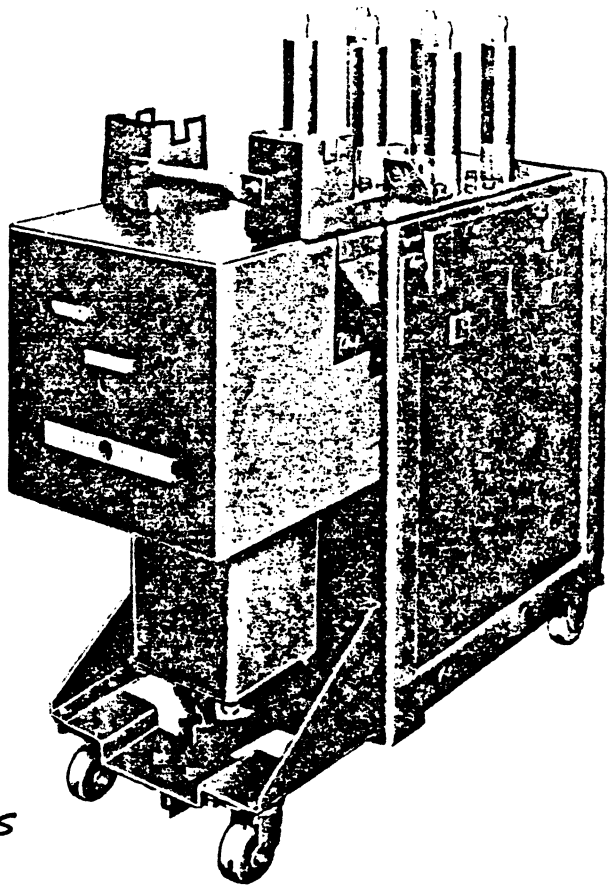
INSTRUCTIONS

Switchgear

POWER CIRCUIT BREAKERS



Magne-Blast Breaker

Types AM-5-50-4 and AM-5-50-5

With MS-9 Mechanism

1200 & 2000 AMPS

GENERAL ELECTRIC

CONTENTS

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.

MAGNE-BLAST AIR CIRCUIT BREAKER

TYPE AM-5-50-4
TYPE AM-5-50-5

WITH MS-9 MECHANISM

INTRODUCTION

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

The Am-5-50-4 Breaker is available in 1200 ampere current rating only, the AM-5-50-5 breaker is available in 600 ampere current rating only. These breakers are designed for application at a maximum circuit voltage of 5000 volts. Within the published interrupting current range, these breakers have an interrupting capacity of 50,000 KVA on a duty cycle basis consisting of two closing-opening operations with a time interval of 15 seconds between them.

The Breaker-Mechanism combinations 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.

RECEIVING, UNPACKING AND STORAGE

RECEIVING

Each Circuit Breaker is carefully inspected and then is packed by workmen experienced in the proper handling of electrical switchgear.

Immediately on 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.

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.

DESCRIPTION

The Magne-Blast Air Circuit Breakers, listed on the cover with MS-9 Mechanism may be seen in a cut-away view on Fig. 5.

It is composed of a solenoid operated mechanism bolted to a fabricated frame; six herkolite bushings with ball ends for good contact and easy installation in Vertical Lift Metal-Clad Switchgear; three operating rods of insulating material; three movable contact arms with primary and arcing contacts three stationary contact blocks and rear arc runner assemblies, containing the blow-out coils which are mounted on the back bushings; three front arc runners mounted on the arc chutes; three molded plastic "boosters" which supply air for aiding in the interruption of low currents; and three arc chutes of arc-resisting and insulating compound which segregate the three interrupting units.

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".

The complete Breaker Mechanism unit has already been assembled, adjusted, inspected, and tested at the factory in accordance with the detailed adjustments listed under the section OPERATION. 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, readjustment.

Before proceeding, the following precautions should be noted:

PRECAUTIONS

Make certain that all Control Circuits have been de-energized.

Make certain that the Primary Breaker Circuits are open and effectively grounded.

