INSTRUCTIONS

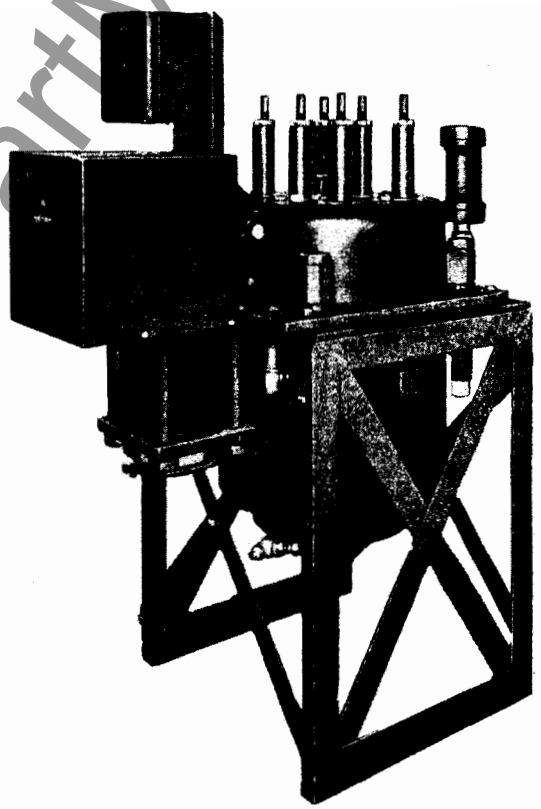
GEI-11313T

SUPERSEDES GEI-11313S AND GEF-3401

OIL-BLAST CIRCUIT BREAKER

Types

FK-255-100
FK-255-150 (Formerly FKR-255A)
FK-255-250 (Formerly FKR-255B)
FK-255-500 (Formerly FKR-255C)



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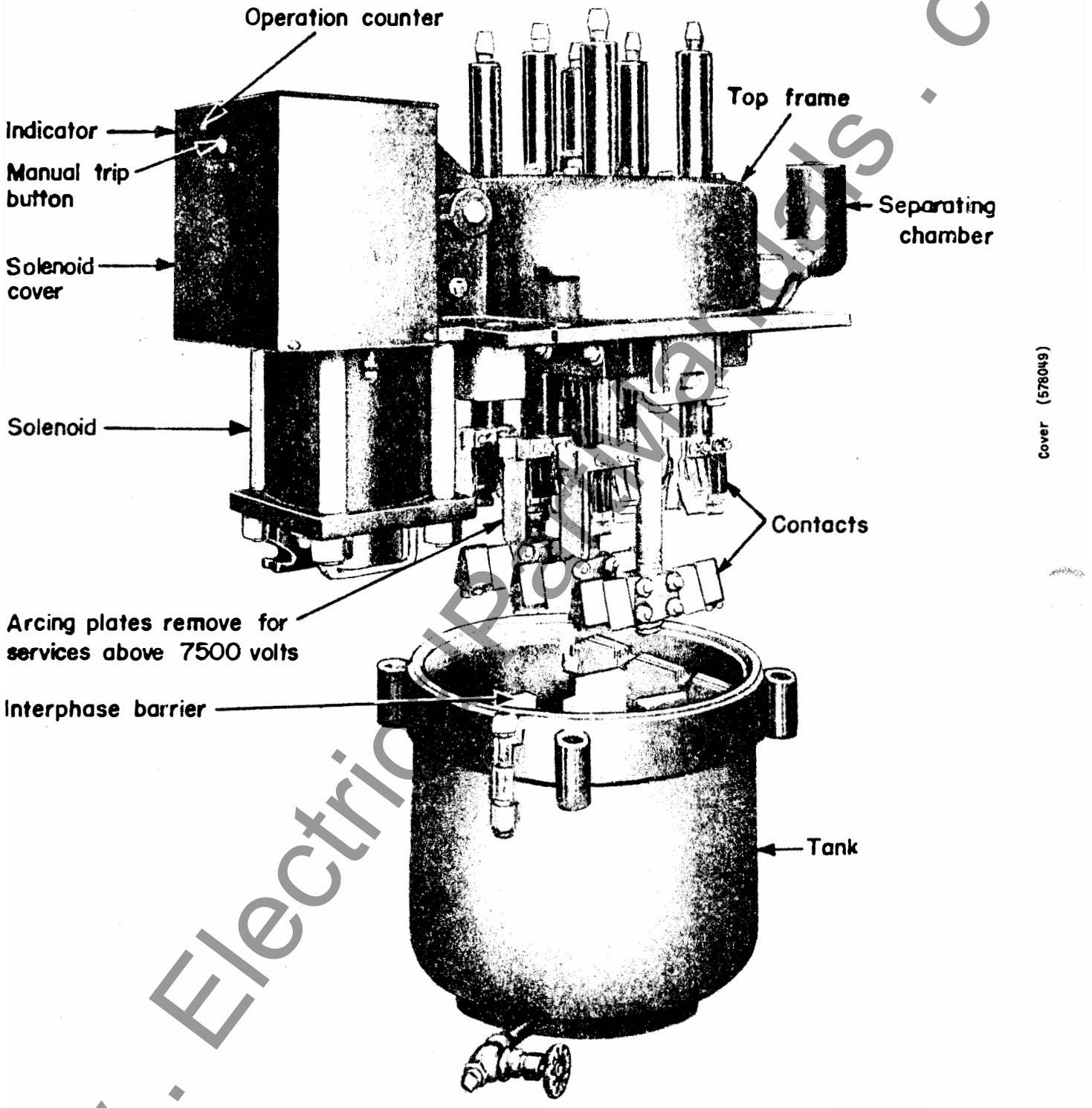

Fig. 1 Type FK-255 Oil Circuit Breaker and Type MS-4 Solenoid with Tank Lowered to Show Interior of Breaker

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OIL-BLAST CIRCUIT BREAKER
TYPE FK-255

INTRODUCTION

The FK-255 is a triple pole, single throw, oil circuit breaker enclosed in a common tank. It may be mounted upon a stationary steel frame; inside a cubicle, cell or switch-house; or installed as a removable element in metal clad switchgear.

The FK-255 circuit breaker is normally supplied with an integrally mounted solenoid operating mechanism type MS-4. The lower ratings can be supplied with an integrally mounted manual operating mechanism type MH-9. For special applications, the FK-255 breaker can also be supplied with a separately mounted solenoid operating mechanism type SD-18. (Refer to GEI-72602.)

Figs. 1, and 3 show an FK-255 and MS-4 combination. The mechanism is mechanically trip free in any position; that is, the oil circuit breaker can be tripped open at any time during the closing stroke.

The mechanism will operate the breaker within the ranges for closing and tripping voltages as stamped on the nameplate. These voltages are to be measured at the solenoid terminals with full operating current flowing. Storage batteries are recommended for the source of power.

The relays used for the control of the mechanisms prevent pumping action in case the breaker is closed in an overcurrent; and permit trip free operation over the entire stroke. All control circuits should be fused.

A maintenance operating lever is provided for operating solenoid actuated breakers when servicing or adjusting. It should not be used for closing breakers on an energized circuit. A bracket beneath the solenoid frame accommodates this portable lever.

RECEIVING, HANDLING AND STORAGE

RECEIVING AND HANDLING

Each oil circuit breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Breakers integral with mechanism are packed for shipping in the closed position; that is, with contacts closed, opening springs charged and the mechanism trip latch cocked. For safety, the trip latch shaft is prevented from rotating (which would trip the breaker) by wiring it securely to the frame.

Breakers with separate operating mechanisms and breakers without operating mechanisms are also shipped in the closed position. The breaker cranks are held in the closed position with a wood block wedged between these cranks and the front of the breaker frame. This block should be removed before the breaker is put in service.

Important: 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 Sales Office should be notified.

It is expected that due care will be exercised during the unpacking and installation of the breaker so that no damage will occur from careless or rough handling, or from exposure to moisture or dirt. Care should be exercised to prevent tools from striking either the crate or any part of the breaker. Loose parts associated with the breaker are always included in the same crate. Check all parts against the packing list to be sure that no parts have been overlooked.

STORAGE

It is recommended that the breaker be put into service immediately in its permanent location. If this is not possible, the following precautions must be taken to insure the proper storage of the breaker:

1. The breaker should be carefully protected against condensation, preferably by storing it in a warm dry room, since water absorption has an adverse effect on the insulation parts. Circuit breakers for outdoor metal-clad switchgear should be stored in the equipment only when power is available and the heaters are in operation to prevent condensation.
2. The breaker should be stored in a clean location, free from corrosive gases or fumes; particular care should be taken to protect the equipment from moisture and cement dust, as this combination has a very corrosive effect on many parts.
3. Machined parts of the operating mechanism, etc., should be coated with a heavy oil or grease to prevent rusting.

If the breaker is stored for any length of time, it should be inspected periodically to see that rusting has not started and to insure good mechanical condition. Should the breaker be stored under unfavorable atmospheric conditions, steps should be taken to dry out the breaker before it is placed in service.

INSTALLATION

Outline drawings show the general arrangement, dimensions, location of holding down bolts and conduits and other information necessary for proper installation of the breakers.

When the breaker and operating mechanism are shipped assembled together they have been tested in that relation at the factory and all adjustments have been made. Under these circumstances, it is only necessary to check the adjustments before putting the breaker into service. When the breaker is not shipped assembled with the operating mechanism, it is necessary to make all adjustments.

LOCATION

For framework mounted breakers, it is only necessary to correctly locate and fasten the frame in position on its foundation. The foundation bolts should be left loose to permit the frame to be properly plumbed and leveled by inserting shims under the feet of the frame, where necessary. After this has been done, the foundation bolts should be tightened and the frame securely fastened to its foundation.

Breakers for cell mounting should be installed as shown on the outline drawing. Precautions should be taken in the

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

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

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construction of the cell to insure proper location of the inserts for supporting the breaker. The cells should be designed for adequate ventilation in the top and bottom in order to permit free circulation of cooling air.

Breakers on trucks or frames, in switchhouses or cubicles, are assembled as complete shipping units in the factory. For metal clad switchgear, breakers are shipped separately, and directions for their installation as given in the Metal Clad Switchgear Instruction Book must be properly observed.

MANUAL OPERATION

Manual operation must be used for all preliminary trials, or when the breaker and mechanism must be checked while operating slowly, to see that no defect or damage has been sustained since leaving the factory.

First the cover should be unbolted and removed from around the mechanism to expose the linkage.

Now apply the maintenance operating lever (manual closing device) in the bracket provided for it under the solenoid, see Fig. 3. Depress the lever to raise the idle armature and plunger until the latter bears against the toggle linkage roller.

A good final downward pressure on the lever is now required to relieve the load (due to the compressed breaker springs) from the supporting prop. The freed prop, accessible through holes in the side plates, should now be rotated counter-clockwise from under the toggle; while, at the same time, keeping firm control on the manual lever.

The lever now should be raised, gradually, to effect the initial trial breaker slow-opening operation.

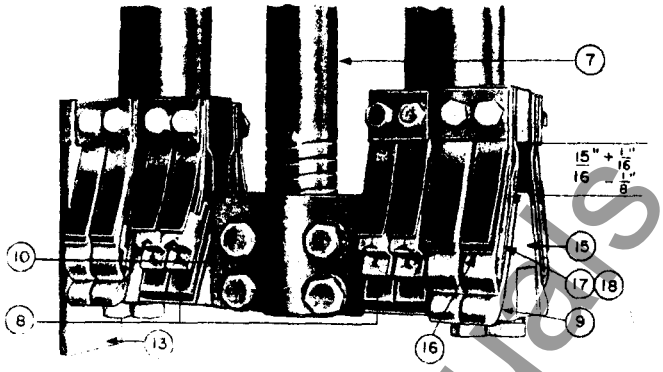
When the manual lever is depressed again, through a full stroke, it will close the breaker, compress the opening springs, and the prop will snap into its restraining position at the end of this closing stroke.

This slow-open-close cycle should be repeated several times to make sure that all working parts of the breaker and mechanism perform properly and smoothly; after which the check wire may be removed from the trip latch and the breaker may be tripped manually by pressing the hand trip button.

At this time the following adjustments should be checked:

1) Stop clearance (page 6)
2) Prop clearance (page 6)
3) Trip latch wipe (page 6)
4) Contact alignment (page 6)
5) Arcing plates (page 7)

First, however, by means of the tank lifting device, the breaker tank may be unbolted, lowered and removed to expose contacts.



