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GEI-9321G

FILE

INSTRUCTIONS

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AIR CIRCUIT BREAKER

TYPES

AE-1-25, AEF-1, and AE-1-25Y1

Formerly Types AE-1B, AEF-1B, and AE-1BY1

RAW

Irving Plant Z

Switchgear

GENERAL ELECTRIC

SCHENECTADY, N.Y.

ILLUSTRATIONS

CONTENTS

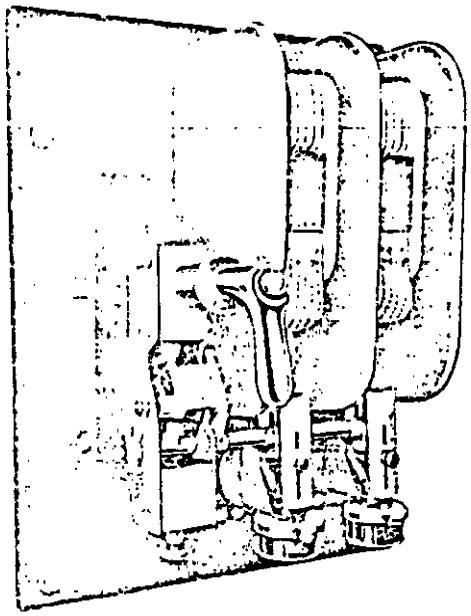


FIG. 1
MANUALLY OPERATED LIVE FRONT BREAKER.

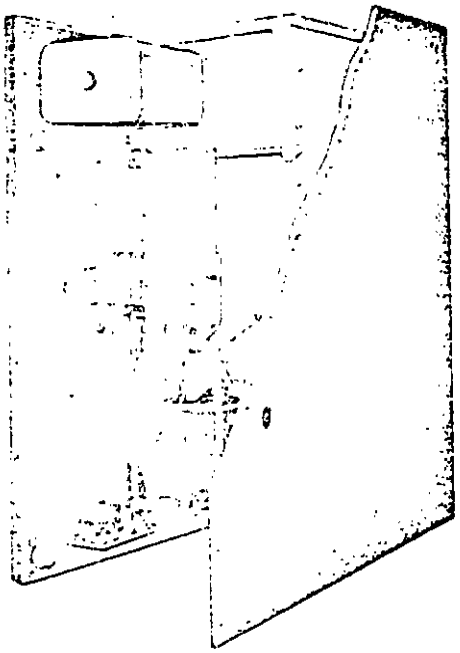


FIG. 2
ELECTRICALLY OPERATED DEAD FRONT BREAKER.

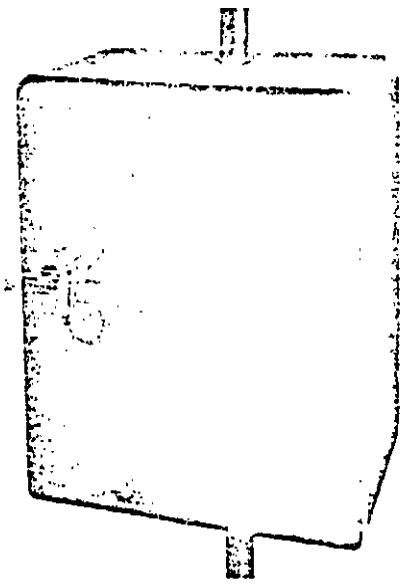
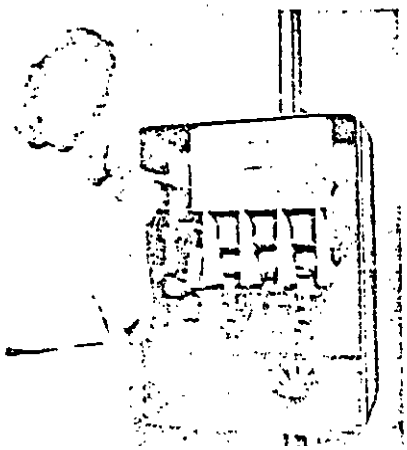
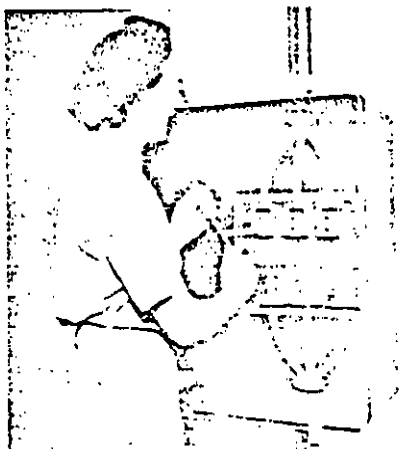


FIG. 3
MANUALLY OPERATED, ENCLOSED BREAKER.





AIR CIRCUIT BREAKERS

TYPES AE-1-25,AEF-1,AE-1-25Y1

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.

GENERAL INFORMATION

These breakers were formerly designated Type AE-1B, Type AEF-1B and Type AE-1-BY1 to which these instructions generally apply.

Before unpacking, installing or attempting to operate these air circuit breakers, read this instruction book thoroughly and carefully.

APPLICATION

The type AE-1-25 air circuit breakers covered by this instruction book are generally used for the protection and control of electrical apparatus, main feeders and branch circuits, including equipment in buildings, industries and power stations, and merchant marine application. The breakers may be equipped with a wide choice of operating and trip devices and accessories for overcurrent and other functions.

Further discussion and application of these breakers will be found in publication GET-3600.

RATINGS

Current Ratings:-
  Up to and including 600 amperes.
Voltage Ratings:-
  Up to and including 600 volts A-c.
  Up to and including 250 volts D-c.
Interrupting Ratings:-
  25,000 amperes.

OPERATING CHARACTERISTICS

Type AE-1-25 breakers can be furnished either live front or dead front, and either manually or electrically operated with one, two, three or four poles and with various accessories. All breakers are provided with arc quenchers to extinquish the arc after the contacts open and box type barriers are provided for dead front and enclosed breakers to confine the arc.

The breaker is closed by a toggle mechanism operated either manually, or electrically by a solenoid, against a heavy spring between the operating mechanism and the operating shaft, upon which the movable contacts are mounted, and against springs behind the contacts. These springs supply the power to open the breaker when a latch is released manually or by tripping devices. The breaker is trip free which assures that the contacts cannot be closed as long as the latch is in the tripped position.

Current enters the breaker by the upper stud, passes through the stationary contacts, the movable contacts, the flexible connection, through the series coil and out the lower stud. When the breaker opens, the main contacts separate first which shunts the current to the arcing contacts to prevent burning of the main silver contacts as described under "Contact Assembly". When these open the current is again shunted to arc runners in series with a blowout coil which magnetically blows the arc upwards among the cooling pins and arc barriers, as described under "Arc Quenchers and Barriers", to quickly open the circuit.

SHIPPING-UNPACKING-STORAGE

TRANSPORTATION DAMAGE

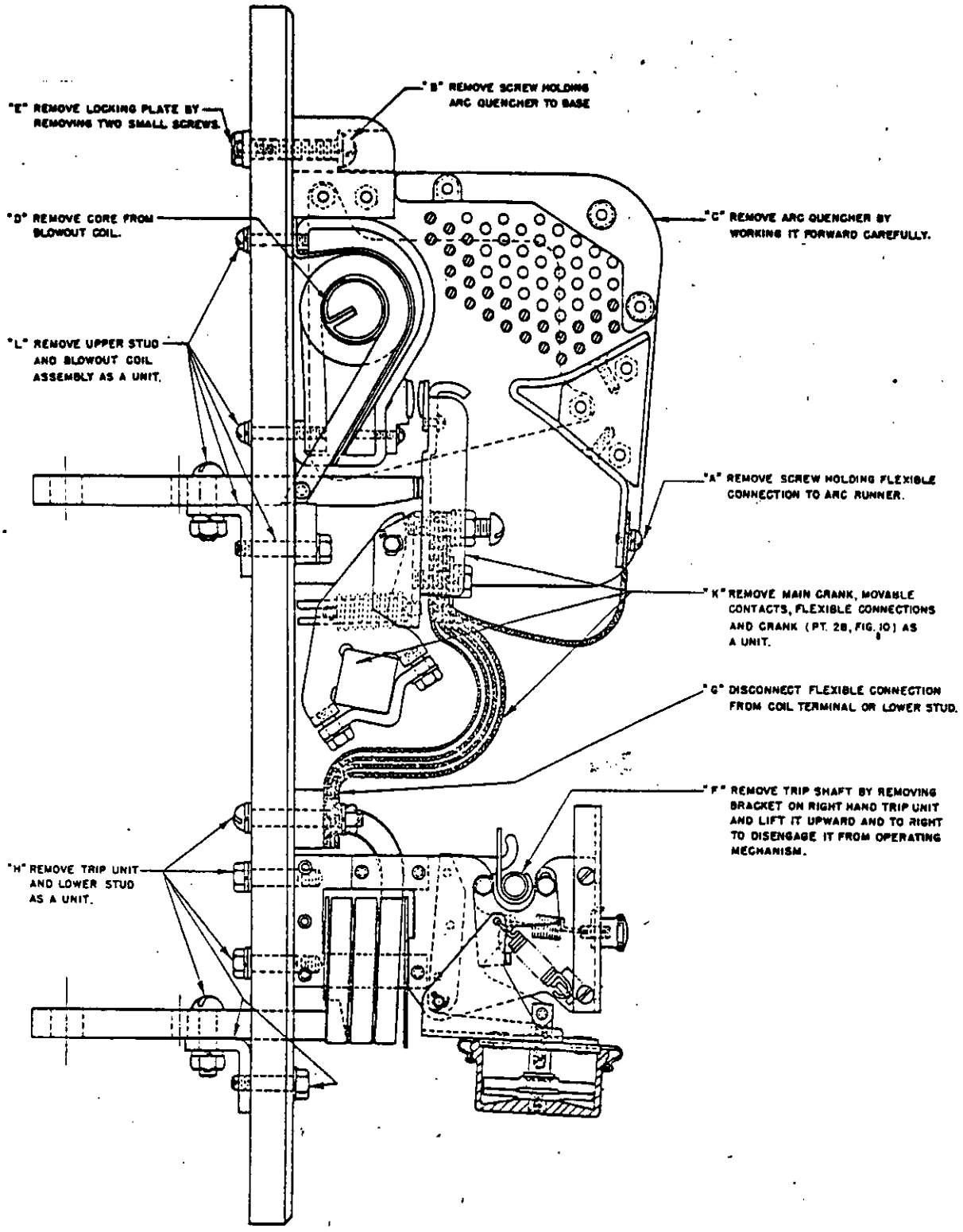
Immediately upon receipt of the breakers, an examination should be made for any damage or loss sustained during transportation. If injury, rough handling, or loss is evident a damage claim should be filed at once with the transportation company and the nearest General Electric Sales Office should be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

UNPACKING

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 locations at once, they should be stored in a clean dry place and preferably in a vertical position. They should be supported to prevent bending of studs, or damage to breaker parts. It is best not to cover the breakers with any packing material 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 and should be used if the breakers are to be stored for any considerable length of time.



"I" (SEE FIG. 10) REMOVE COMPRESSION SPRING (PT. 25) BY PRESSING SPRING GUIDE (PT. 24) TO REAR AND REMOVE IT FROM CAM (PT. 22) AND CRANK (PT. 27) REMOVE PIN FROM CRANK.

"J" (SEE FIG. 10) REMOVE OPERATING MECHANISM AS A UNIT BY REMOVING SCREWS FROM REAR OF BASE.

NOTE:— OTHER DEVICES SHOULD BE REMOVED AS UNITS WITHOUT DISTURBING ADJUSTMENTS OR CALIBRATIONS.

INSTALL THE ABOVE PARTS AND DEVICES ON PERMANENT BASE IN THE REVERSE ORDER.

FIG. 6
REMOVAL OF BREAKER FROM TEMPORARY BASE

INSTALLATION

LOCATION

The AE-1-25 breaker should be installed in a clean, dry place where it is readily accessible for convenient operation, inspection and maintenance. When mounted on a live front switchboard it should preferably be located at the top of the panel. Space of at least 8" should be allowed above arc quenchers if no barriers are provided.

Most breakers are shipped on permanent bases, or panel sections, with or without enclosures, and the mounting consists of simply bolting the bases to the supporting framework or structure.

Silver contacts, described under "Contact Assembly" should be checked as follows before the breaker is put in operation:-

1. Wipe off any dust which may have collected on the contact surfaces with a clean cloth.
2. Clean the contacts with a good grade of silver polish or very fine sandpaper to remove any dark surface film so that the contacts are clean and bright. If silver polish is used, be careful to remove all polish from the contacts or insulated parts, after cleaning. If sandpaper is used, care must be exercised to maintain line contact.
3. Take contact impressions as described under "Contact Assembly" to determine if proper line contact is being maintained. If necessary, improve the contacts as described under "Maintenance".

BREAKER CONNECTIONS

Before connecting current-carrying bus bars or 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 firmly clamped or bolted in place to prevent excessive heating. In enclosed breakers the cables should be clean and of ample size to assure full contact surface when attached by the swivelled clamping screw in the solderless connectors. The connecting bus bars or cables should have adequate current-carrying capacity, otherwise, heat will be conducted from them to the breaker which could not be expected to carry normal current without exceeding the specified temperature rise. Connecting cables or bus bars should be supported so that the breaker studs will not be subjected to unnecessary strains.

DEAD FRONT BREAKERS

Breakers equipped with dead front barriers, Fig. 2, can be installed on framework or elsewhere without removing the barriers.

ENCLOSED BREAKERS

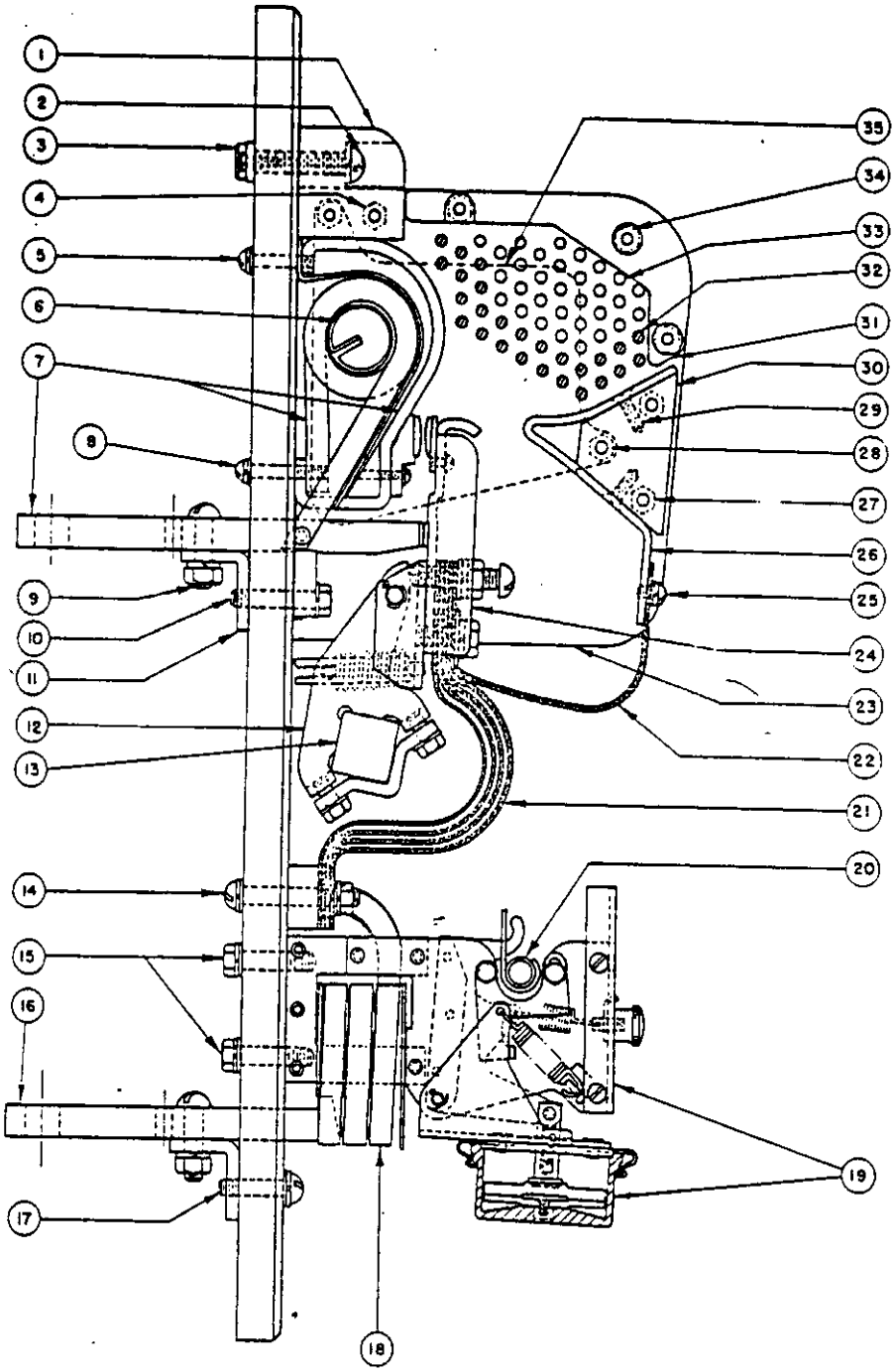
The enclosed breakers, Fig. 3, can easily be installed by first removing the cover and the two top mounting bolts in the breaker base, Fig. 4. Tilt the breaker unit forward to disengage disconnects and for removal. Next, mount the box in the desired location and secure the cables in the solderless connectors in the box, (Fig. 5). Finally, return the removable breaker unit to the box, and replace the two upper mounting bolts and the cover to complete the installation.

WHILE INSTALLING, OR BEFORE REMOVING THE BREAKER, IT IS IMPORTANT THAT IT SHOULD BE IN THE OPEN POSITION.

TEMPORARY BREAKER MOUNTING

It is always preferable to have an air circuit breaker shipped on a permanent base or panel section. Remounting of a breaker by persons not entirely familiar with its detailed construction may result in misalignment or improper adjustment with resultant unsatisfactory operation. Temporary bases will not be supplied when reverse current trip devices are involved.

For those cases where it is found necessary to transfer a breaker from a temporary base to a permanent base or panel, first make sure that the permanent base or panel is properly drilled in accordance with an approved drilling plan furnished by the General Electric Company for the particular breaker. In transferring the breaker, it should not be dismantled any more than is necessary to affect the transfer. Sub-assemblies, such as overcurrent devices, the operating mechanism, etc. should be transferred as units. This will help maintain adjustments and will minimize the possibility of incorrect assembly. A recommended sequence of procedure for transferring an AE-1-25 air circuit breaker is given in Fig. 6. It is suggested that this procedure be followed in the order in which the operations are alphabetically arranged. Reinstall parts and devices on the permanent breaker base in the reverse order. It is important that the main shaft and crank (Pt. 27, Fig. 10) should move freely in bearings and clear of cam (Pt. 22, Fig. 10) before spring (Pt. 25, Fig. 10) is installed. After the transfer has been completed and the operating mechanism, main and trip shafts are working freely, the alignment of the contacts and operation of all parts should be checked as described under "Operation" and "Contact Assembly".



1. SUPPORT
2. SCREW R.H. $\frac{5}{16}$"-18 WITH LOCKWASHER
3. LOCKING PLATE WITH WELDED NUT
4. SCREW RH. #10-32 X $2\frac{1}{2}$" WITH LOCKWASHER AND NUT
5. SCREW RH. #10-32 WITH WASHER AND LOCKWASHER
6. STEEL CORE OF BLOWOUT COIL
7. UPPER STUD AND STATIONARY CONTACT ASSEMBLY (SEE FIG. 8)
8. SCREW RH. #10-32 WITH WASHER AND LOCKWASHER
9. SCREW RH. $\frac{1}{4}$" - 20 WITH LOCKWASHER AND NUT
10. SCREW HEX. HD. $\frac{1}{4}$" - 20 WITH LOCKWASHER
11. STUD BRACKET
12. MOVABLE CONTACT SUPPORT
13. MAIN SHAFT
14. SCREW RH. $\frac{1}{4}$"-20 WITH WASHERS, LOCKWASHERS, AND NUT.
15. SCREWS HEX. HD. $\frac{1}{4}$"-20 WITH WASHERS AND LOCKWASHER
16. LOWER STUD
17. SCREW ROUND HD. $\frac{1}{4}$" - 20 WITH LOCKWASHERS
18. SERIES COIL
19. DUAL OIL FILM MAGNETIC OVERCURRENT TRIP DEVICE (SEE
20. TRIP SHAFT
21. MAIN FLEXIBLE CONNECTION
22. FLEXIBLE CONNECTION
23. SIDE PLATE OF ARC QUENCHER
24. MOVABLE CONTACT ASSEMBLY (SEE FIG. 8)
25. SCREW RH. #10-32 WITH WASHER AND LOCKWASHER
26. FRONT ARC RUNNER
27. SCREW RH. #10-32 X $2\frac{1}{2}$" WITH LOCKWASHER AND NUTS
28. SCREWS RH. #10-32 X $2\frac{3}{4}$" WITH LOCKWASHERS AND NUTS
29. SCREW F.H. #10-32 X $\frac{1}{2}$"
30. INSULATION BLOCK
31. BAFFLES
32. PINS, HIGH MELTING POINT
33. PINS, COPPER
34. SCREWS, RH. #10-32 X $2\frac{5}{8}$" WITH LOCKWASHER AND NU
35. POLE PIECE PLATES

FIG. 7

OPERATION AND MAINTENANCE

OPERATION

After the breaker has been installed, slowly operate it manually several times (as described below) and observe whether the contacts line up properly and make sure that all parts move freely in a proper manner without binding or excessive friction. See that the breaker latches securely and trips freely. If the breaker is equipped with an undervoltage device the breaker cannot be latched unless normal potential is applied to its coil, or the plunger is forced into the coil.

Manually operated AE-1-25 breakers, covered in these instructions, are closed by first turning the operating handle in the counter-clockwise direction from the normal position of "handle down" to a position of "handle up" to reset the operating mechanism latch, and then turning the handle in a clockwise direction to position of "handle down" to close the breaker (as described under "Operating Mechanism"). DO NOT ATTEMPT TO OPEN THE BREAKER BY COUNTER-CLOCKWISE ROTATION OF THE OPERATING HANDLE. The breaker is opened by pushing on the trip button to release the trip latch. The handle remains in the "down" position after tripping.

Electrically operated AE-1-25 breakers, covered in these instructions, may be closed manually by inserting a maintenance closing handle between the armature and the left side frame and under the pin which connects the armature to the operating mechanism, (as described under "Solenoid Operating Mechanism). The breaker is likewise opened by pushing on the trip button to release the trip latch, and not by the maintenance closing handle.

The electrically operated breaker is automatically reset by the falling of the armature when the breaker is tripped, but not if the maintenance closing handle is in place. Therefore, if the breaker has been closed by the maintenance closing handle, be sure to remove it before attempting to trip the breaker.