Never work on either the breaker or mechanism while in the closed position unless the Prop and Trip Latch have been wired or blocked to prevent accidental tripping.

INSPECTION

1. Check all nuts, bolts, screws, and cotter pins to make certain that they are properly tightened.

2. Inspect all wiring and make certain that no damage was done during installation. Check all terminals, screws, and connections and test the circuits for possible short circuits or grounds.

3. Engage the pin through the end of the maintenance closing lever in the notched bracket under the mechanism (see Fig. 5) and push down on the end of the lever closing the breaker. With a screw driver (CAUTION: Keep the fingers clear of the linkage as accidental tripping or fast movement could cause severe injury) rotate the prop from under the closing roller pin with the maintenance operating handle pushed all the way down and then raise the handle to open the breaker. Operate in this cycle of slow close and slow open operation several times making certain that all parts are working freely.

4. Check the operating voltage for both the closing coil and trip coil to determine, if with line drop it is within the limits specified on the nameplate. In the case of a rectifier operated mechanism, the D.C. voltage across the coil terminals with full closing coil current flowing should be 100 volts. Adjustment is possible by means of the tap resistor in the rectifier A.C. line. For detailed description of this adjustment refer to Instruction Book on Copper Oxide Rectifiers for Circuit Breaker Closing Service.

OPERATION

After the breaker has been closed and opened slowly with the maintenance closing lever and the voltage supply for both the closing and the trip coils checked as described under Installation, check the following items:

1. The wipe of the primary contact.
2. The gap between the primary contact fingers and the movable primary contact block with the arcing contacts just touching.
3. The gap between the primary contacts with the breaker in the open position.
4. The latch wipe.
5. The prop clearance.
6. The latch clearance.
7. The plunger clearance.

All these dimensions are given under Adjustments.

The MS-9 solenoid mechanism is trip free and will operate satisfactorily over the standard ranges for closing and tripping voltages as discussed below.

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.

STANDARD CLOSING AND TRIPPING VOLTAGE RANGE

Nominal Voltage	Closing Range	Tripping Range
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. AC.

PRINCIPLES OF OPERATION

The Magne-Blast Circuit Breaker utilizes magnetic forces produced by the load current through the blow-out coils to interrupt the arc. These magnetic forces together with an air stream from the "boosters" drives the arc from the contacts out along the diverging arc runners into the "interleaving" arc chutes. 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 resistance of the arc to cause interruption. Hot exhaust gases are cooled while passing through the muffler at the end of the arc chute. Easily removable box barriers encase each phase separately, segregating the interrupting units and providing insulation between phases and from each phase to the grounded frame.

For the following closing, tripping and trip-free operations Fig. 5 may be consulted.

When the solenoid coil is energized, the armature is driven upwards and the plunger rod threaded into the armature raises the roller carried by the set of links fastened to the operating crank. This

action rotates the crank and closes the breaker contacts. After the armature and linkage have reached the end of their travel, the prop rotates into position under each end of the pin through the roller and the mechanism is held in the closed position. The solenoid coil is de-energized by a relay which is actuated by the cut-off switch at the end of the armature stroke, and the armature is returned by gravity to its original position.

When the trip coil is energized, the plunger forces the latch off the roller causing the linkage to collapse which allows the opening spring to rotate the main crank and open the contacts. During the opening stroke, auxiliary switch contacts open to interrupt the trip coil circuit. After the breaker is open, the mechanism linkage returns to its normal position, and a spring resets the trip latch.

In case the trip coil is energized while the breaker is closing, the trip plunger forces the latch off the trip roller allowing the mechanism linkage to collapse and the breaker to reopen. The armature completes its closing stroke, however, and the coil is de-energized as in a normal closing operation.

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, and then the arcing contacts. The arc is then transferred to the arc runners and, as described before, into the arc chutes where it is interrupted.

ADJUSTMENTS

Adjustments described herein should be referred to not only during placement of breakers in service but also during periodic inspection of the breakers, and should be followed whenever it becomes necessary to repair or replace parts that have become worn or defective in service.

