

**INSTRUCTIONS**

*Switchgear*

**POWER CIRCUIT BREAKERS**

**MAGNE-BLAST AIR CIRCUIT BREAKERS**

**TYPES AM-5-100 AND AM-5-150**

*Mech. - MS 7A*

**GENERAL**  **ELECTRIC**

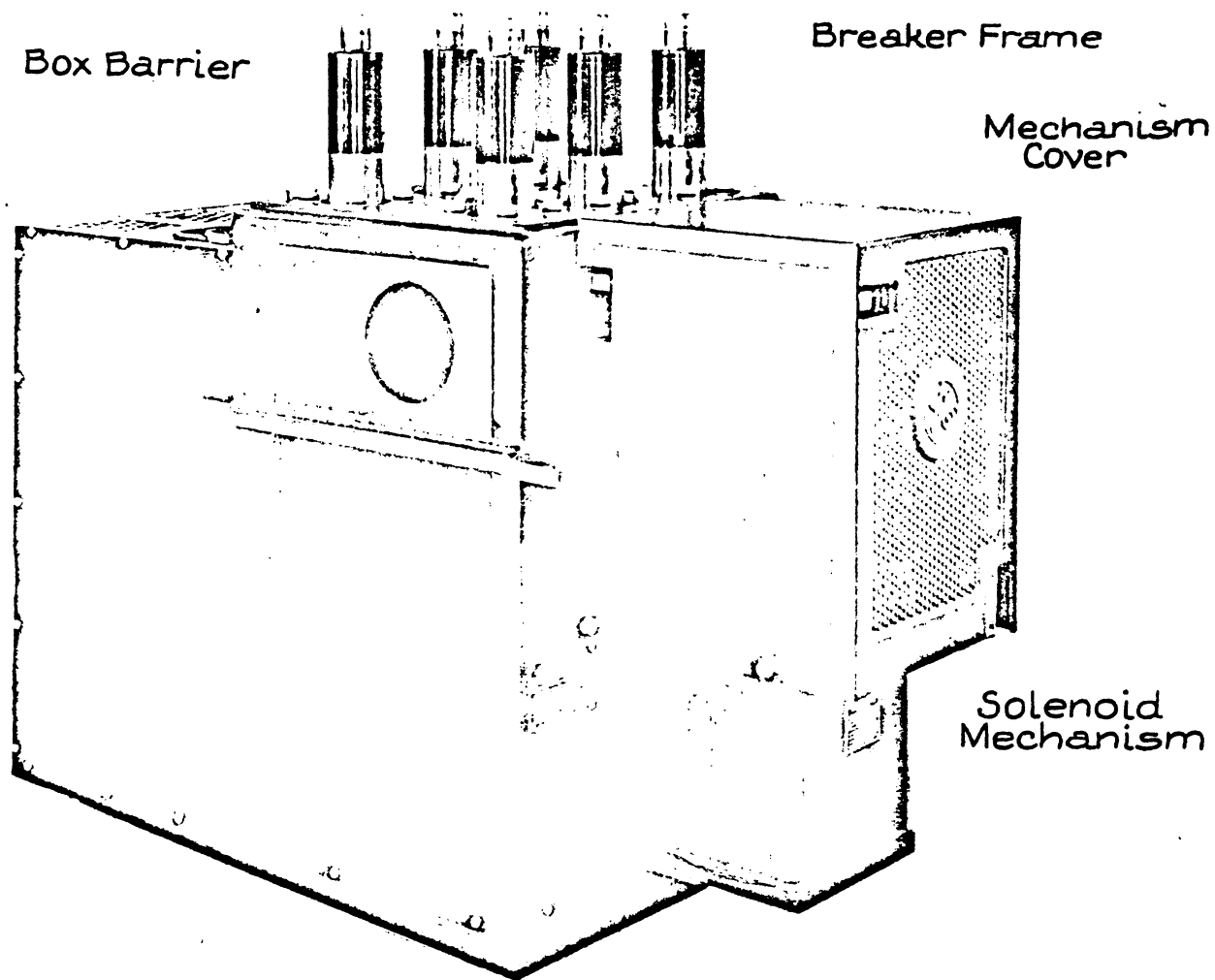


FIG. 1 MAGNE-BLAST BREAKER ARRANGED FOR  
USE IN AN MI-6 METAL CLAD EQUIPMENT UNIT.

# MAGNE-BLAST AIR CIRCUIT BREAKERS

TYPE AM-5-100

AM-5-150

*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

The Magne-Blast Air Circuit Breaker shown in Fig. 1 is a triple pole single throw breaker with integral operating mechanism and is arranged for application in Vertical Lift Metal Clad Switchgear.

These breakers are available in 600, 1200, and 2000 ampere current ratings and are designed for application at a maximum circuit voltage of 5000 volts. Within the published interrupting current range, the AM-5-100 Breaker has an interrupting capacity of 100,000 KVA and the AM-5-150 Breaker has an interrupting capacity of 150,000 KVA on a duty cycle basis consisting of two closing-opening operations with a time interval of 15 seconds between them.

