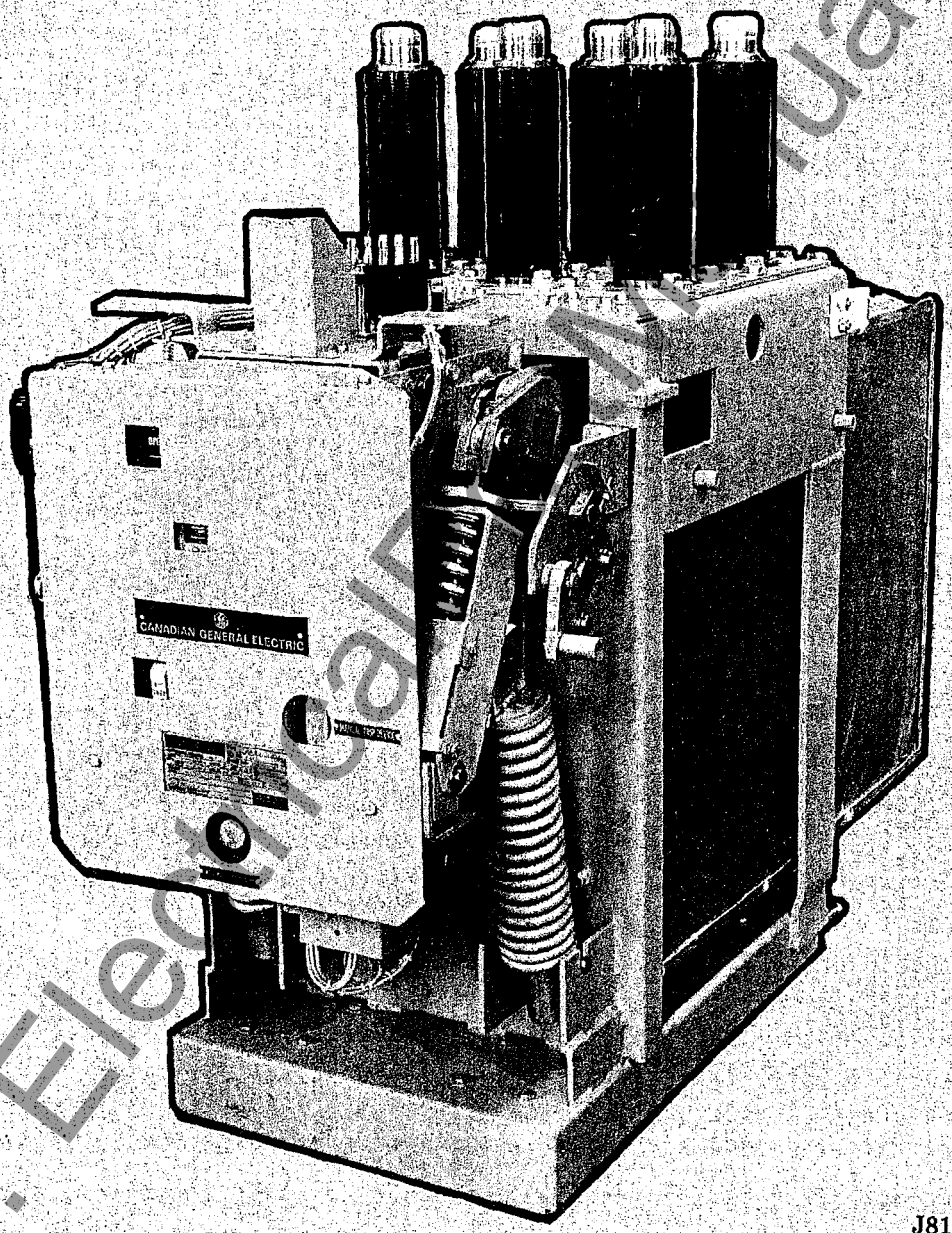
INSTRUCTIONS

PGEI-5037

MAGNE-BLAST FIELD DISCHARGE CIRCUIT BREAKER

TYPE AMF-1A AMF-1B



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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 nearest office of Canadian General Electric Company Limited.