Instructions for the replacement of parts will be found under the later heading of Maintenance.

PRIMARY CONTACTS (Figs. 1 and 5)

With the breaker in the closed position, the top face of the primary contact fingers should be horizontal. This can be adjusted by means of the operating rod adjusting screw. To adjust, remove the pin fastening the adjusting screw to the mechanism crank and push the contact blade far enough closed so the adjusting screw can be turned. To increase the primary contact travel, turn the adjusting screw in the direction to lengthen the rod, and to decrease the primary contact travel, turn the screw to shorten the rod ($\frac{1}{2}$ turn gives approximately 1/32" change in contact travel). Reconnect the operating rod to the crank, and close the breaker manually to check the adjustment.

After the above adjustment has been made, the travel of the contact surface of the primary contact finger should be measured on a manual closing operation. This travel or wipe should be 1/8" or over. If enough material has been removed from the primary contacts, to reduce this travel below 3/32", the primary contacts should be replaced.

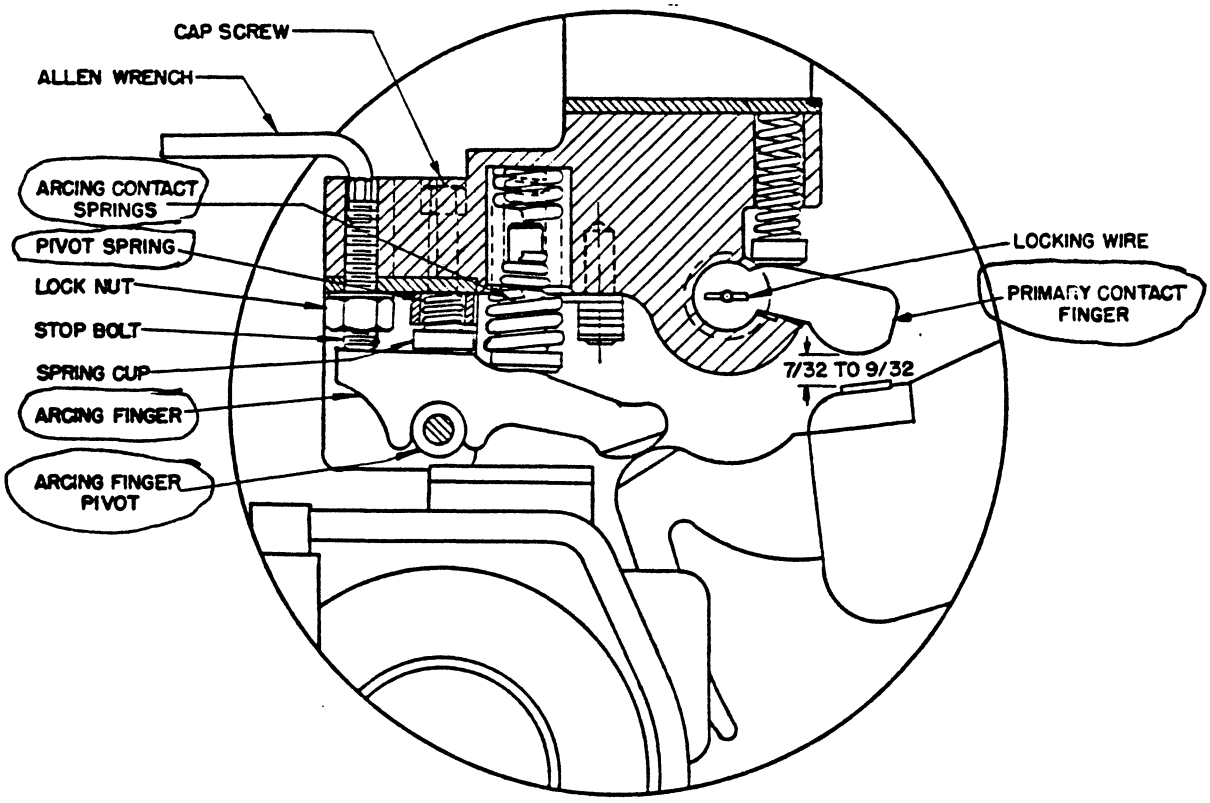


FIG. 1
CONTACT ASSEMBLY

(K-6496371)

ARCING CONTACTS (Fig. 1)

Close the breaker until the arcing contacts just touch. The gap at the primary contacts should be 7/32" to 9/32". To adjust, the following procedure should be followed: -

(a) Remove the arc chute.