After checking the operation manually, as above, an electrically-operated breaker should be operated electrically at rated voltage a few times to make sure that all control circuits are properly connected and the closing solenoid, closing relay and other control attachments are functioning properly. Bear in mind that the solenoid is rated for intermittent service. Reasonable care should be exercised when testing to avoid overheating of the solenoid by repeated operations.

MAINTENANCE

Periodic inspection of the breaker is recommended at least once a year, or more [illegible] dust exist. An inspection of the contacts and arc quenchers should always be made after it is known that the breaker has opened a severe short circuit. If the breaker remains open or closed for a long period of time, it is recommended that arrangements be made to open and close it several times in succession, clean and lubricate, where necessary, to keep the contacts and moving parts in good working condition.

Before inspecting or repairing, make sure that the breaker and accessories are disconnected from all electric power, both primary and control voltages.

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

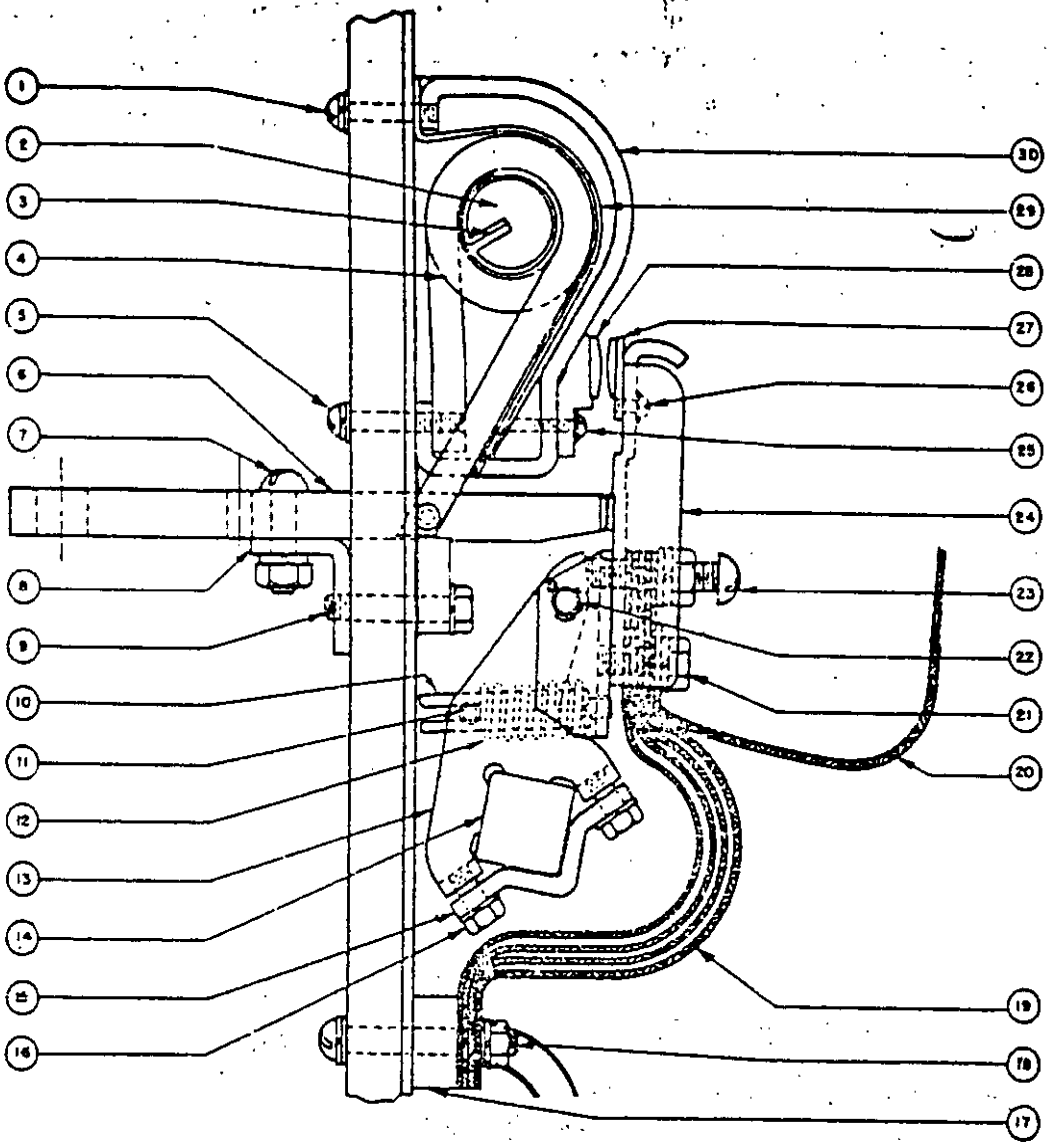
Periodic maintenance of contacts should include the following:

1. Wipe off dust and clean the contacts as described under "Installation".
2. Take contact impressions, as described under "Contact Assembly", and improve the contacts if necessary. Remove high or rough spots with a fine clean file or very fine sandpaper. Do not use emery or crocus cloth. Small pittings need not be removed if 75% of line contact can be obtained.

In general, the breaker mechanism requires very little lubrication which should be applied sparingly. Any excess amount of oil on the breaker parts is apt to collect dust and dirt and is to be avoided. A general recommendation for lubrication of an air circuit breaker mechanism is to occasionally use a few drops of a good grade of light machine oil at bearing points and wipe off any excess with a clean cloth. Latch surfaces should be kept smooth and clean with crocus cloth. They should be lightly greased and the excess removed with a clean cloth.

If the breaker is equipped with an type of oil-film time delay trip devices make sure that, when the breaker is installed, the oil pots of these devices are thoroughly cleaned and filled with oil to the proper level as marked on the pots. It is important that these oil pots be kept clean and properly filled with fresh oil to the proper level at regular inspection periods at least every six months, and more frequently if service is severe. A small can of oil for use in these pots is furnished with each breaker. Additional oil, per General Electric Company specifications D6B7A1, can be obtained from the factory. When cleaning these oil pots, use kerosene or naptha only, and wipe dry with a clean cloth. Other cleaning fluids may act as a solvent of the material of which the pot is made.

At all times it is important not to al



1. SCREW R.H. $\frac{5}{16}$-18 WITH LOCKWASHER
2. CORE OF BLOWOUT COIL
3. INSULATION
4. BLOWOUT COIL
5. SCREW R.H. @ 10-32 WITH WASHER AND LOCKWASHER
6. UPPER STUD AND SILVER CONTACT
7. SCREW R.H. $\frac{1}{4}$-20 WITH LOCKWASHER AND NUT
8. BRACKET
9. SCREW HEX. HD $\frac{1}{4}$-20 WITH LOCKWASHER
10. SPRING GUIDE
11. PIN IN CONTACT SUPPORT
12. COMPRESSION SPRING
13. CONTACT SUPPORT
14. MAIN SHAFT
15. CLAMP
16. SCREW HEX. HD. $\frac{1}{4}$-20 X $\frac{5}{8}$ WITH LOCKWASHER
17. TERMINAL OF SERIES COIL OR LOWER STUD
18. SCREW R.H. $\frac{1}{2}$-20 WITH WASHER, LOCKWASHER AND NUT
19. MAIN FLEXIBLE CONNECTION
20. FLEXIBLE CONNECTION
21. SCREW HEX. HD. $\frac{5}{16}$-18 X $\frac{7}{8}$ WITH WASHER AND LOCKWASHER
22. PIN IN CONTACT SUPPORT AND COTTER PINS
23. ADJUSTING SCREW R.H. $\frac{5}{16}$-18 X $1\frac{1}{2}$ WITH WASHER, LOCKWASHER AND NUT
24. MOVABLE CONTACT AND SILVER CONTACT
25. SCREW R.H. @ 6-40 X $\frac{1}{4}$ WITH LOCKWASHER
26. SCREW R.H. @ 6-40 X $\frac{1}{4}$ WITH LOCKWASHER
27. MOVABLE ARCING CONTACT
28. STATIONARY ARCING CONTACT
29. INSULATION
30. STATIONARY ARC RUNNER, WELDED TO PT. 6

FIG. 8
CONTACT ASSEMBLY

of different degrees of conductivity to short circuit insulation strips or barriers between surfaces of different potential on breaker parts or attachments. Even oil on such insulation surfaces may accumulate dirt to allow leakage of current.

Further discussion of maintenance inspection and trouble-shooting will be found in "How to Maintain Air Circuit Breakers", GET-1165.

DESCRIPTION OF COMPONENTS AND ATTACHMENTS

Although, under this heading, the adjustable features of the air circuit breaker and its attachments are given, it should be understood that the breaker has already been adjusted, tested and inspected at the factory in accordance with the information given herein. However, it is possible that unusually rough handling, transportation, and operating conditions may have resulted in some loosening or disturbance of the equipment to warrant re-checking and, in some cases, readjustment may be necessary.

CONTACT ASSEMBLY

Current is carried through the breaker by solid copper studs, stationary and movable contacts, and flexible connections, as shown in detail in Fig. 8, (see also Fig. 7). The stationary contact assembly consists of an upper stud (Pt. 6) with a brazed silver contact, blowout coil (Pt. 4) and stationary arc runner (Pt. 30), riveted and silver soldered together as one unit and attached to the mounting base by bracket (Pt. 8) and screws (Pts. 1 and 5). A sheet of insulation (Pt. 29) separates the blowout coil and the arcing horn. The main silver contact strip is silver soldered to the front of the upper stud. The removable stationary arcing contact (Pt. 28) with silver alloy contacts is attached to arc runner by screws (Pt. 25).

The movable contact assembly consists of a movable contact (Pt. 24) pivoted to a contact support (Pt. 13) by pin (Pt. 22) and the contact support is rigidly attached to the square main shaft (Pt. 14) by clamp (Pt. 15). The square shaft is covered throughout its length with heavy insulating material and extends through the movable contact assembly of each pole and is connected to the operating mechanism by crank (Pt. 27 Fig. 10). A main silver contact strip is silver soldered to the movable contact. The removable arcing contact (Pt. 27), with silver alloy inserts, is attached to it by screws (Pt. 26). The flexible connection (Pt. 19) is attached to the movable contact by screws (Pt. 21 and 23) and to the upper end of the series coil, or lower stud, by screw (Pt. 18). Compression spring, (Pt. 12), mounted over guide (Pt. 10) and backed up by pin (Pt. 11) in the contact support, causes the movable contact to revolve about pin (Pt. 22) in the contact support to maintain pressure between the main contacts, when the breaker is closed.

In closing, the arcing contacts close before the main contacts close, and, as the contact support (Pt. 13) is drawn further to the rear, the movable contact (Pt. 24) revolves over the main contacts as a fulcrum to draw the arcing contacts apart. Screw (Pt. 23) must be adjusted to cause a gap of .020" to .040" between the arcing contacts when the breaker is latched closed.

Compression spring (Pt. 12) should be set to require a pull of 19 to 24 pounds, applied at the movable arcing contact, to open the main contacts. The arcing contacts should be separated by 3/4" to 1" when the breaker is open. When the arcing contacts just touch, the main contacts should be between 1/16 to 3/16" apart.

As the breaker opens, the arcing contacts close again and remain closed until after the main contacts open. Thus, when the main contacts open the breaker current is shunted to the arcing contacts to prevent burning of the silver contacts. When the movable arcing contact (Pt. 27) passes under the front arc runner (Pt. 26 Fig. 7) of the arc quencher, the breaker current is again shunted over flexible connection (Pt. 20) to the arc runner, and the arc is transferred to the front and rear arc runners and among the pins of the arc quencher. A magnetic field is set up by the shunted current through the blowout coil (Pt. 4) which quickly opens the circuit as described under "Arc Quenchers".

The breaker is equipped with fine silver high pressure line type main contacts, silver soldered to the upper stud (Pt. 6) and the movable contact (Pt. 24). The surfaces of these contacts have been coated with wax at the factory to prevent the formation of surface film. The wax will not interfere with operation as it will volatilize at normal operating temperatures of the breaker.

To maintain line contact in the AE-1-25 breaker the silver inserts on the movable contact are machined flat but those on the upper studs are slightly curved. It is important for proper breaker operation that adequate line contact be maintained which can be checked as follows:-- Hold between the contacts a piece of thin carbon paper with tissue paper on the carbon side. Close and open the breaker and examine the impression on the paper. Good contact is indicated if a well defined impression shows for 75% or more of the length of the contact. Good contact is also indicated if a .002" feeler gauge cannot be inserted between the contacts for more than 25% of the length of the contact. Should poor contact be found, it will be necessary to improve the contacts as described under "Maintenance". The curved surface should be maintained on the stationary contact so that the line contact will not be too broad.

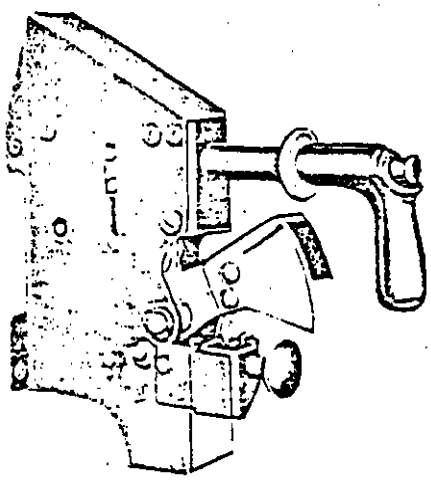
ARC QUENCHERS AND BARRIERS

An arc quencher is provided for each pole of AE-1-25 breakers to quickly extinguish the arc after the contacts open. Each arc quencher, Fig. 7, consists of a large number of small solid pins (Pts. 32 and 33) supported between molded compound side plates (Pt. 23) which are placed vertically on both sides of each set of contacts. The pins are copper except those in the two lower rows which are of a metal that has a higher melting point than copper. Baffles (Pt. 31) of molded compound are placed between the side plates above and in front of the pins. An arc runner (Pt. 26) is mounted on an insulation block (Pt. 30) between the side plates and in front of the pins. To this runner is connected a flexible shunt connection (Pt. 22) after the arc quencher is in place. Pole piece plates (Pt. 35) are placed on the outside of the side plates and act with the blowout coil with a slotted steel core (Pt. 6) of the stationary contact to provide a magnetic path to blow the arc upwards on the arc runners and among the pins and baffles when the breaker current is shunted from the contacts as described under "Contact Assembly". The steel core, enclosed in insulation, is inserted in the coil when the arc quencher is installed. As the arc travels up the arc runners and through the pins and baffles it is lengthened and cooled which quickly opens the circuit. Each arc quencher is attached to the mounting base by a screw (Pt. 2) which passes through a mounting support (Pt. 1) in the upper part of the arc quencher and which engages a locking plate (Pt. 3) mounted on the rear of the mounting base.

For dead front and enclosed AE-1-25 breakers a box type barrier of molded compound is provided to fit over the top, sides and front of all arc quenchers to confine the arcs. Barriers are provided to isolate each pole unit. The front is attached by nuts and can be removed for inspection of arc quenchers. The barrier rests on a horizontal strip above the arc quenchers and is attached to the circuit breaker base by two long bolts with front nuts shown in Fig. 2.

MANUAL OPERATING MECHANISM

The manually operated mechanism of the AE-1-25 breaker is operated by revolving a pistol grip handle (Pt. 23) located at the front of the mechanism, as shown in Fig. 10. The normal position of the handle is "down" and in order to close the manually operated breaker, it must be turned counter-clockwise approximately 180^{0} to the "reset" position which resets the latch (Pt. 12), and then must be turned clockwise to the "down" position, to close the breaker. The mechanism is tripped by pushing on a trip button in the bottom front part of the side frame of the mechanism, or by any tripping device which revolves the trip shaft (Pt. 18) in a counter-clockwise direction (looking from



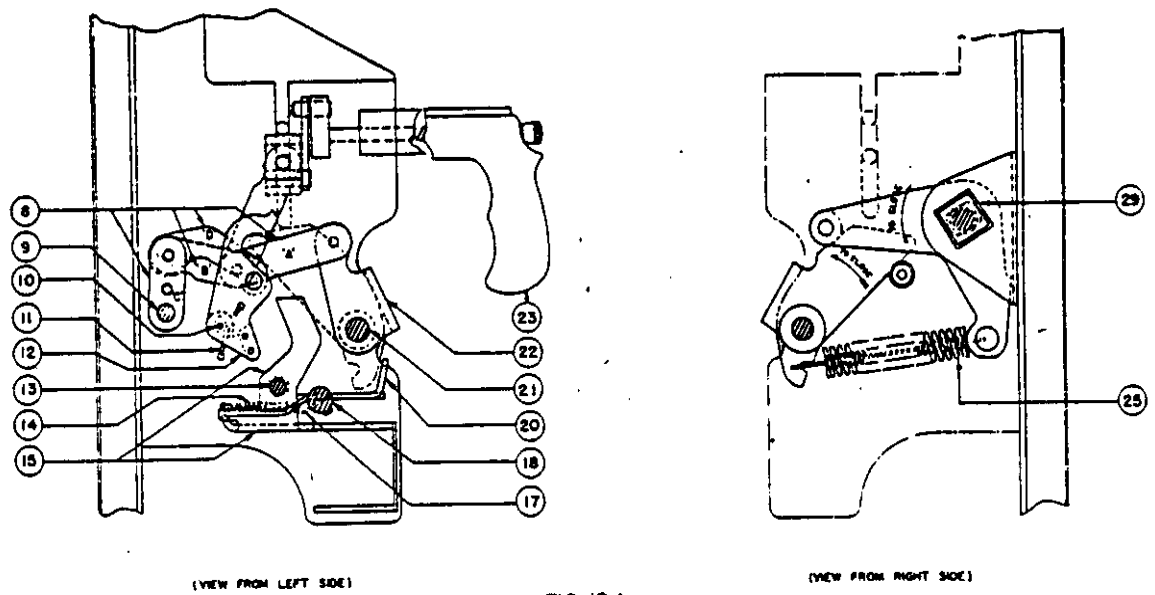


FIG. 10A

TRIPPED POSITION

left) to release the latch (Pt. 12). When tripped manually or by any tripping device, the handle remains in the "down" position. Therefore, to reclose the breaker, the handle must first be turned counter-clockwise to the "reset" position and then clockwise to the "down" position as described above.

The operating mechanism, Fig. 10, of the manually operated breaker consists of a group of toggles, links, levers and a latch attached to the frame by fixed pins (Pt. 9, 10, 13 and 21). The insulation covered main shaft (Pt. 29) the trip shaft (Pt. 18) and the handle shaft also have fixed bearings in the frame. All parts move otherwise on floating pins. The mechanism operates a cam assembly (Pt. 22) to close the breaker and places springs (Pt. 25) of the mechanism and springs (Pt. 12, Fig. 8) of the movable contact assembly under compression. Tripping, by any means, releases the latch (Pt. 12) to allow these springs to extend which supplies the power to open the breaker and hold the contacts apart after tripping.

A torsion spring (Pt. 11) around pin (Pt. 10) applies force to the latch (Pt. 12) in the clockwise direction to reset the latch. The spring (Pt. 14) jointly holds prop (Pt. 15) in the vertical position and trip arm (Pt. 20) in the normal position.

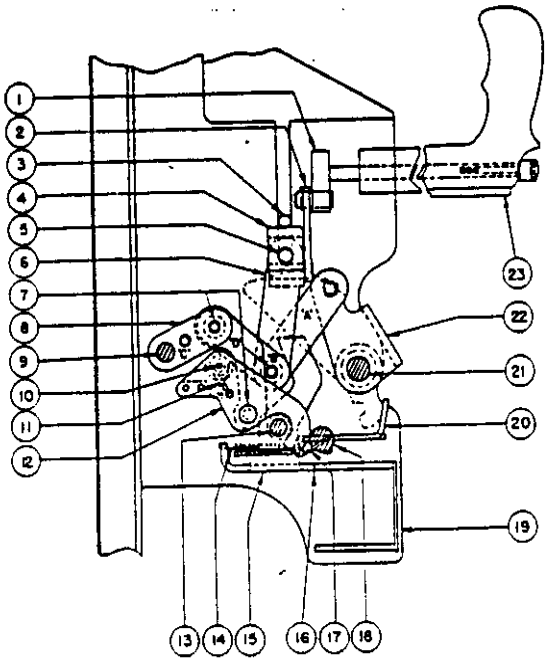
In a cycle of manual operation, the mechanism parts take three positions as follows:-

TRIPPED POSITION - In the tripped position Fig. 10A, the latch (Pt. 12) of the toggle mechanism is in the vertical position and is free of the latch plate (Pt. 17) which is attached to the trip shaft (Pt. 18). The handle is down. Other parts assume positions as shown.

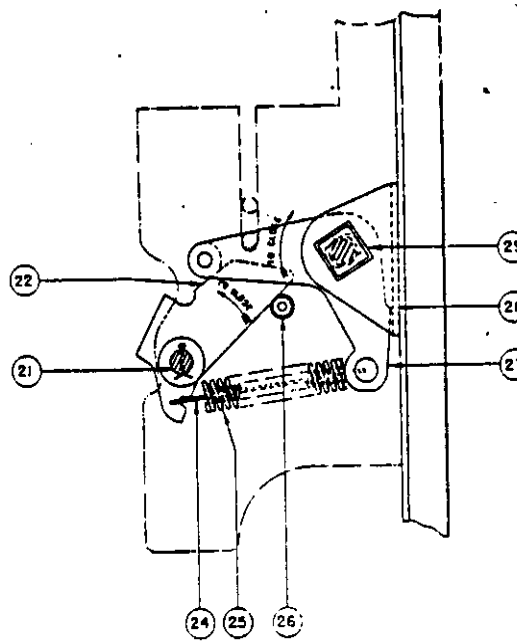
RESET POSITION - When the manual handle (Pt. 23) is turned counter-clockwise to the "reset" position with handle up, Fig. 10B, the eccentric (Pt. 1) on the handle shaft lowers link (Pt. 2), block (Pt. 4) and a pair of closing links (Pt. 6), collapsing toggle links (Pt. 8A and 8B) causing the latch (Pt. 12) to revolve about its fixed pin (Pt. 10) in frame and engage the latch plate (Pt. 17).

CLOSED POSITION - When the manual handle (Pt. 23) is turned clockwise from the "reset" position to the "closed" or "down" position Fig. 10-C, the closing links are raised to the vertical position, extending toggle links (Pt. 8A and 8B) which forces the cam (Pt. 22) forward, because the pin in the rear end of toggle link (Pt. 8D) is held fixed by latch (Pt. 12) which is engaged on latch plate (Pt. 17). The cam raises the operating crank (Pt. 27) which turns the main shaft (Pt. 29) to the closed position to close the contacts. At the same time a torsion spring around pin (Pt. 13) draws prop (Pt. 15) under closing links (Pt. 6) to prevent opening of the breaker by counterclockwise rotation of the manual handle.

The type AE-1-25 breaker is trip free because the toggle links (Pt. 8A and 8B) cannot be extended to move the cam (Pt. 22) forward as long as the trip shaft (Pt. 18) is held in the tripped position by any device. This prevents the latch (Pt. 12) from being held by the latch plate (Pt. 17) as shown in Fig. 10B, and even if an attempt is made to close the breaker, the latch simply returns to the tripped position of Fig. 10A, without moving the cam (Pt. 22) forward.