## OPERATING CHARACTERISTICS

The Breaker-Mechanism combination is designed only for electrical closing and the Maintenance Closing Lever is supplied only for use in making adjustments. NEVER ATTEMPT MANUAL CLOSING WITH THE BREAKER IN SERVICE, for under such conditions sufficient closing force and speed cannot be applied.

The MS-7A solenoid mechanism is trip free and will operate satisfactorily over the standard ranges for closing and tripping voltages discussed later under CONTROL.

When the solenoid coil is energized, the armature (refer to Fig. 3), carrying the closing link is pulled down until it is stopped by the pole piece. A spring maintains engagement between the closing link and roller bearing of the operating crank which is rotated to close the breaker. The breaker is held in the fully closed posi-

tion by the over center position of the compression toggle. The coil is de-energized by the relay actuated by the cut-off switch.

When the trip coil is energized, the trip armature is moved upwards rotating the trip shaft which releases the trip hammer. The trip hammer strikes the closing link forcing it off the roller bearing of the operating crank allowing the opening springs to rotate the crank and open the breaker contacts. The stud strikes the release spring to break the compression toggle allowing the resetting springs to raise the armature and reset the mechanism.

In case the trip coil is energized while the breaker is closing, the trip hammer strikes the closing link forcing it off of the roller bearing of the operating crank allowing the breaker to open. The mechanism immediately resets when the solenoid coil is de-energized by the control relay.

When the breaker is tripped under load or short circuit conditions, the opening springs act to swing the contact arms downward, parting first the primary contacts, then intermediate contacts, and then the arcing contacts. Magnetic forces of the Blowout Coils, together with an air stream from the "Booster" drives the arc from the contacts out along the diverging Arc Runners into the "Interleaving" arc chute. The tapered fins that project alternately from the two opposite inner surfaces of the chute deflect the arc into a gradually deepening serpentine path. This lengthening and consequent cooling action rapidly increases the electrical resistance of the arc to cause interruption. Hot exhaust gases are cooled while passing through the Muffler at the end of the arc chute. An easily removable Box Barrier encases the interrupting units, providing insulation between phases and from each phase to the grounded frame.

## CONTROL

For electrical operation, control power may be from either an alternating or direct current source. In the case of alternating current, it is necessary to use a Copper Oxide Rectifier to supply the direct current required by the closing coil.

Operating ranges are given on the mechanism nameplate. Ordinarily, standard ranges apply and are as follows:

<u>Nominal Voltage</u>	<u>Closing Range</u>	<u>Tripping Range</u>
125 V.DC.	90-130 V.DC.	70-140 V.DC.
250 V.DC.	180-260 V.DC.	140-280 V.DC.
220 V.AC.	180-240 V.AC.	180-240 V.DC.

#### SHIPMENT

Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Immediately upon receipt of a circuit breaker, an examination should be made for any damage sustained during shipment. If injury or rough handling is evident, a damage claim should be filed at once with the transportation company and the nearest General Electric Company's Sales Office should be notified promptly.

#### UNPACKING

The breaker should be removed from the crating with sufficient care so that no damage will result from rough handling. It frequently happens that "loose parts" associated with the apparatus are included in the crate. Care should be taken to make certain that these parts are not overlooked.

After the breaker has been removed from the crating, the brace and steel hooks holding the Box Barrier in position should be removed and discarded. The red painted hex-head shipping bolts holding the top of the box barrier to the frame should be replaced by the Thumb Screws as shown in Fig. 3.

#### STORAGE

It is advisable that the breaker be set up immediately, but if it must be stored, it should be kept in a clean dry place, free from corrosive gases or fumes. During construction work, particular care should be taken to protect this apparatus from moisture and cement dust as this combination has very corrosive effects on many parts. All machined parts except those on the contacts should be coated with heavy oil or grease to prevent rusting.

#### INSTALLATION

Outline, wiring and all other drawings relating to dimensions, electrical connections, and control should be on hand so that points in question are readily settled as they arise. Before any installation work is done, consult these drawings and the Instruction Book for the "Metal-Clad Switchgear" type MI-6, GEI-6256.

The complete Breaker unit has already been assembled, adjusted, inspected and tested at the factory in accordance with the detailed adjustments given later in this

book. It is possible, however, that unusually rough handling or transportation may have caused some loosening or disturbance of the apparatus to warrant a rechecking and in some cases, re-adjustment.

Before proceeding, the following precautions should be noted.

#### PRECAUTIONS

Make certain that all control circuits have been de-energized.

Never work on a closed breaker without blocking to prevent tripping.