(b) Loosen the lock nut on the arcing contact stop bolt.

(c) With Allen wrench, turn the stop bolt until the arcing contacts just touch when the gap at the primary contacts is 7/32" to 9/32".

(d) Lock the stop bolt in position with the lock-nut, and close the breaker manually to check the adjustment.

(e) Replace the arc chute.

CONTACT GAP (Figs. 1 and 5)

With the breaker tripped from the closed position, the minimum distance from the primary contact fingers to the edge of the contact blade should be 4" to 4-3/8". At the same time, the clearance between the underside of the contact blade and the top of the booster cylinder should be at least 3/8" to 3/4". To adjust for these conditions, remove the cotter pin from the mechanism stop nut and turn the stop nut to increase or decrease the contact gap. If the old cotter pin hole cannot be used for the cotter pin to positively lock the stop nut, a new hole should be drilled. After the cotter pin has been replaced, the breaker should be closed and tripped and the adjustment checked. Note: A change in this adjustment may require a change in the adjustment of the plunger rod in the mechanism as described later.

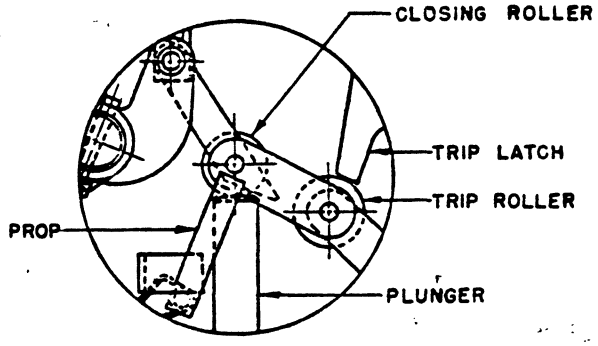


FIG. 2
MECHANISM LINKAGE CLOSED POSITION

Latch Wipe (Fig. 2)

The wipe of the latch on the trip roller should be from 1/8" to 1/4". This can be determined easily by putting a film of grease on the latch, closing the breaker part way, and tripping. To adjust, add or remove washers under the head of the stop bolt located near the top of the latch on the trip coil frame.

Prop Clearance (Fig. 3)

With the breaker closed as far as possible with the manual handle, the clearance of the pin through the closing roller over the prop should be 1/32" to 3/32". This can be adjusted by dropping the closing coil and screwing the plunger rod into or out of the armature. Note: Two set screws are used to lock the plunger rod in position in the armature. If the rod adjustment is changed the rod must be spotted in the correct position and the set screws replaced.

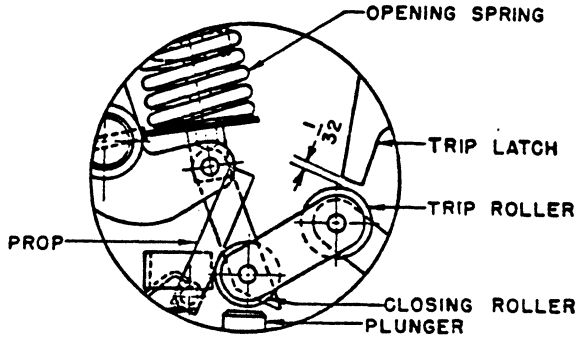


FIG. 3
MECHANISM LINKAGE OPEN POSITION

Latch Clearance (Fig. 3)

The clearance between the trip latch and roller with the breaker open should be approximately 1/32". This can be adjusted by means of the stop bolt in the front of the mechanism frame near the bottom. The lock nut should be fastened securely if any adjustment has been made.