7. Operating Rod
8. Main Contacts
9. Secondary Contact
10. Blade
13. Arcing Plate (Remove for Services Above 7200 Volts)
15. Removable Arcing Tip for Blade
16. Outer Spring
17. Stop
18. Pivot for 17

Fig. 2 Proper Contact Adjustment with Contacts in Closed Position

FILLING THE TANK WITH OIL

With all adjustments completed, the tank should be filled with oil. Before filling with oil, all accessories, such as valves and gauges must be assembled on the breaker and made oil tight. The threads should be filled with G.E. #1201 (red) * Glyptal enamel, or equivalent, before putting in place. Stuffing and gland nuts must be tightened to insure oil tight joints.

In filling, care must be taken so that moisture will not be absorbed by the oil during the filling process. When drums of oil are brought into a place warmer than they are, they should be allowed to stand before opening until there is no condensation on the outside and until they are thoroughly dry. If the installation is outdoors, the preparation and filling should be done on a clear dry day or protection of some kind provided against moisture being absorbed.

Metal, synthetic rubber or oil proof rubber hose must be used instead of natural rubber hose, because the latter may deteriorate and permit impurities to enter the clean oil.

With the tank removed, fill it with oil to within 2 inches of the normal level which is indicated on the gauge glass. After the tank is raised, obtain the final level by filling through the fill plug or draining off through the drain valve. A pipe plug is screwed into the outlet side of the drain valve for shipping purposes. After filling with oil, a final test of operation should be made before putting the breaker into service.

CONNECTIONS

PRIMARY CONNECTIONS

After the breaker has been mounted, electrical connections can be made. Before making these, every precaution must be taken to see that all leads to be connected to the oil circuit breaker are dead.

Leads should be brought down from above if possible. Ample room must be provided between these leads and parts of the station, such as walls, channels, and framework. Leads should be properly supported so that the breaker bushing is not subjected to unnecessary strains. The bushings should not carry cable or bus bar strains. To avoid heating, the connecting leads must be of a current carrying capacity at least equal to that of the current carrying part of the breaker.

Fig. 1 shows bushing studs with silvered spherical terminals for metal clad switchgear application. For other applications, bushing studs are threaded as in Fig. 3, for clamp type terminals for bar or cable connections. Make sure that terminals have good clean electrical contact, afterwards taping up the connections with varnished cambric and non-elastic webbing. Do not disturb studs in their bushings.

CONTROL CONNECTIONS

All control wire should be run in conduit insofar as is practicable. Control wires must be run separately and remote from high tension leads and must not be run in the same duct or parallel to the high tension leads unless the distance separating the two sets of wiring is sufficient to prevent possible communication between them as a result of short circuits. Control wiring of adequate size, should be used so that with full operating current flowing to the operating mechanism, the voltage across the terminals of the mechanism will be within the limits specified for the range of control voltage as stamped on the nameplate.

GROUND CONNECTIONS

Each oil circuit breaker should be permanently grounded. The ground cable should be able to carry 25% of the current rating of the breaker, but should not be smaller than #4/0. A good permanent low resistance ground is essential for adequate protection. A poor ground may be worse than no ground at all, since it gives a false feeling of safety to those working around the equipment and also may result in utlimate loss of life or damage to the apparatus.

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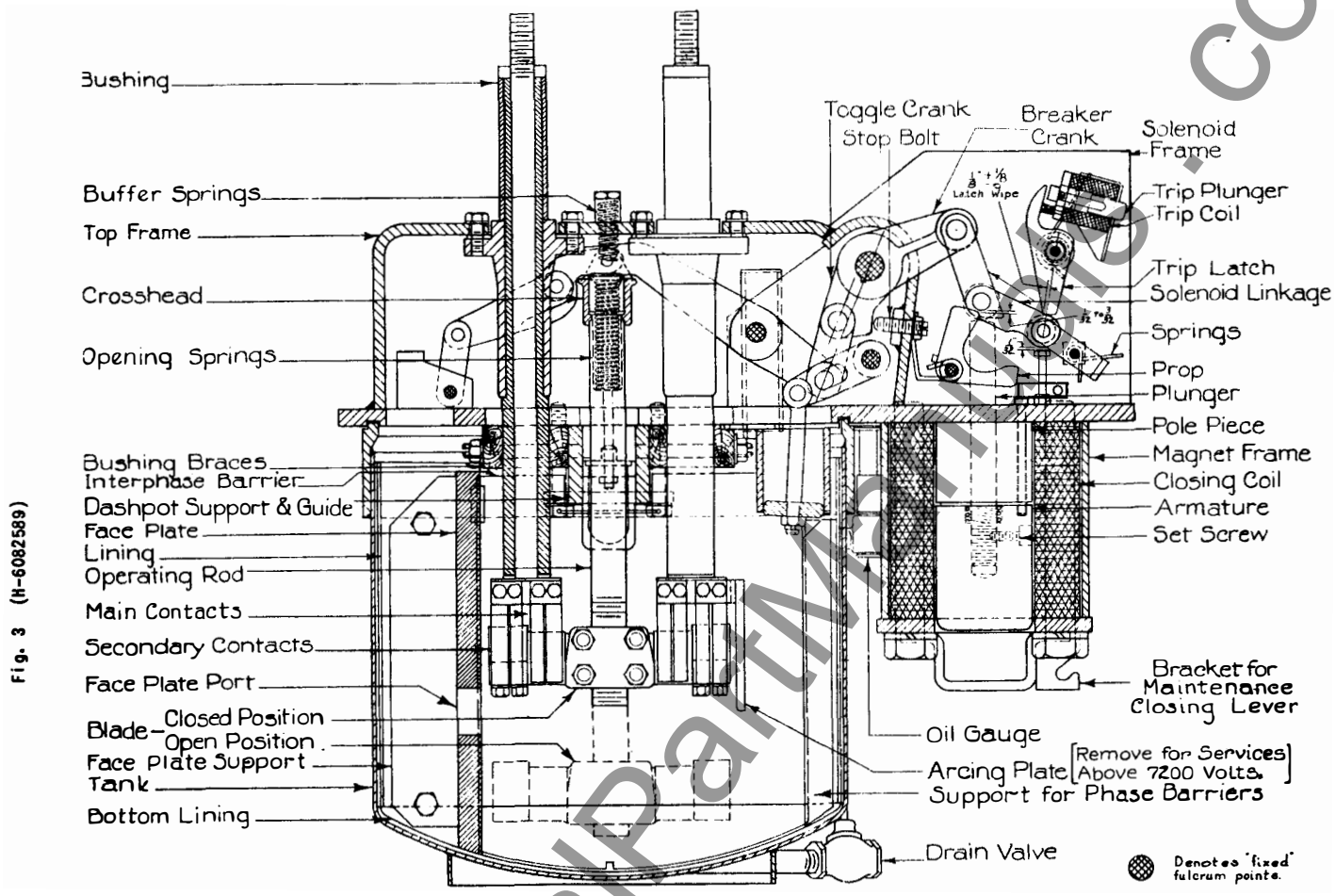

Fig. 3 (H-6082589)

Fig. 3 Representative Type FK-255 Oil Circuit Breaker

DESCRIPTION

Each unit is constructed of a fabricated top frame with a cylindrical oil tank. The top frame supports the bushings, breaker mechanism, operating mechanism (in the case of the integral mounted type) and the contacts. The tank is removable, being fastened to the top frame by short bolts. With the tank removed, all breaker parts are readily accessible.

The breakers are furnished with either integral or separately mounted operating mechanism. The type SD-18 solenoid mechanism is used in the separately mounted type and the type MS-4 solenoid and MH-9 manual mechanisms are applied to the integral type. Fig. 3 shows the type MS-4 solenoid application on the 100, 150, 250 and 500 MVA breakers up to and including 2000 ampere size. These mechanisms are of the latest trip free type. The motion of the mechanism plunger is transmitted to the breaker linkage in the top frame by means of the toggle crank.

Oil dashpots absorb the energy of the moving parts on opening. These dashpots are designed to utilize the oil in the tank.

Opening springs, mounted in the dashpot support and guide, are actuated by the crosshead motion to insure positive opening in all positions. Buffer springs, mounted in the top frame and engaging the crosshead, limit overtravel on closing and also add to the initial effect of the opening springs.

CONTACTS

The contacts illustrated in Fig. 2 consist of movable wedge shaped blades which complete the circuit between two sets of stationary fingers. Each set of fingers consists of silvered main current carrying fingers and either silver or elkonite depending on MVA rating secondary arcing fingers. The blade is made up of silvered main current carrying section and either silvered or elkonite removable arcing tips. The longer secondary fingers and the larger tip section insure that the circuit is made first and broken last on these contacts. Thus, during current interruption, the arcing is confined to these surfaces and the primary current carrying parts are not affected. The arcing contacts should be renewed before they are burned away to a point that arcing may take place on the main contacts.

The number of finger contacts vary with the interrupting and current rating of the breaker.

BUSHINGS

Bushings comprise a solid copper core or stud that is insulated from the adjacent breaker parts by a pressed-on cyclinder of insulating compound of resin-impregnated paper. These * Herkolite bushings should be maintained clean and the glossy surface must be kept unmarred to prevent moisture absorption. If the surface becomes defaced either inside or outside the breaker, it should be scraped or sanded down and refinished with a good grade of spar varnish. To restore the original finish and appearance, use G. E. #1201 (brown) * Glyptal enamel instead of the clear varnish. Use a clean dry cloth to clean bushings that have simply become dirty in service. DO NOT USE CARBON TETRACHLORIDE.

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VENTING

Oil vapor and gases generated during circuit interruption are vented from the inside of the breaker through a pebble-filled separating chamber that is connected to the top frame as shown in Fig. 1. The pebbles baffle the otherwise free exhaust passage and serve to cool, condense and separate free oil and vapor that is thereby conserved and which can flow back into the breaker.

The outlet from each separating chamber should be piped to a common horizontal header. It is recommended that this header should exhaust to the outside of the station building, where preferably a terminal elbow is provided that is directed downward so that rain and moisture are excluded. In breakers for stationary mounting, the cap of the separating chamber is provided with an outlet hole that is tapped for 1" standard pipe. Vertical raiser pipes of suitable height should be interconnected between these outlets and the horizontal exhaust header.

In metal clad switchgear, the only venting pipe-work involved is to connect up the recommended exhaust pipe to the building exterior; for a horizontal exhaust header is built integrally into the stationary structure. The separating chamber automatically becomes connected into this header when the breaker is raised to its operative position in the switchgear stationary elements.

TANK LIFTING DEVICE

This is portable windlass type lifter which consists of two cable drums and supports connected together and operated by a square shaft. The drums and supports are inserted in two opposite tank bolt supports on the top frame after the bolts have been removed. Then the cables are drawn down through the bolt supports on the tank and fastened. The shaft after being inserted through both drums can be turned by a crank or ratchet.

OIL

G.E. No. 10C is used. This is pure mineral oil with the following characteristics:

Flash Point	133°C
Burning Point	148°C
Freezing Point	-40°C
Viscosity at 37.8°C	57 Sec.
Color	Pale amber, clear

While the oil is shipped in sealed containers, careless handling during shipment or storage may result in absorption of moisture by oil. All new oil should be tested before being placed in the oil circuit breaker. The dielectric strength of the oil when shipped is at least 26,000 volts when tested in a standard gap, with 1 inch disc terminals 0.1 inch apart. New oil of less than standard dielectric strength (26,000 volts) should not be put in the breaker tank until its insulating value has been brought up to the above standard (by filtering or otherwise). Customers desiring detailed information on equipment and procedure for filtering G.E. No. 10C oil should obtain Bulletin GEA-11804 from the nearest sales office of the company.

ADJUSTMENTS

BREAKER LINKAGE MECHANISM

By means of the tank lifting device, the breaker tank may be unbolted, lowered and removed to expose the contacts.

The breakers are equipped with buffer springs which are set to give 3/16 inch compression. These springs are locked at the factory and should require no adjustment.

Opening springs are also included in the design of these breakers, but require no adjustment.

MECHANISM PARTS FOR THE CLOSING OPERATION MS-4

Refer to Fig. 3. When the closing coil is energized, the armature moves up until it is stopped by the pole piece. The plunger rod, which is threaded into the armature, makes contact with a roller located directly above it. This roller is carried by a set of links connected to the operating crank. Thus the motion of the roller is transmitted to the crank. After the armature has reached the limit of its travel two props fall in place under one of the link pins and the mechanism is held in the closed position although the coil is de-energized and the armature drops down.