(VIEW FROM LEFT SIDE)



(VIEW FROM RIGHT SIDE)

FIG. 10B

RESET POSITION

1. ECCENTRIC SHAFT
2. LINK
3. GUIDE WELDED TO BLOCK
4. BLOCK
5. PIN
6. CLOSING LINKS
7. RIVETED OVER PIN
8. TOGGLE LINKS A,B,C, & D
9. PIN IN FRAME
10. PIN IN FRAME
11. TORSION SPRING
12. LATCH
13. PIN IN FRAME
14. SPRING
15. PROP
16. STOP SURFACE FOR PROP
17. LATCH PLATE
18. TRIP SHAFT
19. FRAME
20. TRIP ARM
21. PIN IN FRAME
22. CAM
23. MANUAL CLOSING HANDLE
24. GUIDE
25. OUTER AND INNER COMPRESSION SPRINGS.
26. CAM STOP
27. OPERATING CRANK
28. BRACKET
29. MAIN SHAFT

POSITIONS OF OPERATING MECHANISM (A,B,&C)

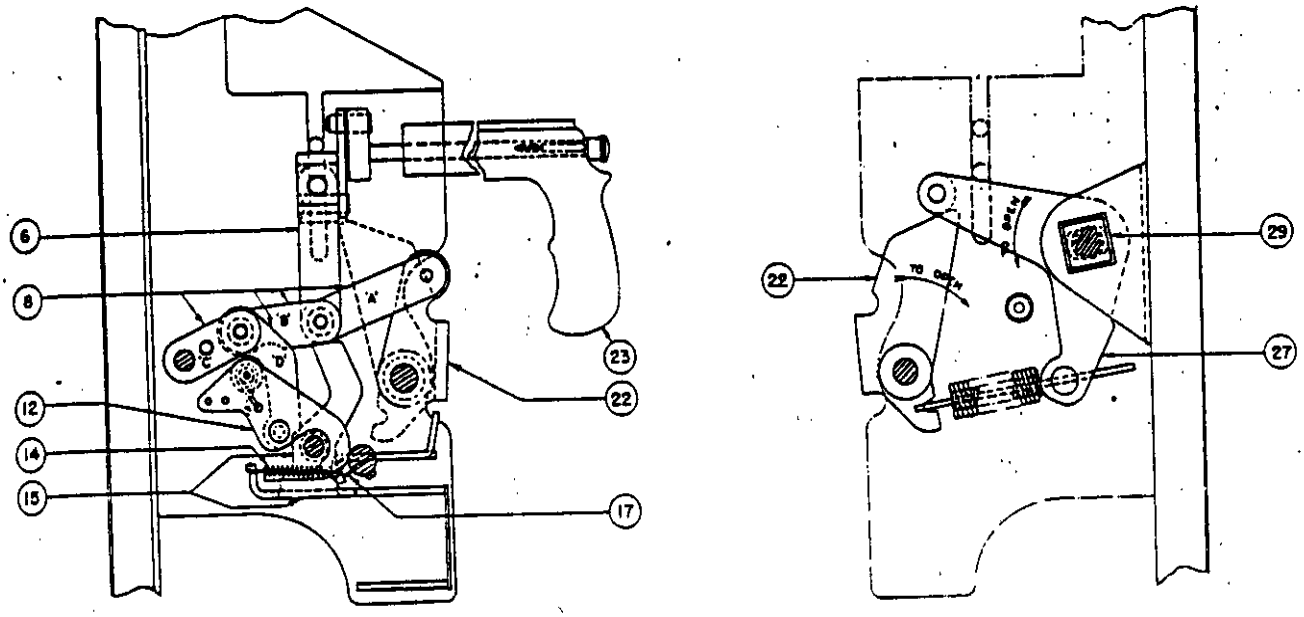
Adjustments are made by cams as shown in Fig. 11. To adjust the engagement between latch (Pt. 2) and latch plate (Pt. 5), slowly move the trip arm (Pt. 7) by hand, with the breaker closed, and measure the travel "A", of the front end of the arm from the point of rest to the point of trip, which should be between 1/8" and 3/16". Adjustment can be made by loosening the screw (Pt. 9) and turning the eccentric stop (Pt. 8), on the left side of the operating mechanism frame, which bears against the buffer spring (Pt. 10) attached to the left end of the trip shaft (Pt. 6). After adjusting the eccentric be sure to tighten the screw.

The latch clearance adjustment is obtained by turning eccentric cam (Pt. 4) by screw-driver after loosening nut (Pt. 3). Although the cam is on the inside of the operating mechanism frame, a threaded shank with a screw-driver slot extends through the frame. A clearance "B" of approximately 1/64" should be allowed between the latch (Pt. 2) and the cam when the latch rests against the latch plate (Pt. 5). If the clearance is too great, the latch receives too great shock, particularly from t ing of the solenoid, and if the clea too small, the latch will not reset. to tighten the lock nut securely af justment.

In replacing the latch plate (P is important that the point of contac latch plate should be on the upper shown in the insert of Fig. 11, and the lower side.

SOLENOID OPERATED MECHANISM

The electrically operated mecha the type AE-1-25 breaker is the sam manual operation except that the fo parts of Fig. 10, manual handle (P eccentric shaft (Pt. 1), link (Pt. 2 (Pt. 3) and block (Pt. 4) are repla solenoid of Fig. 13 and a closing Fig. 14. In solenoid operation the of the latch is automatic, in that th of armature (Pt. 4, Fig. 13) causes lapse of toggle links (Pts. 10A and 10), which duplicates the resetting manually operated mechanism descr Fig. 10B.



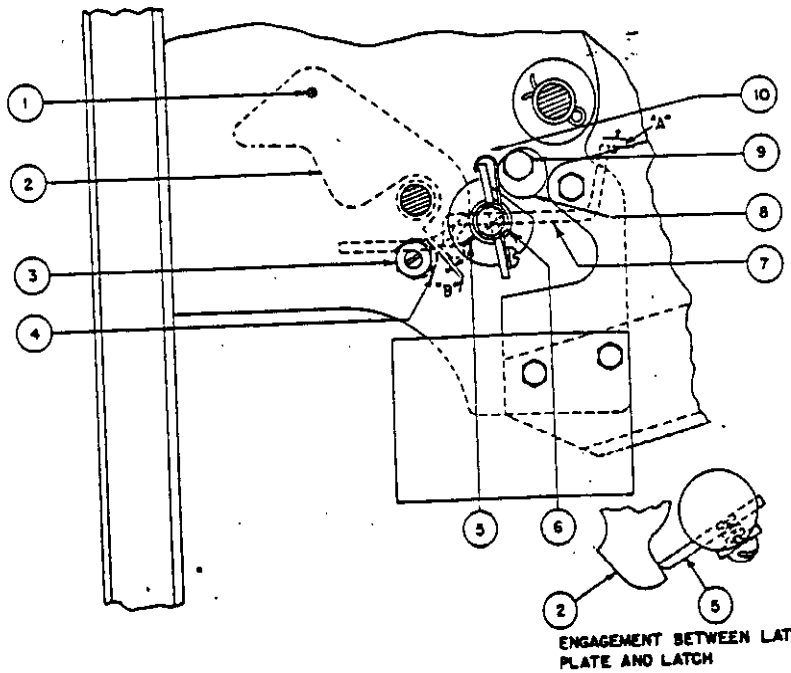
(VIEW FROM LEFT SIDE)

(VIEW FROM RIGHT SIDE)

FIG. 10 C

CLOSED POSITION

(OF OPERATING MECHANISM)



ENGAGEMENT BETWEEN LATCH PLATE AND LATCH

1. PIN IN FRAME
2. LATCH
3. NUT $\frac{1}{4}$ - 20 WITH LOCKWASHER
4. ECCENTRIC WITH $\frac{1}{4}$" THREADED SHANK
5. LATCH PLATE
6. TRIP SHAFT
7. TRIP ARM
8. ECCENTRIC
9. SCREW HEX. HD. 10-32 X $\frac{7}{16}$" WITH LOCKWASHER
10. BUFFER SPRING

FIG. 11

ADJUSTMENT ECCENTRICS

FOR TRIP ARM AND LATCH

Pages 14+15 Missing

Manual closing of the solenoid operated breaker is shown in Fig. 13 by inserting a maintenance closing handle (Pt. 7) through the front of the mechanism under pin (Pt. 5) between the armature (Pt. 4) and the left side frame (Pt. 2) and resting it on pin (Pt. 6) as a fulcrum. Push down on the handle and be sure that the armature is lifted until the breaker is latched closed.

The breaker is likewise tripped by pushing on the trip button to release the trip latch, and not by the maintenance closing handle. In closing the breaker with the maintenance closing handle, it is important to remove it before tripping, as the breaker will have to be reset if the handle is still under the armature.

CLOSING RELAY

An electrically operated AE-1-25 breaker is equipped with a closing relay, Fig. 14, which operates to control the solenoid closing coil current so that the closing switch contacts will not be called upon to break the main closing coil current. This relay is attached to the mounting panel directly below the operating mechanism. No adjustments are required except to keep the contacts clean.

The coil (Pt. 2) is mounted in the magnet (Pt. 1), which is screwed to a separate mounting base (Pt. 11). The coil is held in place by two brass guides (Pt. 3) between armature (Pt. 4) is free to move. ends of the guides are clamped over t and against the coil to keep it fi place, and the upper ends are fasten magnet by self-tapping screws (Pt. 1 the coil is energized by the closin operating switch, Fig. 16, or a remot relay contacts or other devices, the is drawn up into the coil. It carr it a movable contact strip (Pt. 7 bridges the stationary contact block to energize the breaker closing coil control power source and close the As soon as the coil is de-energiz armature falls by its own weight and breaker closing circuit at the mova tact strip.

ROTARY TYPE AUXILIARY SWITCH

The rotary type auxiliary swit 15, is the SB-1 type and is used electrically operated AE-1-25 brea on manually operated breakers when functions are required. It is g placed on the mounting panel above th ing mechanism and connected by cran and link (Pt. 9) to the operating c 27, Fig. 10) of the breaker main sh number of stages and the arrangemen tact switches are determined by the functions desired and the character circuits to be controlled such as i lamps, control circuits, bell alarm locking of breakers, etc.

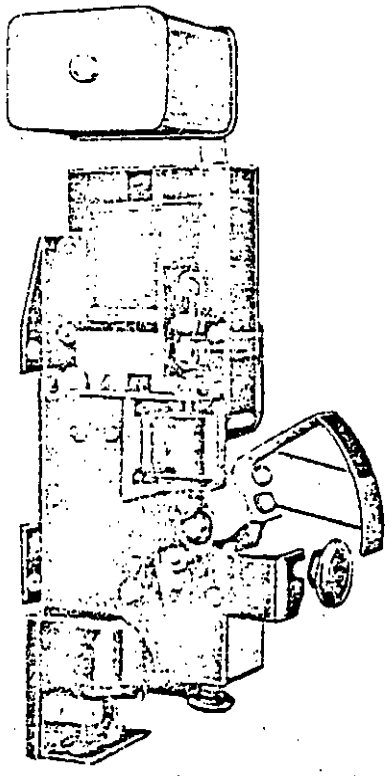


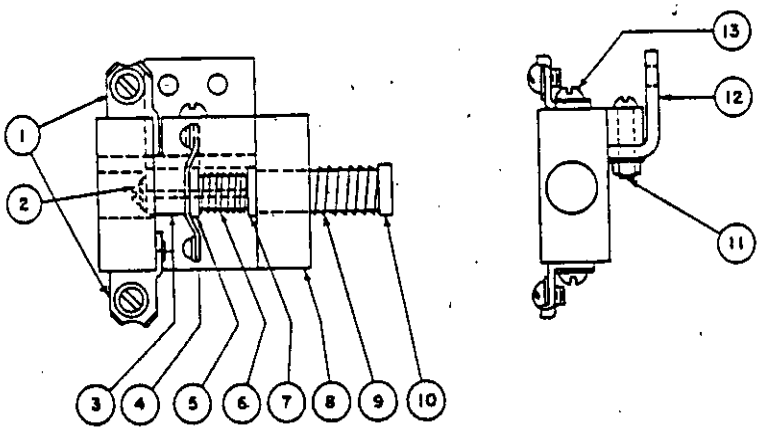
FIG. 12
ELECTRICALLY OPERATED MECHANISM.

in a plane at right angles to the shaft. A stationary contact support (Pt. 4) carries the stationary contacts of all stages and is attached to the front frame and the rear barrier by two round head screws. Two bolts pass through the molded barriers and through the front end frame (Pt. 7). When the shaft is rotated the cam of each stage opens or closes both movable contacts simultaneously. In the auxiliary switch for the AE-1-25 breaker the two stationary contacts are insulated from each other in order that both switches of each stage may be connected in series for one circuit with two breaks as in Stage 1, or may be used for two separate circuits with one break in each circuit, as in Stage 2, as shown in wiring diagrams, Fig. 39 and 40. The cam bushing fits over the square shaft (Pt. 10) and has 24 external teeth and the cam (Pt. 7) with 24 corresponding internal teeth fits over the bushing to allow steps of 15° placement with reference to its setting on the shaft. The proper placement of the cam on the bushing and the bushing on the shaft is important for proper operation of the breaker. There is an index mark on the bushing and reference marks on the cam for this purpose.

The contacts of any stage may be changed from "a" to "b", or any intermediate position required, by a change in breaker operation by changing the position of the cam with reference to the shaft. If a change of 90° is required, the cam and bushing should be removed together and replaced on the square shaft in the proper position. If the change is 15° or a multiple of 15° the cam will have to be relocated on the bushing. Each reference mark on the cam represents 15° of angular placement.

To make the change in the field, first remove interfering wiring and the stationary contact support (Pt. 4) with all the stationary contacts (Pt. 3) by removing two round head screws. Then remove the two tie bolts which hold the molded barriers (Pt. 1) to the front end frame (Pt. 7). Now remove the rear molded barrier with the two movable contacts of the rear stage, which will leave the cam and bushing of the rear stage exposed. Continue removing molded barriers, cams and bushings until the cam to be changed is exposed. In removing cams and bushings be particularly careful to make an accurate sketch showing the relation of reference marks on the cams, the index mark on the bushing and the position of the bushing on the shaft, and keep the parts of each stage together. The cam can then be changed to its new position and the auxiliary switch can be reassembled.

At regular inspection periods of the breaker, the auxiliary switch should be examined for burned contacts, and broken shunts on contact fingers. If contacts are slightly pitted or coated with oxide, scrape them gently with a sharp knife or dress with a



1. CONTACT BRACKETS AND BINDING SCREWS
2. SCREW R.H. #4-40 X 1 1/4" WITH WASHERS
3. GUIDE
4. MOVEABLE CONTACT STRIP
5. INSULATION
6. SPRING
7. WASHER
8. MOLDED BASE
9. SPRING
10. OPERATING ROD
11. SCREW R.H. #8-36 X 3/4" WITH NUT & LOCKWASHER
12. MOUNTING BRACKET
13. SCREW R.H. #10-32 X 3/8" WITH LOCKWASHER

FIG. 16
OPERATING SWITCH

fine file. If the moving contact is burned or has a broken shunt, the entire contact finger assembly should be replaced. If a stationary contact is burned or damaged the complete stationary contact support and contacts should be replaced.

OPERATING SWITCH

The operating switch, Fig. 16, which energizes the closing relay, Fig. 14, of the solenoid operated breaker, is mounted on the front of the solenoid magnet. It requires no attention other than keeping the contacts clean.

The switch consists of a molded base which supports an operating rod (Pt. 10) on which rides a movable bridging contact strip (Pt. 4) and also contact brackets (Pt. 1) which carry the stationary contacts and binding screws. A compression spring (Pt. 9) normally holds rod and contact strip in the open position. Contact spring (Pt. 6) exerts pressure of the contact strip against the stationary contacts when in the closed position.

CUT-OFF DEVICE

The purpose of the cut-off devices, Fig. 17, for the AE-1-25 breaker is to de-energize the breaker closing coil (Pt. 3, Fig. 13) as soon as its armature has been lifted sufficiently to latch the breaker closed, to prevent damage to the closing coil should the operating switch, Fig. 16, be held in the closed position too long. This device is necessary when maintained contact control switches are used, as shown in Wiring Diagrams, Fig. 38 and 40.

The device consists of a two circuit switch and a holding coil mounted vertically on flanges of bracket (Pt. 2) which is attached to the left side frame (Pt. 3) of the operating mechanism. The switch is operated by a flat spring (Pt. 5) which is pivoted on pin (Pt. 4) mounted in this bracket. This spring is lifted by pin (Pt. 6) which replaces pin (Pt. 5, Fig. 13) through the armature of the breaker closing solenoid. When the closing solenoid is energized the pin is lifted and the flat spring bears against washer and cotter pin (Pt. 12) in pin (Pt. 13) of armature (Pt. 8). This pin bears against operating rod (Pt. 15) of the switch and opens the normally closed contacts which de-energizes the closing relay Fig. 14, and therefore, opens the closing solenoid circuit. At the same time the normally open contacts are closed which closes the circuit of holding coil (Pt. 11) to seal the contact in this position as long as the operating switch Fig. 16 is held in the closed positions. This sealing-in also prevents pumping should the breaker fail to be latched. It is important that this device should not open too soon in the closing stroke of the

energize the closing coil before the breaker is latched closed. See also Wiring Diagram Fig. 40.

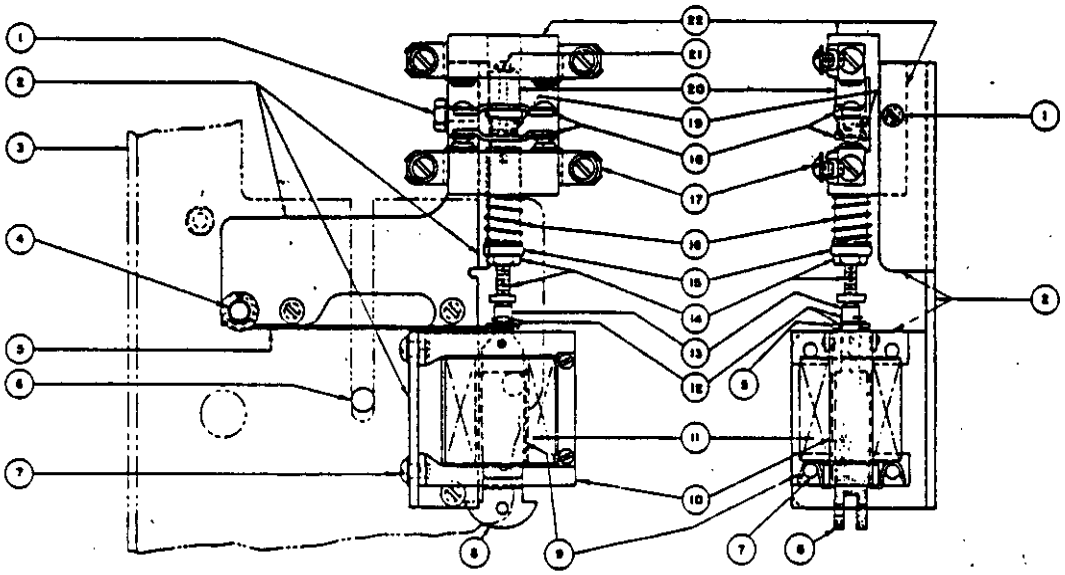
The contact brackets (Pt. 17), with stationary contacts and binding screws, are mounted on a molded base (Pt. 22). The operating rod (Pt. 15) passes through the lower part of the base, and a guide (Pt. 20), attached to the upper end of the operating rod by screw (Pt. 21), passes through the upper part of the molded base. The movable contact strips (Pt. 18) move over the square section of the guide and are separated by contact spring (Pt. 19) which also maintains adequare pressure against the contacts. Spring (Pt. 16) normally holds the operating rod in the lowered position which will close the normally closed contacts in order that the closing solenoid shall be energized as soon as the closing switch is closed.

DUAL MAGNETIC OVERCURRENT TRIP DEVICE (oil Film Type)

This device, Fig. 18, automatically trips the breaker under two distinct conditions of overload; first, with inverse time delay for overcurrents in excess of calibration setting and less than ten times rated current; and second, with instantaneous tripping for interrupting overloads exceeding ten times rated current.

To accomplish inverse time tripping the current in the series coil (Pt. 9) sets up a magnetic circuit which tends to pick up armature (Pt. 1) pivoted on pin (Pt. 13) in frame (Pt. 12) and operate trip finger (Pt. 2) and turn the trip shaft counter-clockwise (looking from the left). The armature (Pt. 1) is restrained by a calibration spring (Pt. 2) held under tension between the armature assembly and the calibration index (Pt. 23) and also by a thin oil film between upper disc (Pt. 17), which is pivoted to the armature assembly, and the lower disc (Pt. 1) attached to the bottom of oil cup (Pt. 1) which holds the oil in which both discs are immersed. For currents below the calibration setting, the calibration spring prevents the armature from picking up and no force is exerted to separate the discs in the oil pot. For currents in excess of the calibration setting the magnetic pull on the armature exceeds the pull on the calibration spring (Pt. 21) and the excess force tends to pull the two flat disc surfaces (Pt. 16 and 17) apart by rupturing the oil film between them. Once this oil film is ruptured, the armature picks up and trips the breaker. The time required to rupture the oil film varies inversely with the force applied and hence inversely with the current through the breaker. Thus, if the overcurrent falls below the calibration setting before the oil film is ruptured the breaker will not trip.