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

CONTENTS

CONTENTS (Cont'd)

LIST OF ILLUSTRATIONS

MAGNE-BLAST FIELD DISCHARGE CIRCUIT BREAKER

AMF-1A AND AMF-1B

INTRODUCTION

The Magne-blast field discharge circuit breaker is a two-pole breaker with field discharge contacts installed in the center pole. When the breaker is opened the field discharge contact closes, thus connecting an external discharge resistor across the field of the generator or motor. When the breaker is closed, the field discharge contact is opened. The field discharge circuit breaker is supplied in two versions for installation in cubicles. The cubicle supplied may be equipped with self-coupling disconnecting devices and a mechanism to move the breaker vertically from the connected to the disconnected position. Interlocks are provided to ensure proper sequence and safe operation of the disconnect mechanism. Alternatively, the cubicle may only be equipped for locating the breaker and bolting it into position. Bus work and terminal clamps are supplied for connection of the breaker to the bus work.

RECEIVING AND HANDLING

Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Immediately upon receipt of the circuit breaker, an examination should be made for any damage sustained in transit. If injury or rough handling is evident, a damage claim should be filed immediately with the transportation company and the nearest Canadian 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. 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:

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 Metalclad switchgear should be stored in the equipment only when power is available and the heaters are in operation to prevent condensation.

The breaker should be stored in a clean location, free from corrosive gasses or fumes; particular care should be taken to protect the equipment from moisture and cement dust, as this combination has a very corrossive effect on many parts.

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

PROCEDURE

Remove the box barrier and front cover and make a visual inspection to ascertain that the breaker and mechanism is in satisfactory condition. Check all bearing surfaces of the mechanism for lubrication. Refer to section on Lubrication.

Charge the breaker closing springs manually using a ratchet wrench to turn the driving eccentric (6, figure 4). Turning the eccentric counter clockwise will advance the ratchet wheel and compress the springs.

When the springs have reached the fully charged position the indicator (6, figure 2) will read CHARGED, and the driving pawl will be raised from the ratchet wheel teeth. Additional turning of the eccentric will not advance the ratchet wheel.

Insert the spring blocking device (4, figure 4) and manually discharge the springs against the pins by pushing the manual close button (1, figure 4). The springs are now blocked and slow closing of the breaker contacts can be accomplished by again turning the driving eccentric with a ratchet wrench.

During the slow closing operation check to insure that

the mechanism does not stick or bind during the entire stroke, that it latches securely in the closed position, and that it trips freely when the manual trip level is operated. The breaker should not be operated electrically until it has been operated several times manually to insure freedom of action. At this time, also check the following adjustments shown in the CORRECTIVE MAINTENANCE section.

a) Primary contact wipe,
b) Arcing contact wipe,
c) Primary contact gap.

WARNING

DO NOT WORK ON EITHER THE BREAKER OR MECHANISM UNLESS THE CLOSING SPRINGS ARE BLOCKED AND THE OPENING SPRINGS HAVE BEEN TRIPPED OR MECHANICALLY BLOCKED. THIS PRECAUTION IS REQUIRED TO PREVENT ACCIDENTIAL CLOSING OR TRIPPING.

After the adjustments have been checked, the springs can be unblocked. Rotate the driving eccentric until the indicator reads CHARGED and the ratchet wheel no longer is advanced. The blocking device can now be removed.

Attach the test coupler to the circuit breaker and operate electrically several times. Check the control voltage as described under Control Power Check.

NOTE

If the breaker secondary wiring is to be given a hi-potential test at 1500 volts, remove both the motor leads from the terminal connection. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

Remove the test coupler and replace the box barrier.

If the breaker has been stored for a long period of time, it is recommended that the insulation be checked with a standard 60 cycle high potential test. Refer to Insulation Test.