Since the pole piece must always act as the stop for the armature, it is necessary to adjust the length of the plunger rod to insure sufficient motion so that the props can fall in place and hold the mechanism in the closed position. To insure this under all conditions, the plunger should be adjusted to give the pin 1/32 inch to 3/32 inch clearance above the props when the armature is against the pole piece.

After the adjustment has been made, the plunger rod is locked in place by a double set of set screws. The plunger rod should be spotted for these set screws.

MECHANISM PARTS FOR THE TRIPPING OPERATION

With the breaker in the closed position, the stop bolt for the trip roller should be checked and locked for 1/32" clearance to the roller. The motion of the armature is transmitted to the crank of the solenoid only if the trip latch remains in position during the closing stroke. After the mechanism has closed, this same latch prevents the breaker from opening. While the props hold the mechanism closed, they will not prevent the breaker from opening if the trip latch is collapsed.

The trip latch, in its proper restraining position, should have from 1/8" to 1/4" latch "wipe". This setting is fixed by using the required number of washers under the head of its stop screw in the trip coil cover.

When the trip coil is energized, the plunger of the trip coil contacts the trip latch allowing the linkage to collapse. The force tending to collapse this linkage is exerted by the oil circuit breaker.

The trip coil is de-energized near the end of the stroke so that the latch and linkage return to the initial open position due to the action of their resetting springs.

This construction permits tripping the oil circuit breaker at any point of the stroke regardless of whether it is being closed electrically or manually. After the collapse of the trip latch, the motion of the armature does not cause any further movement of the crank to close the breaker.

CONTACTING

After the breaker mechanism has the proper stop clearance, the movable blade contacts are adjusted to secure proper contact.

The adjustment of contacts should be such that the movable blade spreads the stationary fingers so that when the breaker is in the fully closed position, the contacts will be as illustrated in Fig. 2. This shows that the blade is drawn up into the fingers until there is approximately 15/16 inch clearance between the top of the burning tip and the under side of the contact head, - assuming that the breaker has been closed, electrically, by the solenoid. This is important, for if closed manually, the crosshead comes to rest at a lower position than when closed electrically.

If it becomes necessary to make adjustment of movable contacts, loosen the operating rod so that it may be turned. This rod is threaded into the blade and clamped in the crosshead. The clamping bolts in the crosshead and in the blade must be loosened before the operating rod can be turned. If the dashpot support and bushing braces are loosened up and dropped down, the crosshead bolts will be accessible.

The main current carrying contacts should bear with a firm, uniform pressure over 50% or more of the contact area when the breaker is closed. Proper contact is obtained if a 0.002 inch feeler cannot be inserted between the fingers and the blade for more than 50% of the contact area.

The secondary contact fingers do not have to meet these same specifications for after arcing takes place, such contact will be destroyed. It is sufficient that these fingers seat properly on the blade tip.

It is generally recognized that the contact members must be kept clean and bright to insure maximum operating efficiency. Contacts should be kept clear of foreign material. Where silver surface contacts are used, care should be taken not to file away this surface during maintenance.

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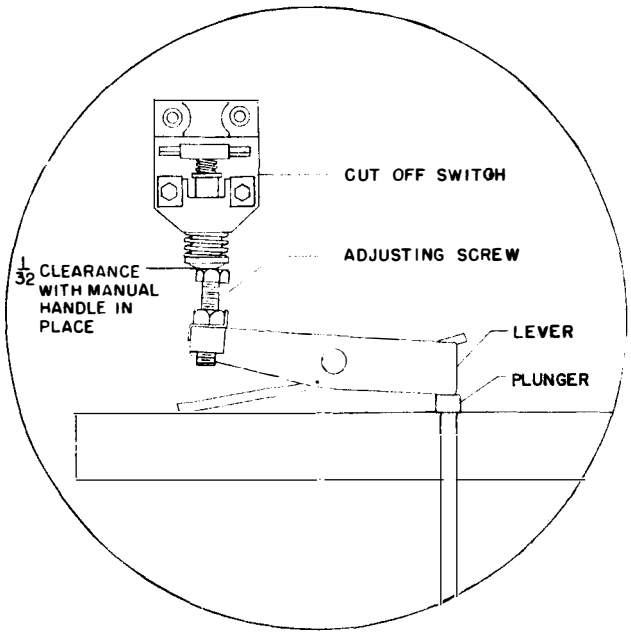

Fig. 4 Cut-off Switch

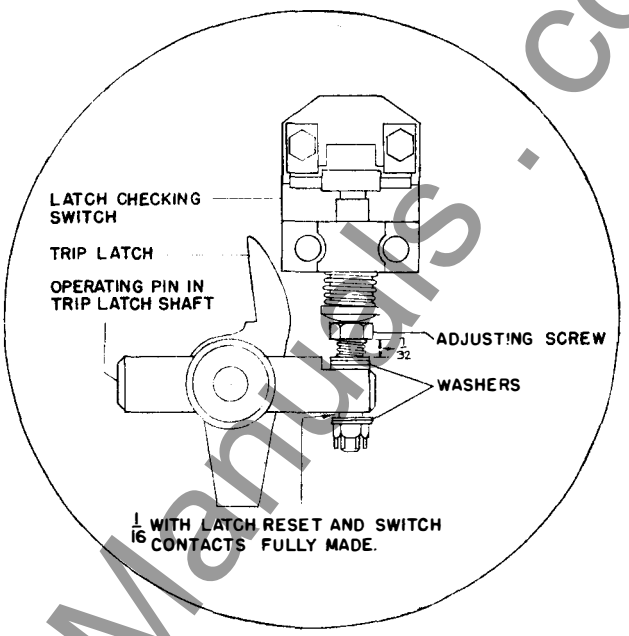

Fig. 5 Latch Checking Switch

Fig. 4 (2748943)

Fig. 5 (2748944)

With the breaker in the closed position and the closing plunger just touching the closing roller, the cut-off switch Fig. 4 sho d have full wipe and there should be 1/32" clearance between the switch plunger and the head of the adjusting screw. This clearance can be adjusted by the use of the screw directly beneath the switch.

The latch checking switch (when furnished) should have full wipe and be adjusted as illustrated in Fig. 5. These clearances can be adjusted by changing the location of the washers on the adjusting screw to either above or below the operating pin. On breakers furnished with an impact trip latch checking switch, the disc must make full contact and the screw head must not strike the contact block.

ARCING PLATES

An arcing plate is mounted next to the arcing fingers on each phase on the bushings farthest removed from the port holes in the face plate. The plates have approximately 1/4" clearance to the end of the blade. For applications between 2300 and 7200 volts inclusive, these plates must be left in place. The purpose of these plates is to control pressures generated during circuit interruption. On services above 7200 volts, these plates must be removed, in order to keep the time of interruption short and to minimize oil deterioration. It is, therefore, necessary to ship breakers according to the service voltage specified, and for the customer to check this point and attend to it.

To remove these arcing plates, it is necessary to remove the arcing finger bolts. This allows the plates and fingers to become free of the bushing so that the arcing plates can then be removed from the locking plates. Now reassemble arcing fingers with locking plates and bolts in their original position. The projection on the locking plates need not be removed as they have sufficient striking distance through the oil to ground.

CONTROL POWER CHECK

After the breaker has been closed and opened slowly several times with the maintenance operating lever, and the mechanism adjustments checked as described above, the operating voltages should be checked at the closing coil and trip coil terminals. For electrical operation of the breaker, the control power may be either an alternating or direct current source. The operating ranges for the closing and tripping voltages are given on the breaker nameplate. Ordinarily, standard ranges apply which are as follows:

NOMINAL VOLTAGE	CLOSING RANGE	TRIPPING RANGE
125v d-c	90-130v d-c	70-140v d-c
250v d-c	180-260v d-c	140-280v d-c
230v a-c	190-250v a-c	190-250v a-c

NOTE: When repetitive operation is required from a direct current source, the closed circuit voltage at the closing coil should not exceed 115v d-c and 230v d-c at the nominal voltages of 125v d-c and 250 v d-c, respectively.

To check the d-c voltage at the closing coil terminals, close the breaker by manually operating the control relay located elsewhere. Hold the relay closed and read the d-c voltage at the closing coil terminals. Release the closing relay to de-energize the circuit.

If the closed circuit voltage at the terminals of the closing coil does not fall in the specified range proceed as follows:

1. A-c control power source using copper oxide rectifiers. Decrease the series resistance to increase the d-c voltage, or increase the series resistance to decrease the d-c voltage. Recheck voltage at the closing coil.
2. D=c control power source. Check voltage at the source of power and line drop between the power source and breaker.

FOR A-C OPERATION

1. When copper oxide rectifiers are used they are mounted in the metal-clad unit or elsewhere. A tapped 1-1/2 ohms resistor is provided in each rectifier circuit to control the d-c voltage. The resistor setting should be adjusted so that the closed circuit voltage at the breaker closing coil terminals is 110 to 120 volts d-c. Where repetitive operation is required, the voltage should be set at 105 to 115 volts d-c.

*A-c Volts (Closed Circuit)	Resistor Setting For Each Resistor	
	Summer	Winter
190-196	1/4	0
194-206	1/2	0
204-216	1/2	1/4
214-226	3/4	1/4
224-236	1	1/2
234-246	1-1/4	3/4
244-250	1-1/4	1

* A-c volts as measured across the rectifier and a-c series resistor.

The preceding tabulation is included as a guide for adjusting the resistors for the particular combination of ambient temperature and a-c supply voltage. Summer

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settings are used where ambient temperatures are normally above freezing (32°F). It is necessary to use winter settings where the ambient temperature may drop to 20°F or less at any time. For a more detailed explanation of copper oxide rectifiers for circuit breaker application, refer to instruction book GEI-11306.

2. When a germanium (color-black, - flanged base) - or a silicon (color-blue, hex base) - rectifier bridge assembly is used, it is mounted in the metal-clad unit or elsewhere. These rectifiers are of the button-type and are hermetically sealed units. They have been tested and the associated resistor properly set at the factory. Unlike copper-oxide rectifiers the output of the germanium or silicon unit is affected very little by ambient temperature changes and it should not be necessary to disturb the factory setting.

DO NOT MAINTAIN VOLTAGE ON THE CLOSING COIL ANY LONGER THAN THE TIME REQUIRED TO CLOSE THE BREAKER. (20 cycles maximum at normal voltage.) Both the coils and the germanium and silicon rectifiers are designed for intermittent operation and may be damaged by prolonged current flow.

When two or more breakers, operating from the same control power source, are required to close simultaneously, the closed circuit voltage at the closing coil of each breaker must fall within the specified limits.

Electrical closing or opening is accomplished by merely energizing the closing or trip coil circuit. Control switches are provided for this purpose. It is also possible to trip the breaker manually by pressing the manual trip button, Fig. 1.

NOTE: The MS-4 mechanism combination is designed only for electrical closing when in use. NEVER ATTEMPT MANUAL CLOSING WITH THE BREAKER IN SERVICE, for under such conditions, sufficient closing force and speed cannot be applied.

FINAL INSPECTION

After an oil circuit breaker has been installed with all mechanical and electrical connections completed, the following inspections and tests should be made:

1. See that the breaker is properly set up and leveled on its supporting structure.

2. Close the breaker slowly by hand and check the following points:

   a. Stop clearance (1/16" ± 1/32")
   b. Contact alignment.
   c. Clearance for all moving parts.

3. See that all bolts, nuts, washers, cotter pins and terminal connections are in place and properly tightened. Plugs or connections removed for inspection should be replaced and properly made up to prevent oil leakage. The flange nuts on all valves and oil gauges should be checked to see that they are sufficiently tight to prevent leakage. In tightening flange nuts, precautions should be taken to prevent damaging the packing through excessive pressure.

4. See that the tank is filled with oil to the proper level.

5. See that all bearing surfaces of the operating and breaker mechanisms have been lubricated with a good quality of light lubricating oil. (SAE-30).

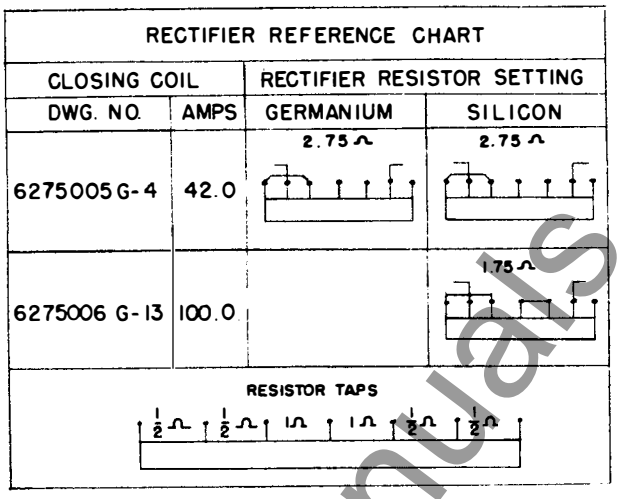

Fig. 6

Fig. 6 (0137A6092)

6. Inspect all insulated wiring to see that no damage has resulted during the process of installing it and test the wiring for possible ground or short circuits.