#### CONTACTS

With the breaker closed, the top surface of the primary contact fingers (Fig. 3) should be horizontal. This can be adjusted by the operating rod adjusting screw shown in Fig. 3. The travel of the primary contact fingers should be  $3/16" \pm 1/32"$  and can be adjusted by the primary finger screws which should be wired after adjustment. The distance between the primary block and fingers with the arcing tip just in contact should be  $1/2"$  to  $9/16"$  which can be adjusted by the contact adjusting screw which is shown in Fig. 3.

The contact blades should have 40 to 60 inch-pounds torque when the blade is in a horizontal position. This can be adjusted by tightening the blade pressure adjusting screw (Fig. 3) and locking it in place with a cotter key.

#### TRIP MECHANISM

To check the adjustment of the trip mechanism close the breaker part way and trip. Then reset the mechanism slowly with the operating handle until the trip hammer is directly under the center of the trip shaft with the trip plate extensions in the raised position. The clearance between the trip hammer and trip shaft should be  $1/32"$  to  $1/64"$  which can be adjusted by shimming with washers between the trip frame and the solenoid frame.

With the breaker closed, adjust the lower stop screw so that the trip shaft has  $1/32"$  to  $1/16"$  lap on the catch of the trip hammer. Lock this screw tightly. If necessary, bend the plate extension over each firing pin so that it clears the firing pin by  $1/16"$  to  $1/8"$  when the trip plate rests on the lower stop screw. Then adjust the upper stop screw so that the end of the trip plate raises  $1/8"$  to  $1/4"$  above the firing pins when at the top of their strokes. Lock the upper stop screw tightly. Now raise each armature separately by hand to the

limit of their stroke and be sure they will each rotate the trip shaft far enough to release the trip hammer catch. Do not remove the trip shaft when making adjustments.

With the breaker in the open position, there should be  $1/16"$  to  $1/8"$  clearance between the trip shaft and the trip hammer. This adjustment is obtained by turning the two set screws on the short arm of the trip hammer in or out as required. The lock nuts should be tightened after this adjustment is made.

#### CLOSING MECHANISM

With the armature in the fully closed position, the closing toggle (4--Fig. 4) (27--Fig. 4) should be free to snap over center  $1/8"$  to  $3/16"$ . This can be adjusted by changing the position of the adjusting stop (5--Fig. 4) and by changing the number of shims (18--Fig. 4) between the armature and pole piece. With the armature in the open position, the operating crank (29--Fig. 4) should be against the buffer stop (30--Fig. 4). The buffer stop (32--Fig. 4) should be adjusted by adding or removing shims to permit unrestrained motion of closing link (25--Fig. 4) over roller bearing at end of operating crank.

A locking wire is provided to prevent the closing link from moving off of the roller bearing. In case of any excessive vibration causing the link to roll, the hook on the link engages the wire and the link is held in place.

On a normal operation of the solenoid the link operates without touching the wire, but if the mechanism overtravels, the closing link may strike the wire causing it to bend or break. A check should be made to see that the four bolts are tight and shims should be added or removed to allow the holding toggle to snap over center  $1/8"$ .

#### SUMMARY OF ADJUSTMENTS

1. Primary contact finger travel -  $3/16"$   $\pm 1/32"$ .
2. Distance between primary block and fingers, arcing tips just in contact  $1/2"$  to  $9/16"$ .
3. Contact blade torque - 40 to 60 inch-pounds.
4. Toggle distance -  $1/8"$  to  $3/16"$ .
5. Tripping mechanism adjustments.
  - a. Clearance between trip hammer and trip shaft raised and trip hammer under center of trip shaft -  $1/32"$   $\pm 1/64"$ .

- b. Lap of trip shaft on trip hammer catch -  $1/32"$  to  $1/16"$ .
- c. Clearance between firing pin and trip shaft extension, both in lowered position -  $1/16"$  to  $1/8"$ .
- d. Clearance between firing pin and trip shaft extension, both in raised position -  $1/8"$  to  $1/4"$ .
- e. Clearance between trip hammer and trip shaft with breaker open -  $1/16"$  to  $1/4"$ .

#### ACCESSORIES

For information and instructions pertaining to accessories such as relays, rectifiers, undervoltage devices, and time delay trip coils refer to the instruction book of the device in question. The numbers of instruction books and renewal parts bulletins will be found on the nameplate of the device.

#### MAINTENANCE

These breakers should be inspected every six months or more often depending upon conditions. The arc chutes on all phases should be removed and the contacts, arc runners and arc chutes inspected for excessive erosion. Arcing contacts, arc runners and arc chutes need not be replaced unless more than  $1/16"$  thickness of the material has been eroded from the surface. The chutes may be removed by removing the supporting bolts (Fig. 2), loosening the two upper coil bolts (Fig. 2), and loosening the lower bolt on the secondary coil connection (Fig. 3). The chute can then be removed, leaving the upper blowout coil assembly on the bushing. With the arc chutes off, the condition of the runners, contacts and arc chutes can be determined.

