring to Fig. 8, the current passes through the breaker by upper stud (34), bridging block (33) and lower stud (29). Laminated bus bars brazed to the studs, pass through the mounting base, providing a means of connecting the primary circuit. One bridging block is used on 2000 Amp. Breakers, two on 4000 Amp, four on 6000 Amp, while 8000 to 12,000 Amp. breakers have five.

In closing, the arcing contacts (1 & 2) close first, then the intermediate contacts (35 & 37), and finally the bridging contacts (34A). Flexible connections (16 & 26) connect the lower stud to the movable arcing and intermediate contacts, which are made of arc-resisting silver alloy material. The contacts open in the reverse order, thus the arcing contacts opening last, at which time the arc is magnetically forced into the arc chute by the blowout coil where it is quickly extinguished.

The breaker is equipped with fine-silver, high pressure, line-type main contacts silver soldering to the front of studs and to the bridging block.

LINE CONTACT

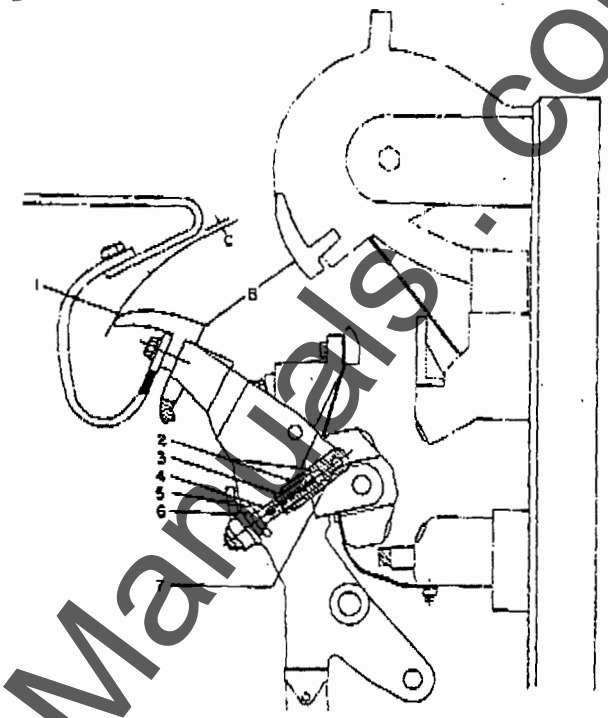
The silver surfaces of the stationary contacts are machined flat, while those of the movable contacts are slightly curved. It is most important for proper breaker operation that adequate line contact be maintained. Line contact may be checked by taking contact impressions as follows:



Dim. "A" 1/8" to 3/16" Air Gap Between Upper Main Contacts with Intermediate Contacts Touching

1. Support for Movable Intermediate Contact
2. Adjustable Nut and Screw
3. Outer Spring
4. Inner Spring
5. Pin
6. Intermediate Contact

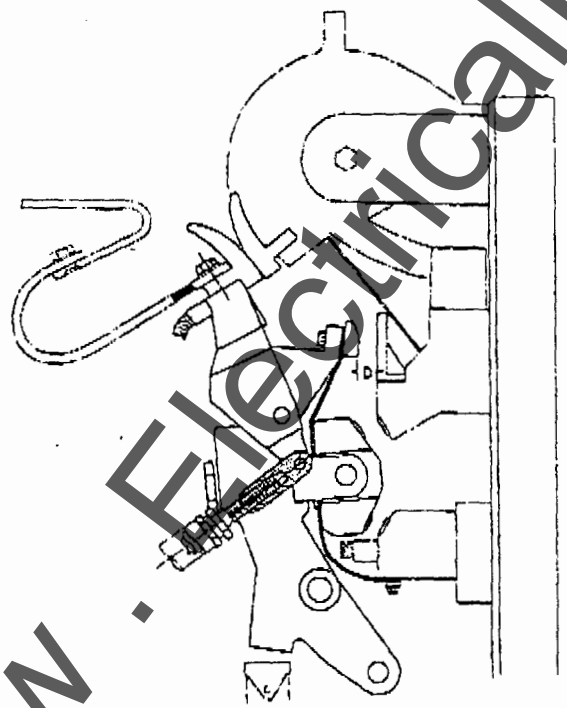
Fig. 4 Main Contact Air Gap Adjustment



Dim. "B" 2-3/4" to 3-1/4" Air Gap Between Contacts - Bkr. Fully Open
Dim. "C" 1/8" Minimum Clearance Between Movable Arcing Contact and Arc Runner

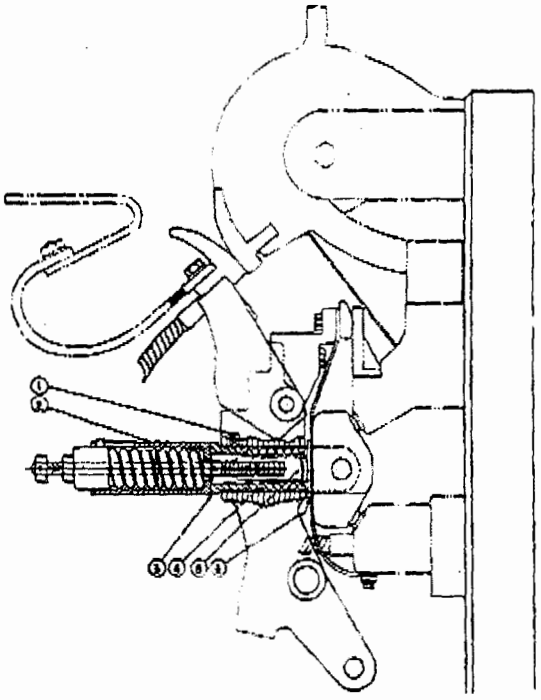
1. Movable Arc Contact
2. Coupling
3. Lock Nut
4. Adjusting Rod
5. Bushing
6. Nut
7. Pin

Fig. 5 Arcing Contact Air Gap Adjustment



Dim. "D" 1/4" Min. Air Gap Between Intermediate Contacts with Arcing Contacts Touching