7. Operate the breaker electrically and check:

   a. Operation (closing, opening and reclosing).
   b. Overtravel (maximum of 1/4")
   c. Rebound (maximum of 10% of stroke)
   d. Contact adjustment as shown in Fig. 2: clearance between arcing-tip and underside of contact head (15/16" + 1/16" - 1/8").

8. Do not operate the breaker excessively in air. The dashpots, which absorb the energy of the moving parts on opening, utilize the oil in the breaker tank and will not function properly unless there is oil in the tank. A leather buffer pad is provided to take care of a limited number of operations in air.

9. See that the current carrying parts connected to the bushings are correctly installed in accordance with standard practice and that all joints whether bolted joints made with cables, are made correctly.

MAINTENANCE

GENERAL RECOMMENDATIONS

To assure proper and reliable operation of the oil circuit breaker, the oil circuit breaker must have regular systematic inspections when every part is looked over carefully. The frequency of the inspections should be determined by each operating company on the basis of the number of operations (including switching), the magnitude of the current interrupted, and any unusual operations which occasionally occur. Operating experience will soon establish a maintenance schedule which will give an assurance of proper breaker condition.

The following paragraphs list the main points to be included in an inspection and a number of cautions to be followed:

1. Be sure the breaker and its mechanism are disconnected from all electric power, both high voltage and operating current, before inspecting or repairing.

2. At regular inspections:

   (a) The contacts should be checked. See that they are aligned and that contact surfaces bear with firm uniform pressure. Replace badly pitted or burned contacts before they are burned away sufficiently to cause damage to other parts of the apparatus. If arcing contact surfaces are roughened, they may be smoothed down by filing.

IMPORTANT

To insure against loss of contact pressure or other hazards, it is recommended that a complete set of new blued steel leaf springs, both outer and inner, be substituted on the secondary or arcing contact fingers only. This should be done when the breaker has completed approximately 5,000 operations. To remove old, and insert new, inner springs, it is necessary just to take out the small "pivot" pins which anchor the spring ends into the formed sheet brass "guides". To do this, the side walls of the guide must be spread outwards, with a screw driver (or other wedg-

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ing instrument) to widen the guide slot so that the shouldered "Pivots" may be extracted. New pivots should be installed with the new inner springs, after which the guide sides should be squeezed back to their original shape to lock the pivots in place.

(b) The oil should be tested and if the dielectric strength is found less than 22,000 volts, it should be removed and replaced with new or filtered oil in accordance with dielectric specifications already described under "Oil".

When sampling oil, the sample container should be a large mouthed glass bottle. The bottle should be cleaned and dried with Benzine, free from moisture, before it is used. A cork stopper should be used. The sample of oil should be at least 1 pint. Test samples should be taken only after the oil has settled for some time. Samples should be taken from the valve at the bottom of the tank and sufficient oil drawn off to make sure the sample represents oil from the tank proper and not that stored in the drain pipe.

(c) All insulating parts should be thoroughly cleaned to remove all traces of carbon which may remain after the oil has been drained from the tank. It is necessary that the oil be removed and the tank cleaned at regular intervals (once a year) because filtering of the oil does not remove the carbon which adheres to the lining and sides of the tank.

(d) The operating and breaker mechanism should be inspected and all bearing surfaces lubricated with a good quality of light lubricating oil.

(e) See that all bolts, nuts, washers, cotter pins and terminal connections are in place and properly tightened. Plugs and connections removed for installation and adjustment should be replaced and properly made up to prevent oil leakage. The flange nuts on all valves and oil gauges should be checked to see that they are sufficiently tight to prevent leakage. In tightening flange nuts, precautions should be taken to prevent damaging the packing through excessive pressure.

(f) Review and check all items listed earlier under "ADJUSTMENTS" and "FINAL INSPECTION".

3. Be sure the breaker frame is well grounded.

4. Inspect the bushing supports as the vibration due to the operation of the breaker may cause the bushings to move slightly and result in misalignment of contacts.

5. Clean the bushings at regular intervals where abnormal conditions prevail such as salt deposits, cement dust or acid fumes, to avoid flashover as a result of the accumulation of foreign substances on their surfaces.

6. See that the oil is kept at the proper level in the tank.

7. Do not operate the breaker excessively without oil in the tanks. Refer to discussion under section "Final Installation Inspection".

8. After making any adjustments, operate apparatus by hand before attempting electrical operation.

9. When testing, coat the main contacts with vaseline.

10. Preparation of gaskets for installation and maintenance.

Coat all surfaces of cork, vellumoid and others of a similar nature with G.E. #1201 (red) *Glyptal enamel by brushing. Air dry for 24 hours.

For permanent joints, coat metal surfaces with the same *Glyptal enamel and assemble gasket while the *Glyptal enamel is still wet. For joints such as covers, manholes or places where the joint has to be opened, coat the metal surfaces against only one side of the gasket with *Glyptal enamel and assemble while the enamel is wet. The gasket surface against the removable cover can be greased to prevent sticking.

11. Tighten tank bolts. For breakers having woven asbestos type tank gasket, the required torque on the tank bolts is 350 lb. ft. For breakers having synthetic rubber tank gasket, the required torque on the tank bolts is 75 lb. ft.

12. Installation and maintenance could result in damage to the surface of the paint and corrosion may result at these points. All such places should be repainted immediately.

*Reg. Trade-Mark of General Electric Co.

BUSHINGS

If at any time it becomes necessary to remove bushings from the breaker, the following procedure is suggested:

1. Loosen the bolts which clamp the movable blade to the operating rod so that the particular blade may be turned away from the bushing which is to be removed.

2. In the 600, 1200 and 2000 ampere breakers the bushings are removed in a downward direction - it is necessary to first disassemble the bushing braces and lower the dashpot support. Since these bushing braces are matched, they should be so marked that they can be replaced in the same relative position from which they were originally removed.

3. Disconnect the operating mechanism from the breaker mechanism by removing the crank pin, then the internal breaker mechanism position may be changed to facilitate the withdrawal of the bushing, after the holding bolts are removed.

4. In the case of the 3000 ampere breaker, the bushings are removable from the top or in an upward direction. First remove the finger contacts and then the contact head which is threaded to the bottom of bushing. Then loosen the wood braces and remove the bushing.

5. In reassembly, care should be exercised in refitting the bushing braces so that no undue strain on the bushing is produced. The flat washers under the head of the bushing bolts should be made up with *Glyptal to seal them against oil leakage.

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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.

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

NOTE: The listed terms "right" and "left" apply when facing the solenoid mechanism end of the breaker.

ORDERING INSTRUCTIONS

1. ALWAYS SPECIFY THE COMPLETE NAMEPLATE DATA OF BOTH THE BREAKER AND THE MECHANISM.
2. SPECIFY THE QUANTITY, CATALOG NUMBER (IF LISTED), REFERENCE NUMBER (IF LISTED), AND DESCRIPTION OF EACH PART ORDERED, AND THIS BULLETIN NUMBER.
3. STANDARD HARDWARE, SUCH AS SCREWS, BOLTS, NUTS, WASHERS, ETC., IS NOT LISTED IN THIS BULLETIN. SUCH ITEMS SHOULD BE PURCHASED LOCALLY.
4. FOR PRICES, REFER TO THE NEAREST OFFICE OF THE GENERAL ELECTRIC COMPANY.

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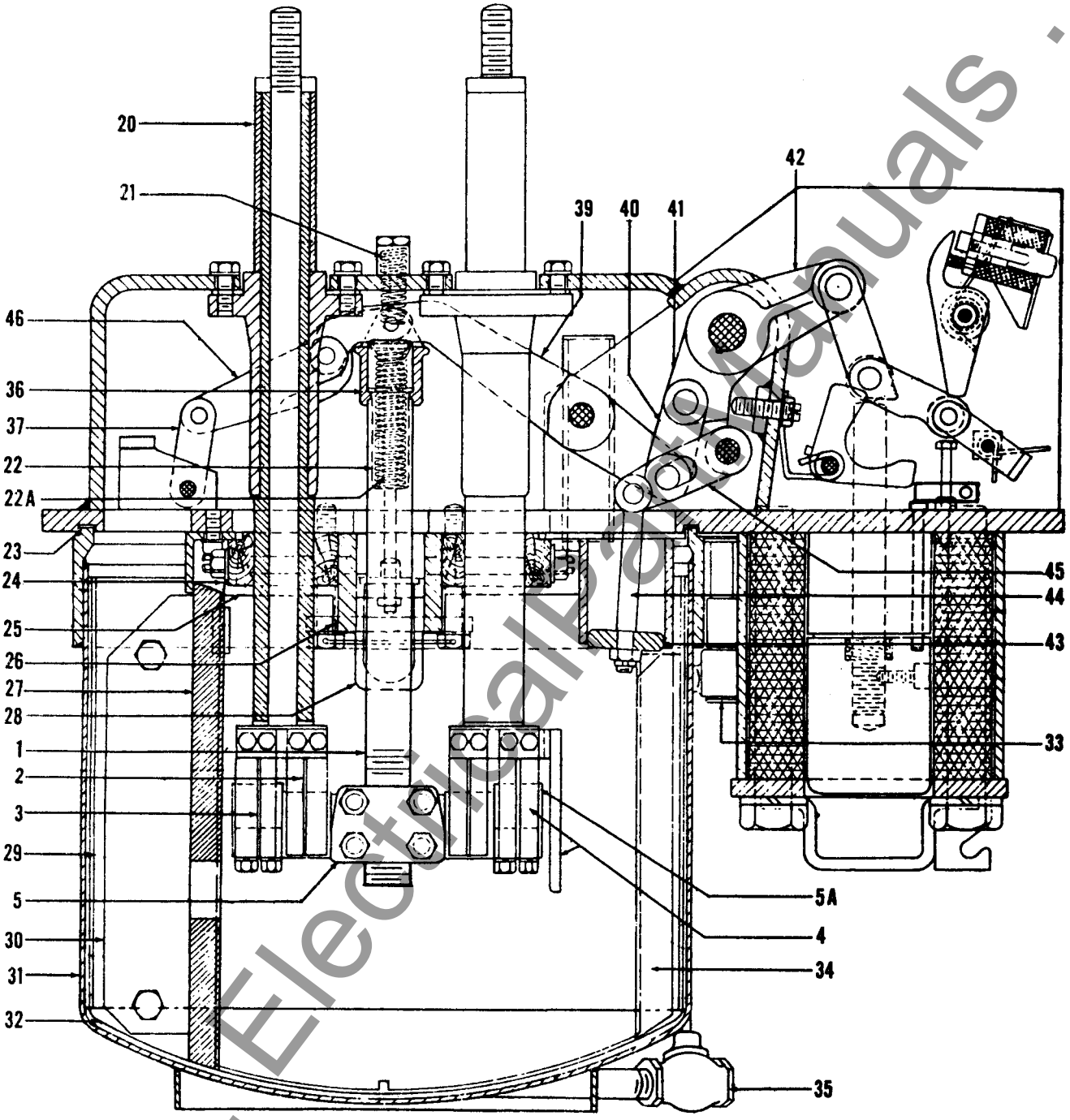

Fig. 7 (39444)

Fig. 7 Oil Circuit Breaker Parts

NOTE: Reference numbers illustrated in Fig. 7 and not listed on Page 13 are listed on Page 19.

Fig. 14 (8004935)

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CAUTION: Be sure to properly compare parts in existing breakers with those illustrated in this bulletin to assure that proper Catalog Numbers are specified on orders.