Scale formed over the surface of the chute must not be removed, but loose scale collected in the muffler should be removed. Cranks which have formed in the fins of the arc chute are to be expected in ceramic materials of this type which are subjected to severe heat. These cranks do not interfere with the operation of the device in any way and should be disregarded. If the chute has had any mechanical injury such as dropping or accidental striking of the fins which has resulted in actual breaking off of complete fins, replacement of the chute is necessary. The insulation parts on the breaker should be kept clean and dry. If the arc chutes show signs of moisture during any of these inspections, heaters should be installed to insure dryness.

The surface of the bushings should be smooth and unscratched. If the insulation surface of the bushing should become damaged

(inside or outside the breaker) the surface should be well cleaned, then retouched with either 1170 clear varnish, or 1202 (clear) or 1210 (brown) Glyptal<sup>®</sup> Enamel. Allow to dry hard and smooth.

In the case of replacement of contact blade assembly, the silver rings on the contact blade and bushing should be lubricated with Saco Vacuum grease EF-323 or equivalent.

1. Keep the mechanism free of all "gritty" deposits, and reasonably clean of "lint" or dust-like substances.
2. Make regular inspections to see that the mechanism is adjusted properly and that no defects have developed.
3. In the case of time delay current trip mechanisms, remove old oil from dashpots, flush with some non-corrosive cleaning fluid, such as carbon-tetrachloride and refill with fresh dashpot oil. This should be done at intervals dependent upon the conditions of installation, but never less frequent than once in six months.
4. In the event that the mechanism fails to operate properly:
  - A. Check applied voltage with that given on the mechanism nameplate.
  - B. Check for burned out coils or loose connections.
  - C. Look for binding in the mechanism

which may be caused by broken, bent or dirty parts.

- D. Check the adjustments of all the mechanism parts against these given.

#### 5. Lubrication:

The various parts of the mechanism are lubricated at the factory in the following manner.

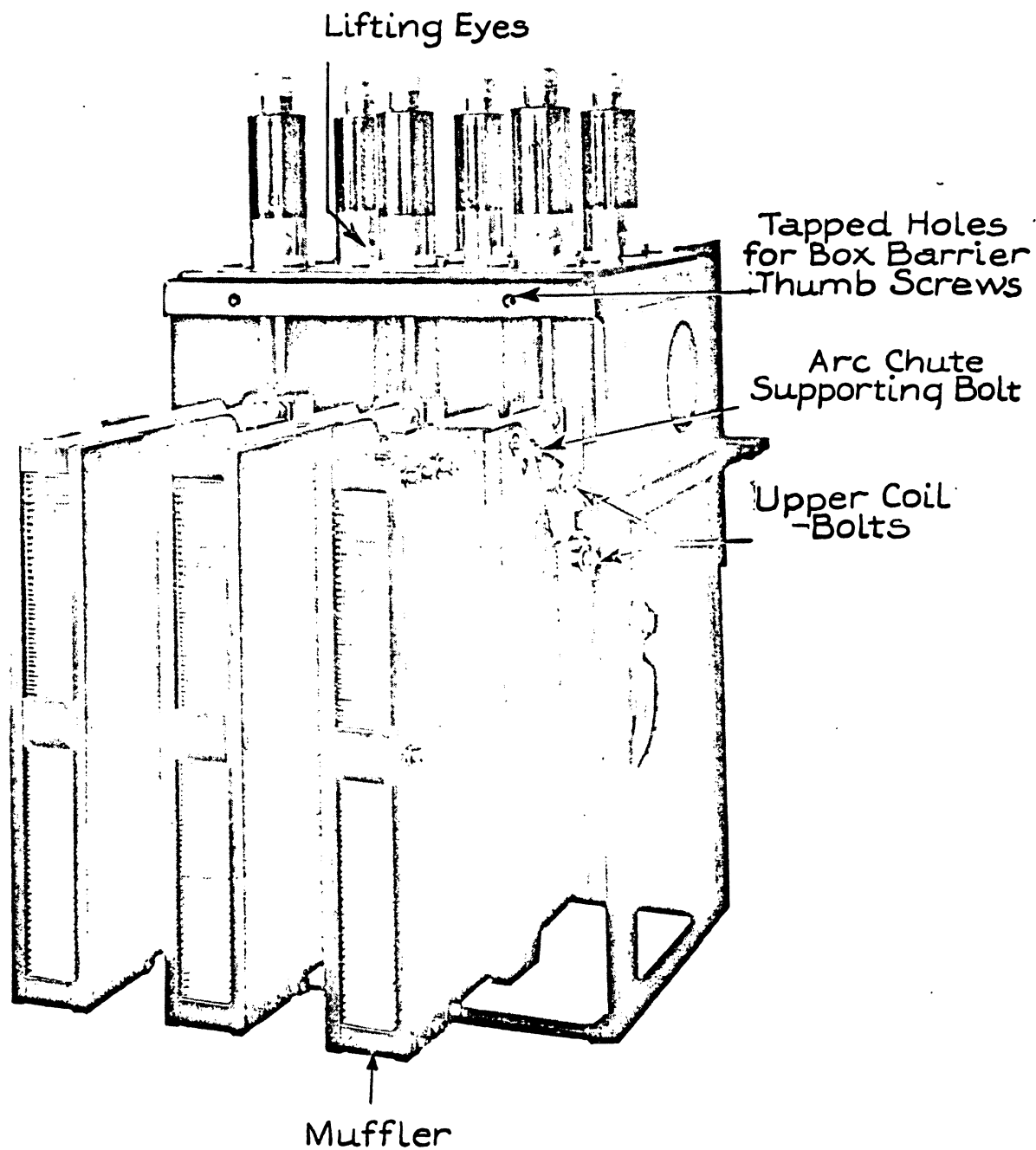
- A. All main bearings such as operating crank, closing link, tripping hammer and manual closing crank, with G.E. Lubricant D50H1C (Lubriplate #110).
- B. Operating crank roller bearing with G.E. Lubricant D50H10 (#SC-518 from Standard Oil Co. of Pennsylvania).
- C. Finished surfaces and bearings of trip shaft, hardened end of tripping hammer and inside of closing link with Rust Ban 347 from Standard Oil Company of New Jersey.