Plunger Clearance

With the breaker in the open position, there should be at least 1/16" clearance between the plunger and closing roller. To increase this clearance, the brackets to catch the armature in the open position should be lowered by placing a shim between them and the coil bottom plate.

After the foregoing items have been checked and any adjustments that may have been required are completed, the breaker may be placed in service.

MAINTENANCE

Dependable service and safety of power distribution equipment is based on the unfailing performance of the circuit breaker.

To maintain such service, it is recommended that a definite schedule be set up and adhered to for the purpose of properly lubricating the wearing

parts. A dependable and observing attendant can be expected to forestall mishaps by reporting loosened nuts, scored surfaces, and other evidences of possible trouble.

In addition, but at less frequent intervals periodic inspection should be made at which time the apparatus should be given such servicing as may be found desirable or necessary. In case of highly repetitive operation it is recommended that the first Periodic Inspection be made after not more than 500 operations to determine whether there has been any loosening up of parts. The interval between later Periodic Inspections should depend on operating conditions and should be determined by experience.

PERIODIC INSPECTION

At this time a thorough inspection should be made of all parts of the breaker and mechanism.

Contacts

After removing the box barrier, the contacts on the two outside phases can readily be inspected. The contacts on the center phase can be seen with the aid of a mirror and flashlight. If the contacts are in good condition, there is no need of removing the arc chute. If, however, the surface of the contacts needs smoothing up with a fine file or sand paper, the arc chutes can be removed as described under the heading REPLACEMENT OF PARTS.

Arc Chute

If the arc chutes are removed for contact maintenance, and are for any reason disassembled for inspection, the following points should be noted:

1. Scale formed over the surface of the chute must not be removed but loose particles collected in the muffler should be blown out.

2. Cracks which have formed in the fins of the arc chute are to be expected in ceramic materials of this type when subjected to the severe heat of an arc. These cracks do not interfere with the operation of the device in any way and should be disregarded. If the chute has had any mechanical injury due to dropping or accidental striking which has resulted in actual breaking off of fins, replacement of the chute is necessary.

Insulation Parts

The insulation parts on the breaker should be kept clean and dry. Smoke or dust collected between inspection periods should be wiped off, and if dampness is apparent, heaters should be installed to insure dryness.

Bushings

The surface of the bushings should be smooth and unscratched. If the insulation surface should become damaged, it should be well cleaned and then re-touched with either 1170 clear varnish or 1202 (clear) or 1210 (brown) glyptal. Allow to dry smooth and hard.

Mechanism

Careful inspection should be made to check for loose nuts or bolts and broken cotter pins. The latch surface should be inspected for wear and the surfaces of the rollers should be inspected for chipping or other evidences of damage. Lubrication should be done in accordance with the instructions under the heading LUBRICATION.

LUBRICATION

During assembly at the Factory, all wearing parts and bearing surfaces on both the breaker and mechanism have been coated with a film of medium soft lubricating and rust resisting greases. All main bearing surfaces such as the prop face are lubricated with G.E. Lubricant D50H1C (Lubriplate #110); Roller bearings with G.E. Ball Bearing Lubriplate D50H1E; Pivots of the contact arms with G.E. Lubricant #5485 (Socony-Vacuum #323).

In case of an overhaul or repair where the breaker and mechanism parts have been disassembled, it is recommended that these greases (or similar) which are available in 1 lb. or 5 lbs. can be used.

REPLACEMENT OF PARTS

Before maintenance or replacement of contacts, the arc chutes must be removed.

Arc Chute Removal (Fig. 5)

To remove the arc chutes, first loosen the two arc chute supporting bolts (one on each side of the chute) and remove the arc runner connection bolt. The arc chute is then free to be pulled away from the mechanism.