Lubricate the silver portion of the primary disconnect studs by rubbing a small amount of contact lubricant D50H47 to form a thin coating on the ball contact.

Refer to Metalclad instruction book PGEI-1202 for final instruction before inserting the breaker into the Metalclad unit.

ADJUSTMENTS

In order to perform the adjustment refer to Adjustments under CORRECTIVE MAINTENANCE.

OPERATION

GENERAL

The Magne-blast breaker is composed of two major parts: the breaker element and the operating mechanism. The breaker element comprises of two outer main pole units, each of which consists of main and arcing contacts and an interruptor. The center pole has a field discharge contact which closes as the main poles open. All three poles are enclosed in a box barrier that segregates the individual poles from each other to provide insulation from pole to pole and from each pole to ground. The primary connections to the associated equipment are made through the high-voltage bushing studs. The ML-13 operating mechanism is of the stored energy type, designed to give high-speed closing and opening. The mechanism will operate from a-c or d-c control voltage as indicated on the breakerr nameplate. Closing and opening operations are controlled electrically by the control switch mounted in the associated equipment or mechanically by the manual close and trip levers on the breaker. All secondary connections from the breaker to the associated equipment are made through the secondary coupler (1, figure 1).

On breakers equipped for installation in the vertical lift unit, a positive interlock roller (2, figure 3) and interlock switch (2, figure 1) are provided between the breaker and the cubicle to prevent raising or lowering the breaker in the unit when the breaker is in a closed position, and to prevent a closing operation when the breaker is not in either the fully-raised for fully-lowered position.

Roll-in type breakers can be supplied with a kirk interlock to lock the breaker in the open position for maintenance operations. A plunger may be installed on the breaker to operate additional auxiliary switch contacts for control circuit operation.

A spring release interlock (see figure 21) will, if the breaker is in the closed position with closing springs charged, trip the breaker open and hold the mechanism in a trip-free position while discharging the closing springs as the breaker is inserted or removed from the cubicle.

SPRING CHARGING

The mechanism consists of a high-speed gear-motor that compresses a set of closing springs through the action of a simple eccentric, ratchet and pawl assembly. The rotary action of the motor (2, figure 4) is converted to a short stroke pumping action through the eccentric (6) and a lever that carries a spring-loaded driving pawl (5).

The pawl advances the ratchet wheel (3, figure 3) only a few degrees each stroke, where it is held in position by the latching pawls (1). When the ratchet wheel has been rotated approximately 180°, the closing springs (6) will be fully compressed. As the ratchet continues to rotate, the spring load will shift over center and attempt to dis-

charge. After only a few degrees of rotation, the closing latch roller (10, figure 1) will engage the closing latch (11) and the compressed springs will be held in repose until a closing operation is required. During the last few degrees of the ratchet wheel rotation, the motor and interlock switches (6) are released and the driving pawl is raised from the ratchet wheel surface. This allows the motor and driving mechanism to coast to a natural stop, expending all residual energy.

During the time springs are being compressed, a relay (6, figure 6) locks the closing power circuits open and the relay will remain energized until the springs are fully charged and the control contacts are reset.

The closing springs may be charged manually if control voltage is lost. A ratchet wrench can be used to rotate the eccentric in a counterclockwise direction until the indicator reads CHARGED and the drive pawl no longer engages the ratchet wheel. The use of the ratchet wrench provides for maximum safety in the event that control power is suddenly restored without warning. In this event, the motor drive will take over again and continue to charge the springs.