It is recommended that these lubricants or their equivalent be used during maintenance at least once a year.

#### RENEWAL PARTS

For renewal parts refer to Renewal Parts Bulletin GEG-4422. When ordering, address the nearest sales office of the General Electric Company, specify the quantity, describe the parts and give all the information that appears on the nameplate. Also give the requisition number under which the breakers were purchased if it is available.

\* Registered Trade-Mark of General Electric company.



**FIG. 2 ARC CHUTE END OF MAGNE-BLAST BREAKER WITH BOX BARRIER REMOVED.**

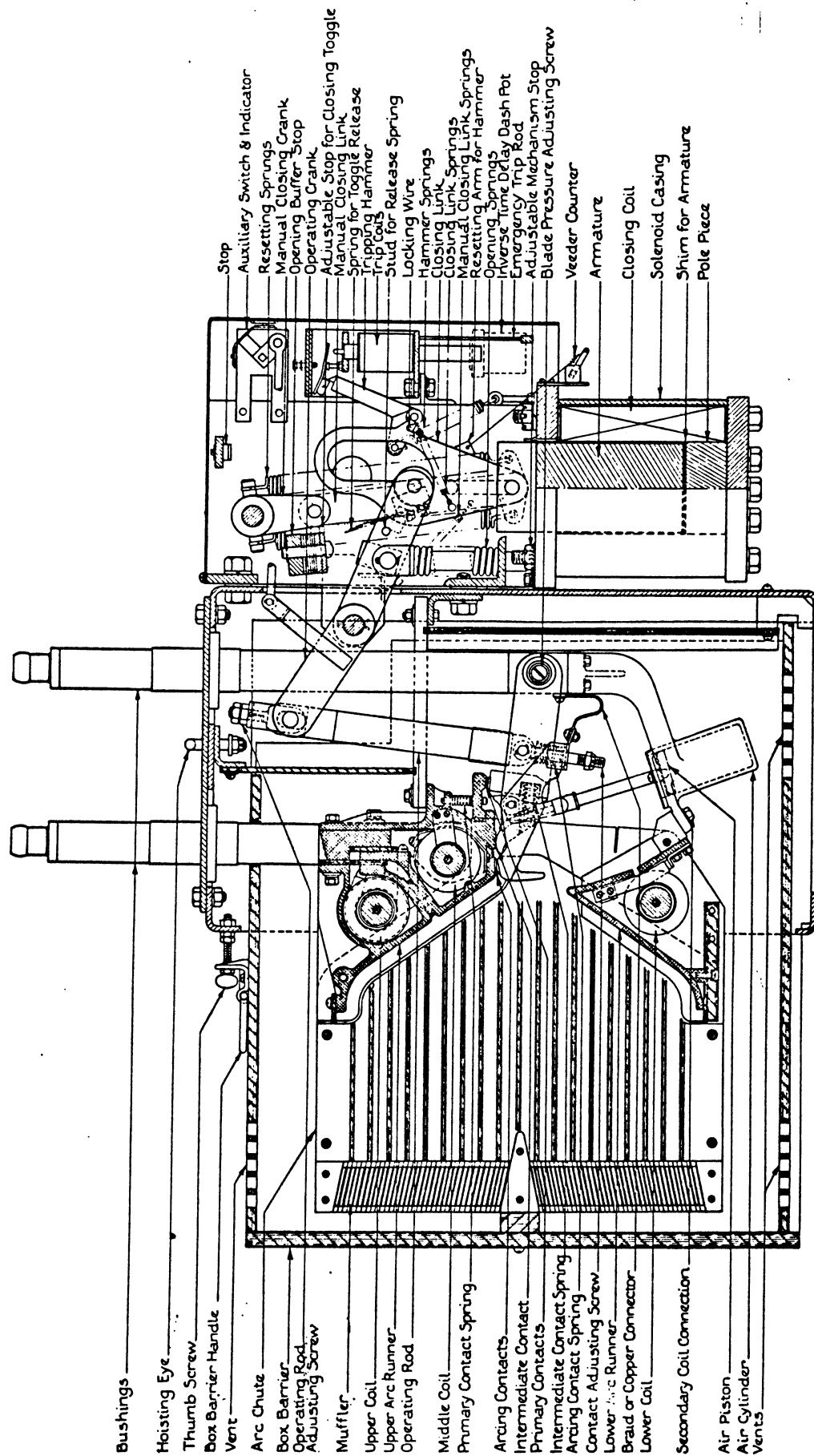


FIG. 3  
 MAGNE-BLAST AIR CIRCUIT BREAKER TYPE AM 5-100 & 5-150  
 SHOWN IN CLOSED POSITION



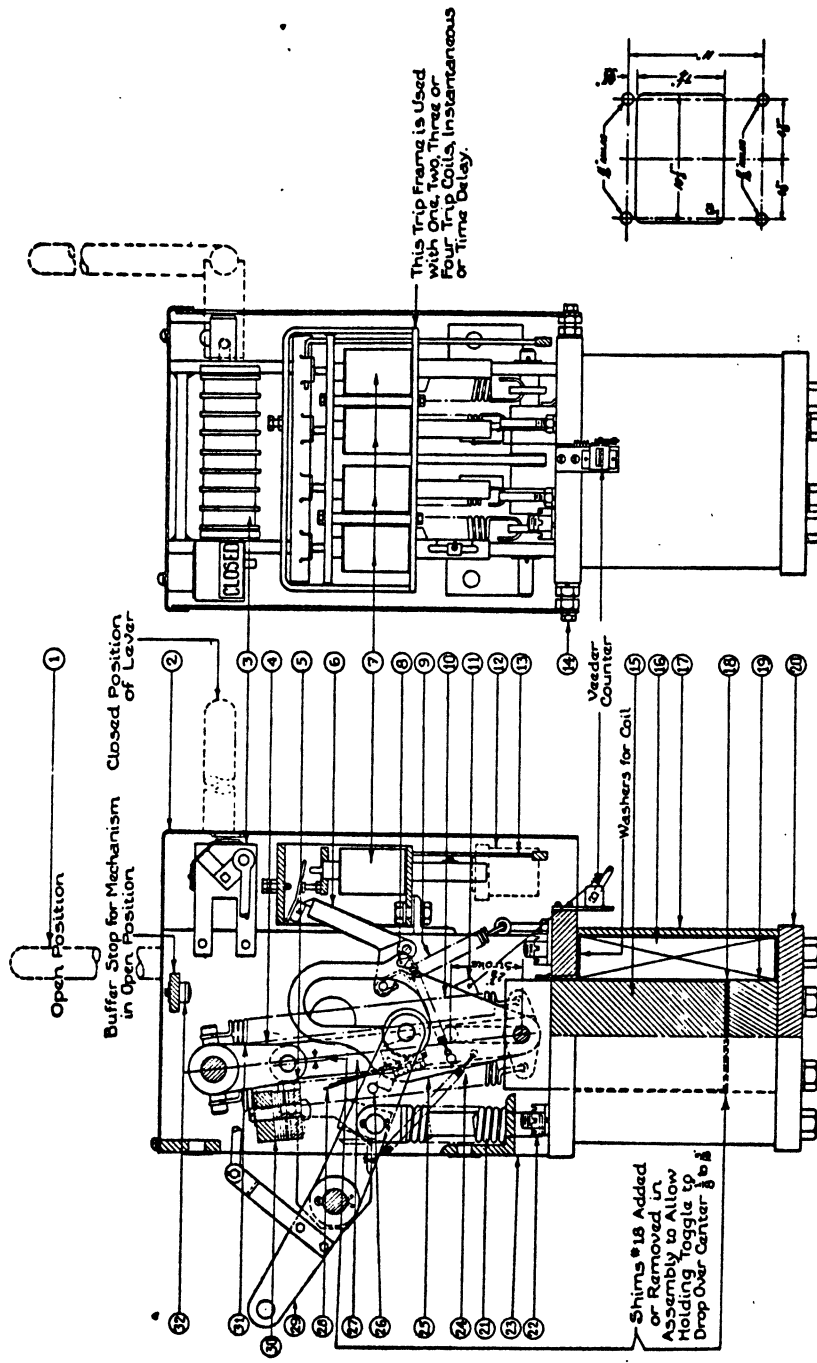