Primary Contacts (Fig. 5)

The primary contacts are designed to carry the normal load current with a minimum amount of heating and are provided with an inlaid block of silver to minimize the effects of wear. The stationary primary contacts consist of 4 fingers for the 1200 ampere breaker and are mounted along with the associated springs on the support casting carried by the rear bushing. The fingers may be replaced after removing the locking wire through the pivot end.

The movable primary contact is carried on the blade hinged at the front bushing. The arc chute must be removed (see section Arc Chute Removal) and the following steps should be followed for replacement of the contact blade:-

(a) Remove the bolt fastening the arc chute supporting bracket to the lower end of the front bushing, and remove the bracket.

(b) Disconnect the puffer tube and operating rod form the contact blade.

(c) At the blade hinge, remove the bolt, springs, spacers (only on 600 amp. breaker) and thimbles, see Fig. 4.

(d) Slip the contact blade off the end of the bushing and withdraw.

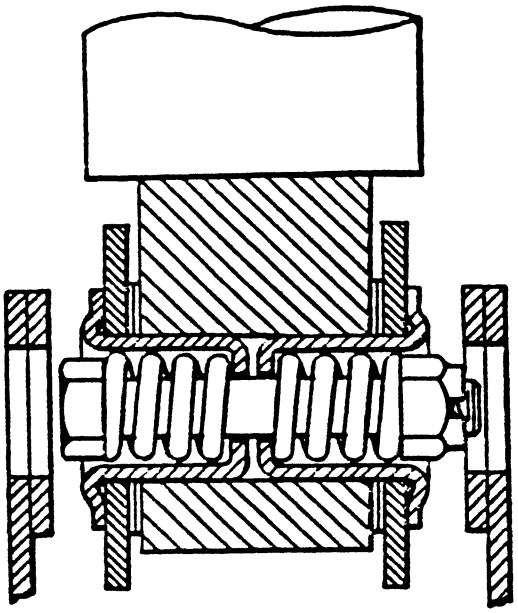


FIG. 4
CONTACT BLADE HINGE

Reassemble the replacement parts making certain that all cotter pins are replaced. If a new hinge bolt has been used, or if it seems desirable for any other reason, the pressure at the hinge joint should be checked by measuring with a spring balance the force required to swing the contact arm. For both the 600 and 1200 ampere breakers, this force should be between 40 and 60 pound-inches.

Arcing Contacts

The movable arcing contact is bolted on the front of the contact block on the primary contact blade and is more convenient to replace with the contact blade removed.

The stationary arcing contact (see Fig. 1) is carried by the bracket fastened to the lower side of the rear bushing. To remove, take out the two Allen head cap screws from the top. To replace, the following steps should be followed:

(a) Remove lock nut and stop bolt.

(b) Place arcing finger on pivot pin.

(c) Place fibre spring cut on top of the arcing finger.

(d) Place pivot spring guide block in position on the underside of the top of the bracket.

(e) Insert spring through the top of the bracket, spring block and into the spring cup.

(f) Place the assembly on the underside of the bushing, and engage the cap screws one turn in the spring guide block.

(g) Insert the arcing contact springs and guide.

(h) Tighten the cap screws, and reassemble the stop bolt and lock nut.

The contacts should be adjusted as described previously under the section ADJUSTMENTS.

RENEWAL PARTS

It is recommended that sufficient Renewal Parts be carried in stock to enable the prompt replacement of any worn, broken or damaged parts. A stock of such parts minimizes service interruptions caused by breakdowns, and saves time and expense. When continuous operation is a primary consideration, more renewal parts should be carried, the amount depending upon the severity of the service and the time required to secure replacements.

A complete list of renewal parts is contained in Renewal Parts Bulletin GEF-3391. Those parts subject to wear in ordinary operation and to damage or breakage due to abnormal conditions are marked as recommended renewal parts.

When ordering renewal parts, address the nearest General Electric Sales Office, specify the quantity required and give the catalog number from the Renewal Parts Bulletin.