The following parts constitute those which are recommended for normal maintenance:

FOR BREAKERS RATED 100 MVA TO 250 MVA INCLUSIVE

Ref. No.	100 MVA 600 Amp 1200 Amp	150 MVA 250 MVA 600 Amp 1200 Amp	250 MVA 2000 Amp	No. Furnished in Breaker	Description
1	6024201 P24	6024201P24	6024201P23	3	Operating rod
2	6318253 G1	6318253 G1	† 6318253 G3 △ø 6318253 G2	6	Main contact assembly complete with fingers, springs, pivots and stops
3	6318113 G10	6318113 G2	△ 6318113 G4 †ø 6318113 G6	§ 3	§Arcing contact assembly complete with fingers, springs, pivots and stops without arcing plate.
4	6318113 G9	6318113 G1	△ 6318113 G3 †ø 6318113 G5	§ 3	§Arcing contact assembly complete with fingers, springs, pivots and stops with arcing plate.
5 5A 5B	6020914 P12 3810294 P7 6020914 G-4	6020914 P12 6017837 P11 6020914 G-5	See page 18 See page 18 See page 18	3 6 3	Contact blade only Arcing tip only Contact blade complete with arcing tip.

FOR BREAKERS RATED 500 MVA

Ref. No.	600 Amp	1200 Amp	2000 Amp	No. Furnished in Breaker	Description
1	6024201 P23	6024201 P23	6024201 P23	3	Operating rod
2	6318253 G1	6318253 G1	† 6318253 G3 △ø 6318253 G2	6	Main contact assembly complete with fingers, springs, pivots and stops
3	† 6412200 G2 ø 6318113 G8	† 6412200 G2 ø 6318113 G8	† 6412200 G4 △ 6318113 G4 ø 6318113 G6	§ 3	§Arcing contact assembly complete with fingers, springs, pivots and stops without arcing plate
4	† 6412200 G1 ø 6318113 G7	† 6412200 G1 ø 6318113 G7	† 6412200 G3 △ 6318113 G3 ø 6318113 G5	§ 3	§Arcing contact assembly complete with fingers, springs, pivots and stops with arcing plate
5 5A	See page 18 See page 18	See page 18 See page 18	See page 18 See page 18	3 6	Contact blade only Arcing tip only

† Early Design - for identification of detail parts refer to Pages 16 and 17

ø Modern Design - for identification of detail parts refer to Pages 16 and 17.

§ In some of the early designs of this line of breakers, these "Arcing contact fingers with arcing plate" were not furnished. Instead, six of the "Arcing contact fingers without arcing plate" were furnished. Also in breakers of modern design all are furnished with a set of three of the "Arcing contact fingers with arcing plate." However, for applications of 7500 volts and above, the arcing plates are removed from the breakers, and thus for such installations the breaker is equipped with six of the "Arcing contact fingers without arcing plate." Be sure to specify Cat. No. of this arcing contact assembly which corresponds exactly with that to be replaced in the existing breaker.

△ Intermediate Design - for identification of detail parts refer to Pages 14, 15, 16 and 17.

Fig. 11 (8004933)

Fig. 12 (8004936)

Fig. 13 (8004933)

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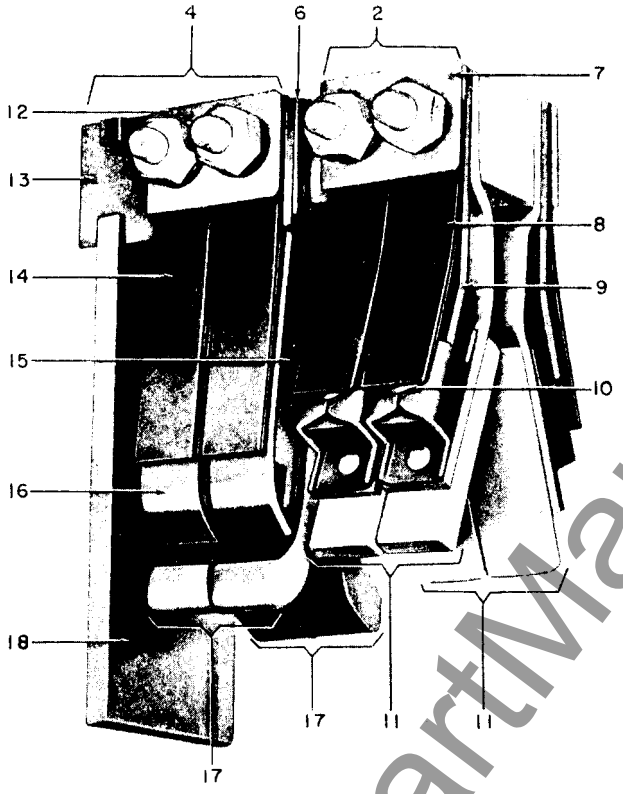

Fig. 8 (8004934)

Fig. 8 Main and Arcing Contacts for Breakers Rated 100 MVA, 150 MVA and 250 MVA, 600 Amp. and 1200 Amp.

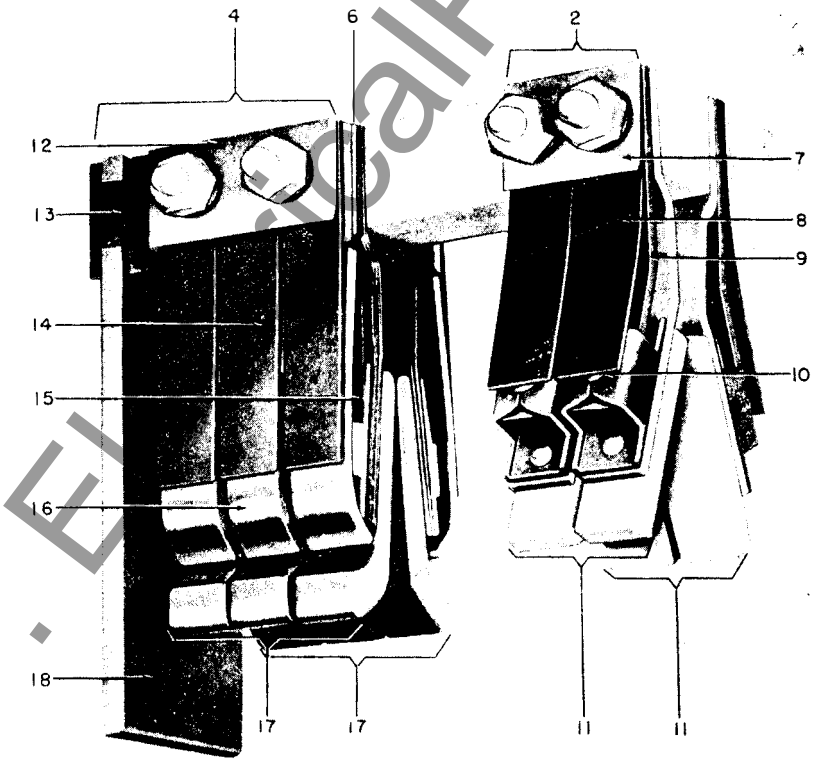

Fig. 9 (8004952)

Fig. 10 (8004937)

Fig. 9 Modern Design of Main and Arcing Contacts for Breakers Rated 500 MVA, 600 Amp. and 1200 Amp.

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CONTACTS FOR BREAKERS RATED 600 AMPERES AND 1200 AMPERES

The following parts are seldom required except as noted:

Ref. No.	Cat. No. 100 MVA (Fig. 8)	Cat. No. 150 MVA 250 MVA (Fig. 8)	Cat. No. Modern Design 500 MVA (Fig. 9)	Cat. No. Early Design 500 MVA (Fig. 9)	No. Furnished in Breaker	Description
¶2	See page	See page	See page	See page	6	Main contact assembly complete
¶4	See page	See page	See page	See page	-	Arcing contact assembly complete
6	6245473	6245473	6245474	6245473	ø	Support plate
7	6045899	6045899	6045899	6045899	12	Washer
8	2455063	2455063	2455063	2455063	36	Spring
9	2455067	2455067	2455067	2455067	12	Stop
10	2469258	2469258	2469258	2469258	24	Pivot
11	6059611	6059611	6059611	6059611	12	Finger (main)
12	6045899	6045899	2456561	6057427	12	Washer
¶13	6059119	6059119	6059481	6057426	3	Retaining washer - near side
¶§ 13A	6059118	6059118	6059480	6057425	3	Retaining washer - far side
¶§ 13B	6049992	6049992	6049994	6057428	6	Retaining washer
14	6041445	6041445	6041583	6041445	Δ	Spring
15	6041444	6041444	6041584	6041444	†	Stop
16	6049991	6049991	6049993	6049991	ø	Support
17	6441135	6049816	6144899	6049816	ø	Finger (arcing)
¶18	6049503	6049503	6049503	6049503	3	Arcing plate
§19	6049961	6049961	6049961	6049961	‡†	Pivot for Ref. No. 15

¶ **Parts recommended for normal maintenance**

ø **24 in Early Design 500 MVA (Fig. 10); 12 in all other ratings**

§ **Not illustrated**

Δ **72 in Early Design 500 MVA (Fig. 10); 36 in all other ratings**

† **48 in Early Design 500 MVA (Fig. 10); 24 in all other ratings**

‡ **36 in Modern Design 500 MVA (Fig. 9); 24 in all other ratings**

¶ **When contacts include no arcing plate (Ref. No. 18) specify retaining washer Ref. No. 13B only.**

¶ **When contacts include arcing plate (Ref. No. 18) specify retaining washer Ref. No. 13A only.**

Fig. 10 (8004937)

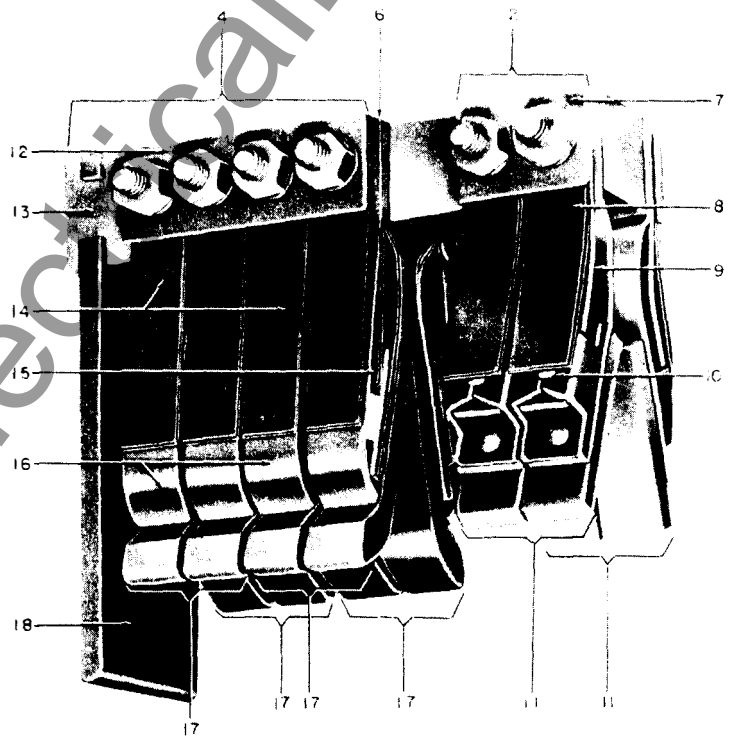

Fig. 10 Early design of main and arcing contacts for breakers rated 500 MVA, 600 amp. and 1200 amp.

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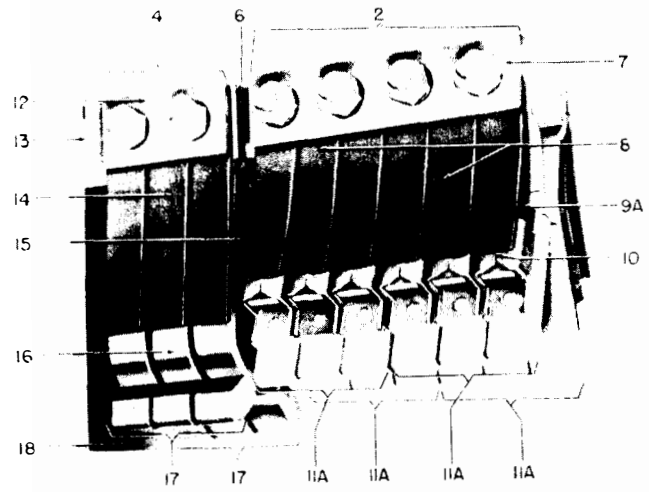

Fig. 11 Modern Design of Main and Arcing Contacts for Breakers Rated 250 MVA and 500 MVA, 2000 Amp.