CLOSING OPERATION

Closing the breaker is accomplished by energizing the closing solenoid or by manually pressing the close button. In either case, a closing latch is removed from the spring blocking location allowing the springs to discharge. The energy of the springs is applied to the rotation of a cam (16, figure 5) that operates the breaker contacts through a simple linkage and connecting rods. The mechanism linkage remains trip-free at all times. As the mechanism starts to close, the field discharge contact of the center pole begins motion from its fully made position. The outer main pole contacts and contact blades are starting to move toward the closed position as the field discharge contact is moving to open. The two main pole contacts will close before the field discharge contact opens. After the field discharge contact opens, the motion of the main contact blades and contacts will be retarded as the field discharge contact moves to its fully open position. The closing stroke of the main contact is delayed during the final portion of the mechanism closing operation by action of a cam and roller assembly connecting the mechanism operating crank and the operating rods on the outer two poles (1, 2, 3, figure 53).

OPENING OPERATION

An electrical opening operation is initiated by energizing the trip coil. This is accomplished either by operating the opening control switch on the equipment, or the associated equipment control circuits may have a relay contact wired in series with the breaker trip circuit to open the breaker. By energizing the trip coil, the trip plunger rotates the trip latch (7, figure 5) causing the operating mechanism linkage to collapse. The energy stored in the opening springs is thus released to operate the breaker. As the mechanism starts to open, the cam and roller linkage on the outer poles delay the opening of the outer pole contacts. The moving portion of the center pole discharge contacts is starting to close while the other pole contacts are retarded. Contact will be made with the stationary portion of the discharge contacts before the outer pole contacts part. As the outer pole contacts continue through their opening stroke, the center discharge contacts will wipe to their fully-made position. During this operation, the trip coil circuit is de-energized, and upon completion of the opening operation the operating mechanisn is returned to its normal position ready for closing.

As the breaker opens, the outer two poles operate in parallel and the main contacts (22, figure 7) part first, shunting the current through the acing contacts. An arc forms as the arcing contacts (see figure 7) part. As the moveable acing contact is withdrawn through the probes on the arc runner, the upper end of the arc is transferred to the upper arc runner (4). To assist the interruption at this point, a stream of air is emitted from the booster tube (25) and forces the arc onto the lower arc runner (8). Establishment of the arc on the runners automatically inserts the blowout coil into the circuit, introducing a magnetic field between the pole pieces which tends to draw the arc away from the arcing contacts. The interruptor contains one upper blowout coil and one lower blowout coil, each connected with its respective arc runner. The arc is forced outward along the diverging arc runner by the magnetic field.

At the same time, the arc is being forced into the arc chute (3) which is composed of a series of gradually interleaving insulating fins. These fins, which project alternately from the two opposite inner surfaces of the chute, elongate the arc into a gradually deepening serpentine path so that the electrical resistance in the path of the arc is rapidly increased and the heat from the arc is absorbed. The increased resistance and lengthening and cooling of the arc result in interruption.

Manual tripping follows the same procedure except that, instead of energizing the trip circuit, the manual trip crank (11, figure 2) is used.

TRIP-FREE OPERATION

If the trip coil circuit is energized while the breaker is closing, the trip plunger will force the trip latch (8, figure 5) away from the trip roller (9) causing the linkage to collapse, and the breaker will reopen. The closing cam (16) will complete its closing stroke and the springs will recharge as in a normal closing operation.

PREVENTIVE MAINTENANCE

Dependable service and safer power equipment are contingent upon the unfailing performance of the power circuit breaker. To maintain such service, it is recommended that a definite inspection and maintenance schedule be set up and followed, as serious shutdowns can often be avoided by locating potential sources of trouble in an early stage. A periodic lubrication of parts subject to wear is also vitally important for the successful operation of the breaker.

WARNING

BEFORE ANY MAINTENANCE WORK IS PERFORMED, MAKE CERTAIN THAT ALL CONTROL CIRCUITS ARE OPENED AND THAT THE BREAKER IS REMOVED FROM THE METALCLAD UNIT. DO NOT WORK ON THE BREAKER OR MECHANISM WHILE IN THE CLOSED POSITION UNLESS THE PROP AND TRIP LATCH HAVE BEEN SECURELY WIRED OR BLOCKED TO PREVENT ACCIDENTIAL TRIPPING. DO NOT WORK ON THE BREAKER OR MECHANISM WHILE THE SPRINGS ARE CHARGED UNLESS THEY ARE SECURED IN THAT POSITION BY THE MAINTENANCE SPRING BLOCKING DEVICE.