Fig. 6 Intermediate Contact Air Gap Adjustment



1. Set Screw
2. Main Contact Pressure Gage
3. Adjusting Nut
4. Main Contact Spring
5. Guide Pin
6. Spacer

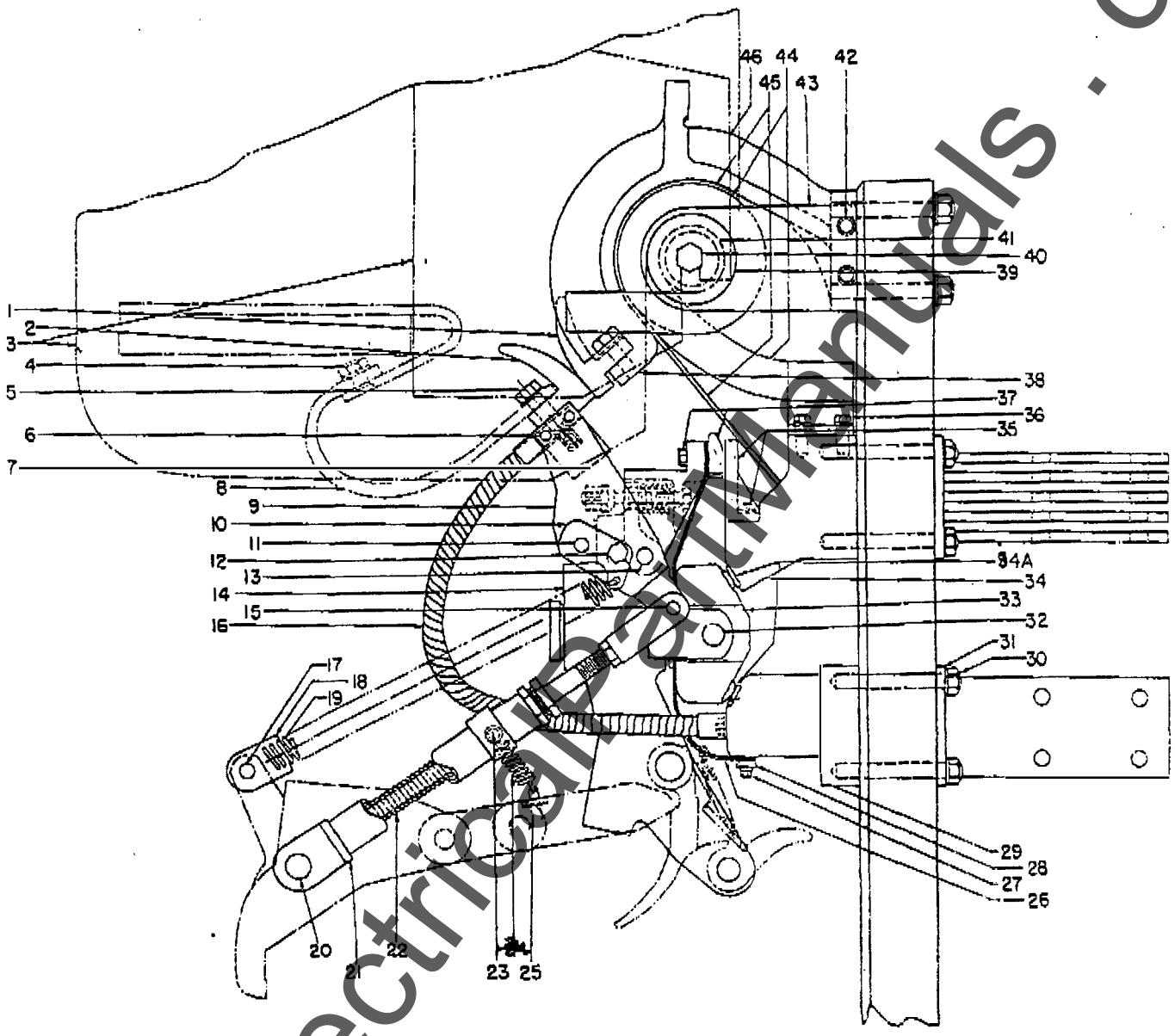
Fig. 7 Main Contact Pressure Adjustment

Fig. 4 (N-6249189)

Fig. 5 (N-6249190)

Fig. 6 (N-6249179)

Fig. 7 (N-6249191)



1. Stationary Arcing Contact
2. Movable Arcing Contact
3. Arc Chute
4. Screw & Jam Nut
5. Bolt
6. Rivet Button
7. Block
8. Flexible Connection
9. Secondary Contact Lever
10. Spring Support
11. Screw
12. Screw
13. Pin
14. Main Contact Lever
15. Pin
16. Flexible Connection
17. Pin
18. Spring Holder
19. Spring
20. Pin
21. Tube Coupling
22. Spring
23. Rod
24. Spring
25. Stud and Nut
26. Flexible Connection
27. Screw
28. Clamping Plate
29. Lower Stud
30. Screw
31. Clamping Plate
32. Pin
33. Bridging Block
34. Upper Stud
34A Bridging Contacts (Main)
35. Stationary Intermediate Contact and Screw
36. Screw
37. Movable Intermediate Contact & Screw
38. Screw
39. Washer
40. Mounting Bolt
41. Insulation Tube
42. Screw
43. Insulating Support
44. Blowout Coil
45. Insulation Barriers
46. Blowout Coil Frame

Fig. 8 Blowout Coil and Contact Arrangement

1. Hold between the contacts, a piece of thin carbon paper with tissue paper on the carbon side.

2. Close and open the breaker and examine the impressions on the paper.

3. Good line contact is indicated if a well-defined impression shows for 75% or more of the length of the contact. Good line contact is also indicated if a .002 feeler gauge cannot be inserted between the main silver surfaces for more than 25% of the length of the contact.

4. Should poor line contact be found, it will be necessary to improve the contacts as described below.

CARE OF CONTACTS

To clean and improve contacts, proceed as follows:

NOTE: It is important that the curved surfaces of the movable contacts be maintained so that the impressions will not be too broad. Do not scrape the movable contact curved surfaces.

1. Wipe off dust which may have collected on the contacts with a clean cloth.

2. Clean the contacts with a good grade of silver polish or a very fine file to remove any dark surfaces. If silver polish is used, be careful to remove all polish from contacts and insulated parts. Exercise care in cleaning to maintain line contact.

3. If contact impressions indicate improving the stationary contacts is required to obtain proper line contact, remove any rough or high spots by scraping the stationary contacts with a high-tempered piece of steel. A file, which has had its teeth removed from the front portion, is satisfactory. It is usually best to scrape with a horizontal motion. Pits need not be removed if 75% of line contact can be obtained.

NOTE: Do not use emery or crocus cloth.

ADJUSTMENTS

Contact adjustments may be made by the following procedure and should be made in the sequence listed below:

1. Refer to Fig. 4. The gap between the main contacts (Dim. "A" Fig. 4) should be approximately 1/8 to 3/16 inch when the intermediate contacts (6) just touch. This adjustment can be made by the adjusting nut (2). After the adjustment has been made, be sure to replace all locking cotter pins.

2. Refer to Fig. 5. With the breaker fully open, the arcing contact gap (Dim. "B" Fig. 5) should be 2-3/4 to 3-1/4 inches. To make this adjustment, remove the cotter pins from pin (7), loosen lock nut (3) and turn the adjustable couplings (2) on each side of the arcing contact support, as required. After adjustment has been made, be sure to tighten lock nut (3) and replace all cotter pins.

3. With the arcing contacts just touching, the intermediate contact gap (Dim. "D" Fig. 6) should be no less than 1/4 inch. If the gap is less than the required 1/4 inch, a thorough inspection of the contact support and related parts should be made for bent or broken parts.

CONTACT PRESSURE - MAIN BRIDGING Fig. 7

The pressure of the bridging member against the stationary contact is adjusted at the factory and there should be little or no occasion to check this feature unless parts have been changed or contacts filed down appreciably. The pressure is maintained by the large adjusting nut (3) in the front center of the main contact lever casting (14), Fig. 8. A set screw in the top of this casting holds the adjusting nut in position. Pressure is held by a heavy-backing spring inside the casting; this spring being compressed by tightening the adjusting nut. Pressure per bridging contact should range from 300 to 350 lbs. and may be checked by use of a special gage as shown in Fig. 7.

Contact pressure may be checked as follows:

1. Open the breaker and place a strip of thin paper on each stationary silver contact.

2. Close the breaker.

3. Screw the special pressure gage (2) into the tapped hole in the spring guide pin (5).

4. Turn the nut on the outer end of the gage until the thin paper can be withdrawn from between the contacts and read the calibration on the gage. If the required pressure, 300 to 350 lbs. does not exist, make adjustments as described below.

NOTE: Do not open breaker or allow current to pass through it while the gage is inserted.

5. To increase contact pressure, remove set screw (1) in the side of the contact lever and turn the large adjusting nut (3) clockwise about 1/2 turn at a time. Read the gage after each 1/2 turn until the required pressure is obtained.

6. To decrease contact pressure, turn the large adjusting nut (3) counterclockwise and check the gage in the same manner as stated in step 5.

NOTE: In some cases, it may be necessary to remove adjusting nut (3) and place a washer between the nut and spring (4) in order to secure sufficient pressure. If this is done, be sure that the spring is not compressed solidly when the breaker closes, as damage to parts may result.