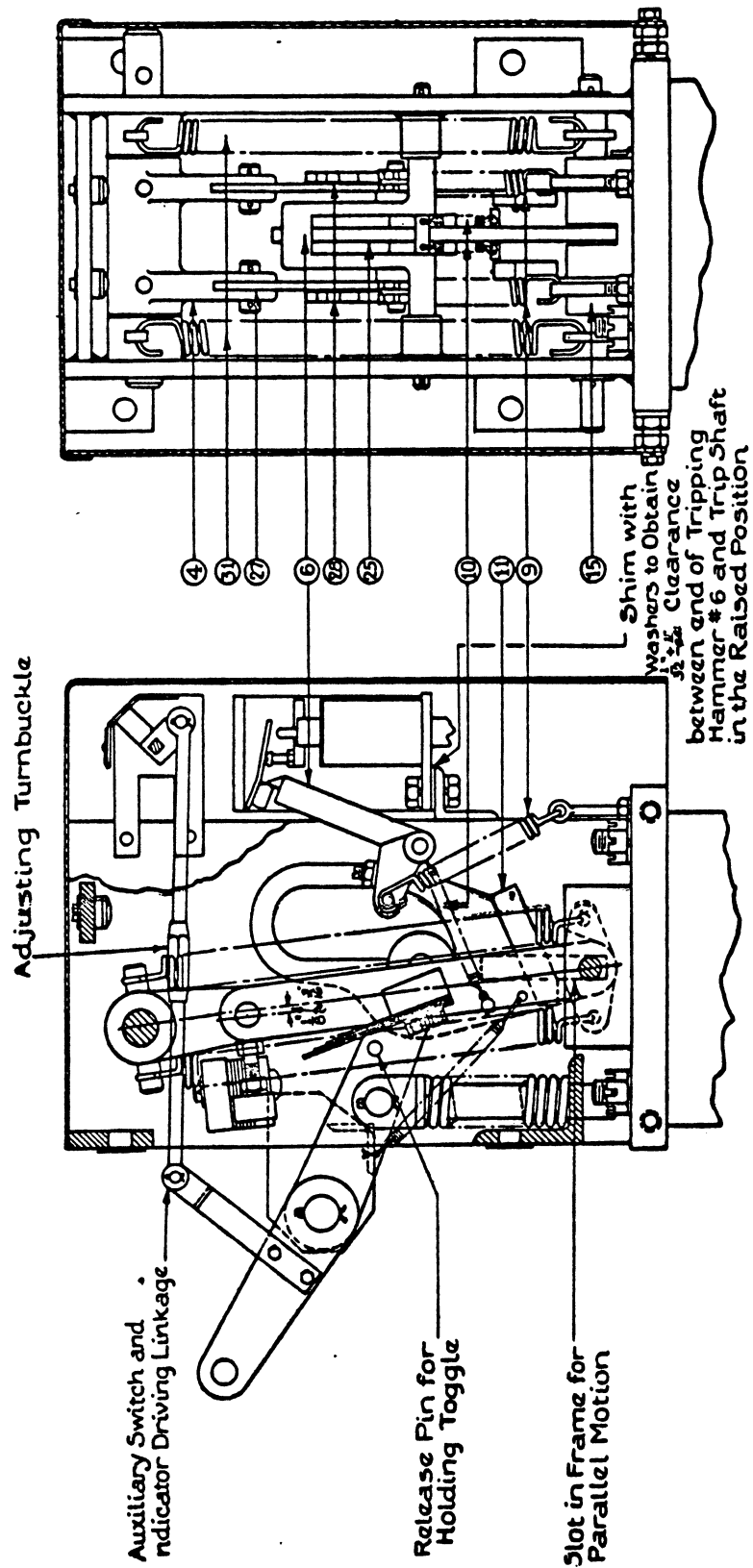
FIG. 4

FIG. 5

# SOLENOID MECHANISM FOR MAGNE-BLAST AIR CIRCUIT BREAKER

AM 5-100 & AM 5-150 SHOWN IN CLOSED POSITION

- |  |                             |                                       |                              |
|--|-----------------------------|---------------------------------------|------------------------------|
| 1 Manual Operating Handle                | 9 Hammer Springs            | 17 Solenoid Casing                    | 25 Closing Link              |
| 2 Mechanism Cover                        | 10 Closing Link Springs     | 18 Shim for Armature                  | 26 Stud for Release Spring   |
| 3 Auxiliary Switch (8 Stage) & Indicator | 11 Resetting Arm for Hammer | 19 Pole Piece                         | 27 Manual Closing Spring     |
| 4 Manual Closing Crank                   | 12 Dash Pot                 | 20 Casing Bottom Plate                | 28 Spring for Toggle Release |
| 5 Adjustable Stop for Closing Toggle     | 13 Emergency Trip Rod       | 21 Opening Spring                     | 29 Operating Crank           |
| 6 Tripping Hammer                        | 14 Cover Mounting Bolts     | 22 Mounting Bolts for Solenoid Casing | 30 Buffer                    |
| 7 Trip Coils                             | 15 Armature                 | 23 Mechanism Frame                    | 31 Resetting Springs         |
| 8 Locking Wire                           | 16 Closing Coil             | 24 Manual Closing Link Spring         | 32 Stop                      |