PERIODIC INSPECTION

The frequency of periodic inspection should be determined by each operating company on the basis of the number of operations (including switching), the magnitude of currents interrupted, and any unusual operations which occur from time to time. Operating experience will soon establish a maintenance schedule which will give assurance of proper breaker condition.

On installations where a combination of fault duty and repetitive operation is encountered, an inspection is recommended after any severe fault operation. The following instructions list the main points to be included in an inspection and a number of general recommendations.

ARC CHUTES

It is not necessary to inspect the arc chutes unless there is evidence of damage or if the arc chutes are removed for any reason. When inspecting an arc chute, it should be disassembled and the following points noted:

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

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 arc chute has suffered any mechanical injury due to dropping or accidental striking, resulting in the actual breaking off of fins, replacement of the chute will be necessary. Small broken corners on the exhaust end of the chute will not interfere with its performance and can also be disregarded.

The plastisol flexible covering the pole pieces (3 and 17, figure 15) should be inspected for breaks in the insulation. If there are holes or breaks in the insulation they should be repaired or the part replaced.

BREAKER CONTACTS

By removing the box barrier the movable and stationary primary contacts and the movable arcing contacts can be inspected. The stationary arcing contacts can be inspected after removing the arc chute assembly as explained under Repair and Replacement. If the contacts are burned or pitted, they should be made smooth with a fine file.

After completing inspection of the contacts, check the contact adjustments as specified under Adjustments.

MECHANISM

A careful inspection should be made to check for loose nuts or bolts and broken retaining rings. All cam, roller, and latch surfaces should be inspected for any evidence of damage or excessive wear. Lubricate the mechanism as outlined below, then using the manual charging wrench, open and close the breaker several times to make certain that the mechanism operates freely throughout its entire stroke. Check the mechanism adjustments as specified under Adjustments. Check all terminal connections.

BUSHINGS AND INSULATION

The surface of the bushings should be kept clean and unmarred to prevent moisture absorption. If the insulation surface should become damaged, it should be sanded and cleaned, and should be refinished with either clear varnish or clear resin. Allow to dry smooth and hard.

All other 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.

INSULATION TEST

When insulation has been repaired or replaced, or when the breaker has been stored under adverse conditions, it is recommended that the insulation be checked before the breaker is placed in service. A standard 60 hertz high potential test at 14,000 volts RMS will normally indicate whether the breaker is satisfactory for service. With the breaker contacts in the fully open position, apply the high potential to each terminal of the breaker individually for one minute with all other terminals and the breaker frame grounded. After high potential tests are made on organic insulation materials, these materials should be inspected for visible leakage current paths, and necessary action must be taken to replace insulation that may have been affected by moisture absorption.

If the breaker secondary wiring is to be given a hi-potential test at 1500 volts, remove both of the motor leads from the terminal boards. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

LUBRICATION

In order to maintain reliable operation, it is important that all circuit breakers be properly lubricated at all times. Most of the bearings and rolling surfaces utilize a new type of dry lubrication that will require no maintenance and will last the life of the equipment. Only a few of the bearings and surfaces listed in the lubrication chart require lubrication. These have been properly lubricated, during assembly at the factory, using the finest grades of lubricants available. However, even the finest oils and greases have a tendency to oxidize with age, as evidenced by hardening and darkening in color. Elimination of the hardened lubricant is essential for the proper operation of circuit breakers. Also frequent operation of the breaker causes the lubricant to be forced out from between the bearing surfaces. A simple lubrication will often clear up minor disturbances which might be mistaken for more serious trouble.