For instantaneous tripping for currents in excess of ten times the breaker rat



1. SCREW R.H. #8-36 x 3/4" WITH NUT AND LOCKWASHER
2. FLANGED BRACKET
3. FRAME OF OPERATING MECHANISM
4. PIN AND COTTER PIN
5. FLAT SPRING
6. PIN (REPLACING PIN PT 5 FIG. 10)
7. SCREWS R.H. #8-36 X 3/8" WITH LOCKWASHERS
8. ARMATURE
9. BRASS GUIDE
10. MAGNET
11. COIL
12. WASHER AND COTTER PIN
13. PIN IN ARMATURE
14. SCREW #10-32 WITH LOCKNUT
15. OPERATING ROD
16. SPRING
17. CONTACT BRACKETS WITH BINDING SCREW
18. MOVEABLE CONTACT STRIPS
19. CONTACT SPRING
20. GUIDE
21. SCREW R.H. #4-40 x 1/4" WITH LOCKWASHERS
22. MOLDED BASE OF SWITCH

FIG. 17

CUT-OFF DEVICE

BREAKER IN OPEN POSITION

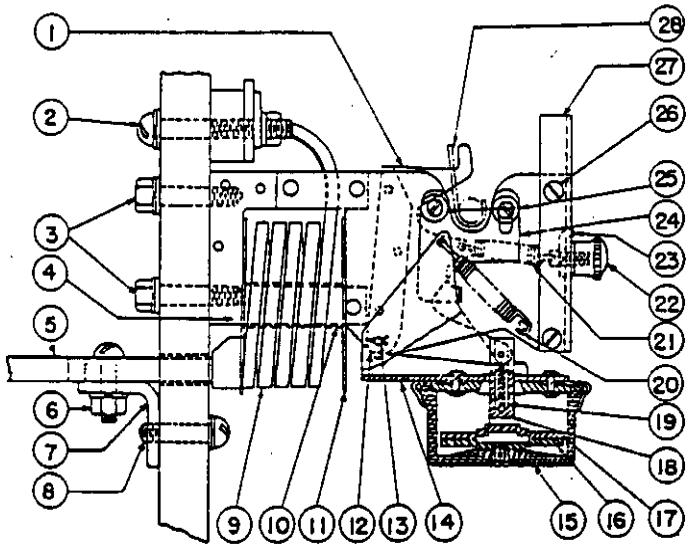


FIG. 18

DUAL MAGNETIC OVERCURRENT TRIP DEVICE.
(OIL FILM TYPE)

1. ARMATURE ASSEMBLY
2. SCREW R.H. 1/4-20, NUT AND WASHERS
3. SCREW HEX. HD. 1/4-20, AND WASHERS
4. MAGNET
5. LOWER STUD (WELDED TO COIL)
6. SCREW R.H. 1/4-20 NUT AND WASHER
7. LOWER STUD BRACKET
8. SCREW R.H. 1/4-20 AND WASHERS
9. SERIES OVERCURRENT COIL WITH UPPER TERMINAL
10. INSULATING TUBE
11. INSULATING WASHERS
12. FRAME
13. PIN & COTTERS
14. PIVOTED COVER & SUPPORT
15. OIL POT
16. LOWER DISC
17. UPPER DISC
18. SHANK
19. SPRING
20. INSTANTANEOUS TRIP SPRING
21. CALIBRATION SPRING
22. CALIBRATION ADJUSTING KNOB
23. CALIBRATION INDEX & SCREW
24. ADJUSTING STOP
25. SCREWS HEX. HD. 10-32 X 1/2 NUT AND WASHERS
26. SCREWS R.H. #8-36 X 1/4 AND WASHER
27. CALIBRATION PLATE
28. TRIP FRAME

the armature is further restrained by a pair of heavier instantaneous trip springs (Pt. 20), one on each side of the device, attached at the lower front end to the fixed frame (Pt. 12) and at the upper rear end to the cover and support (Pt. 14). This cover is pivoted on pin (Pt. 13) and supports the oil pots. Thus, if overcurrent demands immediate tripping, the heavier pull on the upper disc lifts the complete oil pot assembly, as the springs yield, without waiting for the rupture of the oil film, allowing the armature to pick up and trip the breaker immediately.

Calibration settings for 100, 125, 150, 175, and 200 per cent of breaker normal current rating are marked in amperes on the calibration plate (Pt. 27). For general feeder applications, the calibration setting should not be less than 125 per cent of actual load being carried by the breaker.

An adjustment is provided for varying the amount of time delay obtained. This is accomplished by turning the oil pot (Pt. 15) to different marked time delay settings, which increases or decreases the area of disc surfaces separated by oil film. The disc surfaces have part of their contact area cut away in the form of a wide band parallel to the diameter of the disc surfaces. The smaller the contact area between discs, the shorter will be the time delay obtained.

The armature air gap is adjusted at the factory by an adjustable stop (Pt. 24) which is pivoted to the frame (Pt. 12) by screw (Pt. 25) in the rear end and adjusted by a similar screw through a slot in the front end. This stop registers with the pivoted cover and support (Pt. 14) which carries the oil pot. By raising or lowering the oil pot, the armature air gap is changed because shank (Pt. 18) is pivoted to both the armature assembly and to the upper disc (Pt. 17). The air gap should not be changed unless means are available for the recalibration of the complete device.

To check the adjustment of this device for positive tripping, pick up the armature manually; the breaker should trip with approximately 1/32" gap between the magnet and the armature. To obtain this adjustment, bend the trip finger (Pt. 28) attached to the trip shaft so that the armature will engage the trip finger sooner or later as required.

It is important that the facing surfaces of the discs be clean and smooth, otherwise the calibration will be affected. If these surfaces are damaged or affected in any way they should be relapped or made smooth by rubbing them over crocus cloth backed up by a smooth, flat surface. It is of utmost importance that the oil in the cup be kept clean and at the proper level. See "Mainte-

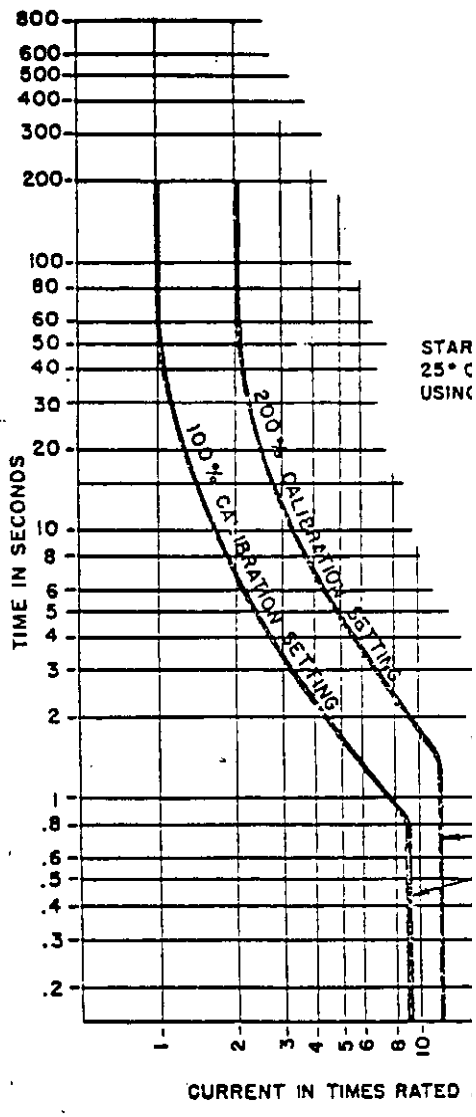


FIG. 19

APPROXIMATE TIME-CURRENT CHA
OF DUAL MAGNETIC OVERCURRENT

If a new series coil is req
any considerable repair is necess
recommended that a complete fact
brated dual magnetic overcurrent
vice be supplied.

A typical time-current trip
for this device is shown in Fig.
curve is approximate and consider
tion in time delay may be expect
ing upon the cleanliness of the
the film, the time allowed for

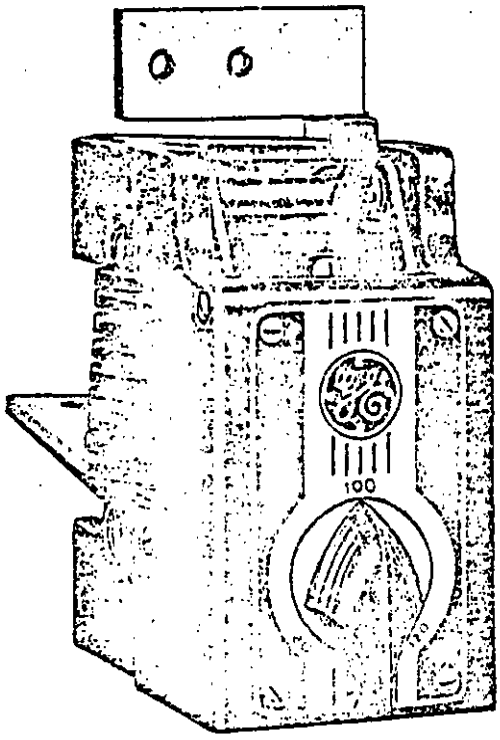


FIG. 20
THERMAL MAGNETIC OVERCURRENT TRIP DEVICE.
(EXTERNAL VIEW)

THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

This device, Fig. 22, also automatically trips the breaker under two distinct conditions of overcurrent, first, with inverse time delay when the current exceeds the value of calibration setting and is less than 12 to 15 times the breaker rating, the inverse time tripping being obtained by the time required to heat and flex a bimetallic strip; and second, instantaneously when the breaker current exceeds 12 to 15 times the normal breaker current.

This device operates on alternating current only, and is principally used for motor protection. The unit is enclosed in a molded frame as shown in Fig. 20.

Current in the series coil (Pt. 5) sets up a magnetic circuit which tends to pick up the armature (Pt. 19) as described below, and operate the trip finger (Pt. 30) on trip shaft. The armature is attached to the lower member of the magnet (Pt. 6) by a spring hinge (Pt. 14) and is restrained by a yoke (Pt. 20) which is pivoted to the center of the armature by pin (Pt. 25) between two flat buffer springs (Pt. 22). The yoke is restrained at the bottom by a latch plate (Pt. 15) and also at the top by two heavy compression short circuit springs (Pt. 1) supported between pin (Pt. 28) in the yoke and the rear frame. Current in the series coil induces current in the short-circuited ring (Pt. 7), mounted around the lower magnet member, generating heat which is conducted to the bimetallic strip (Pt. 13). This strip is riveted at its rear end to the thermal trip arm (Pt. 9) and held at the front end between the calibrating cam (Pt. 18) and the compression spring (Pt. 16). The thermal trip arm (Pt. 9) is pivoted to the frame on pin (Pt. 8). When sufficient heat has been developed to cause the bimetallic strip (Pt. 13) to bend, with the convex surface downward, the thermal trip arm will tend to revolve about pin (Pt. 8) in a clockwise direction (looking from left) and bear against an adjusting screw (Pt. 12), set in the latch support (Pt. 10), also pivoted on pin (Pt. 8), to cause the latch plate (Pt. 15) to disengage the yoke (Pt. 20) at the lower end. This will allow the armature to be picked up and trip the breaker as the lower end of the yoke moves to the rear over the latch plate (Pt. 15) while the upper end of the yoke is held fixed by the heavy springs (Pt. 1). A torsion spring (Pt. 11) is mounted over pin (Pt. 8) to hold the thermal trip arm (Pt. 9) and latch support (Pt. 10) together against the adjusting screw (Pt. 12). Thus, if the overcurrent falls below the calibration setting before the bimetallic strip is sufficiently bent, the breaker will not be tripped.

Should the overcurrent exceed 12 to 15 times the breaker rating, the heavier pull on the armature (Pt. 19) will cause the upper

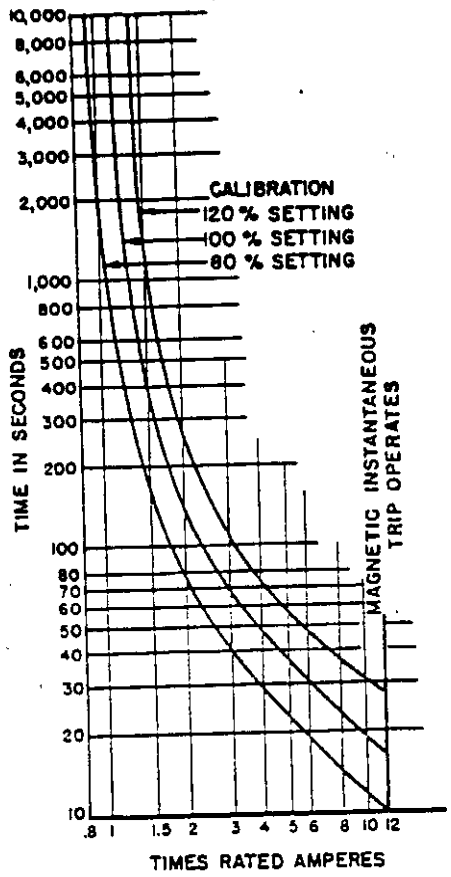


FIG. 21

APPROXIMATE TIME-CURRENT CHARACTERISTIC OF THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

(STARTING COLD IN 24° CAMBIENT)

end of yoke (Pt. 20) to compress the heavy short circuit springs (Pt. 1), while the lower end of the yoke is held fixed against latch plate (Pt. 15). As these heavy springs yield the armature will pick up and trip the breaker immediately without waiting for release of latch plate (Pt. 15) by the heating of the bimetallic strip as described above.

The lock nut on spring guide (Pt. 2) controls the compression of the short circuit spring (Pt. 1) and is adjusted at the factory to provide instantaneous tripping when the current exceeds approximately 12 to 15 times normal breaker current.

The adjustable stop screw (Pt. 23) is secured to the armature (Pt. 19) and provides a stop against the front molded frame to control the clearance of 1/16" to 3/32" between the latch surface on the yoke (Pt. 20) and the latch plate (Pt. 15) to insure positive reset. The reset spring (Pt. 26) between adjusting screw (Pt. 27) and the lower end of yoke (Pt. 20), provides the proper tension to the yoke to insure positive resetting after a tripping operation by drawing the lower end of the yoke forward to engage the latch plate (Pt. 15).

strip (Pt. 13) must bend before releasing latch plate (Pt. 15) to trip the breaker.

The calibration adjustment knob (Pt. can be turned to revolve the cam (Pt. 18) indications as marked on the nameplate change the calibration range from 80 to per cent of breaker rating. Revolving t cam raises or lowers the front end of bimetallic strip against spring (Pt. 16

To check the adjustment of this dev for positive tripping, pick up the armat manually and the breaker should trip w approximately 1/32" gap between the armat and the magnet. To obtain this adjustme bend the trip finger (Pt. 30) attached the trip shaft so that the trip arm (Pt. engages this finger sooner or later as quired.

There are available other special cessories that can be attached to the tension of the thermal trip arm (Pt. 9) perform special functions when the bimetal strip (Pt. 13) flexes. These are spec and information concerning them should obtained from the nearest sales office the company.

Typical time-current tripping cur

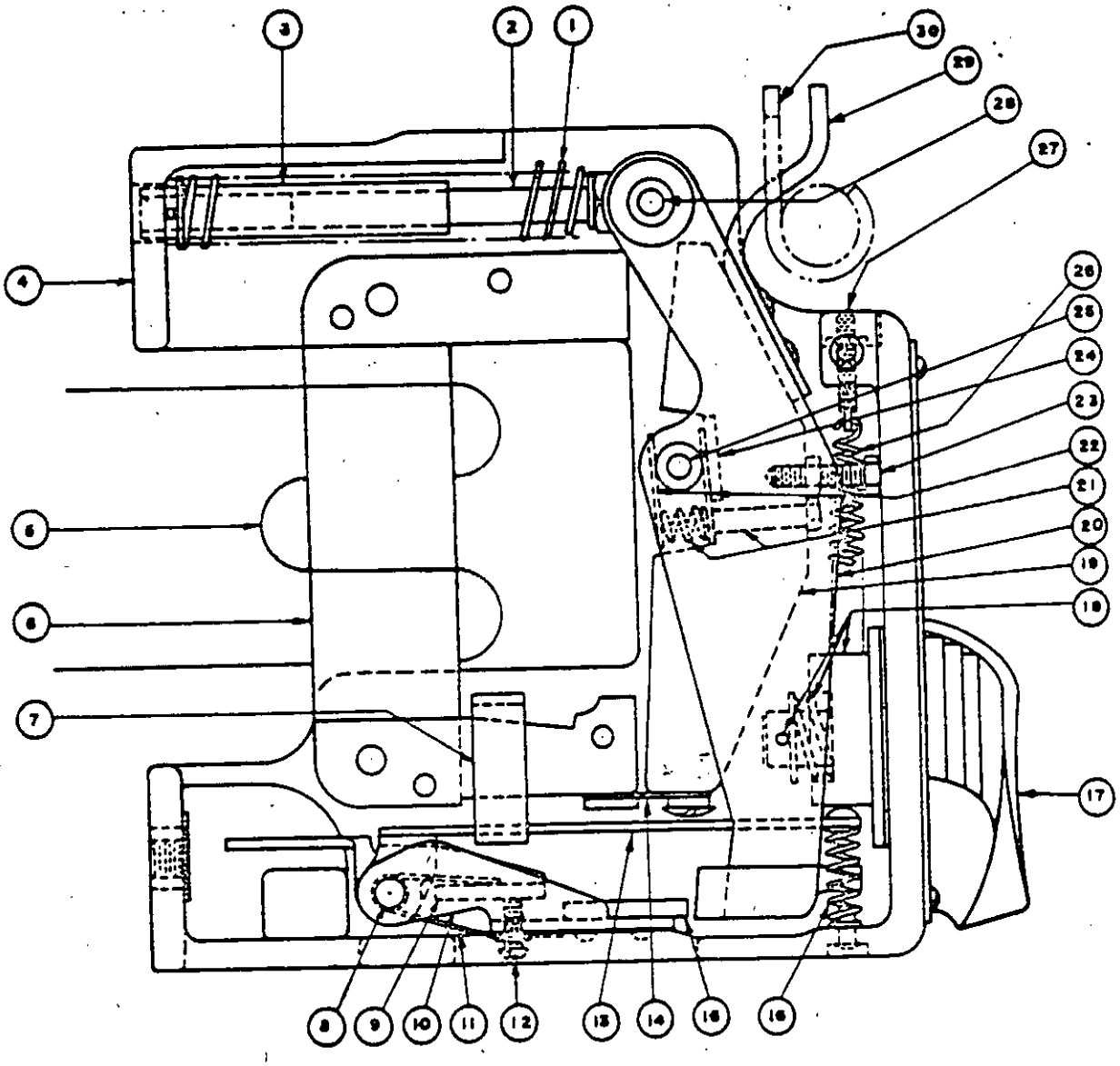


FIG. 22
THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

1. SHORT CIRCUIT SPRING
2. SPRING GUIDE AND LOCK NUT
3. TUBULAR SPRING GUIDE AND COTTER
4. MOLDED FRAME
5. SERIES COIL
6. MAGNET
7. INDUCTION RING
8. PIN
9. THERMAL TRIP ARM
10. LATCH SUPPORT
11. TORSION SPRING
12. ADJUSTING SCREW
13. BIMETALLIC STRIP
14. SPRING HINGE
15. LATCH PLATE
16. SPRING FOR THERMAL TRIP ARM
17. CALIBRATING KNOB
18. CALIBRATING CAM, SPRING, AND COTTER
19. ARMATURE
20. YOKE
21. ADJUSTING SCREW AND SPRING
22. FLAT BUFFER SPRING
23. ARMATURE ADJUSTING SCREW AND NUT
24. LEATHER BUFFER
25. YOKE AND ARMATURE PIN
26. RESET SPRING FOR YOKE
27. ADJUSTING SCREW
28. PIN
29. TRIP ARM
30. TRIP FINGER

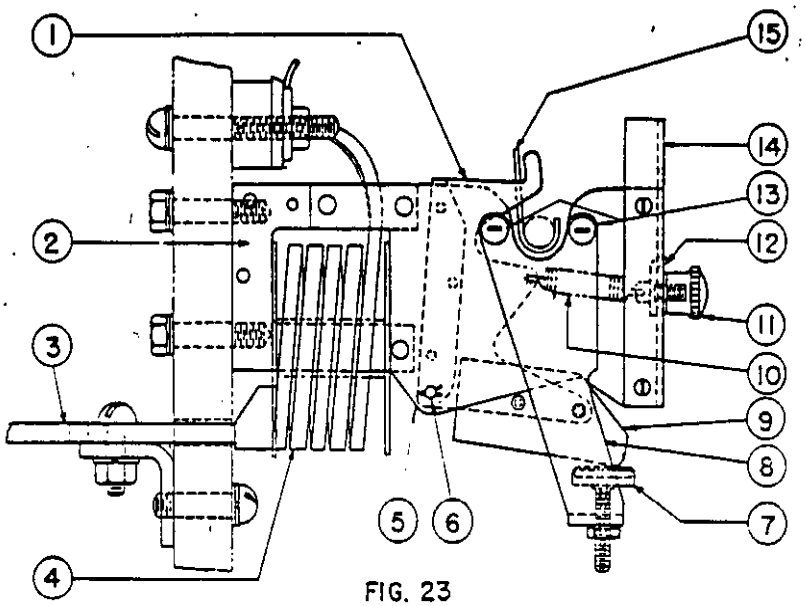
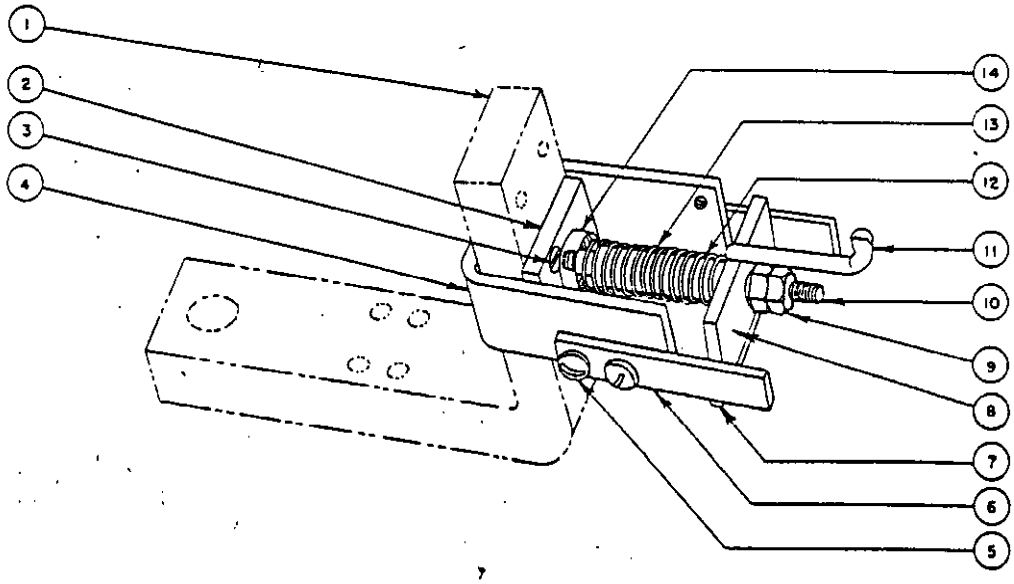


FIG. 23

MAGNETIC INSTANTANEOUS OVERCURRENT TRIP DEVICE

1. ARMATURE ASSEMBLY
2. MAGNET
3. LOWER STUD
4. SERIES COIL
5. FRAME
6. PIN AND COTTER PIN
7. STOP AND HEX NUT
8. SUPPORT FOR STOP
9. STOP PLATE, RIVETED TO ARMATURE ASSEMBLY
10. CALIBRATION SPRING
11. CALIBRATION ADJUSTING KNOB
12. CALIBRATION INDEX
13. SCREW R.H. #10-32 X $\frac{1}{2}$" AND LOCKWASHERS
14. CALIBRATION PLATE
15. TRIP FINGER



1. LOWER STUD
2. BRASS PLATE
3. SCREWS, F.H. 10-32 X 1
4. MAGNET
5. SCREWS, R.H. 10-32 X $\frac{7}{16}$" & LOCKWASHER
6. BRASS GUIDES
7. GUIDE ROD, WELDED TO 8
8. ARMATURE
9. NUTS $\frac{1}{4}$"-20
10. BRASS ROD, BRAZED TO 2
11. TRIP ARM
12. BRASS TUBE
13. COMPRESSION SPRING
14. BRASS CUP

MAGNETIC INSTANTANEOUS OVERCURRENT TRIP DEVICE

This device, Fig. 23, is magnetically operated to trip the breaker instantaneously by the current through the breaker when this current exceeds the calibration setting. Standard calibration settings for 100, 125, 150, 175 and 200 per cent of breaker normal current rating are marked on the calibration plate. For general applications, the calibration setting used should not be less than 125 per cent of normal load.