Note :- Part Numbers Refer to Those on Fig's. 4 & 5

FIG. 6

PROFILE OF MECHANISM  
WITH COVER AND SIDE  
OF FRAME REMOVED

FIG. 7

FRONT ELEVATION OF MECHANISM  
WITH COVER, TRIP COILS AND  
AUXILIARY SWITCH REMOVED

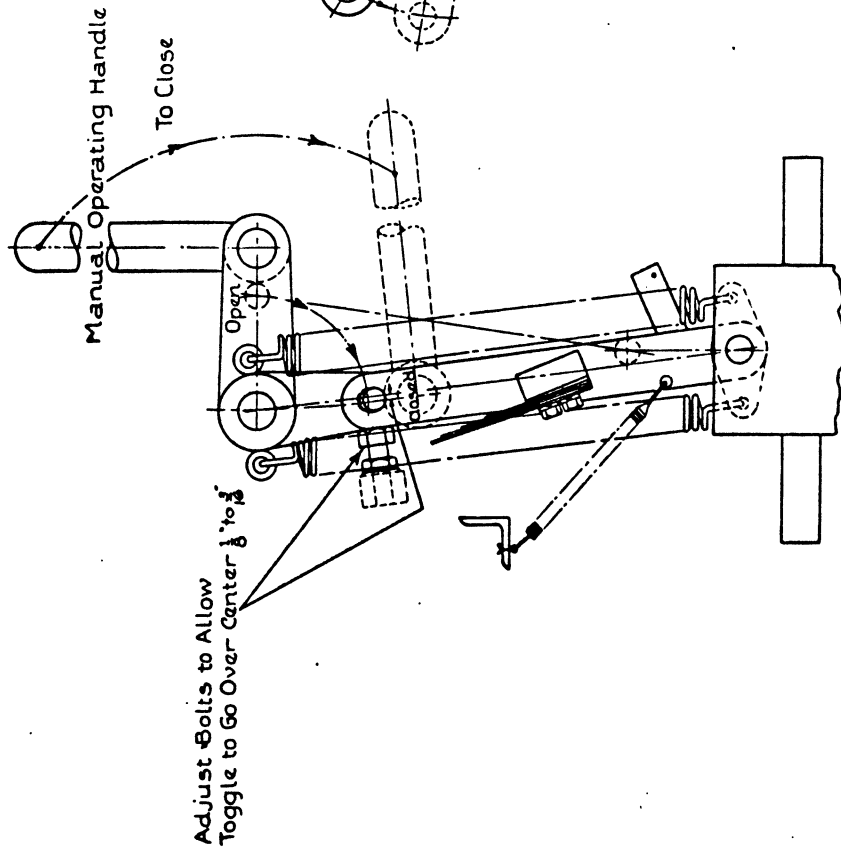


FIG. 8  
MANUAL CLOSING MECHANISM

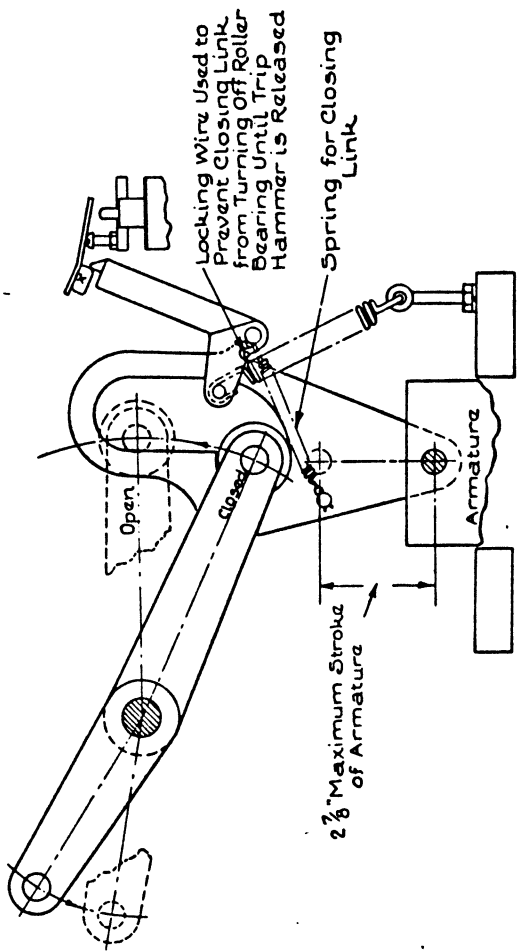


FIG. 9  
SOLENOID CLOSING MECHANISM