Fig. 11 (8004953)

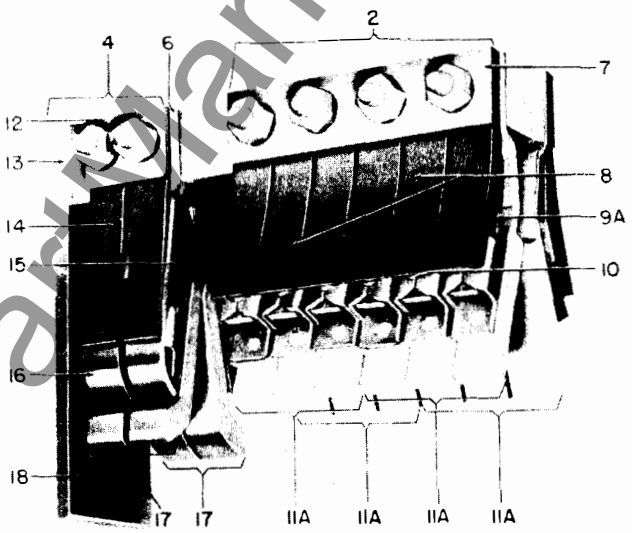

Fig. 12 Intermediate Design of Main and Arcing Contacts for Breakers Rated 250 MVA and 500 MVA, 2000 Amp.

Fig. 12 (8004936)

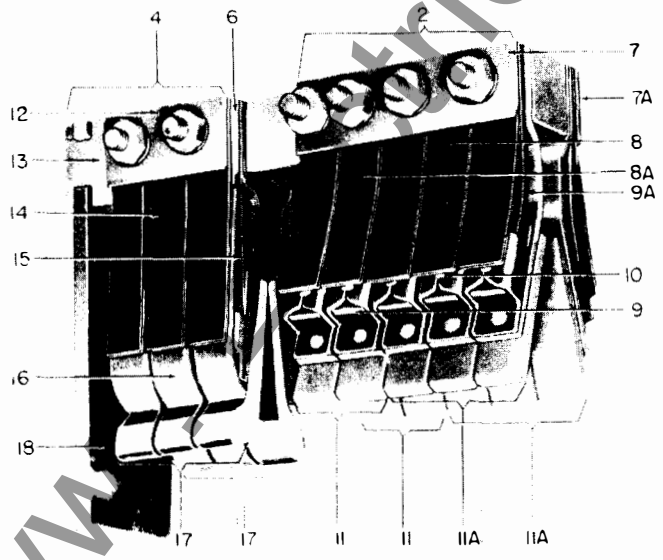

Fig. 13 Early Design of Main and Arcing Contacts for Breakers Rated 250 MVA, 2000 Amp.

Fig. 13 (8004933)

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CONTACTS FOR BREAKERS RATED 2000 AMPERES

The following parts are seldom required except as noted:

Ref. No.	Cat. No. Modern Design 250 MVA 500 MVA (Fig. 11)	Cat. No. Intermediate Design 250 MVA 500 MVA (Fig. 12)	Cat. No. Early Design 250 MVA (Fig. 13)	Cat. No. Early Design 500 MVA (Fig. 14)	No. Furnished in Breaker	Description
¶2	See page 13	See page 13	See page 13	See page 13	6	Main contact assembly complete
¶4	See page 13	See page 13	See page 13	See page 13	-	Arcing contact assembly complete
6	6245474	6245473	6245474	6245473	ø	Support plate
7	6041448	6041448	----------	----------	12	Washer
7	----------	----------	6045902	6045902	6	Washer
7A	----------	----------	6045901	6045901	6	Washer
8	2455062	2455062	2455062	2455062	¶	Spring
8A	----------	----------	2455063	2455063	36	Spring
9	----------	----------	2455067	2455067	12	Stop
9A	2455065	2455065	2455065	2455065	†	Stop
10	2469258	2469258	2469258	2469258	(a)	Pivot
11	-------	----------	6059611	6059611	12	Finger (main)
11A	6059612	6059612	6059612	6059612	†	Finger (main)
12	2456561	6045899	2456561	6057427	12	Washer
Δ 13	6059481	6059119	6059481	6057426	3	Retaining washer - near side
Δ§13A	6059480	6059118	6059480	6057425	3	Retaining washer - far side
Δ§13B	6049994	6049992	6049994	6057428	6	Retaining washer
14	6041583	6041445	6041583	6041445	(b)	Spring
15	6041584	6041444	6041584	6041444	(c)	Stop
16	6049993	6049991	6049993	6049991	ø	Support
17	6144899	6049816	6144899	6049816	ø	Finger (arcing)
¶18	6049503	6049503	6049503	6049503	3	Arcing plate
§19	6049961	6049961	6049961	6049961	(c) (d)	Pivot for Ref. No. 15

¶ Parts recommended for normal maintenance

ø 24 in Early Design 500 MVA (Fig. 14); 12 in all other ratings

Δ When contacts include no arcing plate (Ref. No. 18) specify retaining washers Ref. No. 13B only

△ When contacts include arcing plate (Ref. 18) also specify retaining washer Ref. No. 13A

¶ 36 in Early Design 250 MVA and 500 MVA (Fig. 13 and 14); 72 in all other ratings

† 12 in Early Design 250 MVA and 500 MVA (Fig. 13 and 14); 24 in all other ratings

§ Not illustrated

(a) 60 in Early Design 250 MVA and 500 MVA (Fig. 13 and 14); 72 in all other ratings

(b) 72 in Early Design 500 MVA (Fig. 14); 36 in all other ratings

(c) 48 in Early Design 500 MVA (Fig. 14); 24 in all other ratings

(d) 36 in Early Design 250 MVA, Modern Design 250 MVA and 500 MVA; 24 in all other ratings

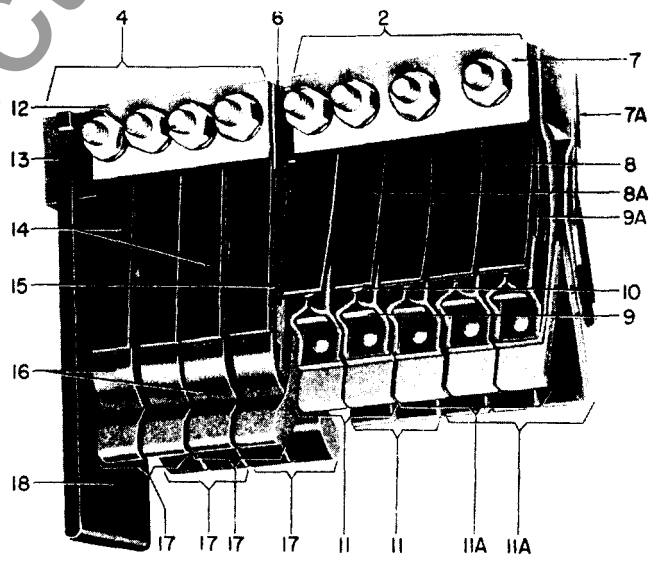

Fig. 14 (8004935)

Fig. 14 Early design of main and arcing contacts for breakers rated 500 MVA, 2000 amp.

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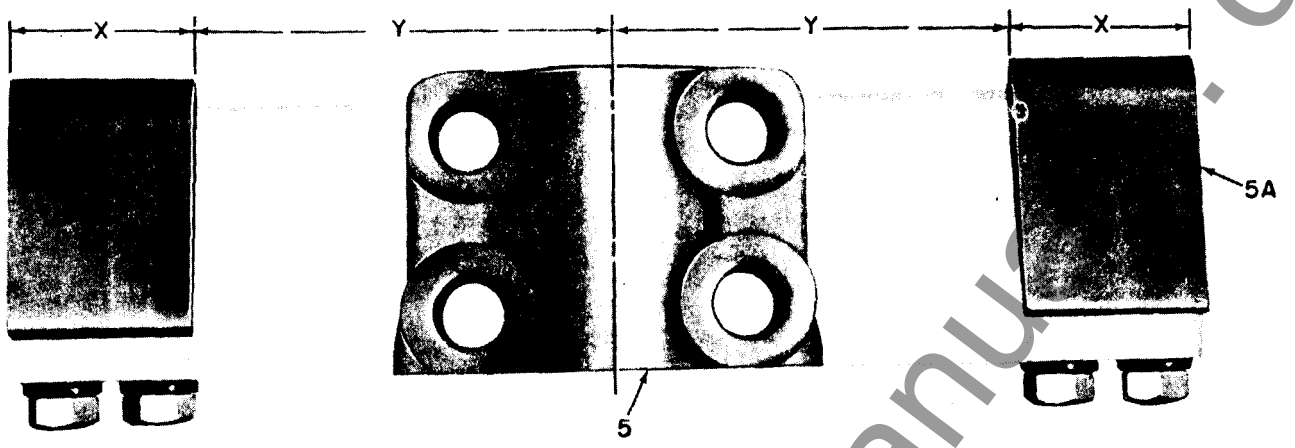

Fig. 15 Contact Blade and Arcing Tip

Fig. 15 (8006022)

CAUTION: When ordering contact blade or arcing tip, check dimensions of existing unit with dimensions listed below for the various Catalog Numbers applicable.

The following parts constitute those which are recommended for normal maintenance:

CONTACT BLADE ONLY (WITHOUT ARCING TIP) (REF. NO. 5)

Ref. No.	Breaker Rating MVA	Breaker Rating AMP	Cat. No.	Dimensions in Inches X	Dimensions in Inches Y	No. Furnished in Breaker	Description
5	250	2000	6029581 P2	2 1/4	6 1/2	3	Contact blade only (modern design)
	250	2000	6029581 P15	1 9/16	7 3/16	3	Contact blade only (intermediate design)
	250	2000	6029581 P2	2 1/4	6 1/2	3	Contact blade only (early design)
	500	600 1200	6126017 P14	2 1/4	5 1/8	3	Contact blade only (modern design)
	500	600 1200	6126017 P9	2 15/16	5 1/8	3	Contact blade only (early design)
	500	2000	6029581 P2	2 1/4	6 1/2	3	Contact blade only (modern design)
	500	2000	6029581 P15	1 9/16	7 3/16	3	Contact blade only (intermediate design)
	500	2000	6029581 P10	2 15/16	5 13/16	3	Contact blade only (early design)

ARCING TIPS ONLY (REF. NO. 5A)

Ref. No.	Breaker Rating MVA	Breaker Rating AMP	Cat. No.	No. Furnished in Breaker	Description
5A	250	2000	6105181 P9	6	Arcing tip only (modern design)
	250	2000	6017837 P11	6	Arcing tip only (intermediate design)
	250	2000	6105181 P9	6	Arcing tip only (early design)
	500	600 1200	6105181 P9	6	Arcing tip only (modern design)
	500	600 1200	6105181 P8	6	Arcing tip only (early design)
	500	2000	6105181 P9	6	Arcing tip only (modern design)
	500	2000	6017837 P11	6	Arcing tip only (intermediate design)
	500	2000	6105181 P8	6	Arcing tip only (early design)

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PARTS LISTED BELOW ARE ILLUSTRATED IN FIG. 7, PAGE 12

The following parts are seldom required:

Ref. No.	Cat. No. FK-255-100 -150, -250 600 & 1200 Amp	Cat. No. FK-255-500 600 & 1200 Amp	Cat. No. FK-255-250 -500 2000 Amp	No. Furnished in Breaker	Description
20	See page 14	See page 14	See page 14	6	Bushing
21	3806486 G2	3806486 G2	3806486 G2	2	Buffer, closing
22	6006644	2412446	2412446	ø	Opening spring, (outer)
22A	2412447	2412447	2412447	ø	Opening spring, (inner)
23	121A5921 P1	121A5921 P1	121A5921 P2	1	Tank gasket
24	6018053 G3	6017511 G4	--------	2	Bushing brace (for 600-amp breakers)
24	6018053 G4	6017511 G3	--------	2	Bushing brace (for 1200-amp breakers)
24	----------	----------	6017511 G2	2	Bushing brace (for 2000-amp breakers)
25	6124744 P1	6124747 P2	6124747 P2	1	△ Interphase barrier (left)
25	6124744 P1	6124747 P2	6124747 P2	1	△ Interphase barrier (right)
26	‡	6126847 G1	6126690 G2	1	Dashpot support and guide
27	6117239 P1	6124747 P1	6124747 P1	1	Face plate
28	6106289 G1	6118446 G2	6118446 G1	2	Dashpot
29	6124729 G5	6124887 G7	6124887 G8	1	Lining
30	6124980 P3	6196075 P3	6196075 P3	2	Face plate support
31	156C9417 G1	6186264 G3	6186262 G6	1	Oil tank
32	6098794 P1	†	†	1	Bottom lining
33	6090960 P3	6090960 P4	6090960 P4	1	Oil gage
34	6124744 P3	6124747 P4	6124747 P4	1	Support for phase barriers
35	6001070 P1	6001070 P2	6001070 P2	1	Drain valve
36	6022724 G1	6020986 G1	6020986 G2	1	Crosshead
37	6049815	6049493	6049493	2	Supporting link
39	6029322 P1	6028639 P1	6028639 P3	1	Operating lever
40	6049814	6059639	6049831	2	Connecting link
41	6029322 P4	6028639 P6	6028639 P6	1	Toggle crank
42	6029361 G3	6029373 G1	6029373 G1	1	∠ Operating crank (left)
42	6029361 P17	6029373 P3	6029373 P3	1	∠ Operating crank (right potential trip)
42	6186200 G1	6186200 G2	6186200 G2	1	∠ Operating crank (right, current trip)
43	6049932	6049497	6049497	1	Plunger
44	6049931	6049800	6049800	1	Eyebolt
45	6058306	6049835	6049835	1	Guide link
46	6229083 P3	6229083 P1	6229083 P1	1	∠ Crosshead lever (right)
46	6229083 P4	6229083 P2	6229083 P2	1	∠ Crosshead lever (left)