This device is similar to the dual magnetic overcurrent trip device without the time delay assembly and support and the heavy instantaneous trip springs. As shown in Fig. 23, the armature has a stop plate or weight (Pt. 9) riveted to it and is pivoted on pin (Pt. 6) in the frame (Pt. 5). It is restrained by the calibration spring (Pt. 10) only. The armature air gap is adjusted by raising or lowering the stop (Pt. 7) in support (Pt. 8) which is attached to the frame (Pt. 5) by screws (Pt. 13).

INSTANTANEOUS SHORT-CIRCUIT TRIP DEVICE

According to NEMA standards, all air circuit breakers shall be inherently automatic for overcurrent tripping. Hence, if the type AE-1-25 breaker is not to be equipped with time delay or instantaneous overcurrent trip device, it will be furnished with an instantaneous short-circuit trip device. For the type AE-1-25 breaker this device is set to operate at 9000 amperes and no provision is made for field adjustment.

The instantaneous short-circuit trip device, Fig. 24, is mounted on the upright portion of the lower stud on the front of the mounting base. It consists of a U-shaped magnet (Pt. 4) attached to the stud (Pt. 1) by flat head screws (Pt. 3) through a brass plate (Pt. 2) to which is brazed a brass rod (Pt. 10). This rod supports the armature assembly (Pt. 8) which includes a guide rod (Pt. 7), the trip arm (Pt. 11) and the brass guide tube (Pt. 12) which slides over the rod (Pt. 10). A compression spring (Pt. 13) slides over the rod (Pt. 10) and fits into a brass cup against the brass plate (Pt. 2) to force the armature (Pt. 8) against the lock nuts (Pt. 9) on the rod. Brass guides (Pt. 6) are attached to the magnet by screws (Pt. 5). Current in the lower stud sets up a magnetic field which picks up the armature to trip the breaker when trip arm (Pt. 11) engages a trip finger on the trip shaft.

INSTANTANEOUS UNDERVOLTAGE TRIP DEVICE

The function of this device is to trip the breaker when the voltage drops below a predetermined value. As long as a voltage of this value or greater, is impressed on the coil, the armature is held down into the coil and the device has no effect upon closing or tripping of the breaker in any way, but when the voltage drops to approximately 50% of normal, or lower, the magnet is weakened and a strong spring draws the armature out of the coil and causes the breaker to trip. The breaker cannot be reclosed until the necessary voltage returns.

The device, Fig. 25A, is mounted on the front of the mounting base under the breaker shaft and the trip shaft and to the right of the breaker poles. An insulation barrier (Pt. 17) is placed between the mounting strap (Pt. 19) of the device and the mounting base (Pt. 18) and also covers the entire right side of the device. The coil (Pt. 22) is mounted in magnet (Pt. 23) over two brass guides (Pt. 24) between which the armature (Pt. 25) is free to move. The upper ends of the guides are clamped over the magnet and holds the coil in place and the lower ends are fastened to the magnet by screws (Pt. 16). A trip lever (Pt. 9) is pivoted on pin (Pt. 10) in frame (Pt. 13) and is restrained by tension spring (Pt. 12) attached by adjusting screw (Pt. 14) to the same frame which extends forward and is riveted to the sides of the magnet. A trip adjusting screw (Pt. 4) in the trip lever (Pt. 9) bears against the trip arm (Pt. 6) which is attached to the trip shaft (Pt. 5).

Fig. 25A shows the breaker in the open position, with or without potential applied to the coil (Pt. 22). The reset arm (Pt. 1) is in the lowered position against buffer spring (Pt. 27) and the armature (Pt. 25) is forced down into the coil. However, when the breaker is in the closed position, with potential applied to the coil, the reset arm is lifted clear of the buffer spring by the main shaft (Pt. 30) as it revolves clockwise (looking from right) to close the breaker contacts. The breaker cannot be kept closed unless potential is applied to the coil. When the voltage fails, or drops below the predetermined value, the coil is de-energized. This allows spring (Pt. 12) to draw the front end of trip lever (Pt. 9) down and the trip adjusting screw (Pt. 4) bears against the rear end of trip arm (Pt. 6) which causes the trip shaft (Pt. 5) to revolve clockwise to trip the breaker. At the same time the rear end of trip lever (Pt. 9) lifts the armature out of the coil and exerts a hammer blow against the reset adjusting screw (Pt. 29), which is set in the reset link (Pt. 7), causing the latter, together with springs (Pts. 2 and 3) to revolve clockwise about pin (Pt. 28) in the support (Pt. 27). A stop link (Pt. 11) is attached by pin (Pt. 8) to the reset link (Pt. 7) and is hooked under the trip lever (Pt. 9) to prevent the reset link from springing upward to the vertical position and remaining there. The rear end of the trip lever (Pt. 9) is stopped by pin (Pt. 28).

When voltage is applied to the de-energized coil, the pull of the magnet is not strong enough to draw the armature down into it against the force of spring (Pt. 12) so that a means of resetting must be provided.

When the breaker is open, whether the coil is energized or not, the reset arm (Pt. 1) is against buffer spring (Pt. 2) and the armature is pressed down into the coil, as shown in Fig. 25A, and is therefore in the reset position. When the breaker opens it is automatically reset as follows:- Just as soon as the main shaft (Pt. 30) revolves counter-clockwise to open the breaker contacts, the reset arm (Pt. 1) is forced downwards against buffer spring (Pt. 2) which cause adjusting screw (Pt. 29) to force the armature firmly against the bottom member of magnet (Pt. 23), in the case of alternating current applications, or against set screw (Pt. 15) in direct current application. Then, if potential is applied to the coil, the armature will be held within the coil.

For direct current application, the brass stop screw and locknut (Pt. 15) through the lower member of the magnet are necessary to slightly separate the armature from the magnet to prevent sticking due to residual magnetism and allow tripping.

Adjustments consist first, in direct current application, in setting the stop screw (Pt. 15) so that the bottom of the armature (Pt. 25) is just separated from the magnet (Pt. 23).

Make the following adjustments for both alternating and direct current applications.

With the breaker in the open position and the reset arm (Pt. 1) in the open position, as shown in Fig. 25A, the reset adjusting screw (Pt. 29) should be set to allow between 1/32" to 1/8" between the buffer spring (Pt. 2) and flat spring (Pt. 3) when the reset arm presses against the buffer spring. Then tighten lock nut.

With the breaker in the closed position and the coil de-energized, turn the trip adjusting screw (Pt. 4) in the trip lever (Pt. 9) until the breaker trips, and then continue to turn the screw between 1/2 and 3/4 of a turn more and then tighten the locknut.

The spring (Pt. 12) should be adjusted by adjusting screw (Pt. 14) to prevent dropout of armature (Pt. 25) when the breaker is closed and the coil is energized by voltages above 50% of normal, but to positively trip at 50% of normal or less.

TIME DELAY UNDERVOLTAGE TRIP DEVICE

This device, Fig. 25B, is constructed and operates in a similar manner as in the instantaneous undervoltage trip device with the addition of the oil film time delay attachment and the omission of the reset stop link (Pt. 11). The time delay attachment consists of a disc (Pt. 37) immersed in oil in a dash pot (Pt. 36) which is attached to a cover (Pt. 35) which, in turn, is riveted to its own frame (Pt. 34) and fastened by

7) by plunger assembly (Pt. 33) to delay th tripping of the breaker until the oil film between the lapped surfaces of the disc an the bottom of the dash pot, ruptures. Thus if normal voltage is restored before the oi film ruptures, the breaker will not open.

First adjust, in direct current applica tion, the clearance of the bottom of armatur (Pt. 25) from the magnet by stop screw (Pt 15) as described in instantaneous undervolta trip device adjustment above.

Make the following adjustments for bo alternating and direct current application Then with the breaker in the closed positi and the coil (Pt. 22) de-energized, push t armature (Pt. 25) down into the coil to lo er the reset link (Pt. 7) and disc (Pt. 37 Now screw the dash pot cup on the cover (P 35) until the reset link (Pt. 7) begins lift and then turn it another half turn whi should make the cup tight against its sea If not seated by about half a turn, then tu the adjusting screw (Pt. 29) and repeat unt this condition is obtained.

Now, when the breaker is opened and t reset arm (Pt. 1) is down, the disc shou be pressed firmly against the bottom of t dash pot by the buffer spring (Pt. 2) whi should now be about 1/32" to 1/8" from t flat spring (Pt. 3). If not, the buff spring will have to be bent to secure th clearance.

The adjustment of trip adjustment scr (Pt. 4) and the spring (Pt. 12) will be t same as in the instantaneous undervolta trip devices, described above.

REVERSE CURRENT TRIP DEVICE (ROTOR TYPE

A direct acting reverse current tr device of the rotor type, Fig. 26, is ava able for the AE-1-25 breaker for direct c rent application which will trip the brea when the reversed current exceeds the ca bration setting. The device is construc similar to a bipolar motor with a station pole assembly in which is mounted a seri coil carrying the breaker current, and rotating armature on which is wound a tential coil. The magnetic field set up the current in the potential coil toget with the field set-up by the load current the series coil in the normal directi produces a torque which tends to rotate armature in a direction to prevent trippi However, when the current in the series c is reversed, the torque is reversed to ca the reverse rotation which trips the break

As shown in Fig. 26, the motor elem is mounted horizontally on the rear of mounting base by studs (Pt. 34). The ar ture shaft (Pt. 14) extends through to front to operate the tripping equipment. series coil (Pt. 5) is mounted vertically

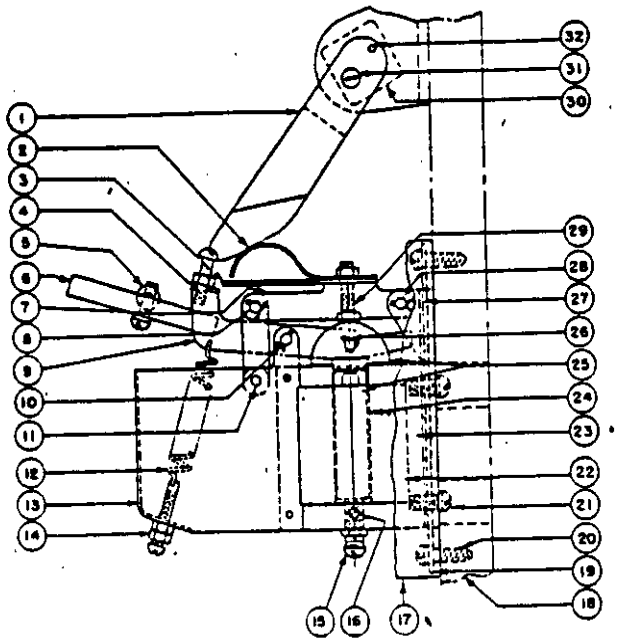


FIG. 25 A

INSTANTANEOUS UNDERVOLTAGE TRIP DEVICE
WITH BREAKER IN OPEN POSITION

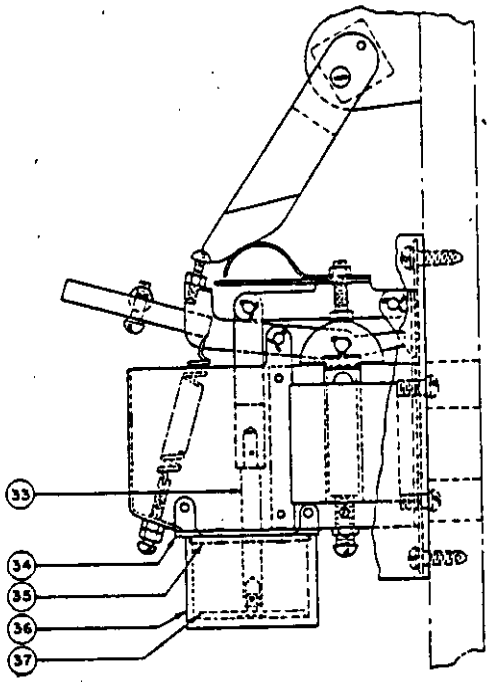


FIG. 25 B

TIME DELAY UNDERVOLTAGE TRIP DEVICE
WITH BREAKER IN OPEN POSITION

1. RESETTING ARM
2. BUFFER SPRING
3. FLAT SPRING
4. TRIP ADJUSTING SCREW R.H. #10-32 X $\frac{5}{8}$" AND NUTS
5. BREAKER TRIP SHAFT
6. COMPOSITION TRIP ARM
7. RESET LINK
8. PIN AND COTTER PINS
9. TRIP LEVER
10. PIN AND COTTER PINS
11. STOP LINK
12. SPRING
13. FRAME
14. SPRING ADJUSTING SCREW R.H. #10-32 X $1\frac{1}{2}$" AND NUTS
15. STOP SCREW R.H. $\frac{1}{4}$-20 X $\frac{5}{8}$" WITH HEX NUT (DIRECT CURRENT ONLY)
16. SCREW R.H. SELF TAPPING #4 X $\frac{1}{4}$"
17. BARRIER
18. MOUNTING BASE
19. MOUNTING STRAP
20. SCREW R.H. SELF-TAPPING #8 X $\frac{1}{8}$" LONG AND LOCKWASHER
21. SCREW R.H. #10-32 X $\frac{1}{2}$" WITH LOCKWASHER
22. COIL
23. MAGNET
24. BRASS GUIDES
25. ARMATURE
26. PIN AND COTTER PINS
27. SUPPORT FOR PT. 7
28. PIN AND COTTER PIN
29. RESET ADJUSTING SCREW HEX. HD. #10-32 X $\frac{5}{8}$" WITH NUT
30. MAIN SHAFT
31. SCREW R.H. #10-32 X $\frac{1}{8}$" WITH LOCKWASHER
32. GROOV PIN TYPE I, $\frac{1}{8}$" DIA. X $\frac{5}{8}$"
33. PLUNGER ASSEMBLY
34. FRAME
35. COVER
36. OIL DASH POT
37. DISC

41) by screws (Pt. 3) and to the pole shoes (Pt. 43) by screws (Pt. 1). The upper part of the coil extends to the rear as a connection bar (Pt. 39) for external load connection which is supported by bar support (Pt. 40) held in place by screws (Pts. 3 and 4). The lower part of the coil is connected to the lower stud (Pt. 7) by connection bar (Pt. 8) and screw (Pt. 6).

The armature shaft (Pt. 14) is supported in bronze bearing castings (Pts. 33 and 38) which are fastened to the pole shoes by screws (Pt. 37) at the rear and by studs (Pt. 34) with nuts (Pt. 31) in spacer (Pt. 32) with nut housings at the front: An escutcheon plate (Pt. 30) is mounted on the front of the mounting base by nuts (Pt. 31) on studs (Pt. 34) and to it are riveted two posts for calibration plate (Pt. 18) and two posts for stop screws (Pts. 12 and 22). A trip crank (Pt. 13) is clamped firmly by screw (Pt. 15) and set screw (Pt. 16) to the extended armature shaft (Pt. 14) and supports the trip arm assembly (Pt. 25) on pin (Pt. 26). A trip lever (Pt. 24) is screwed to the trip shaft (Pt. 23) and is free to move over the upper end of the rod between properly spaced jam nuts to permit sufficient travel when the breaker is tripped by other devices.

When current passes through the series coil in the normal direction, the armature will tend to revolve clockwise (looking from the front) to force the trip crank (Pt. 13) against stop screw (Pt. 22). The calibration spring (Pt. 20) also normally, holds the trip crank against this stop screw. But when current passes through the series coil in the reverse direction, the armature will tend to rotate counter-clockwise away from this stop screw, and when the current exceeds the calibration setting, it will rotate sufficient to lower the trip rod (Pt. 25) and trip the breaker. The stop screw (Pt. 12) limits the counter-clockwise travel. The calibration plate (Pt. 18) is mounted on posts on the escutcheon plate. The calibration screw (Pt. 17) passes through these posts (Pt. 29) and carries a threaded calibration index (Pt. 19) attached to the calibration spring. By turning the hexagonal head of the calibration screw against the compression spring (Pt. 21), the reverse current trip setting can be changed.

The trip crank is clamped to the armature shaft so that the potential coil (Pt. 44) will be located approximately in the vertical position with a somewhat larger air gap on the trip side when the crank is against the stop screw (Pt. 22), which should extend approximately 1/16" to 3/32" beyond the post. When rated voltage is applied to the potential coil with no current passing through the breaker and the calibration spring is connected, there should be no movement of the armature in the tripping direction. However, if a movement is detected, back off slightly on the stop screw (Pt. 22) to increase the [illegible] to the pole piece on the trip side.

After this adjustment has been completed, the stop screw (Pt. 12) can be set to limit the travel of the armature so that the trip crank (Pt. 13) will be stopped slightly past the horizontal. Now adjust the nuts at the top of trip rod (Pt. 25) so that the breaker will trip with 1/32" overtravel of the trip lever measured at the trip lever. Slight variations of these adjustments may be necessary to improve the operation of the device.

The adjustment of stop screw (Pt. 22) and the tripping crank (Pt. 13) will affect the calibration of the reverse current device so their setting should not be changed unless facilities for checking calibration are available.

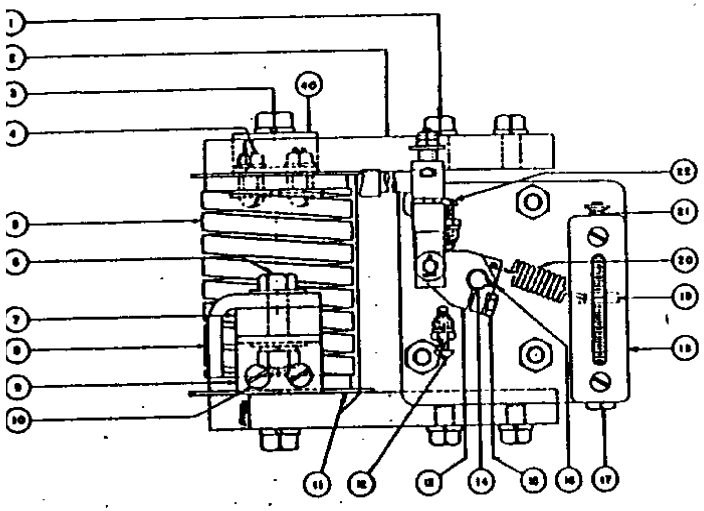
Because the potential must not drop below 80% of normal, the potential coil should be connected to a reliable constant potential source, preferably to a station battery bus, if possible.

REVERSE CURRENT TRIP DEVICE (HINGED ARMATURE)

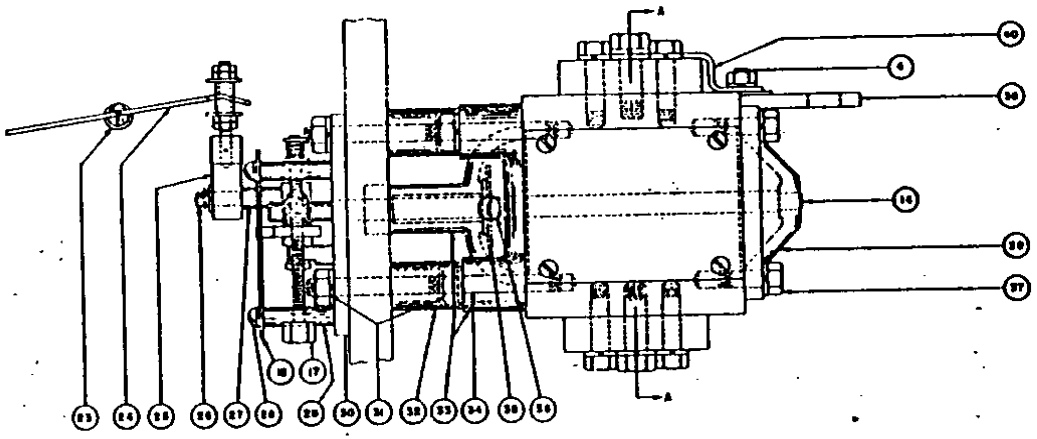
A direct acting reverse current trip device of the magnet and hinged armature type is available for AE-1-25 breakers for direct current applications. It will operate to trip the breaker when the reverse current exceeds the calibration setting. The principle of operation is shown diagrammatically in Fig. 27, and in detail in Fig. 28A and B.

The device consists of a composite magnet with a series coil on the middle core, which carries the breaker current, and a potential coil on the bottom core. An air gap in the upper leg of the magnet is bridged by an armature which is attracted to the magnet and held by the flux from the potential coil alone, or more firmly when reinforced by the flux due to the current of the breaker through the series coil in the normal direction. But, when the current passes through the breaker in the reverse direction, the two fluxes are on longer cumulative and the flux across the air gap is weakened sufficiently to allow a spring to pull the armature away and trip the breaker.

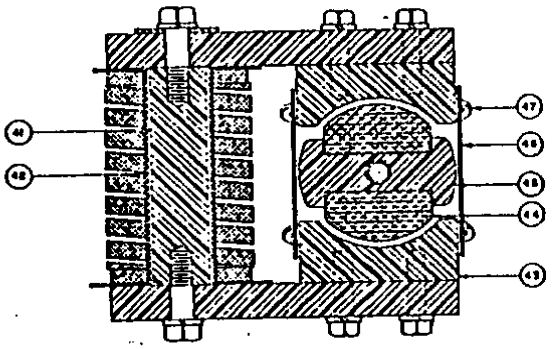
The series coil (Pt. 4) is in the same location as the standard overcurrent coil, between the lower stud and the connection to the movable contact on the front of the breaker base. It is mounted on the middle core of the composite magnet (Pts. 2 and 6) while the potential coil (Pt. 9) is mounted on the bottom core. The magnet is provided with two thin non-magnetic spacers to provide two small magnetic gaps so placed to cause the greater part of both fluxes to flow through the upper leg of the magnet. The armature assembly (Pt. 11) is pivoted on pin (Pt. 10) which passes through the supporting frame (Pt. 12). The pivoted armature (Pt. 22) is held against the magnet to close the air gap when the potential coil is energized, and



FRONT VIEW (MOTOR ELEMENT NOT DETAILED)



RIGHT SIDE VIEW (COIL NOT DETAILED)



SECTION "A A"

1. SCREWS HEX. HD. $\frac{5}{16}$"-18 X 1$\frac{1}{4}$" AND LOCKWASHER
2. SUPPORT
3. SCREWS HEX. HD. $\frac{3}{8}$"-16 X 1$\frac{1}{4}$" AND LOCKWASHER
4. SCREWS R.H. $\frac{1}{4}$"-20 X 1" WITH LOCKWASHERS AND NUTS AND INSULATION WASHERS AND BUSHINGS
5. SERIES COIL
6. SCREWS HEX. HD. $\frac{3}{8}$"-16 X 1$\frac{1}{4}$" WITH WASHER, LOCKWASHER & NUT
7. LOWER STUD
8. LOWER CONNECTION BAR, WELDED TO PT. 5
9. ANGLE SUPPORT FOR LOWER STUD SEE PT 8, FIG 8
10. SCREWS R.H. $\frac{1}{4}$"-20 X 1$\frac{1}{4}$" WITH WASHER & LOCKWASHER SEE PT 9, FIG 8
11. INSULATION WASHERS
12. STOP SCREW WITH LOCKWASHER AND NUT
13. TRIP CRANK
14. ARMATURE SHAFT
15. SCREW HEX. HD. #10-32 X $\frac{3}{8}$" AND LOCKWASHER
16. SET SCREW CUP POINT #8-36 X $\frac{1}{4}$"
17. CALIBRATION SCREW HEX. HD. WASHER AND COTTER PIN
18. CALIBRATION PLATE
19. CALIBRATION INDEX
20. CALIBRATION SPRING
21. COMPRESSION SPRING
22. STOP SCREW WITH LOCKWASHER AND NUT
23. TRIP SHAFT
24. TRIP LEVER
25. TRIP ROD ASSEMBLY
26. PIN, WASHER AND COTTER PIN
27. SPACER
28. SCREWS #10-32 X $\frac{3}{8}$" AND LOCKWASHER
29. POST
30. ESCUTCHEON PLATE
31. NUTS, HEX. $\frac{3}{16}$"-18 AND LOCKWASHER
32. SPACER WITH NUT HOUSING
33. FRONT BRONZE BEARING
34. STUDS
35. THRUST WASHER AND INSULATION WASHER
36. GROMMET
37. SCREWS HEX. HD. $\frac{5}{16}$"-18 X $\frac{3}{8}$" AND LOCKWASHER
38. REAR BRONZE BEARING
39. UPPER CONNECTION BAR WELDED TO PT. 6
40. CONNECTION BAR SUPPORT
41. CORE
42. INSULATION TUBE
43. POLE SHOES
44. POTENTIAL COIL
45. ARMATURE
46. DUST COVER
47. SCREWS R.H. SELF TAPPING #8 X $\frac{1}{2}$" WITH WASHER & LOCKWASHER

FIG. 26
REVERSE CURRENT TRIP DEVICE (ROTOR TYPE)

is held more firmly when the magnetic flux is increased by the breaker current in the normal direction.