OPERATING MECHANISM - Fig. 9

The MC breaker operating mechanism is a toggle-type linkage assembly which is actuated and operated by a solenoid mounted within the breaker frame. The upward movement of the solenoid armature raises the center of the toggle linkage, and in so doing, straightens the toggle allowing it to move forward to the closed position, where it is latched and propped closed.

When the solenoid is energized, the armature (11) and closing pin (12) are pulled upward, thus forcing the mechanism roller (18) upward allowing the mechanism linkage to move to the closed position. The mechanism is then latched closed by the engagement of catch toggle link (19) with catch lever (1), cat h plate (25) with trip latch (27), to hold the mechanism in the closed position. The mechanism is then propped closed by means of the main toggle prop (13) engaging stop stud (3).

REBOUND HOOK - Fig. 3

The purpose of the rebound hook is to prevent a breaker which opens abruptly, as on a short- circuit, from rebounding toward the closed position, thus preventing the movable contacts from "kissing" the stationary contacts. This is accomplished by the engaging of the rebound hook (13) with pin (14) when the breaker opens.

On older model breakers the mounting of the rebound hook is rotated 180 degrees, however, its function and operation are the same as mentioned above.

During the initial stage of a closing operation, the rebound hook (13) is released from pin (14). Energizing the closing solenoid forces the solenoid plunger upward causing rod (9) to engage pawl (10), thus rotating the rebound hook off pin (14) and allowing the breaker to close.

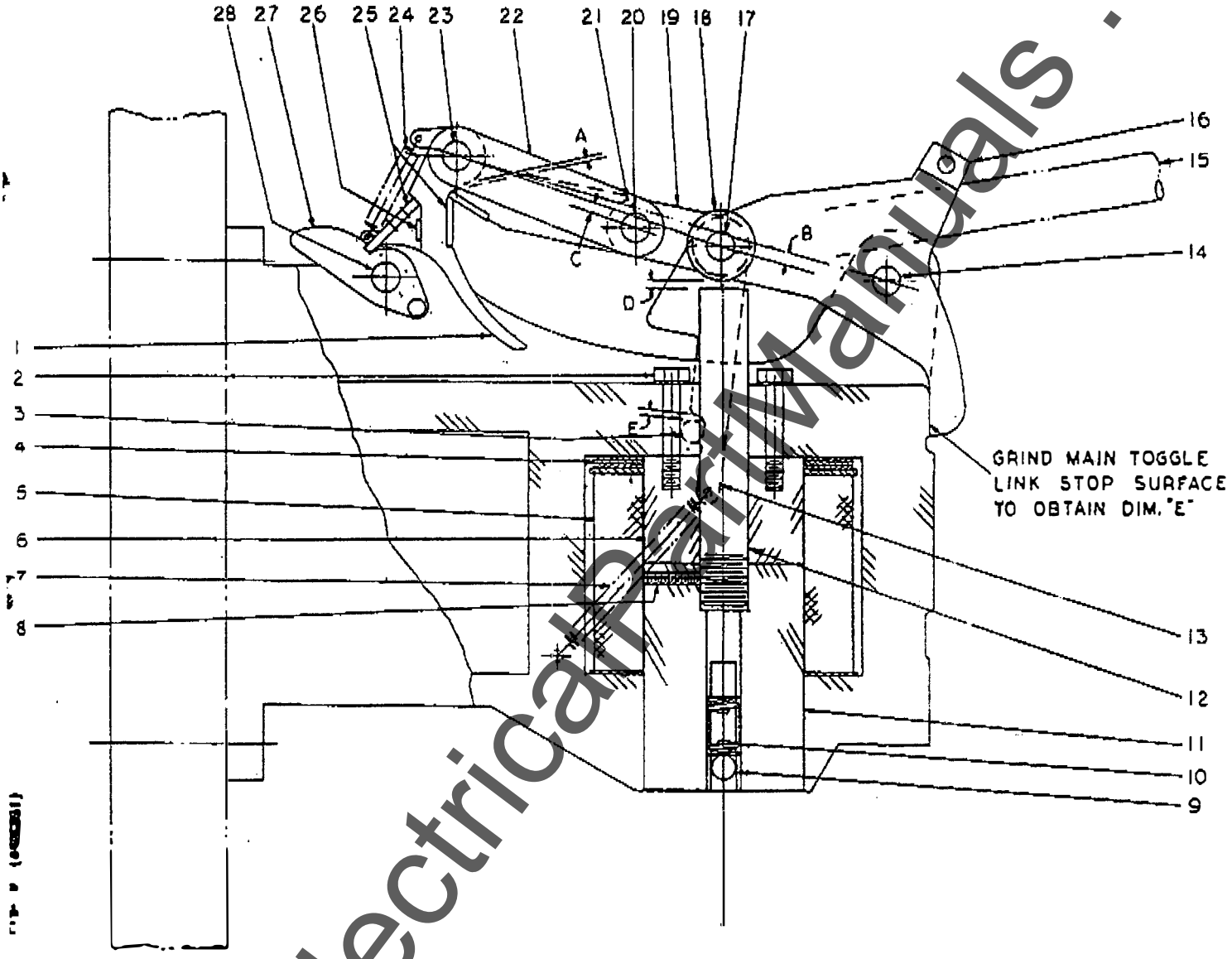
ADJUSTMENTS - Fig. 9

If for any reason the operating mechanism requires adjusting to maintain the clearances specified in Fig. 9, proceed as follows:

1. Remove the left hand mechanism side plate.

2. Insert the manual maintenance closing handle (15) and close the breaker. Hold the closing handle down as far as it will go and manually lift the closing armature (11) up as far as it will go. With the armature and mechanism in this position, there should be 1/16 inch maximum clearance (Dim. "D", Fig. 9) between the closing pin (12) and mechanism roller (18). If this dimension is not obtained, remove the armature stop pin (9), at the bottom of the breaker frame, allowing the armature to be lowered and removed. Remove the allen head set screw (8) and turn the closing pin to the proper length. One half turn of the closing pin increases the length approximately 1/32 of an inch. Be sure the set screw is tightened before the armature is reassembled.

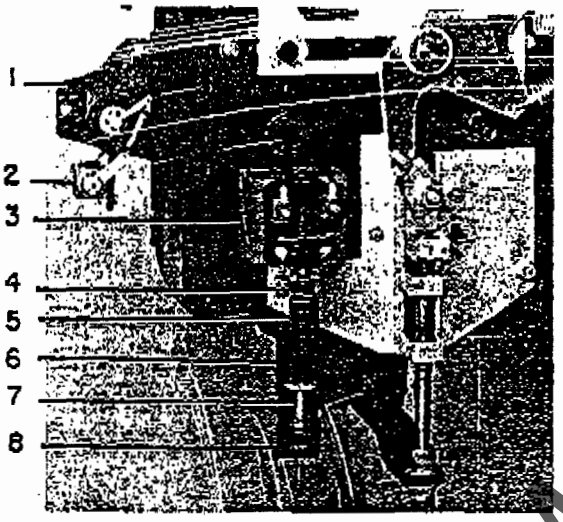
3. With the mechanism in the position described in step 2, a maximum clearance (Dim. "E", Fig. 9) between the main toggle prop (13) and stop stud (3) should also be obtained. It may be necessary to file or grind the "main toggle link stop surface", indicated on Fig. 9, in order to obtain sufficient movement to close the breaker and secure the required clearance. If too much of the stop surface is filed away, the toggle will be permitted to go too close to center and the breaker may fail to open properly. Should this occur, it may be necessary to replace the main toggle link (16), as dimensions "B" and "C", Fig. 9, should each be approximately 1/4 inch with the breaker closed.