ø 2 in breakers rated FK-255 -100, -150, -250, 600 and 1200 amperes; 4 in all other ratings

∠ Right and left side identified when facing mechanism end of breaker

‡ For 600-amp breakers specify Cat. No. 6116178 G1; for 1200-amp breakers specify Cat. No. 6116148 G1

† None furnished on breakers of this rating

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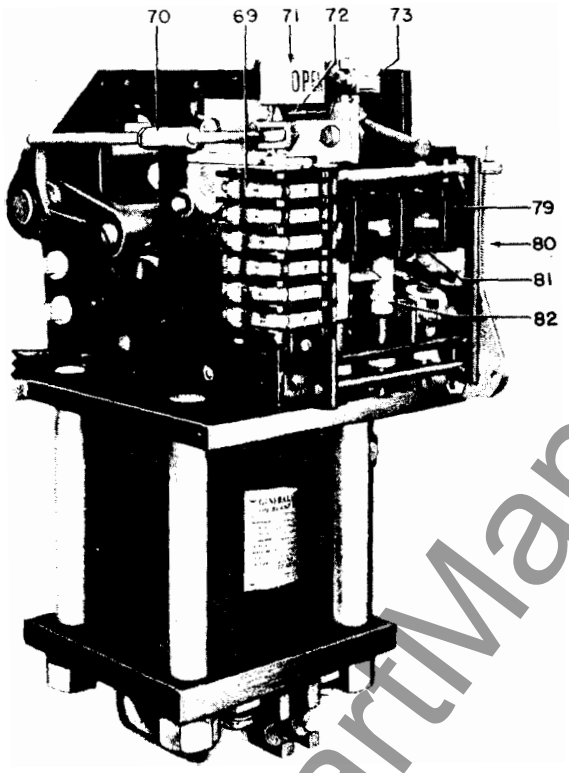

Fig. 16A (8005972)

Fig. 16A Left Front View of Solenoid Mechanism

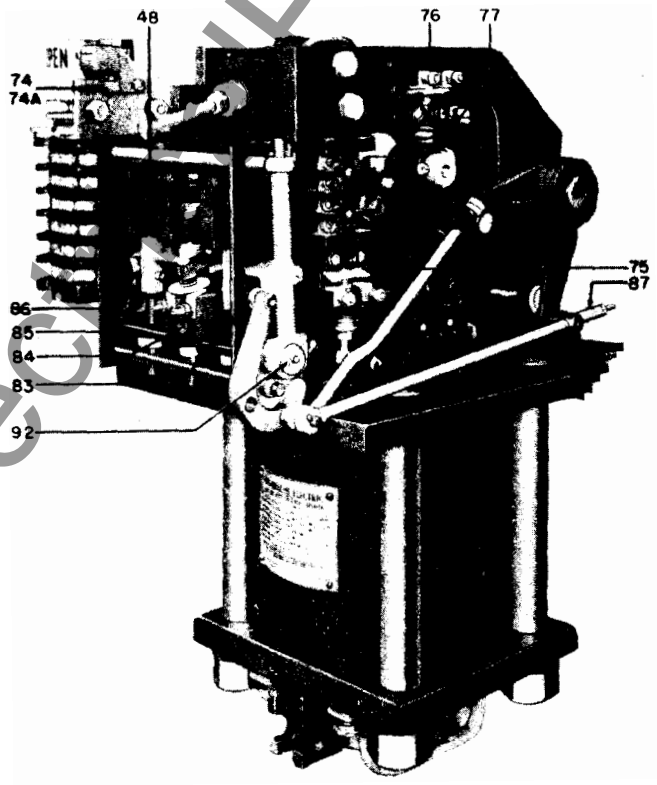

Fig. 16B (8005971)

Fig. 16B Right Front View of Solenoid Mechanism

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MS-4 SOLENOID MECHANISM

The following parts constitute those which are recommended for normal maintenance:

Ref. No.	FK-255-100 -150, -250 600 & 1200 Amp	FK-255-250 2000 Amp / FK-255-500, 600 1200 &2000 Amp	No. Furnished in Breaker	Description
47	6275070 G1 6174582 G34 6174582 G1 6174582 G2 6174582 G14		1	Potential trip coil 24-volt d-c operation 48-volt d-c operation 125-volt d-c operation 250-volt d-c operation 220-volt a-c operation
48	6174599 G2 6174599 G7 22D3G226		3	Current trip coil (when furnished) Fig.11B 3 ampere 4 ampere 5 ampere
49	6275005 G4 6275005 G10	6275006 G13 6275006 G14	1	Closing coil 125-volt d-c operation 250-volt d-c operation
The following parts are seldom required:				
50	6211377 G1	6211377 G1	1	Lever
51	6116928 P6	6116928 P7	1	Plunger
52	6157477 P1	6157477 P2	1	Spring
53	6508713 G2	6508713 G2	1	Trip plunger
54	6075557 G2	6075557 G1	1	Trip latch and shaft
55	6270513 G1	6270513 G1	1	Lever
56	6074235 P2	6074235 P2	1	△Reset spring (left)
56	6074235 P1	6074235 P1	1	△Reset spring (right)
57	6113986 G1	6113986 G1	1	Prop
58	6176833 P2	6176833 P2	1	Spring for prop
60	6270515 P2	6270515 P2	2	Link
61	6186105 G8	6186105 G6	1	Armature & Plunger
62	6007298	6007298	1	Spring for armature
63	6146080 P1	6146080 P1	1	Link
64	6477425EA P1	6477425EA P1	1	Roller (outer)
65	6172825 P2	6172825 P1	1	Trip latch spring
66	6229143 G4	6229143 G4	1	Prop roller
67	205SZZ-8	205SZZ-8	2	Bearing
68	201SZZ-5	201SZZ-5	2	Bearing (inside roller Ref. No. 64)
69	@	@	-	Auxiliary switch
70	6117466 G7	6117466 G3	1	Link
71	6117501 G1	6117501 G1	1	Semaphore
72	6176838	6176838	1	Spring
73	6186120 G1	6186120 G1	1	Operation counter
74	6147140	6147140	1	Support for counter (framework)
74A	6243920	6243920	1	Support for counter (metal clad)
75	6222110 G1	6222110 G2	1	Cutoff switch (aa) with linkage
75A	6412114 P1	6412114 P1	1	Cutoff switch
76	6412114 P9	6412114 P9	1	Latch checking switch (1c)
77	6240824	6240824	1	Screw
#78	6200445	6200445	1	Spring (on Ref. No. 77)
79	4905058 G4	4905058 G4	1	Frame
80	6074236	6074236	1	Spring
81	2236575	2236575	3	Guide
82	6077450 G1	6077450 G1	3	Armature (instantaneous trip)
83	6477418AA P10	6477418AA P10	1	Ball bearing
84	6116526 G2	6116526 G2	1	Latch checking switch
85	6146067	6146067	3	Body (instantaneous trip)
86	6076156	6076156	1	Spring
87	6074238	6074238	1	Spring
#88	6009459 G3	6009459 G3	1	Dashpot
#89	6197274 G1	6197274 G1	1	Plunger for dashpot
#90	6116427 P4	6116427 P4	1	Body (time delay)
#91	6197274 P1	6197274 P1	1	Armature (time delay trip)
92	6477418AA P7	6477418AA P7	1	Ball bearing

@ For auxiliary switch parts refer to bulletin GEF-2445A

Not illustrated

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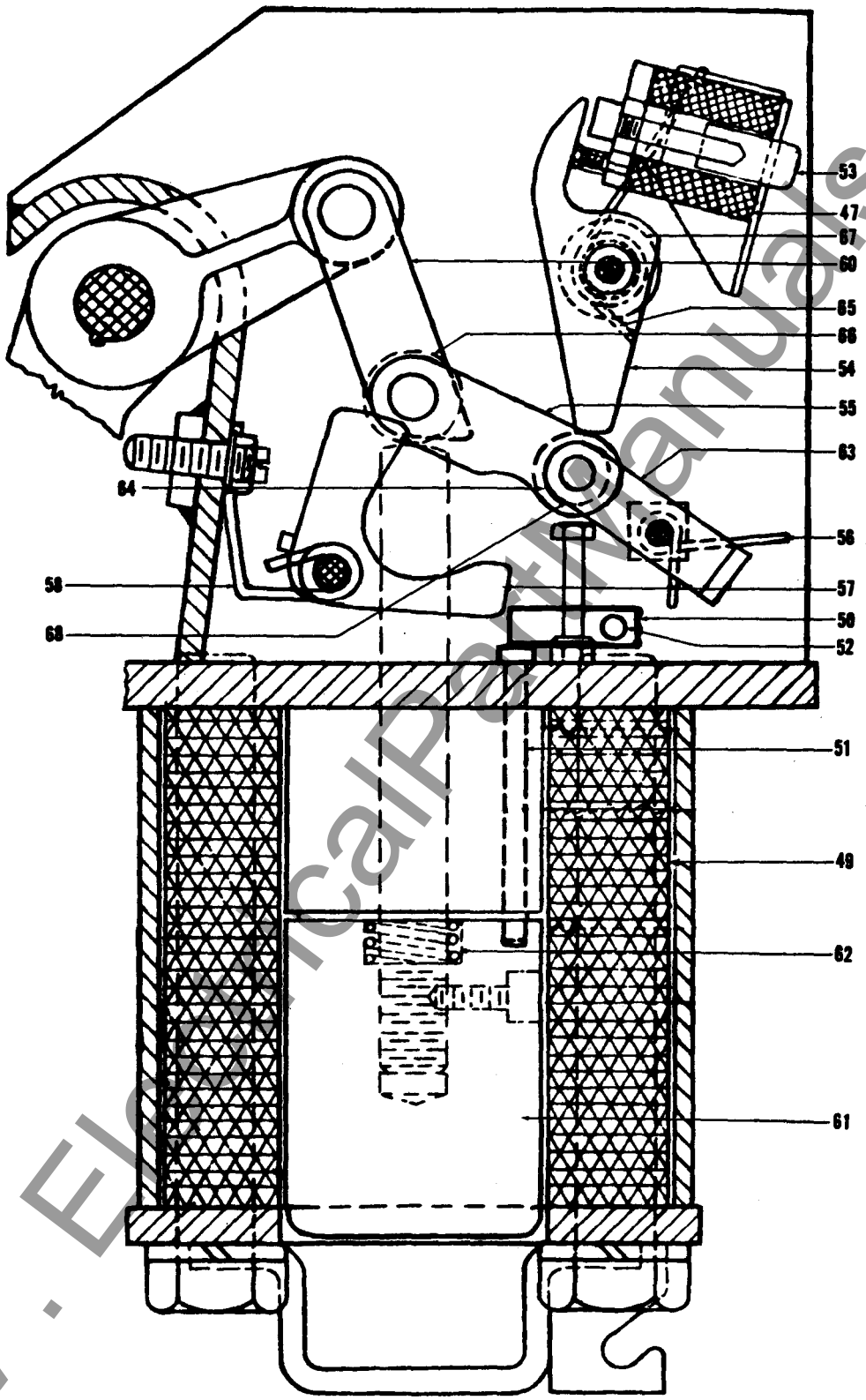

Fig. 17 (17X10)