When the current in the series coil reverses the magnetic pull on the pivoted armature (Pt. 22) in armature assembly (Pt. 11) decreases, and when the reverse current exceeds the calibration setting, the pull is not enough to overcome the pull of the spring (Pt. 15) which moves the armature away from the magnet. When the armature assembly is pulled away it strikes the trigger (Pt. 18) attached to the trip shaft (Pt. 19) which is supported in bearing plate (Pt. 20) attached to the frame by two screws (Pt. 21). This causes the trip shaft to revolve counter-clockwise, (looking from left), to trip the breaker.

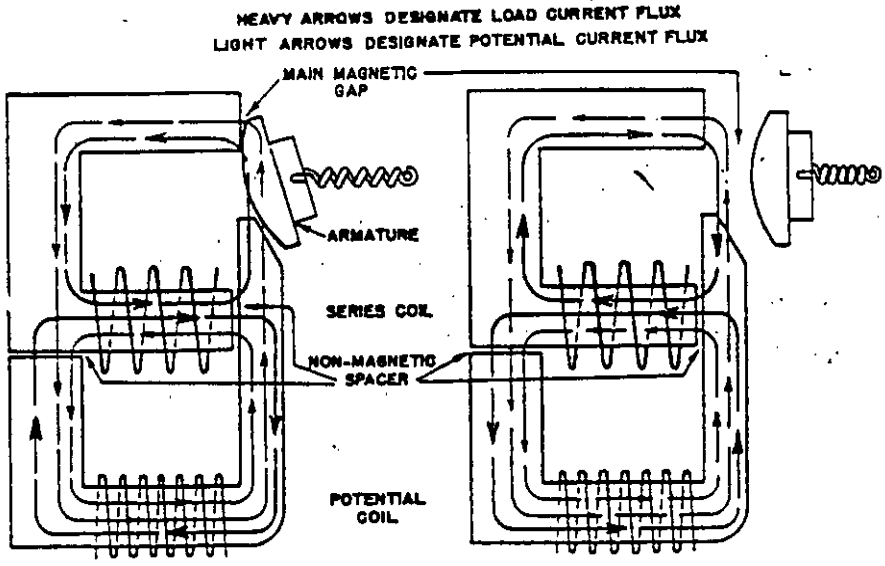
The magnetic pull produced by the potential coil alone will not draw the pivoted armature (Pt. 22) to close the air gap against the pull of the spring (Pt. 15) after the break has tripped due to reversed current, making it necessary to reset the armature as follows:- As soon as the breaker opens the main shaft (Pt. 23) and reset crank (Pt. 25) revolve clockwise (looking from left) and draw insulation link (Pt. 26) and link (Pt. 27) to the left. This link (Pt. 27) and reset lever (Pt. 30) are pivoted on the same pin (Pt. 28) and held together by torsion spring (Pt. 29) against lugs on each, so that when the reset lever (Pt. 30) is moved to the left it pushes the pivoted armature (Pt. 22) against the magnet (Pt. 2) where it is held by the magnetic pull of the potential coil (Pt. 9). The potential coil must be connected to the circuit so that it will be continously energized in order to hold the armature against the magnet when the breaker is tripped by other means than reversed current, otherwise the armature assembly will hold the trip shaft in the tripped positi and the breaker will not close.

When the breaker is closed and the ma shaft (Pt. 23) revolves counter-clockwis the reset linkage drives the reset leve (Pt. 30) away from the armature assembly (P 11) so that it will not retard the armatu when released by reverse current.

Because the potential must not drop b low 80% of normal, the potential coil shou be connected to a reliable constant potenti source, preferable to a station battery bu if possible.

When all the poles of a breaker requi series coils for overcurrent trips, it i necessary to place the reverse current tr device, of this type, "off pole" in the l cation of an additional pole to the right the regular poles. In this case, the seri coil is placed in series with the coil of adjoining pole by placing a connection b between the lower studs back of the mounti base. An upper stud is supplied for conne tion to the source, or the load, as desire Extensions are provided for the main shaf and trip shaft to make provision for the r setting linkage and tripping. In such i stallations the current in the series co is in the opposite direction from standa practice in which case it will be importa that the potential coil should also be r versed.

For correct operation, the armature a magnet face must be kept clean. The armatu should be firmly seated against the top l and the vertical leg of the magnet. If a justments are made to the reverse curre device, the calibration should be check after the adjustments are made.



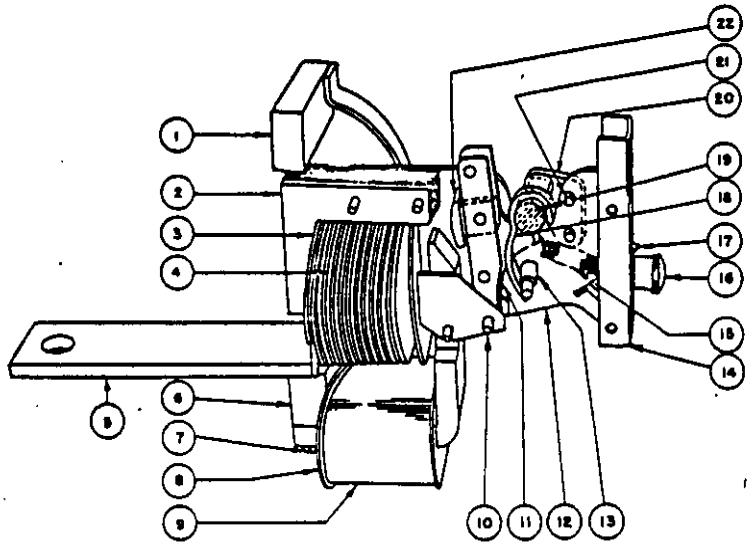
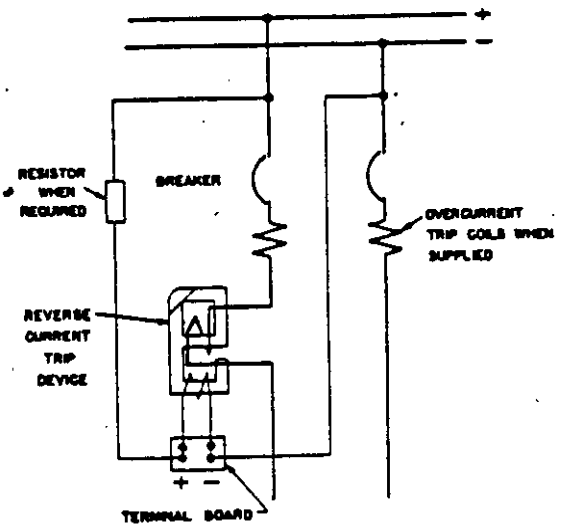


FIG. 28 A
TRIPPED POSITION
(WITH LEFT COVER AND RESET MECHANISM REMOVED)



WIRING DIAGRAM
(BACK VIEW)

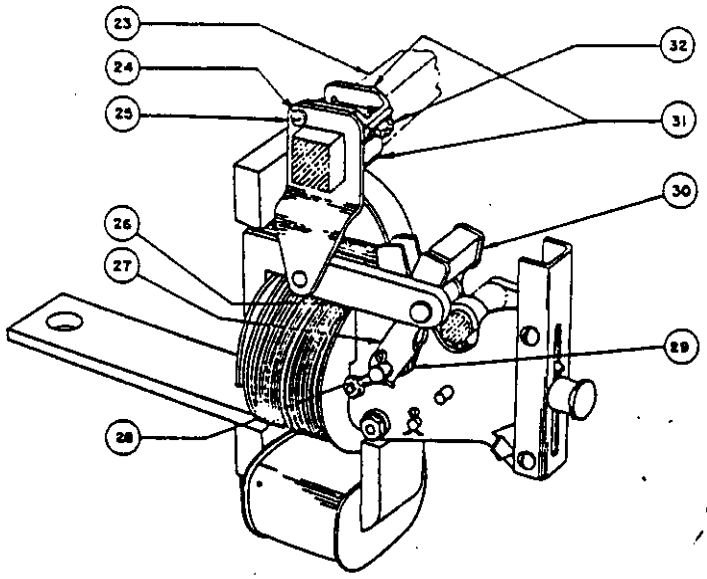
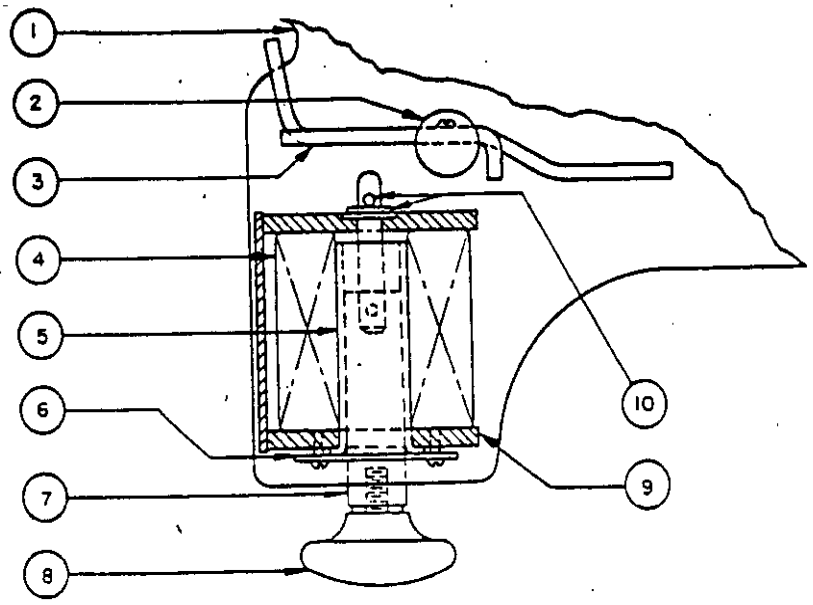


FIG. 28 B
POTENTIAL COIL ENERGIZED AND
BREAKER IN CLOSED POSITION

REVERSE CURRENT TRIP DEVICE (HINGED TYPE)

1. TERMINAL OF SERIES COIL
2. LAMINATED SECTION OF MAGNET
3. INSULATION
4. SERIES COIL
5. LOWER STUD
6. SOLID SECTION OF MAGNET
7. SCREW HEX. HD. $\frac{5}{16}$-20 X $\frac{1}{2}$" WITH LOCKWASHER
8. INSULATION
9. POTENTIAL COIL
10. PIN AND COTTER FOR ARMATURE
11. ARMATURE ASSEMBLY
12. FRAMES
13. STOP PIN
14. CALIBRATION PLATE
15. CALIBRATION SPRING
16. CALIBRATION KNOB
17. CALIBRATION INDEX AND SCREW
18. TRIGGER
19. TRIP SHAFT
20. BEARING PLATE
21. SCREWS R.H. #10-32 X $\frac{3}{8}$" WITH LOCKWASHER
22. PIVOTED ARMATURE
23. MAIN SHAFT
24. SCREWS R.H. $\frac{5}{16}$-20 X $\frac{5}{8}$" WITH LOCKWASHER
25. RESET CRANK
26. INSULATION LINK
27. LINK
28. PIN AND COTTER FOR LINK AND RESET LEVER
29. TORSION SPRING
30. RESET LEVER
31. CRANK AND CLAMP
32. SCREWS HEX. HD. $\frac{5}{16}$-20 X $\frac{5}{8}$" WITH LOCKWASHER



1. FRAME
2. TRIP SHAFT
3. TRIP ARM
4. COIL
5. GUIDE TUBE
6. WASHER
7. TRIP ARMATURE
8. BUTTON
9. MAGNET
10. COTTER PIN AND WAS

FIG. 29

SHUNT TRIP DEVICE

SHUNT TRIP DEVICE

A shunt trip device, Fig. 29, is available for AE-1-25 breakers which will trip the breaker when its coil is energized by closing a switch, or relay contacts, at some remote point. The coil is designed for intermittent service only, hence it should be so connected that the opening of the breaker, by any means, will open the shunt trip device circuit. The usual means is to place an "a" contact of an auxiliary switch in the shunt trip circuits, as shown in the wiring diagrams.

The device in the AE-1-25 breaker is mounted between the lower front part of the side plates that enclose the operating mechanism. It consists of a solenoid with a coil and armature in a vertical position, and, when energized, the armature is lifted into the coil which causes a pin in the upper end to engage the trip arm (Pt. 3) and trip the breaker. When de-energized, the armature falls by its own weight to the normal position.

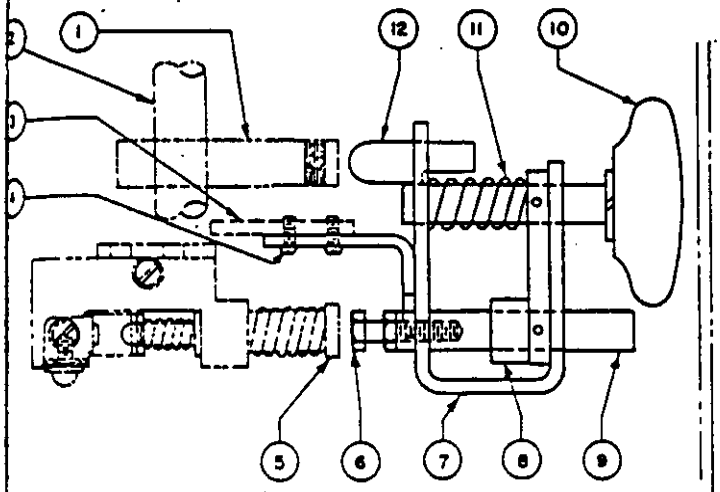
The coil (Pt. 4) is mounted over a brass guide tube (Pt. 5) within which the armature (Pt. 7) is free to move. The fall of the armature is limited by the travel of a cotter pin (Pt. 10) in the armature pin against brass and cork washers in the top of magnet (Pt. 9). The guide tube (Pt. 5) is held in place by washer (Pt. 6) which is attached by screws

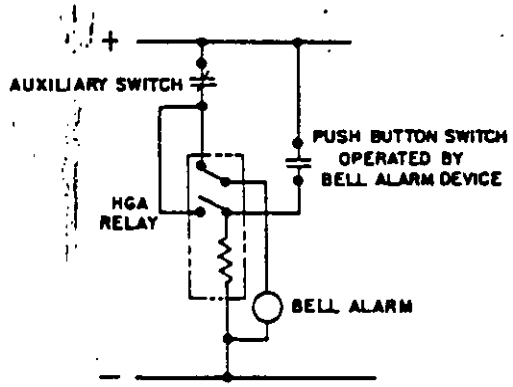
BELL ALARM DEVICE

This device, Fig. 30, together with HGA relay, and a push botton switch, simi to the operating switch, Fig. 16, and in same position, is designed to provide a me of silencing the bell alarm after the brea is automatically tripped and to prevent bell alarm from ringing when the breaker manually tripped. It consists of a horiz tally operated manual trip rod and butt and an additional rod operated simultaneou and to the left of the main trip rod assemb This latter rod operates the push but switch. Fig. 30 shows a plan view of t device and a wiring diagram of connectio

When the breaker is tripped automatic ly, a "b" contact of the auxiliary switch closed to ring the bell alarm through normally closed contacts of an HGA rel Then when the hand trip button is opera the normally open contacts of the push but switch are closed to close a circuit to ergize the relay. This opens the norma closed contacts of the relay to open the b circuit and seals in the relay, thus silenc the bell.

When the breaker is tripped manually the trip button, the push button switch w be operated to energize the relay coil wh will de-energize the bell alarm circuit, fore the main trip rod will trip the breal as described below, and prevent the operat





1. TRIP ARM (SEE FIG. 10)
2. BREAKER TRIP SHAFT (SEE FIG. 10)
3. LEFT FRAME OF OPERATING MECHANISM
4. SCREWS R.H. #10-32 X 5/16" WITH LOCKWASHERS
5. PUSH BUTTON SWITCH (SEE FIG. 16)
6. ADJUSTING SCREW HEX. HD. #10-32 X 1 1/8" WITH LOCKNUT
7. BRACKET
8. YOKE WITH BOSS AND GROOV PINS
9. ROD
10. BUTTON AND LOCKWASHER
11. SPRING
12. TRIP ROD ASSEMBLY

FIG. 30
BELL ALARM DEVICE
(PLAN VIEW)

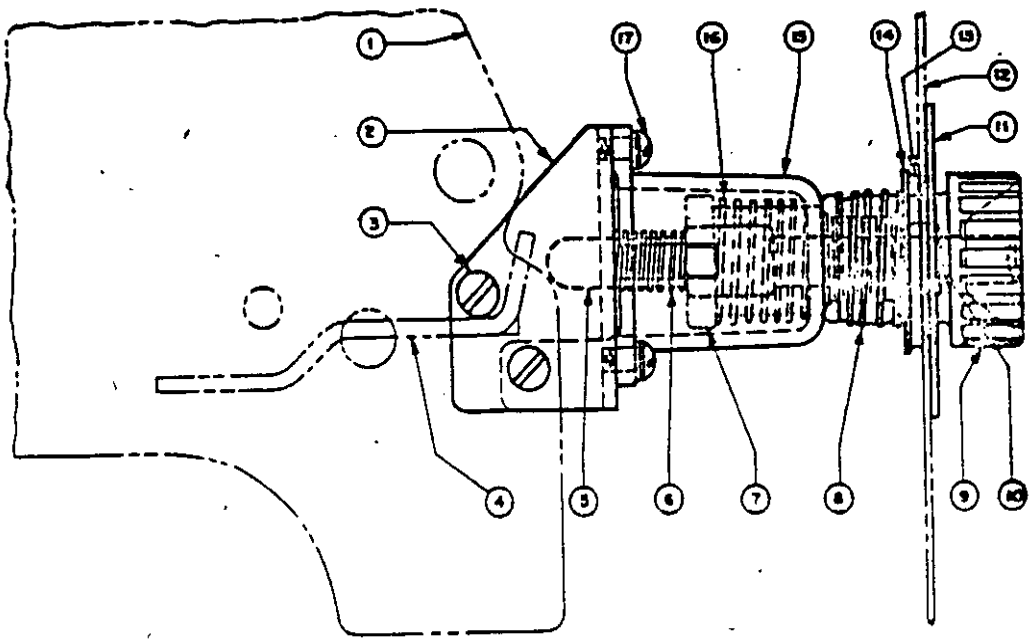
The device consists of a bracket (Pt. 7) attached to the left side of the operating mechanism frame (Pt. 3) by screws (Pt. 4). The main trip rod assembly (Pt. 12) with a trip button (Pt. 10) passes through this bracket and engages the breaker trip arm (Pt. 1). Spring (Pt. 11) normally keeps it disengaged. Another rod (Pt. 9) passes through this bracket parallel to rod (Pt. 12) and is operated by a yoke (Pt. 8) so that both rods operate simultaneously in the same direction when button (Pt. 10) is pressed. An adjusting screw (Pt. 6), in the rear of the rod (Pt. 9), provides the adjustment that the push button switch will be operated before the breaker trip arm is engaged. Thus the button can be operated by the operator at will to silence the bell alarm after the breaker is tripped automatically, or to manually trip the breaker without ringing the bell alarm.

SAFETY INTERLOCK FOR ENCLOSED BREAKERS

The purpose of this interlock (Fig. 31) is to make provision that the breaker will be tripped whenever the door of an enclosing case is opened.

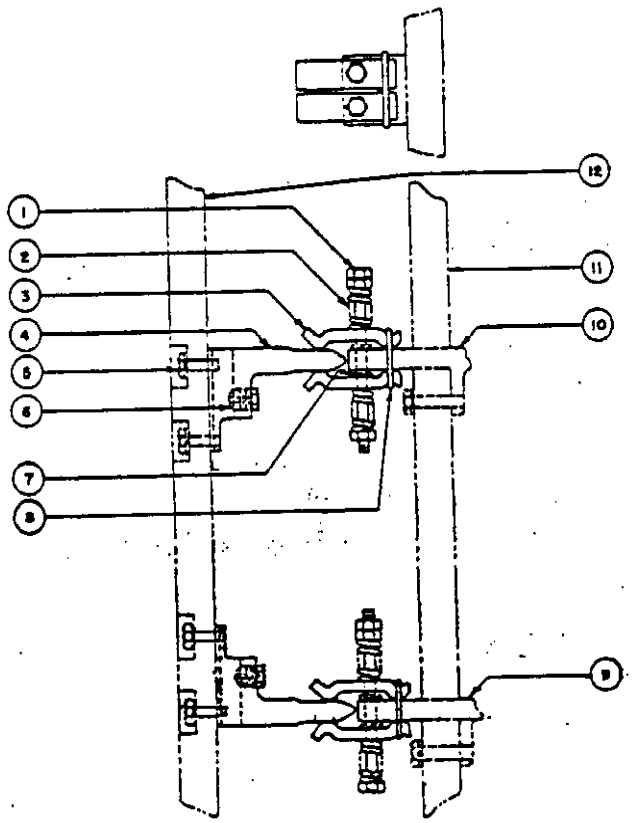
The trip rod (Pt. 5) operates horizontally in a molded trip rod guide (Pt. 7) and extends through to the front of a molded handle (Pt. 9), mounted on the front of the enclosing case door (Pt. 12). The guide has lugs on the right and left sides which allow it to slide horizontally through slots in the molded support (Pt. 15). The support is attached to bracket (Pt. 2), which is attached to the operating mechanism side frames (Pt. 1).