A definite lubrication schedule should be set up taking into consideration the frequency of operation of the breaker and local conditions. Until such a schedule is worked out, the breaker should be lubricated at each periodic inspection and also whenever it is overhauled, in accordance with the lubrication chart. It is also recommended that all circuit breakers be operated at regular intervals to insure the user that the equipment is operating freely.

The lubrication chart is divided into two methods of lubrication. The first method outlines the maintenance lubrication which should be performed at the time of periodic maintenance, and requires no disassembly. The second method outlines a lubrication procedure similar to that performed on the breaker at the factory, but should be used only in case of a general overhaul or disassembly for other reasons, or if the operation of the breaker becomes slower.

General Electric lubricants D50H15 and D50H47 are available in 1/4 pound collapsible tubes. It is so packaged to insure cleanliness and to prevent oxidation.

METHOD OF CLEANING BEARINGS

Whenever cleaning is required, as indicated on the lubrication chart, the following procedures are recommended.

Sleeve Berings

The sleeve bearings used throughout the linkage utilize Textolite surfaces and require only light lubrication. If contaminants are present they should be removed by immersing the link and bearing in clean petroleum solvent or similar cleaner and using a still brush. Do not remove the bearings from the links.

WARNING

DO NOT USE CARBON TETRACHLORIDE.

The hinge of the primary contact arm (24, figure 7) should be disassembled, cleaned and lubricated with GE D50H47 lubricant at general overhaul periods.

The main shaft bearings (24, figure 5) and the driving pawl lever bearing should be removed, cleaned and lubricated with GE D50H15 lubricant at general overhaul periods.

Roller and Needle Bearings

The cam follower bearings (6, figure 5), latch roller bearing (9), and cam shaft bearings (25, figure 5) should be removed from the mechanism and the inner race disassembled. They should then be placed in a container of clean petroleum solvent or similar cleaner.

WARNING

DO NOT USE CARBON TETRACHLORIDE.

If the grease in the bearings has become badly oxidized, it may be necessary to use alcohol (type used for thinning shellac) to remove it. Ordinarily, by agitating the bearings in the cleaning solution, and using a stiff brush to remove the solid particles, the bearings can be satisfactorily cleaned. After the bearings have been thoroughly cleaned, spin them in clean new light machine oil until the cleaner or solvent is entirely removed. Allow this oil to drain off and then repack them immediately with GE lubricant D50H15 being sure all metal parts are greased.

NOTE

If it becomes necessary to clean the bearings in alcohol (shellac thinner), be sure the alcohol is perfectly clean, and do not allow the bearings to remain in the alcohol

more than a few hours. If it is desirable to leave the bearings in the alcohol for a longer time, an inhibited alcohol such as is used for anti-freeze should be used. Even then the bearings should be removed from the alcohol within twenty-four hours. Esso Anti-Freeze and Du Pont Zerone are satisfactory for this purpose. Precautions against the toxic effects of the alcohol must be exercised by wearing rubber gloves and by using the alcohol in a well ventilated room; excessive exposure to the fumes is sometimes unpleasant to personnel. Washing the bearings in the light oil and draining should follow immediately, then apply the lubricant.

Bearings that are pressed into the frame or other members such as the eccentric drive bearings (2, figure 14) should not be removed. After removing the shaft and inner race the bearing can usually be cleaned satisfactorily with petroleum solvent or a similar cleaner and a stiff brush. Follow the procedure outlined above using a light machine oil and GE lubricant D50H15 before reassembling the inner race and shaft.

Rolling Surfaces
A number of rolling and rubbing surfaces in the mechanism have been lubricated with a baked-on, dry, molybdenum disulfide coating. This requires no maintenance and should last the life of the breaker.

MAINTENANCE FOR REPETITIVE SWITCHING DUTY

GENERAL
Magne-blast breakers applied to repetitive operation such as switching arc furnaces and motors should be serviced and maintained according to the following schedule.

EVERY 2000 OPERATIONS, OR SEMI ANNUALLY (WHICHEVER COMES FIRST)
Remove the box barriers.