1. Catch Lever
2. Screw
3. Stop Stud
4. Spacer
5. Closing Coil
6. Pole Piece
7. Toggle Catch Spring
8. Closing Pin Set Screw
9. Armature Stop Pin
10. Closing Pin Spring
11. Armature
12. Closing Pin
13. Main Toggle Prop
14. Main Toggle Pin
15. Maintenance Handle
16. Main Toggle Link
17. Catch Toggle Pin
18. Mechanism Roller
19. Catch Toggle Link
20. Secondary Toggle Pin
21. Secondary Toggle Roller
22. Secondary Toggle Link
23. Supporting Lever Pin
24. Secondary Toggle Spring
25. Catch Plates
26. Locking Plate
27. Trip Latch
28. Trip Latch Pivot Pin

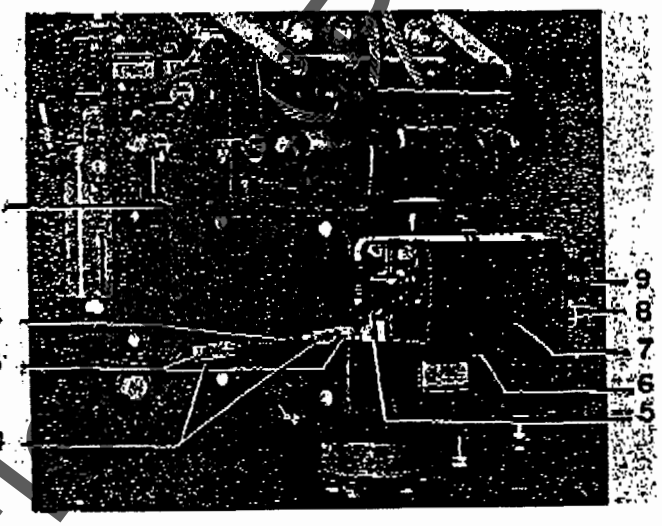
Fig. 9 Operating Mechanism - Closed Position

Solenoid



1. Position Indicator
2. Operation Counter
3. Cutoff Switch
4. Spring
5. Switch Plunger
6. Solenoid Plunger
7. Adjusting Screw
8. Operating Lever

Fig. 10 Cutoff Switch (Cover Removed)



1. Connecting Link
2. Operating Rod
3. Coupling Pin
4. Adjustable Coupling
5. Switch Crank
6. Switch Cover
7. Auxiliary Switch
8. Operation Counter
9. Position Indicator

Fig. 11 Auxiliary Switch and Operating Linkage 750 V Breaker

4. A space of 1/16 inch should appear between catch toggle link (19) and the catch lever (1) (Dim. "A", Fig. 9). To obtain this 1/16 inch, it may be necessary to grind the top surface of the catch link (19).

NOTE - No attempt should be made to adjust the case hardened latch parts by grinding, as this will remove the hardened surface. Rapid wear and subsequent trouble will result.

5. Keep trip latch (27) and catch plates (25) polished with crocus cloth. They should be lightly greased and the excess grease removed with a clean cloth.

CUTOFF SWITCH - Fig. 10

The purpose of the cutoff switch (3) is to operate the Y relay during a closing operation, thus providing the anti-pump feature as described under "Electrical Operation". The switch is mounted on the right side of the solenoid mechanism and is operated by an operating lever (8) fastened to the solenoid plunger (6). An adjusting screw (7), mounted at the top of the operating lever (8), provides a means for adjusting the point at which the switch contact will close during a closing operation. The switch should always be adjusted so that its contact closes as late in the closing stroke as possible, and still obtain positive contact. When the closing solenoid is energized, the operating lever (8) is forced upward against the switch plunger (5), causing the plunger to move upward and the switch contacts to close. When the closing solenoid is de-energized and the armature resets to its normal position, the switch plunger (5) is then forced downward by spring (4), opening the switch contact.

AUXILIARY SWITCH - Fig. 11

An auxiliary switch (7) with "a" and "b" contacts for various control functions is available for use on all MC breakers. Auxiliary switch contacts are the cam operated type, "a" contacts are normally open and "b" contacts normally closed. The contacts of any stage may be changed from "a" to "b" or vice versa. If changes are desired in the operation of the contacts, an approved drawing of the cam arrangement should be obtained or a careful sketch made. To change an "a" contact to a "b" contact, remove the switch cover (6) and tie bolts, and change the position of the particular cam 90° in relation to the shaft.

The auxiliary switch (7) on 750 volt stationary breakers is mounted on the front of the solenoid mechanism together with the position indicator (9) and operation counter (8). The switch is operated with the breaker contacts by a linkage assembly as shown in Fig. 11. Most drawout and 1000 volt breakers have the auxiliary switch mounted below the solenoid mechanism with the position indicator and operation counter mounted on the front of the solenoid as shown in Fig. 12.