The molded handle (Pt. 9) is inserted through the door (Pt. 12) and is attached to it by screws (Pt. 10) through the nameplate (Pt. 11). Spring (Pt. 8), backed up by contracted turns in the rear of the handle, exerts pressure to seal the steel washer (Pt. 14) and felt washer (Pt. 13) against the inside of the door. The rear end of the handle is internally threaded, and is screwed over the threaded front end of the trip rod guide (Pt. 7) when the door is closed, and, in so doing, draws the trip rod guide forward to the position as shown in Fig. 31. Compression spring (Pt. 6), backed up against the bracket (Pt. 2), forces the trip rod forward through

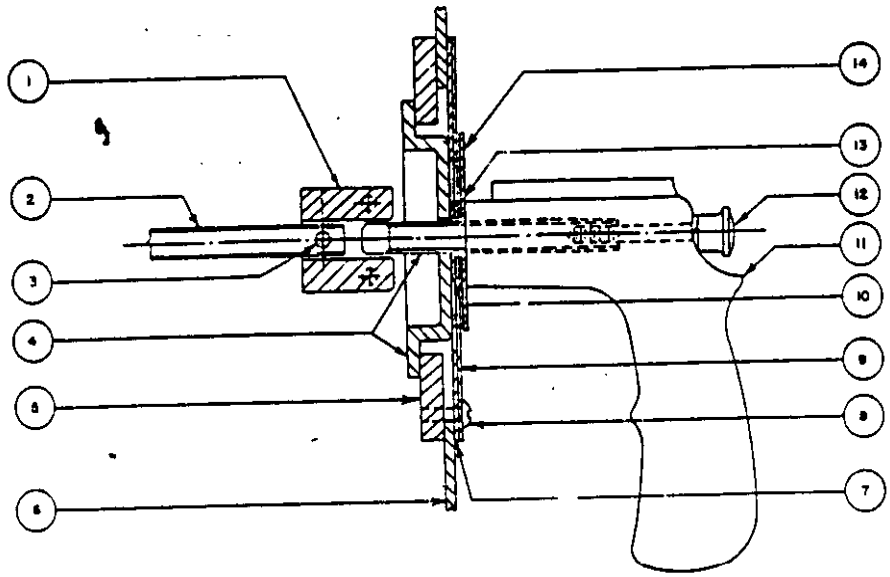


1. OPERATING MECHANISM FRAME
2. BRACKET
3. SCREWS R.H.$^{\circledast}$ 10-32 X $\frac{3}{16}$" WITH LOCKWASHERS
4. TRIP LEVER
5. TRIP ROD
6. COMPRESSION SPRING
7. MOLDED TRIP ROD GUIDE
8. COMPRESSION SPRING
9. MOLDED HANDLE
10. SCREWS R.H.$^{\circledast}$ 4 X $\frac{5}{8}$" SELF TAPPING WITH LOCKWASHER
11. NAME PLATE
12. ENCLOSED CASE DOOR
13. FELT WASHER
14. STEEL WASHER
15. MOLDED SUPPORT
16. COMPRESSION SPRING
17. SCREWS R.H.$^{\circledast}$ 8-36 X $\frac{5}{8}$" WITH WASHER AND LOCKWASHER

FIG. 31
INTERLOCK FOR ENCLOSED CASES



1. SCREWS HEX. HD. $\frac{1}{4}$"-20 WITH NUTS
2. SPRINGS
3. CONTACT FINGER
4. STATIONARY STUD TERMINAL
5. SCREW HEX. HD. $\frac{5}{16}$"-18 X $\frac{3}{4}$" WITH LOCKWASHER
6. SWIVELLED CABLE CLAMP
7. WASHERS AND SHIMS
8. RETAINING RING
9. BREAKER LOWER STUD
10. BREAKER UPPER STUD
11. BREAKER BASE
12. ENCLOSED CASE BASE



1. COUPLING
2. SHAFT
3. SET SCREW 10-32 X 1/4" ALLEN HD. CUP PT.
4. SHAFT AND BRAZED PLATE
5. CLAMPING RING
6. STEEL DOOR
7. STEEL WASHER
8. SCREWS R.H. #8-36 X 1/2" WITH LOCKWASHERS
9. NAME PLATE
10. WASHER
11. MOLDED HANDLE
12. KNOB AND LOCKWASHER
13. SHIM
14. WASHER

FIG.33
MANUAL OPERATING HANDLE ASSEMBLY SWITCHBOARD FRONT PLATE

e guide (Pt. 7) and clear of the breaker rip lever (Pt. 4) when the door is closed. In this position the trip rod (Pt. 5) can be operated through the molded handle against compression spring (Pt. 6) to trip the breaker.

The design is such that the door cannot be opened until the handle is unscrewed from the trip rod guide (Pt. 7). When the handle is unscrewed, the compression spring (Pt. 16), backed up against the inside front end of the support (Pt. 15), forces the trip rod guide and trip rod to the rear to engage the breaker trip lever (Pt. 4) and trip the breaker whenever the door is opened.

DISCONNECTS FOR ENCLOSED BREAKERS

When type AE-1-25 breakers are to be installed in enclosed cases, spring maintained contact fingers are provided for both upper and lower studs. These have silver contact surfaces and automatically fit over stationary studs, with silver contact surfaces, mounted in the enclosed housing. Before the door of an enclosed case opens, Fig. 31, and before the breaker is removed from the enclosed case, the breaker is automatically opened, so that these contact fingers will not be called upon to open the breaker current, nor can the breaker be installed in the enclosure in the closed position.

Fig. 32 shows the contact fingers (Pt.) attached to the breaker studs by screws (Pt. 1), springs (Pt. 2) and retaining rings (Pt. 8). The stationary stud terminals (Pt. 4) are mounted on a base (Pt. 12) in the enclosed case. Power cables are connected to stationary stud terminals with swivelled cable clamps (Pt. 6).

MANUAL OPERATING HANDLE ASSEMBLY FOR SWITCHBOARD FRONT PLATES

On certain installations a disconnecting handle (Pt. 11) is provided and attached to the door to engage the shaft of the operating mechanism as shown in Fig. 33.

A clamping ring (Pt. 5) is attached to the steel door (Pt. 6) by three screws (Pt. 8) which pass through the nameplate (Pt. 9) and steel washer (Pt. 7). The shaft and plate (Pt. 4) are brazed together and pass through the door from the rear. Handle (Pt. 11), washer (Pt. 14) shim (Pt. 13) and washer (Pt. 10) are attached to the front of the shaft by knob (Pt. 12). When the door closes the rear end of the shaft (Pt. 4) engages coupling (Pt. 1) which is attached to shaft (Pt. 2) of the operating mechanism by set screw (Pt. 3).

To prevent undue friction in the movement of the handle it is recommended that a lubricant should be applied to the engaging surfaces between shaft and plate (Pt. 4) and the clamping ring (Pt. 5). Lubricate #130-A, G.E. Spec. D50H10 should be used.

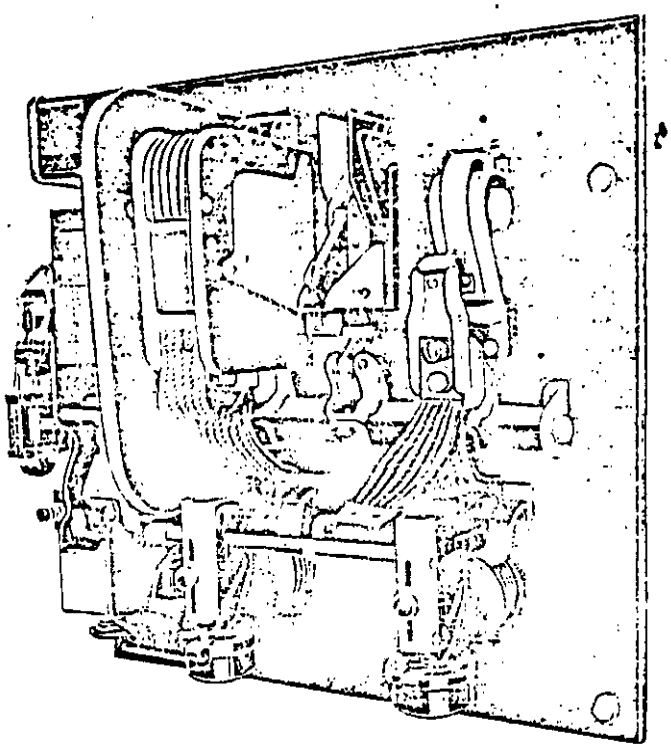


FIG. 34
ELECTRICALLY OPERATED TYPE AEF-1 FIELD SWITCH (LIVE FRONT).

TYPE AEF-1 FIELD SWITCH

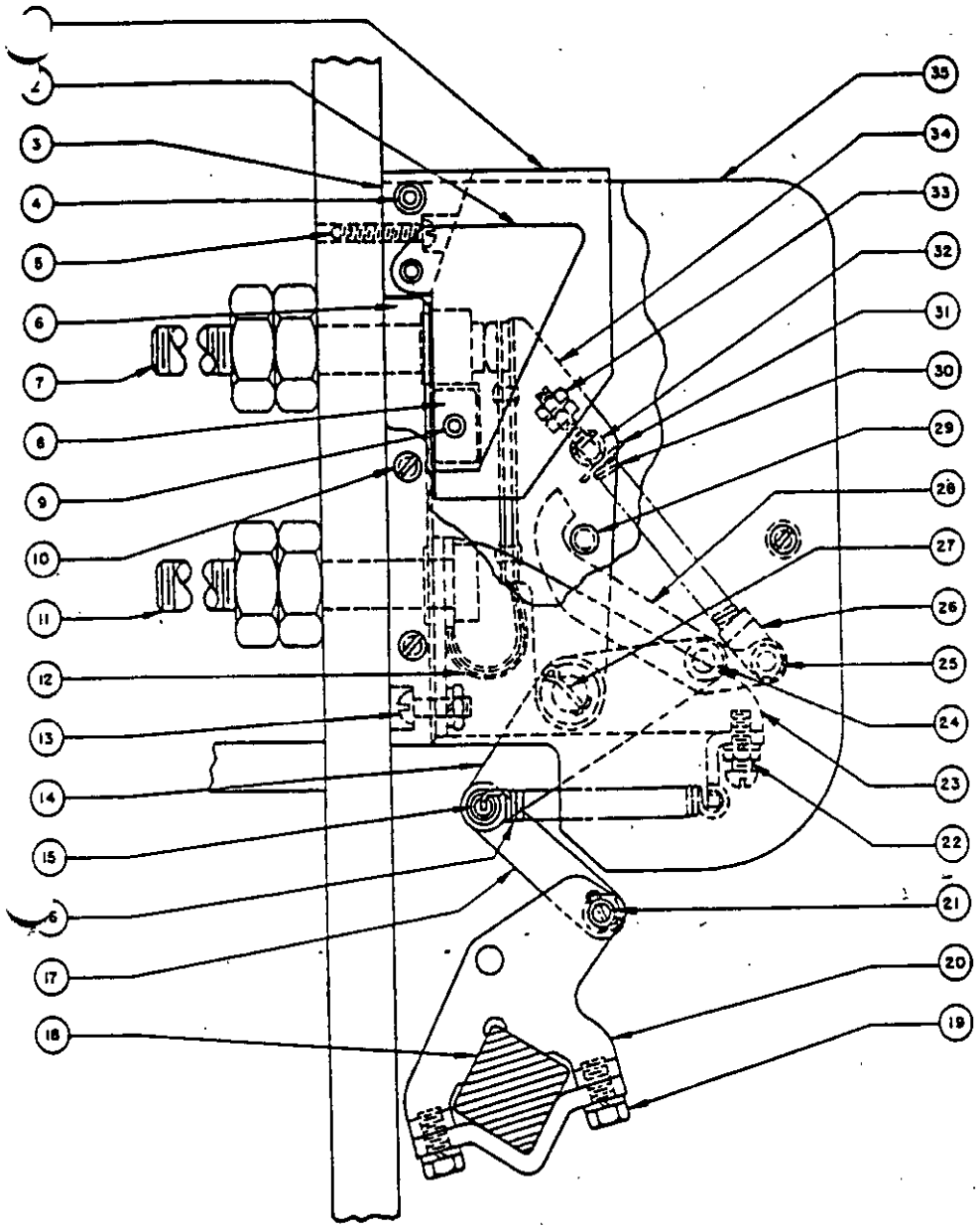
The type AEF-1 field switch, Fig. 34, is used for the control of generator or motor shunt field circuits. It consists of a regular two pole type AE-1-25 air circuit breaker, manually or electrically operated, automatic or non-automatic, as described herein, but equipped with a field discharge switch placed between the two main poles of the field switch. The contacts of the discharge switch are closed and opened by a self-contained mechanism connected to the main shaft of the field switch. The discharge switch is operated and constructed, as described below, to connect a discharge resistor across the shunt field terminals when the field switch opens the field circuit. The connection of this resistor prevents a high induced voltage across the field terminals caused by the rapid collapse of flux in the magnetic circuit of the shunt field.

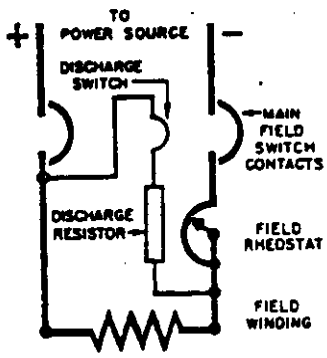
This field switch is not used with synchronous condensers or synchronous motors which start on alternating current as induction motors at full or reduced voltage.

FIELD DISCHARGE SWITCH

The field discharge switch, Fig. 35 of the AEF-1 field switch consists of an upper stud (Pt. 7) with a silver alloy contact, a lower stud (Pt. 11) both mounted through the bases of both the field switch and the pivoted on pin (Pt. 27) in the frame and an operating mechanism. The cont is connected to the lower stud by connection (Pt. 12) and has a silv contact at the top which registers similar contact on the upper stud. shaft (Pt. 18) is connected to the lever by crank (Pt. 20), link (Pt. (Pt. 14), catch (Pt. 28) and spring 26) as described below so that when shaft revolves clockwise (looking left) to open the field circuit, the of the discharge switch will positive before the contacts of the field swi The closing of these contacts conn discharge resistor directly across minals of the shunt field to disch induced high voltage in the field, in the accompanying connection diagr 35 shows the discharge switch in th tion.

When the main shaft revolves clockwise to close the main contact field switch, the spring rod (Pt. pulled forward through pin (Pt. 32) contact lever against the pressure pression spring (Pt. 30), but bef locknuts (Pt. 33) engage the pin, t (Pt. 28) engages rivet (Pt. 29) als contact lever, and draws the cont forward to open the contacts far apart as the lower end of catch (Pt. 28 over the kick-off screw (Pt. 22) as crum, the catch disengages the riv





TYPICAL CONNECTION DIAGRAM

1. BARRIER FOR ARC CHUTE
2. POLE PIECE OF ARC CHUTE
3. SUPPORT FOR ARC CHUTE
4. RIVETED PIN
5. SCREW R.H. SELF TAPPING #6 X 1"
6. BASE
7. UPPER STUD AND CONTACT
8. MAGNET
9. RIVETED PIN
10. SCREW R.H. SELF TAPPING #8 X 3/8" FOR PT. 35
11. LOWER STUD
12. FLEXIBLE CONNECTION (INCLUDED IN PT. 34)
13. SCREW R.H. #10-32 X 3/8" WITH LOCKWASHER AND NUT
14. CRANK
15. PIN AND SPACER
16. TENSION SPRING
17. LINK
18. MAIN SHAFT
19. SCREW HEX. HD. 1/4"-20 X 3/8" WITH LOCKWASHER
20. CRANK AND CLAMP
21. PIN, COTTER PIN AND SPACER
22. SCREW R.H. #10-32 X 3/8" WITH LOCKWASHER AND NUT
23. FRAME
24. RIVET AND WASHERS
25. RIVET
26. SPRING ROD
27. PIN, COTTER PIN AND SPACER
28. CATCH
29. RIVET
30. COMPRESSION SPRING
31. WASHER
32. PIN
33. LOCKNUTS AND LOCKWASHER
34. CONTACT LEVER
35. BARRIER FOR LIVE FRONT SWITCHES

FIG. 35
FIELD DISCHARGE SWITCH
WITH FIELD SWITCH IN OPEN POSITION

to the rear allows compression spring (Pt. 30) to force the contact lever in the closing direction but the contacts do not close because pin (Pt. 32) is stopped by the locknuts to keep the contacts apart 1/8 of an inch.

Then when the field switch opens and the main shaft revolves clockwise, the spring rod and locknuts move to the rear to close the discharge switch contacts.

An arc chute encloses the contacts with a barrier (Pt. 1) and pole pieces (Pt. 2) on each side and supported to the field switch base by support (Pt. 3), rivets (Pt. 4) and self-tapping screw (Pt. 5). A magnet (Pt. 8) is supported between the barriers below the upper stud (Pt. 7) by rivet (Pt. 9). In live front field switches barriers (Pt. 35) are attached to the discharge switch base (Pt. 6) by self-tapping screws (Pt. 10).

The first adjustment consists of adjusting the kickoff screw (Pt. 22) so that the catch (Pt. 28) disengages rivet (Pt. 29) just before the field switch is fully closed.

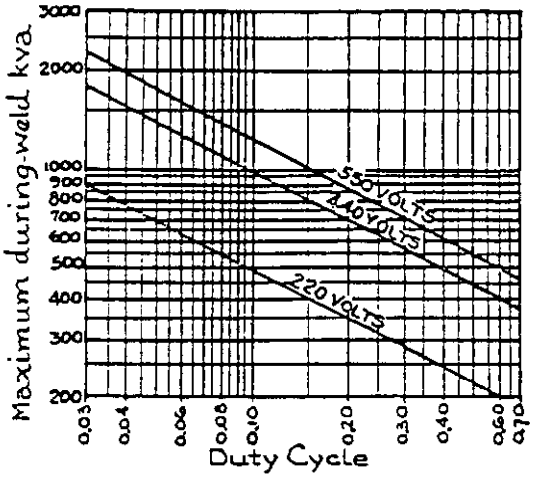
The second adjustment consists of adjusting the locknuts (Pt. 33) on spring rod (Pt. 26) until the contacts of the discharge switch are 1/8 of an inch apart when the field switch is fully closed.

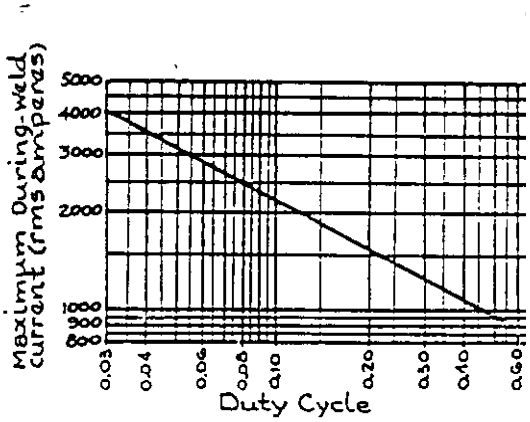
TYPE AE-1-25YI AIR CIRCUIT BI

This breaker is designed for the tion of resistance welding machines stantaneously trip at higher current than provided with the regular insta overcurrent trip device as shown in The breaker differs from the regul AE-1-25 breaker only in the provisio tain higher current settings. This a special trip shaft to allow large ture travel of the instantaneous ove trip device for current settings ab amperes.

Standard calibration ranges ar 1500 amperes, 1400 to 4000 amperes to 5000 amperes. Within reasonable other ranges can be provided where t est calibration setting will not approximately 2-1/2 times the lowes bration setting.

As the duty imposed on the AE breaker is intermittent and quite v depending upon various types of wel be done, the breaker is not given a ous current rating. It is designed t carry "during-weld amperes" or "duri KVA" at welding periods not to exce corresponding "duty-cycle" as tabul Fig. 36.





Duty Cycle	During-weld AMP Rms	During-weld KVA		
		220 Volts	440 Volts	550 Volts
0.03	4040	890	1780	2225
.04	3500	770	1540	1925
.05	3130	689	1378	1722
.06	2860	629	1258	1574
.07	2640	580	1161	1453
.08	2740	544	1087	1360
.09	2330	513	1025	1282
.10	2215	487	974	1219
.20	1566	345	689	861
.30	1278	281	562	703
.40	1107	244	487	609
.50	990	218	436	545

WIRING DIAGRAMS

Figs. 37 and 38 show schematic wiring diagrams for electrically operated AE-1-25 breakers with momentary and maintained contact control switches respectively. Fig. 39 and 40 show typical wiring diagrams with the momentary and maintained contact control switches respectively.

The standard arrangement for direct current circuits is to have voltage coils connected solidly to the negative bus or line where possible.

CUT-OFF DEVICE FIG. 17 IS MECHANICALLY PICKED UP BY CLOSING MECHANISM OF BREAKER

'a' - AUX. SW. OPEN WHEN BREAKER IS OPEN.
'b' - AUX. SW. CLOSED WHEN BREAKER IS OPEN.

⊣⊢ - CONTACT OPEN WHEN DEVICE IS IN THE DE-ENERGIZED OR NON-OPERATED POSITION.
⊣⊢ - CONTACT CLOSED WHEN DEVICE IS IN THE DE-ENERGIZED OR NON-OPERATED POSITION.

TERMINAL BOARDS FOR CONTROL WIRING ARE PROVIDED WITH STANDARD BREAKERS. CONNECT CONTROL POWER TO TERMINAL POINTS #1 AND #2. IF D.C. POWER IS USED MAKE #1 POSITIVE AND 2 NEGATIVE. FOR REMOTE OPERATION CONNECT THE CLOSING SWITCH BETWEEN TERMINAL POINTS #1 AND #3 AND THE TRIPPING SWITCH BETWEEN TERMINAL POINTS #1 AND #4.