Fig. 17 Type MS-4 Solenoid Mechanism

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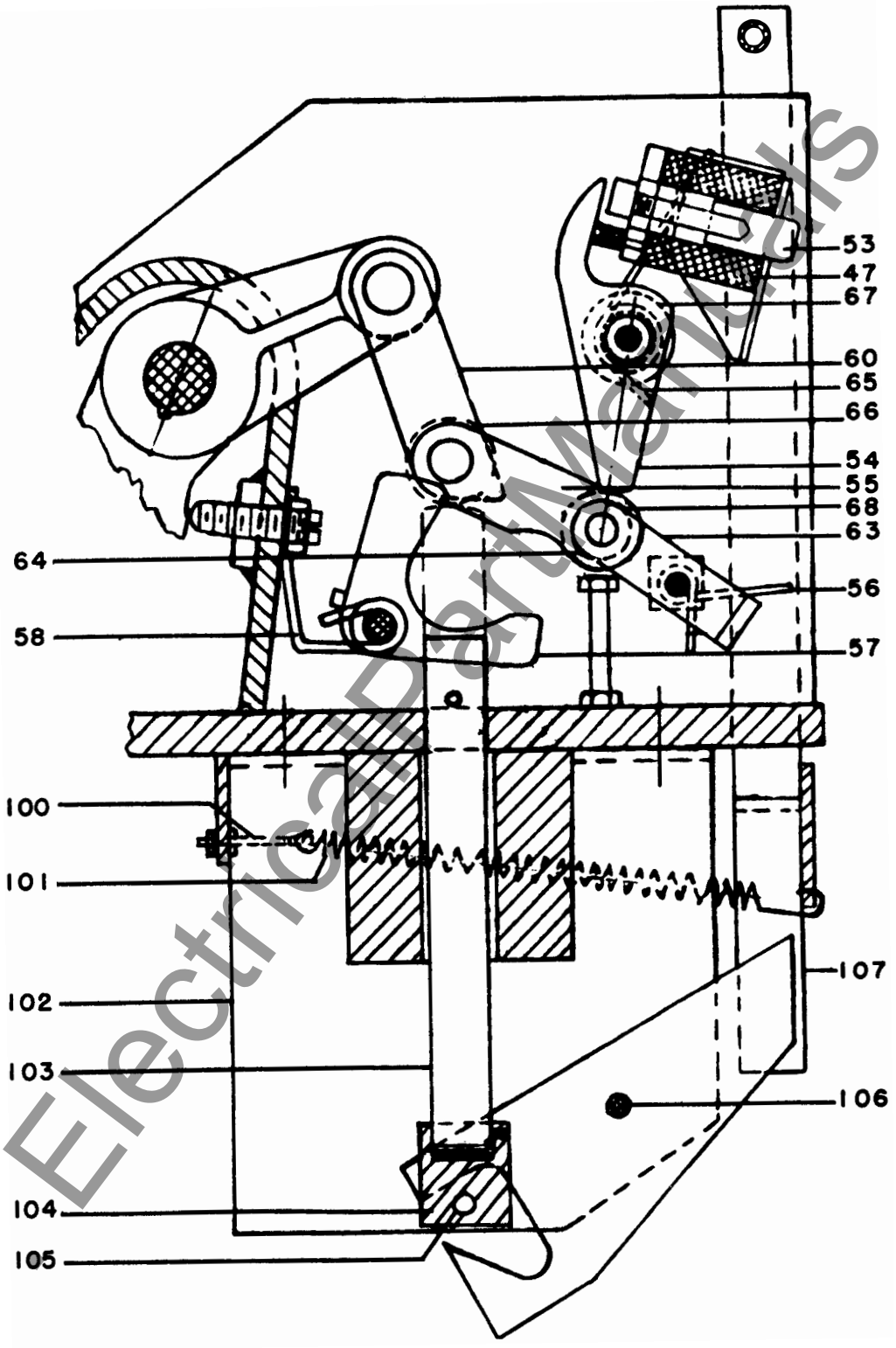

Fig. 18 Type MH-9 Manual Mechanism

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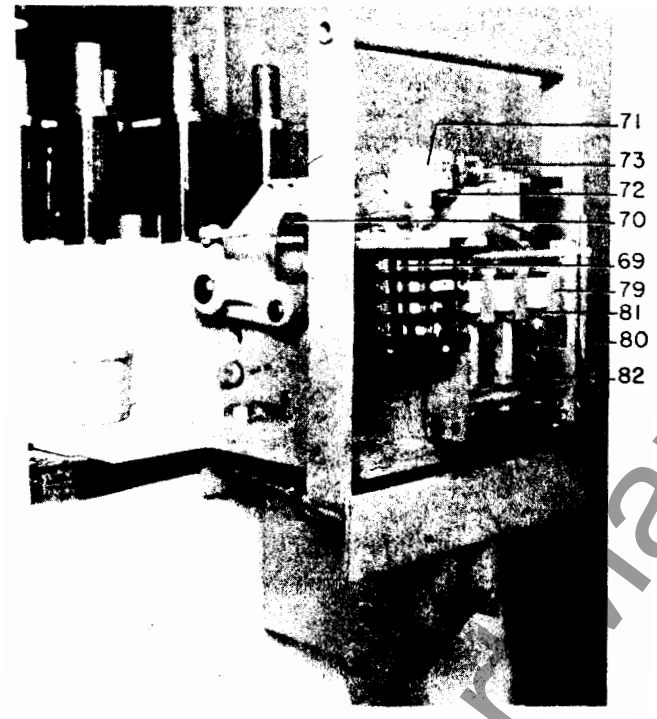

Fig. 19A (8024748)

Fig. 19A Left Front View Manual Mechanism

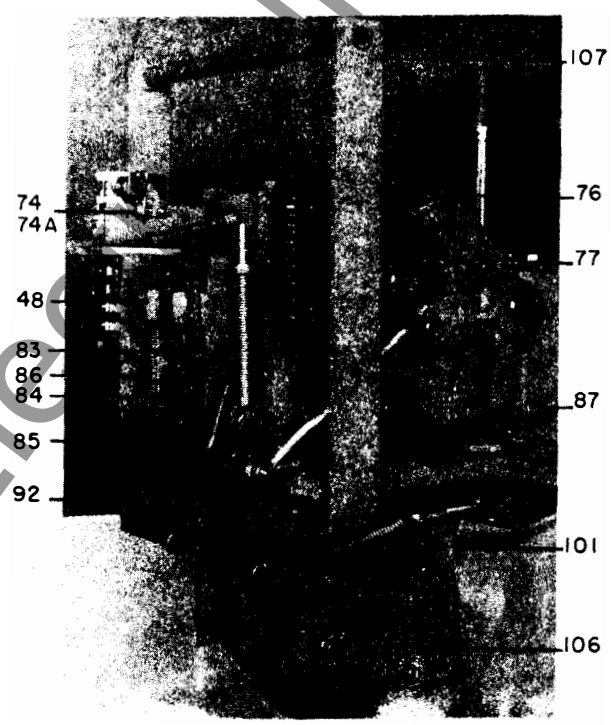

Fig. 19B (8024746)

Fig. 19B Right Front View Manual Mechanism

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MH-9 MANUAL MECHANISM

The following parts constitute those which are recommended for normal maintenance:

Ref. No.	Cat. No. FK-255-100, -150, -250 600 & 1200 Amp	No. Furnished in Breaker	Description
47	6275070 G1 6174582 G34 6174582 G1 6174582 G2 6174582 G14	1	Potential trip coil 24-volt d-c operation 48-volt d-c operation 125-volt d-c operation 250-volt d-c operation 220-volt a-c operation
48	6174599 G2 6174599 G7 22D3G226	3	Current trip coil (when furnished) Fig. 16B) 3 ampere 4 ampere 5 ampere
The following parts are seldom required:			
53	6508713 G2	1	Trip plunger
54	6075557 G2	1	Trip latch and shaft
55	6270513 G1	1	Lever
56	6074235 P2	1	△ Reset spring (left)
56	6074235 P1	1	△ Reset spring (right)
57	6113986 G1	1	Prop
58	6176833 P2	1	Spring for prop
63	6146080 P1	1	Link
64	6477425AA P12	1	Roller
65	6172825 P2	1	Trip latch spring
66	6229143 G4	1	Prop roller
67	205SZZ-8	2	Bearing
68	201SZZ-5	2	Bearing (inside roller Ref. No. 64)
69	@	-	Auxiliary switch
70	6117466 G7	1	Link
71	6117501 G1	1	Semaphore
72	6176838	1	Spring
73	6186120 G1	1	Operation counter
74	6147140	1	Support for counter (framework)
74A	6243920	1	Support for counter (metal clad)
#75	6222110 G1	1	Cutoff switch (aa) with linkage
75A	6412114 P1	1	Cutoff switch
76	6412114 P9	1	Latch checking switch (1c)
77	6240824	1	Screw
#78	6200445	1	Spring (on Ref. No. 77)
79	4905058 G4	1	Frame
80	6074236	1	Spring
81	2236575	3	Guide
82	6077450 G1	3	Armature (instantaneous trip)
83	6477418AA P10	1	Ball bearing
84	6116526 G2	1	Latch checking switch
85	6146067	3	Body (instantaneous trip)
86	6076156	1	Spring
87	6074238	1	Spring
#88	6009459 G3	1	Dashpot
#89	6197274 G1	1	Plunger for dashpot
#90	6116427 P4	1	Body (time delay)
#91	6197274 P1	1	Armature (time delay trip)
92	6477418AA P7	1	Ball bearing
100	6076412 P13	2	Eye bolt
101	6552989	2	Spring
102	269C848 P3	1	△ Bracket (Left)
102	269C848 P4	1	△ Bracket (Right)
103	269C848 P16	1	Plunger
104	269C848 P14	1	Prop
105	269C848 P18	1	Pin
106	269C848 P17	1	Pin
107	269C848 G-3	1	Handle complete

@ For auxiliary switch parts refer to bulletin GEF-2445A

Not illustrated.

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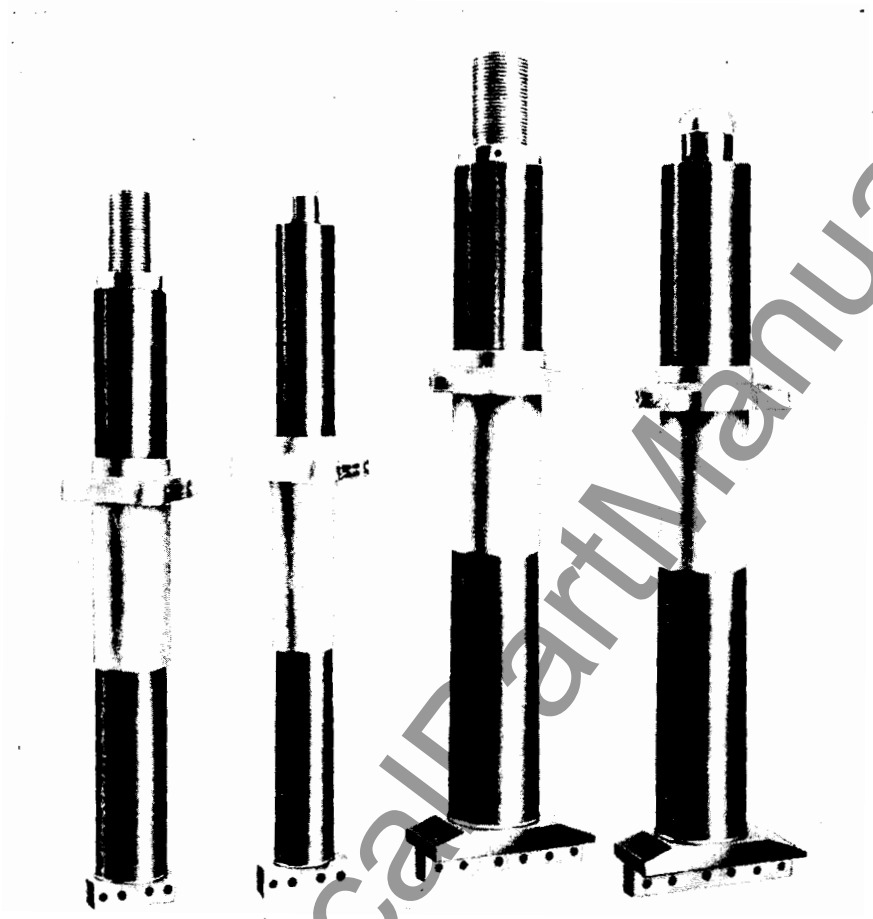

(128749)

Fig. 20 Fig. 21 Fig. 22 Fig. 23

NOTE: The bushings illustrated by Fig. 13 and 15 represent the design which is furnished in breakers used in metal-clad switchgear.

When ordering bushings complete nameplate data will be required.

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