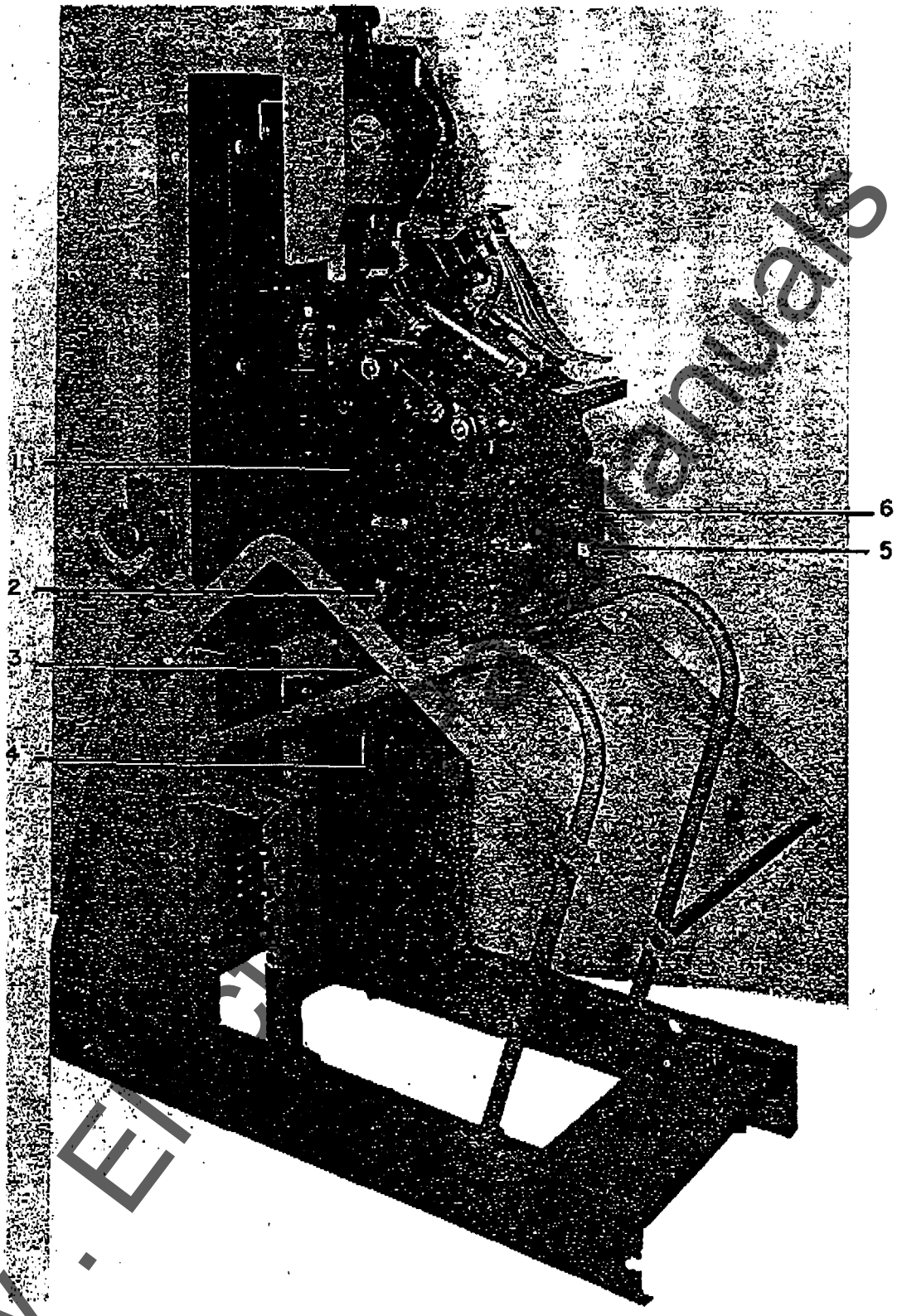
ADJUSTMENTS - Fig. 11

The switch should be adjusted so that the "a" contacts are closed before the arcing contacts touch. Adjustable couplings (4) are provided on the operating rod (2) for adjusting the switch operation. The operating rod is connected to the breaker operating crank by a connecting link (1). To adjust the operating rod (2) length, remove either coupling pin (3) by removing its cotter pin, and turn the adjustable couplings (4) as required.

When the auxiliary switch is mounted in the location shown in Fig. 12, the operation of the switch contacts may be adjusted in the same manner mentioned above. Adjustable coupling (2) Fig. 12 fastened to operating rod (3) Fig. 12 is provided for making this adjustment.

Fig. 10 (8027320)

Fig. 11 (8020520)



1. Connecting Link
2. Adjustable Coupling
3. Operating Rod
4. Auxiliary Switch
5. Operation Counter
6. Position Indicator

Fig. 12 MC-6A Drawout Breaker with Arc Chute Removed, Showing Auxiliary Switch Location

PROTECTIVE DEVICES

OVERCURRENT TRIPPING DEVICE UP TO 4000 AMP.

The overcurrent trip device for type MC breakers is magnetically operated to trip the breaker either instantaneously or with a time-delay when the current through the breaker exceeds the value of the device calibration setting.

INSTANTANEOUS TRIPPING - Fig. 13

The instantaneous tripping device consists mainly of a magnet around the breaker lower stud and an armature at the right hand side. The magnet (31) is clamped against the lower stud by screw (35) and support (33). The armature is pivoted to the enlarged and extended end laminations (32) of the magnet. An extension of the armature engages the trip latch (13), thereby tripping the breaker when the armature (29) closes. On the front of the device is a supporting plate (20), provided with a slot, on which is mounted a calibrating plate (16) marked with calibrating points. To adjust the instantaneous current value at which the device will pick-up and trip the breaker, turn the calibrating screw (23) by means of the thumb nut (25), thus increasing or decreasing the spring tension until the spring holder (21) is opposite the desired tripping value on the calibrating plate. (The center groove filled with white on the spring holder (21) is used as an indicating point for calibrating purposes.)

Adjustments - Fig. 13

1. The adjusting screw (28) is provided to set the correct open air gap between the armature and magnet. The screw is factory adjusted. Should it be necessary to remove the screw, accurate measurements should be made before it is removed so that it can be returned to exactly the same position.

2. Check the device to be sure that the armature has sufficient travel to release the trip latch (13). This can be done by slo ly forcing the armature against the magnet and determining if it will trip the breaker. The armature should have approximately 1/32" overtravel beyond the point at which the trip latch is released. If overtravel is too great, file the armature trip lever extension at the point where it engages the trip latch (13). If overtravel is too small, it can be increased by moving the armature and carefully forming the trip lever extension down until the proper amount of overtravel is obtained.

INVERSE TIME-DELAY TRIPPING - Fig. 14

This device is similar to the instantaneous tripping device with the addition of the time-delay feature by means of an oil pot (36) and connecting link (42). The oil pot is fastened to the overcurrent device by means of the yoke (45), while the oil pot disc and link (42) are connected to armature lever (46) of the overcurrent device. The engaging surfaces of the upper disc (38) and lower disc plate (37) in the bottom of the pot are accurately machined and the inverse time-delay is obtained by the rupturing characteristics of an oil film between these two surfaces, when the device armature is operated.

ADJUSTMENTS - Fig. 14

1. For proper operation of the device, clean the oil pot thoroughly and fill with oil per General Electric Spec. S.I. 51853-6-1 to a depth not to exceed 1/8" above the surface of the lower disc (37).

2. The amount of time delay obtained is adjustable by changing the area of the oil film between the two disc surfaces. This can be done by rotation of the oil pot (36). To rotate the oil pot loosen the knurled clamping ring (40), and turn the pot to the desired point and tighten the clamping ring. Points for minimum, intermediate and maximum values of time-delay are marked on the pot. The desired time-delay setting is obtained by the alignment of one of these marks with a mark at the edge of the top cover (41) of the oil pot.

3. The armature open air gap and armature overtravel may be adjusted in the same manner as previously described for the instantaneous device.

OVERCURRENT TRIPPING DEVICE 6000 AMPERES AND ABOVE

This overcurrent trip device is magnetically operated to trip the breaker instantaneously when the current through the breaker exceeds the value of the device calibration setting.

This device is seldom furnished with the time-delay feature, however, it is available upon request.

INSTANTANEOUS TRIPPING - Fig. 15

The magnet (1) of this device is mounted on plate (2) which is attached to the back of the breaker base. The device armature and support assembly (3) is pivoted on shaft (4), supported through two right angle projections of plate (2). The right hand end of the armature support (facing the breaker from the back) is extended to form an arm (mostly dotted in Fig. 15) which passes through the breaker base. To this arm is fastened the upper end of calibrating spring (12). A small lateral extension on this arm is drilled and tapped to provide for the trip adjusting screw (8). This trip adjusting screw bears against the bottom of an independent trip arm (7) which also pivots on the shaft (4) at the back of the breaker base and likewise passes through the same opening in the breaker base, parallel to the extended arm of the armature support. The end of this trip arm operates against the bottom of stud (18) in trip lever (17), thus pivoting the other end of the trip lever downward against trip latch (20), and disengaging the trip latch.

ADJUSTMENT - Fig. 15

1. A stop screw (6) in block (5) attached to magnet plate (2) provides the adjustment of the open air gap between the magnet and armature. This stop screw (6) should be set to allow an air gap of approximately 5/16" for 6000 amp. breakers, 3/8" for 8,000 amp. breakers, and about 13/32" for 10,000 and 12,000 amp. breakers. This measurement should be taken at the edge of the magnet (1) nearest the panel.

NOTE: The factory setting of the open air gap should not be changed unless facilities are available to recalibrate the device.

2. The armature should have approximately 1/32" overtravel from the point at which the trip latch is released. To make this adjustment the trip arm stop screw (15) should first be adjusted to allow 1/16" clearance between the trip arm (7) and stud (18) in the trip lever (17). With this adjustment made, place a 1/32" spacer between the magnet and the armature, and manually pick-up the armature. With the armature picked-up, turn the trip adjustment screw (8) until the breaker just trips. Lock the adjustment screw (8) in this position and remove the 1/32" spacer, thus establishing the 1/32" overtravel of the armature from the point of tripping the breaker.