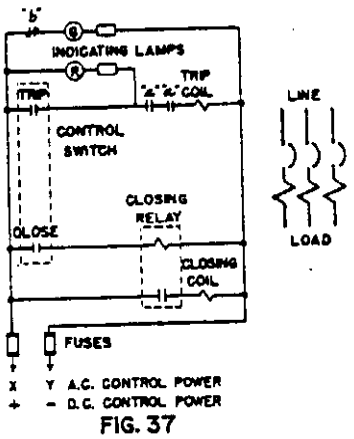


FIG. 37

SCHEMATIC WIRING
FOR ELECTRICALLY OPERATED AE-1-25 BREAKER
WITH MOMENTARY CONTACT CONTROL SWITCH

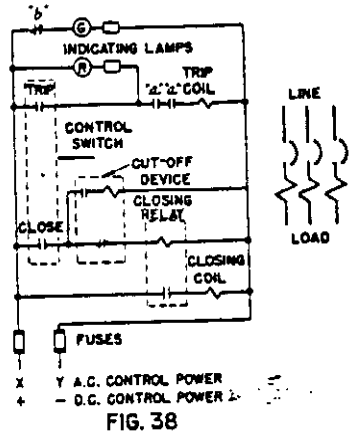


FIG. 38

SCHEMATIC WIRING
FOR ELECTRICALLY OPERATED AE-1-25 BREAKER
WITH MAINTAINED CONTACT CONTROL SWITCH

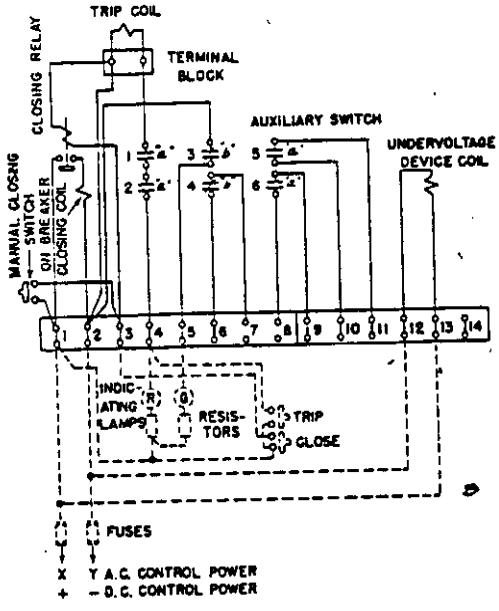


FIG. 39

TYPICAL WIRING DIAGRAM
FOR ELECTRICALLY OPERATED AE-1-25 BREAKER
WITH MOMENTARY CONTACT CONTROL SWITCH

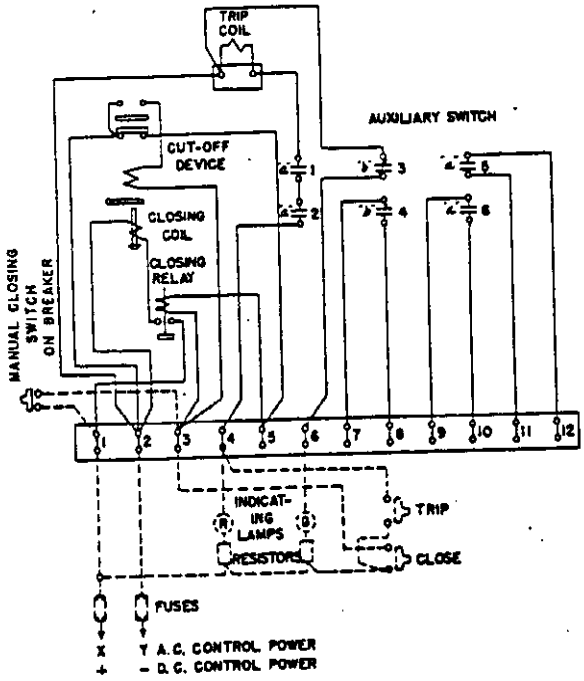


FIG. 40.

TYPICAL WIRING DIAGRAM
FOR ELECTRICALLY OPERATED AE-1-25 BREAKER
WITH MAINTAINED CONTACT CONTROL SWITCH

SPARE PARTS

Item		Pt.	Fig.
CONTACT STUDS, POLE UNIT ASSEMBLY			
1	Upper Stud, Blowout Coil and Arc Runner Assembly	4,6,30	8
	Upper Stud, Blowout Coil and Arc Runner Assembly	7	7
2	Series Coil, Lower Stud Assembly	See Overcurrent Devices	
3	Insulation	29	8
4	Core	2	8
	"	6	7
5	Insulation	3	8
6	Stationary Arcing Contact	28	8
7	Screws RH 5/16-18 with lockwasher	1	8
	Screws RH 5/16-18 with lockwasher	5	7
8	Screws RH #10-32 with Washer and Lockwasher	5	8
	Screws RH #10-32 with Washer and Lockwasher	8	7
9	Screws RH #6-40 x 1/2" with Lockwashers	25	8
10	Bracket	8	8
	"	11	7
	"	7	18
	"	9	26
11	Screws RH 1/4-20 with Lockwasher and Nut	7	8
	Screws RH 1/4-20 with Lockwasher and Nut	9	7
	Screws RH 1/4-20 with Lockwasher and Nut	6	18
12	Screws Hex. Hd. 1/4"-20 with Lockwasher	17	7
	Screws Hex. Hd. 1/4"-20 with Lockwasher	18	8
	Screws Hex. Hd. 1/4"-20 with Lockwasher	8	18
13	Movable contact and Silver Contact	24	8
14	Movable Arcing Contact	27	8
15	Screw RH #6-40 x 3/8" with Lockwasher	26	8
16	Adjusting Screw RH 5/16" - 18 x 1-1/4 with washer, Lockwasher and Nut	23	8
17	Screw Hex. Hd. 5/16"-18 x 7/8" with Lockwasher and Washer	21	8
		22	8
18	Pin and Cotter Pins	13	8
19	Contact Support	12	7
	" "	15	8
20	Clamp		
21	Screw, Hex. Hd. #4-20 x 5/8" with Lockwasher	16	8
22	Compression Spring	12	8
23	Spring Guide	10	8
24	Pin	11	8
25	Main Shaft	14	8
	" "	13	7
	" "	29	10
	" "	30	25
	" "	18	34
26	Flexible Connection	19,20	8

Item		Pt.	Fig.
27	Screw RH 1/4"-20 with Washer, Lockwasher and Nut	18	8
	Screw RH 1/4"-20 with Washer, Lockwasher and Nut	14	7
	Screw RH 1/4"-20 with Washer, Lockwasher and Nut	2	8
28	Screws Hex. Hd. 1/4"-20 with Washer and Lockwasher	15	7
	Screws Hex. Hd. 1/4"-20 with Washer and Lockwasher	3	18
29	Screws RH 1/4-20 with Lock washers	17	7
	Screws RH 1/4-20 with Lockwashers	6	18
	Screws RH 1/4-20 with Lockwashers	10	26
30	Trip Shaft	20	7
	" "	18	10
	" "	5	25
	" "	19	28
	" "	2	29
	" "	2	30
ARC QUENCHER			
31	Side Plates	23	7
32	Support for Arc Quencher	1	7
33	Screw RH 5/8"-18 with Lockwasher	2	7
34	Locking Plate and Self-Tapping Screws	3	7
35	Screws RH #10-32 x 2-1/2 with Lockwashers and Nuts	4	7
36	Pole Piece Plates	35	7
37	Screws RH. #10-32 x 2-3/4 with Lockwasher and Nuts	28	7
38	Front Arc Runners	26	7
39	Insulation Blocks	30	7
40	Screws RH #10-32 x 1/4" with Lockwasher and Washer	25	7
41	Screws FH #10-32 x 1/2	29	7
42	Screws R.H. #10-32 x 1/2 with Lockwashers and Nuts	27	7
43	Baffles	31	7
44	Screws R.H. #10-32 x 2-5/8" with Lockwashers and Nuts	34	7
45	Pins, Copper	33	7
46	Pins, High Melting Point	32	7
OPERATING MECHANISM			
47	Manual Closing Handle	23	1
48	Eccentric Shaft	1	1
49	Link	2	1
50	Block and Guide Pin	3,4	1
51	Pin	5	1
52	Closing Links	6	1
53	Toggle Links, A,B,C,D	8	1
54	Pin in Frame	9	1
55	Pin in Frame	10	1
56	Torsion Spring	11	1
57	Latch	12	1
58	Pin in Frame	13	1

Item		Pt.	Fig.
	Spring	14	10
60	Prop	15	10
61	Latch Plate	17	10
62	Frame	19	10
	"	2	13
	"	3	17
	"	3	30
63	Trip Arm	20	10
	" "	3	29
	" "	1	30
	" "	4	31
64	Pin in Frame	21	10
65	Cam	22	10
66	Outer and Inner Springs	25	10
67	Spring Guide	24	10
68	Cam Stop Pin	26	10
69	Operating Cam	27	10
70	Bracket	28	10
	ADJUSTMENT ECCENTRICS FOR TRIP ARM AND LATCH		
71	Eccentric with 1/4"-20 Threaded Shank	4	11
72	Nut 1/4"-20	3	11
73	Eccentric	8	11
74	Screw, Hex. Hd. #10-32 x 7/16" with Lockwasher	9	11
75	Buffer Spring	10	11
	SOLENOID OPERATING MECHANISM		
76	Magnet	1	13
77	Coil	3	13
	Armature	4	13
	Pin in Armature	5	13
	" " "	6	17
80	Pin in Frame	6	13
81	Maintenance Closing Handle	7	13
	CLOSING RELAY		
82	Magnet	1	14
83	Coil	2	14
84	Brass Guide	3	14
85	Armature	4	14
86	Stationary Contacts	5	14
87	Binding Screws and Lockwashers	6	14
88	Movable Contact Assembly	7	14
89	Pin and Cotter Pin	8	14
90	Insulation Angle	9	14
91	Screw, R.H. Self-Tapping #8 x 3/8 with Lockwasher	10	14
92	Relay Base	11	14
93	Screw F.H. #10-32 x 3/4"	12	14
94	Screw FH #8-36 x 1/2	13	14
95	Screw RH #10-32 with Lockwasher and Nut	15	14
96	Screw R.H. Self-Tapping #6 x 3/16"	16	14
97	Screw R.H. Self-Tapping #4 x 1/4"	17	14
	ROTARY TYPE AUXILIARY SWITCH		
98	Molded Barriers	1	15
	Movable Contact Assembly	2	15
	Stationary Contact Assembly	3	15
101	Stationary Contact Support	4	15
102	Cover	5	15
103	Cam and Toothed Bushing	6	15
104	End Frame	7	15
105	Crank, Pin and Cotter Pin	8	15
106	Link	9	15
107	Shaft	10	15
	OPERATING SWITCH		
108	Mounting Bracket	12	16
109	Screw R.H. #8-36 x 3/4 with Nut and Lockwasher	11	16
110	Molded Base	8	16
111	Contact Brackets and Binding Screws	1	16
112	Screw R.H. #10-32 x 3/4 with Lockwasher	13	16
113	Operating Rod	10	16
114	Spring	9	16
115	Washer	7	16
116	Contact Spring	6	16
117	Insulation	5	16
118	Movable Contact Strip	4	16
119	Guide	3	16
120	Screw R.H. #4-40 x 1-1/4 with Washers	2	16
	CUT-OFF DEVICE		
121	Flanged Bracket	2	17
122	Pin and Cotter Pin in Bracket	4	17
123	Flat Spring	5	17
124	Pin in Armature	6	17
125	Screws R.H. #8-36 x 3/8" with Lockwashers	7	17
126	Magnet	10	17
127	Coil	11	17
128	Armature	8	17
129	Brass Guides	9	17
130	Pin in Armature	13	17
131	Washer and Cotter Pin	12	17
132	Screw and Locknut	14	17
133	Operating Rod	15	17
134	Spring	16	17
135	Contact Brackets and Binding Screws	17	17
136	Movable Contact Strips	18	17
137	Contact Spring	19	117
138	Guide	20	17
139	Screw, R.H. #4-40 x 1-1/4 with Washers	21	17
140	Screw R.H. #8-36 x 3/4 with Lockwasher and Nut	1	17
141	Molded Base	22	17
142	Screw R.H. #8-36 x 3/4" with Lockwasher and Nut	1	17
	MAGNETIC OVERCURRENT TRIP DEVICE (OIL-FILM TYPE)		
143	Series Coil, Lower Stud and Terminal	5,9	18
	Series Coil, Lower Stud and Terminal	3,4	23
	Series Coil, Lower Stud and Terminal	4,5	28
144	Magnet	4	18
	"	2	23

Item	Pt.	Fig.
145 Insulating Tube	10	18
146 Insulating Washers	11	18
" "	3	28
147 Frame	12	18
"	5	23
148 Armature Assembly	1	18
149 Pin and Cotter Pins	13	18
" " " "	6	23
150 Calibration Spring	21	18
" "	10	23
151 Calibration Index and Screw	23	18
" " " "	12	23
152 Calibration Adjusting Knob.	22	18
" " " .	11	23
153 Calibration Plate	27	18
" "	14	23
154 Screws R.H. #8-36 x 1/4 with Washers	26	18
Screws R.H. #8-36 x 1/4 with Washers	13	23
155 Pivoted Cover and Support	14	18
156 Oil Pot	15	18
157 Lower Disc	16	18
158 Upper Disc	17	18
159 Shank	18	18
160 Spring	19	18
161 Instantaneous Spring	20	18
162 Adjusting Stop	24	18
163 Screws Hex. Hd. #10-32 x 1/2" with Nuts and Washers.	25	18
	28	18
164 Trip Finger	15	23
" "		

THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

165 Molded Frame	4	20
166 Magnet	6	20
167 Coil	5	20
168 Armature	19	20
169 Spring Hinge	14	20
170 Yoke	20	20
171 Pin	28	20
172 Short Circuit Spring	1	20
173 Spring Guide and Locknut	2	20
174 Tubular Spring Guide and Cotter Pin	3	20
175 Pin in Armature and Yoke	25	20
176 Flat Buffer Springs	22	20
177 Leather Washer	24	20
178 Adjusting Screw and Spring.	21	20
179 Armature Adjusting Screw and Nut	23	20
180 Reset Spring for Yoke	26	20
181 Adjusting Screw	27	20
182 Bimetallic Thermal Strip	13	20
183 Induction Ring	7	20
184 Pin	8	20
185 Thermal Trip Arm	9	20
186 Latch Support	10	20
187 Torsion Spring on Pt. 8	11	20
188 Adjusting Screw	12	20
189 Latch Plate	15	20
190 Spring for Thermal Trip Arm	16	20
191 Calibration Cam, Spring and Cotter Pin	18	20
192 Calibration Knob	17	20

Item	Pt.	F
MAGNETIC INSTANTANEOUS OVERCURRENT TRIP DEV		
(See Dual Oil Film Magnetic Overcurrent T		
Device for Common Parts).		
195 Armature assembly and Stop Plate	1	
196 Stop Screw and Hex. Nut	7	
197 Support	8	
198 Lower Stud	1	
199 Brass Plate and Rod	2,10	
200 Screws F.H. #10-32 x 1"	3	
201 Magnet	4	
202 Screws R.H. #10-32 x 7/16 with Lockwashers	5	
203 Brass Guides	6	
204 Armature, Guide Rod and Trip Arm	7,8,11	
205 Nuts 1/4"-20	9	
206 Brass Tube	12	
207 Compression Spring	13	
208 Brass Cup	14	

UNDERVOLTAGE TRIP DEVICE

209 Reset Arm	1	
210 Buffer Spring	2	
211 Flat Spring	3	
212 Trip Adjusting Screw R.H. #10-32 x 5/8 and Nut	4	
213 Trip Arm	6	
214 Reset Link	7	
215 Pin and Cotter Pins	8	
216 Trip Lever	9	
217 Pin and Cotter Pins	10	
218 Stop Link	11	
219 Spring	12	
220 Frame	13	
221 Adjusting Screw R.H. #10-32 x 1-1/2" and Nuts	14	
222 Stop Screw R.H. 1/4"-20 x 5/8" with Nut	15	
223 Screw R.H. Self-Tapping #4 x 1/4"	16	
224 Barrier	17	
225 Mounting Strap	19	
226 Screws R.H. Self-Tapping #8 x 7/8" and Lockwasher	20	
227 Screws R.H. #10-32 x 1/2 with Lockwasher	21	
228 Coil	22	
229 Magnet	23	
230 Brass Guides	24	
231 Armature	25	
232 Pin and Cotter Pins	26	
233 Support for Pt. 7	27	
234 Pin and Cotter Pins	28	
235 Adjusting Screw Hex. Hd. #10-32 x 5/8" with Nut	29	
236 Screw R.H. #10-32 x 1/2" with Lockwasher	31	
237 Groov Pin Type 1/8" dia 5/8" long	32	
238 Plunger Assembly	33	
239 Frame	34	
240 Cover	35	
241 Oil Dash Pot	36	

Item	Pt.	Fig.
REVERSE CURRENT TRIP DEVICE		
243 Series Coil and Connection Bars	5	26
244 Core	41	26
245 Screws Hex. Hd. 3/8"-16 x 1-1/4 with Lockwasher	3	26
246 Supports	2	26
247 Upper Connection Bar Support	40	26
248 Screws R.H. 1/4"-20 x 1" with Lockwashers and Nuts... and Insulating Washers and Bushings	4	26
249 Screws Hex. Hd. 3/8-16 x 1-1/2" with Washer, Lockwasher and Nut	6	26
250 Lower Stud	7	26
251 Insulation Tube	42	26
252 Insulation Washers	11	26
253 Screws, Hex. Hd. 5/16-18 x 1-1/4 with Lockwashers	1	26
254 Armature Shaft	14	26
255 Rear Bronze Bearing	38	26
256 Screws, Hex. Hd. 5/16-18 x 7/8" with Lockwashers	37	26
257 Front Bronze Bearing	33	26
258 Studs	34	26
259 Nuts, Hex. 5/16-18 with Lockwashers	31	26
260 Spacers with Nut Housings	32	26
261 Thrust Washer and Insulation Washers	35	26
262 Grommet	36	26
263 Armature	45	26
264 Coil	44	26
265 Pole Shoes	43	26
266 Dust Covers	46	26
267 Screws, R.H. Self-Tapping #8 x 3/8" with Washer and Lockwasher	47	26
268 Escutcheon Plate	30	26
269 Posts	29	26
270 Trip Crank	13	26
271 Screw, Hex. Hd. #10-32 x 9/16" and Lockwasher	15	26
272 Set Screw, Cup Point #8-36 x 1/8"	16	26
273 Calibration Spring	20	26
274 Calibration Index	19	26
275 Calibration Plate	18	26
276 Screws, R.H. #10-32 x 3/8" with Lockwasher	28	26
277 Calibration Screw Hex. Hd. Washer and Cotter Pin	17	26
278 Compression Spring	21	26
279 Stop Screw with Lockwasher and Nut, Reverse	12	26
280 Stop Screw with Lockwasher and Nut, Normal	22	26
281 Pin, Washer and Cotter Pin	26	26
282 Spacer	27	26
283 Trip Rod Assembly	25	26
284 Trip Lever	24	26
REVERSE CURRENT TRIP DEVICE (HINGED ARMATURE)		
285 Laminated Section of Magnet	2	28A
286 Solid Section of Magnet	6	28A
287 Screw Fil. Hd. A, 1/4"-20 x 3/4"	7	28A
288 Insulation Washer	8	28A
289 Potential Coil	9	28A
290 Pin and Cotter Pin	10	28A
291 Armature Assembly	11	28A
292 Frame	12	28A
293 Pivoted Armature	22	28A
294 Stop Pin	13	28A
295 Trigger	18	28A
296 Bearing Plate	20	28A
297 Screws R.H. #10-32 x 3/8" with Lockwasher	21	28A
298 Calibration Plate	14	28A
299 Calibration Spring	15	28A
300 Calibration Knob	16	28A
301 Calibration Index and Screw	17	28A
302 Reset Crank	25	28B
303 Screw Hex. Hd. 1/4"-20 x 1/2" with Lockwasher	24	28B
304 Insulation Link	26	28B
305 Link	27	28B
306 Pin and Cotter Pins	28	28B
307 Torsion Spring	29	28B
308 Reset Lever	30	28B
309 Crank and Clamp	31	28B
310 Screws Hex. Hd. 1/4-20 x 5/8" with Lockwasher	32	28B
SHUNT TRIP		
311 Coil	4	29
312 Guide Tube	5	29
313 Washer	6	29
314 Trip Armature	7	29
315 Button	8	29
316 Magnet	9	29
317 Cotter Pin and Washer	10	29
BELL ALARM DEVICE		
318 Bracket	7	30
319 Screws R.H. #10-32 x 5/16" with Lockwashers	4	30
320 Adjusting Screw Hex. Hd. #10-32 x 1-1/8" with Lockout	6	30
321 Yoke with Boss and Groov Pins	8	30
322 Rod	9	30
323 Button and Lockwasher	10	30
324 Spring	11	30
325 Trip Rod Assembly	12	30
INTERLOCK FOR ENCLOSED BREAKERS		
326 Bracket	2	31
327 Screw R.H. #10-32 x 5" with Lockwasher	3	31
328 Trip Rod	5	31
329 Compression Spring	6	31
330 Molded Trip Rod Guide	7	31
331 Compression Spring	8	31
332 Molded Handle	9	31
333 Screws, R.H. #4 x 3/16" Self-Tapping with Lockwasher	10	31
334 Nameplate	11	31
335 Felt Washer	13	31
336 Steel Washer	14	31
337 Molded Support	15	31
338 Compression Spring	16	31

Item	Pt.	Fig.
339 Screws, R.H. #8-36 x 1/2" with Washer and Lockwasher...	17	31
DISCONNECTS FOR ENCLOSED BREAKERS		
340 Screws, Hex. Hd. 1/4"-20 x 4 with Nuts.....	1	32
341 Springs.....	2	32
342 Contact Fingers.....	3	32
343 Stationary Stud Terminal.....	4	32
344 Screws Hex. Hd. 5/16-18 x 3/4 with Lockwasher.....	5	32
345 Swivelled cable clamp.....	6	32
346 Washers and Shims.....	7	32
347 Retaining Ring.....	8	32
348 Breaker Lower Stud.....	9	32
349 Breaker Upper Stud.....	10	32
350 Enclosed Case Base.....	12	32
MANUAL OPERATING HANDLE ASSEMBLY FOR SWITCHBOARD FRONT PLATES		
351 Coupling.....	1	33
352 Set Screw.....	3	33
353 Shaft and Plate.....	4	33
354 Clamp Ring.....	5	33
355 Steel Washer.....	7	33
356 Screws R.H. #8-36 x 1/2 with Lockwashers.....	8	33
357 Nameplate.....	9	33
358 Washer.....	10	33
359 Molded Handle.....	11	33
360 Knob.....	12	33
361 Shim.....	13	33
362 Washer.....	14	33
FIELD DISCHARGE SWITCH		
363 Barrier for Arc Chute.....	1	35
364 Pole Piece for Arc Chute.....	2	35
365 Support for Arc Chute.....	3	35
366 Riveted Pin.....	4	35
367 Screws, R.H. Self-Tapping #6 x 1".....	5	35
368 Base.....	6	35
369 Upper Stud and Contact and Nuts.....	7	35
370 Magnet.....	8	35
371 Riveted Pin.....	9	35
372 Screws R.H. Self-Tapping #8 x 3/8".....	10	35
373 Lower Stud and Nuts.....	11	35
374 Screws R.H. #10-32 x 5/8" with Lockwasher and Nut.....	13	35
375 Crank.....	14	35
376 Pin and Spacer.....	15	35
377 Torsion Spring.....	16	35
378 Link.....	17	35
379 Screws, Hex. Hd. 1/4"-20 x 5/8" with Lockwasher.....	19	35
380 Crank and Clamp.....	20	35
381 Pin, Cotter Pins and Spacer..	21	35
382 Screw, R.H. #10-32 x 5/8" with Lockwasher and Nut.....	22	35
383 Frame.....	23	35
384 Rivet and Washers.....	24	35
385 Rivet.....	25	35
386 Spring Rod.....	26	35
387 Pin, Cotter Pins and Spacer..	27	35
388 Catch.....	28	35
389 Rivet Stop.....	29	35
390 Compression Spring.....	30	35
391 Washer.....	31	35
392 Pin.....	32	35
393 Locknuts and Lockwasher.....	33	35
394 Contact Arm and Flexible Connection.....	34	35
395 Barrier.....	35	35