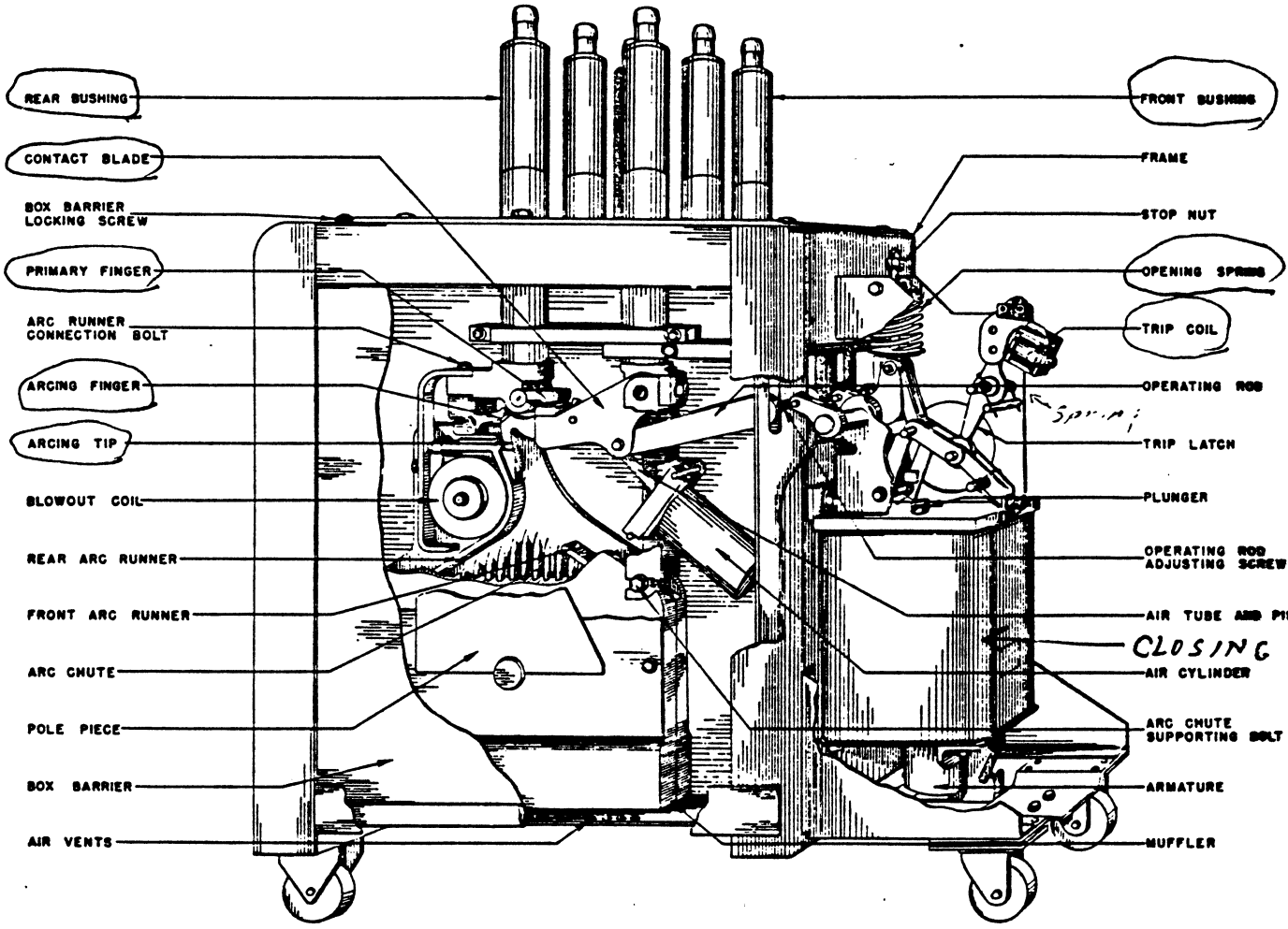


FIG. 5

TYPICAL MAGNE-BLAST AIR CIRCUIT BREAKER
TYPE AM 5-50 WITH MS-9 MECHANISM