3. After the adjustments of steps 1 and 2 have been obtained, the desired instantaneous trip setting may be made. Mounted on the front of the breaker base immediately below the trip arm is a calibration plate (10) provided with a slot and marked off with calibrating points. By turning calibration adjustment screw (13), it is possible to move spring holder (11) upward or downward, thus increasing or decreasing the amount of tension in the calibrating spring (12). The spring holder (11) serves as an indicator directly behind the calibration plate (10). The amount of tension in the spring determines the value of current at which the breaker will trip. Turn the calibrating screw (13) until the desired calibration point on the calibration plate (10) lines up with the spring holder indicator (11).

SHUNT TRIP DEVICE - Fig. 13

The function of the shunt trip device is to trip the breaker electrically by energizing the shunt trip coil from a remote switch or relay. The coil of this device is not designed for continuous energization and for this reason, the coil is connected in series with suitable "a" contacts of the auxiliary switch. When the breaker trips, the "a" contacts open and de-energize the shunt trip coil. Refer to the wiring diagram Fig. 2 for the electrical circuit.

The shunt trip device is mounted to the overcurrent trip device support (33) and the breaker lower stud by means of a bracket (8) and screw (35). The trip lever (11) and manual trip button (10) are attached to bracket (8) by pivot pin (12). The trip lever (11) is also attached to the armature (6) by armature pin (9). Coil (7) is mounted in a V-shaped frame (4) which is attached to bracket (8) by screws (3).

When the device operates, the armature (6) is pulled upward, thus pivoting the trip lever (11) about pivot pin (12), and downward against the trip latch (13), releasing the trip latch and tripping the breaker.

The breaker may be tripped manually by pushing upward on the trip button (10), pivoting the trip lever in the same manner as described above.

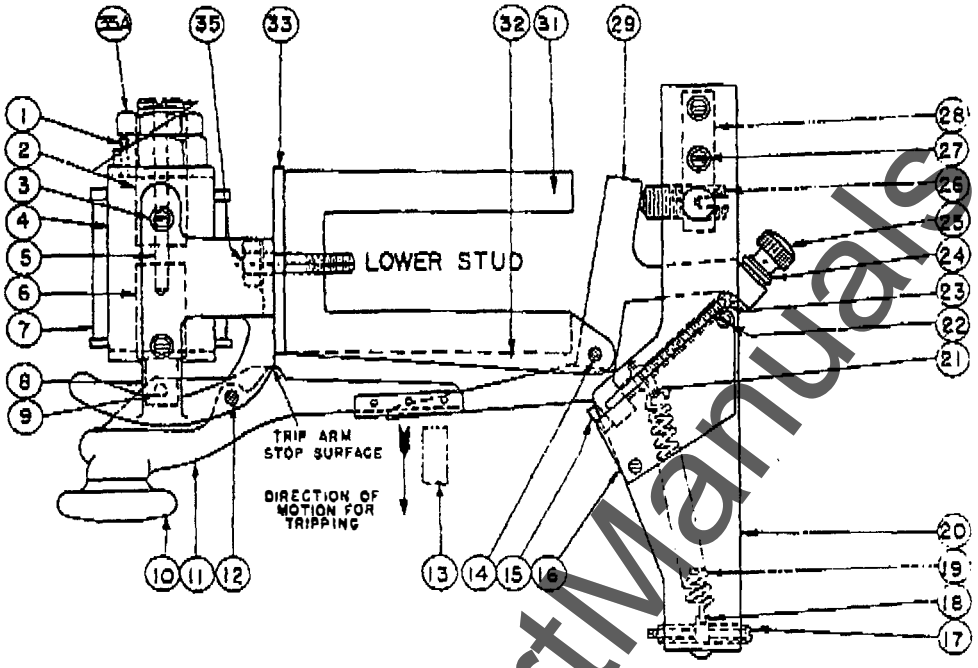


Fig. 13 (H-6249193)

Fig. 13 Shunt Trip and Instantaneous Overcurrent Trip Devices up to 4000 Amperes

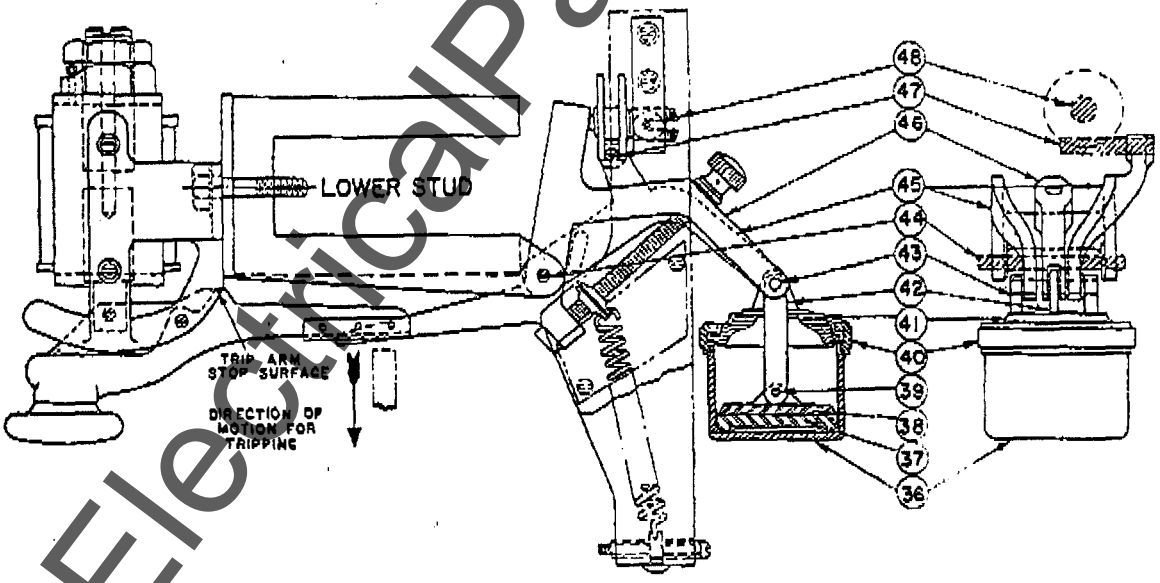


Fig. 14 (H-6249193)

1. Cotter Pin
2. Pole Piece (Adjusting Screw)
3. Screw
4. Magnet Frame
5. Guide Rod
6. Armature
7. Coil
8. Bracket
9. Armature Pin
10. Trip Button
11. Trip Lever
12. Pivot Pin
13. Trip Latch
14. Pivot Pin
15. Collar and Cotter Pin
16. Calibration Plate
17. Screw
18. Stud
19. Spring
20. Plate
21. Indicator and Spring Holder
22. Screw
23. Calibrating Screw
24. Locknut
25. Thumb Nut
26. Adjusting Screw
27. Screw
28. Supporting Block
29. Armature
31. Magnet
32. Armature Support
33. Support
35. Screw
35A Pal Nut
36. Oil Pot
37. Lower Disc Plate
38. Upper Disc
39. Pin, Washer and Cotter Pin
40. Clamping Ring
41. Cover
42. Link
43. Pin
44. Pivot Pin
45. Yoke
46. Armature Lever
47. Stud
48. Guide & Adjusting Screw

Fig. 14 Shunt Trip and Inverse Time-Delay Overcurrent Trip Devices up to 4000 Amperes

ADJUSTMENTS - Fig. 13

The shunt trip device is adjusted before the breaker leaves the factory. However, if it becomes necessary to replace any parts of the device it will be necessary to readjust the device as follows:

1. To adjust for positive tripping, first close the breaker and loosen pal nut (35A) on the pole piece (2). (Note that the pole piece is adjustable in the magnet frame (4), and serves as a means of adjusting positive tripping and armature open air gap.) Advance the pole piece (2) (turn downward with a screwdriver) until the breaker no longer trips. Place a second, thin shafted screwdriver between the bottom of the armature pin (9) and the top surface of the bracket (8). Push downward at the handle of the second screwdriver and back off the pole piece until the breaker trips, noting the position of the slot in the top of the pole piece where the breaker first trips. Back off the pole piece an additional 1/4 turn from the position noted, and the correct amount of positive tripping should be obtained. Tighten pal nut (35A), locking the pole piece in position.

2. It is essential that the open air gap of the armature (6) be maintained at the minimum necessary to give the required movement of the armature for tripping the breaker. This minimum air gap should be obtained if the positive tripping adjustment (step 1) is properly made.

COIL REPLACEMENT - Fig. 13

1. To change the coil (7), remove cotter pin (1) and unscrew pole piece (2).

2. Remove two screws (3) and the coil may be removed.

3. Install a new coil in the reverse order. After installing new coil, adjust for positive tripping as described under "adjustments" above.

REVERSE CURRENT TRIPPING DEVICE - Fig. 16

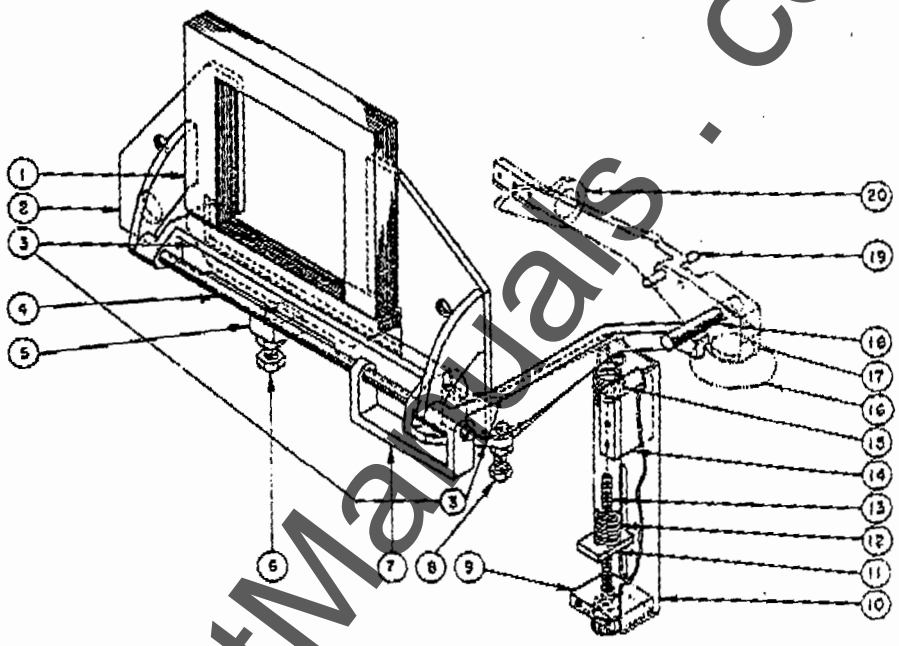
NOTE: The potential coil of the reverse current device must be energized before the breaker can be closed.

Type MC breakers are available with a high speed direct-acting reverse current trip device. The construction of this device is as follows: On the back of the breaker panel, a laminated magnet (32) surrounds the lower stud (31) of the breaker. The upright sides of the magnet are bridged midway below the stud by a horizontal core (28) on which is wound a continuously excited potential coil (30). A small air gap at the lower horizontal end of the laminated magnet is bridged at all times by a small button type armature (19), except when the breaker is being tripped.

Trip rod (15) is biased by spring (14) to move forward to the tripping position. Spring (14), held in place by a fixed portion of the device at the magnet end, presses against a collar (13) on the trip rod at the other end. A calibrating spring (21) at the rear of the device adds an additional bias in the tripping direction.

One end of this calibrating spring (21) acts directly against the trip rod, (15) while the other end is held on a calibrating screw plug (22), contained in a tube-link projection (24) from the body of the supporting casting. By this screw plug, which may be adjusted with a screw driver from the rear, the amount of compression of the calibrating spring may be varied. This in turn, varies the amount of reverse current required to trip the breaker. Outside of the spring container is a slotted calibrating plate (25). The calibrating plug is tapped at four places, each 90° from the other, so that a locking screw (23) may be passed through the plate slot and threaded into one of the four tapped holes, thus permitting small changes in the amount of compression on the spring and in turn locking of the screw plug in fixed position. Both ends of the plate slot are closed so that when the locking screw is inserted in any of the four tapped holes, the calibrating screw plug cannot be set to exert too great or too little pressure on the calibrating spring (21). Compression of the calibrating spring should never be decreased as this may result in insufficient force available for tripping the breaker.

With the circuit breaker in the open position, the button armature is held mechanically against its seat on the laminted magnet by spring (16). If the potential coil is excited, a field is established which firmly seats the armature against the magnet, holding the tripping calibrating springs (14 and 21) under compression and moving the plunger (5) and collar (13) away from the trip latch (4) so that the breaker can be closed. Current through the breaker in the normal direction, produces additional flux in the same direction through the armature as that produced by the potential coil. This additional flux helps to hold the armature more securely than the flux from the potential coil alone. As long as this condition prevails, or if no current flows in the breaker, the armature will be attracted to its seat when full voltage is on the potential coil. This attraction will gradually weaken as the flux decreases. Current through the breaker in the reverse direction produces flux in the opposite direction through the armature with the result that the potential coil flux is neutralized and the armature is released to trip the breaker. The normal and reversed magnetic circuits are shown in Fig. 17.



1. Magnet
2. Plate
3. Armature and Support
4. Shaft
5. Block
6. Armature Stop Screw
7. Trip Arm
8. Trip Adjustment Screw
9. Block
10. Calibration Plate
11. Indicator & Spring Holder
12. Spring
13. Calibrating Screw
14. Block
15. Trip Arm Stop Screw
16. Trip Button
17. Trip Lever
18. Stud
19. Pivot Pin
20. Trip Latch

Fig. 15 Instantaneous Overcurrent Trip Device 6000 Amperes and Above (Back View)

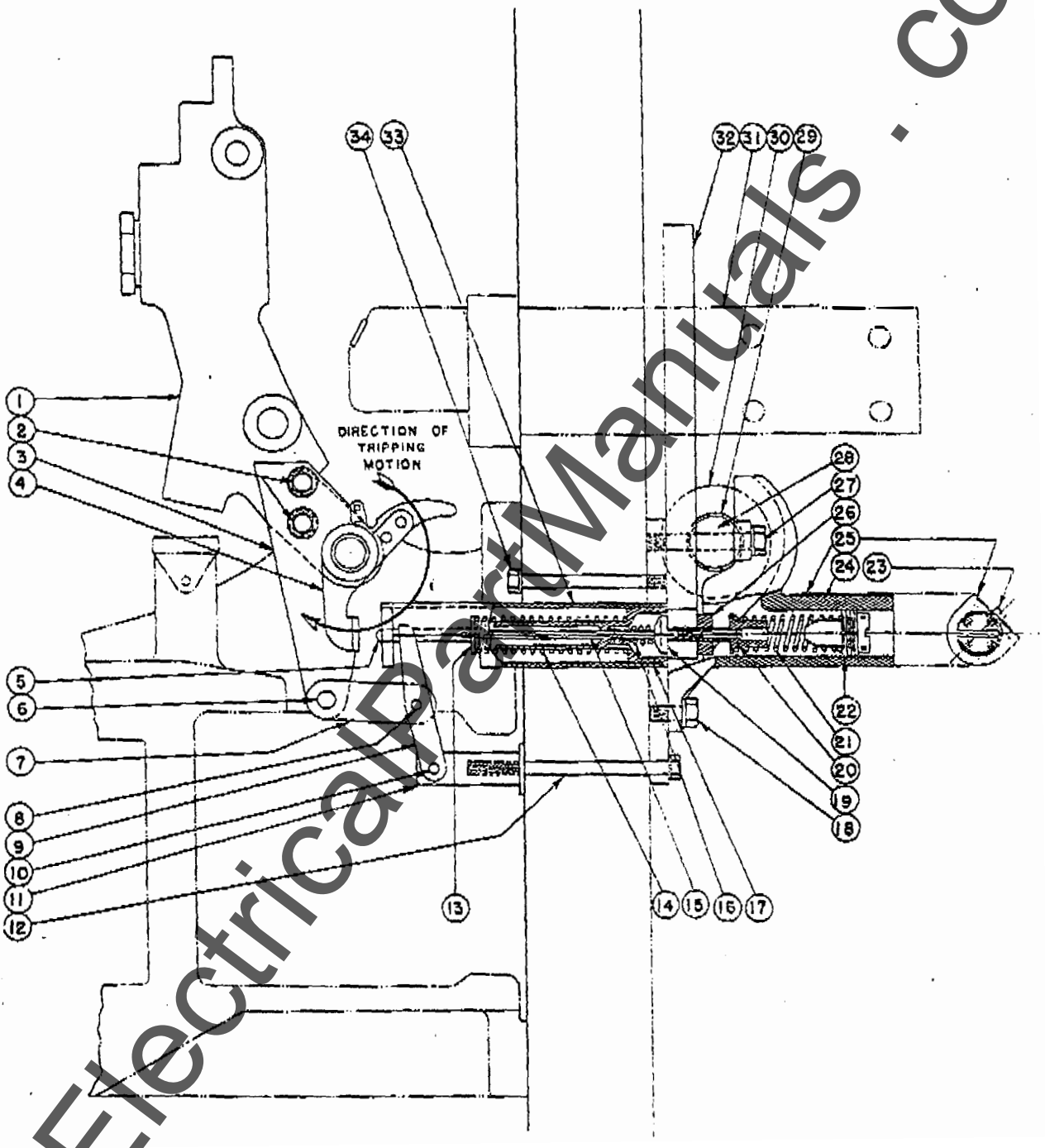


Fig. 16 (K-5249984)

1. Main Contact Lever
2. Screw
3. Extension Plate
4. Trip Latch
5. Plunger
6. Pin
7. Link
8. Pin
9. Reset Lever
10. Pin
11. Lever Support
12. Screw
13. Collar
14. Trip Spring
15. Rod
16. Compression Spring
17. Spring Cup
18. Screw
19. Armature
20. Spring Guide
21. Calibrating Spring
22. Calibrating Plug
23. Locking Screw
24. Supporting Casting
25. Calibrating Plate
26. Buffer
27. Screw
28. Core
29. Insulation Tube
30. Coil & Resistor
31. Lower Stud
32. Series Magnet

Fig. 16 Reverse Current Trip Device

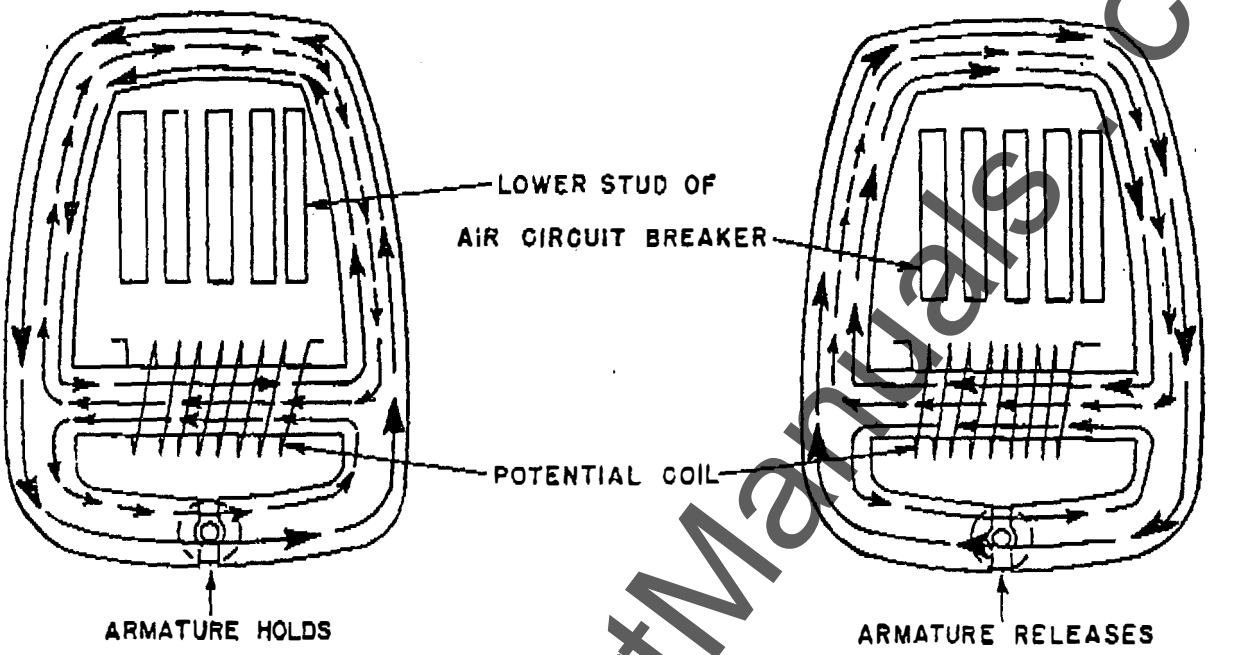


Fig. 17 Reverse Current Trip Device Showing Magnetic Circuit

After the armature has moved to the breaker tripping position, knocking off the breaker trip latch (4), the breaker starts to open. A reset lever (9) is pivoted on a lever support (11), and attached to link (7), which in turn is pivoted on an extension plate (3). This extension plate is bolted to the lower end of the main contact lever (1). The upper end of the reset lever acts against a collar (13) on the trip rod to force the trip rod back to the position it occupied before tripping and, at the same time, compress both the tripping and calibrating springs. The armature in the meantime, is moved back to its seat on the magnet and held there by the small compression spring.

REPLACEMENT - Fig. 16

It is important that the surface of the armature and the armature seat on the magnet be kept clean. The faces of these parts are lapped to insure good seating of the armature. If dust or other foreign particles collect on these surfaces, the armature will not seat properly and it will be impossible to close the breaker. To clean the surfaces, replace the potential coil (30) or other parts of the device, the device may be dismantled by the following procedure.

1. Remove the locking screw (23) from the calibrating plug (22) at the back of the calibrating spring (21).

2. Remove the calibrating plug (22) being careful to note its exact position.

3. Remove the calibrating spring (21).

4. Remove three mounting bolts (18 and 27), allowing the removal of the coil (30), core (28) and cover.

5. With these parts removed, the laminated magnet (32) may be moved a short distance over the stud (31) away from the breaker panel.

6. The surfaces of the magnet and armature can now be cleaned by means of an air hose.

7. Replace parts in reverse order, be sure to return calibrating plug (22) to its original position.

RENEWAL PARTS

When ordering renewal parts, address the nearest General Electric Company Sales Office, specifying the quantity required and describing the parts by catalogue numbers as shown in renewal parts bulletin GEF-3344D.

In the absence of a Renewal Parts Bulletin, the described parts should be identified by giving the complete nameplate data of the breaker or accessory.

Renewal parts which are furnished may not be identical with the original part since design improvements are made from time to time. Parts however, will be interchangeable.