Wipe all insulating parts clean of smoke deposit and dust with a clean dry cloth, including the bushings, and the inside of the box barriers.

All areas in the throat area of the arc chute should be thoroughly cleaned by using sandpaper. This cleaning should be performed any time the arc chute is removed. The arc chute fins should not be cleaned. Whenever the arc chute is removed, loose dust and dirt should be blown out before replacing arc chutes.

Primary Contacts
Inspect the condition of the stationary contact fingers and movable contact blocks. Badly pitted or burned contacts should be replaced.

NOTE

Burned primary contacts indicate the probable need for arcing contact replacement.

If the contact surfaces are only roughened or galled, they should be smoothed with crocus cloth or draw filed.

Arcing Contacts
When the arcing contact wipe is less than the minimum specified under Adjustments, the contacts should be replaced. The contacts should be inspected for uneven wear and/or damage using a mirror to inspect the stationary contacts. Normally it will not be necessary to remove the arc chutes for this 2000 operation servicing unless an inadequate wipe or contact condition indicates a need for replacement. When the arc chutes are removed, the contact braids, coil protectors, and other parts subject to arcing should be checked for possible cleaning or replacement. Do not grease the arcing contacts under any circumstances.

Check the breaker and mechanism adjustments as summarized under Inspection and Test. The necessary readjustments should be made as described under Adjustments.

The breaker and operating mechanism should be carefully inspected for loose nuts, bolts, retaining ring, etc. All cam, latch and roller surfaces should be inspected for damage or excessive wear. The buffer blocks and their retainers on the bottom of the stationary contact support should be inspected for possible need of replacement.

The contacts of the control relay should be inspected for wear and cleaned if necessary.

The contacts of the auxiliary switch should be inspected for wear and cleaned if necessary.

Lubricate the breaker operating mechanism in accordance with the table under Lubrication.

Inspect all wiring for tightness of connections and possible damage to insulation.

After the breaker has been serviced, it should be slowly closed and opened, as described in Installation, to be sure there is no binding or friction and that the breaker contacts can move to the fully opened and fully closed positions. Its electrical operation should then be checked using either a test cabinet or the test couplers.

EVERY 10,000 OPERATIONS
In addition to the servicing done each 2,000 operations, the arc chutes should be removed from the breaker and disassembled to permit a detailed inspection of insulation, blow-out coils, arc runners and assemblies which can become contaminated by arc products.

The blow-out coils should be carefully examined and if the insulation has been cracked, shrunk or eroded from arc action and heat so that the turns of the coils are not fully insulated from each other, the coils should be replaced. All connections should be checked for tightness.

The arc runners should be inspected and replaced when any part of their area has been reduced to 25% of the original metal thickness as a result of arc erosion.

Check the stationary arc contacts to assure that the arcing contacts are in good condition and that their

connections are tight.

Insulating material that is carbonized and cannot be satisfactorily cleaned should be replaced.

Any parts damaged or severely burned and/or eroded from arc action should be replaced.

NOTE

Fine cracks may develop in the fins of the arc chute sides. This is to be expected with ceramic materials when subjected to the high heat of an arc and may be disregarded unless they are long and present a possibility of fin sections breaking completely off. Small broken corners on the exhaust end of the arc chute will not interfere with its performance and can also be disregarded.

The cup bearing and the contact ring at the hinge point of the contact blade should be disassembled, inspected, cleaned, and relubricated with GE contact lubricant D50H47. The contact ring should be inspected for wear and replaced when reduced in thickness to less than 1/32 inch.

EVERY 20,000 OPERATIONS OR EVERY FIVE YEARS (WHICHEVER COMES FIRST)

At this time the breaker should be given a general overhaul and all excessively worn parts in both the mechanism and breaker replaced. Such wear will usually be indicated when the breaker cannot be adjusted to instruction book tolerances. This overhaul and inspection is more detailed and will require disassembly of mechanism and breaker operating parts.

All roller and needle bearings in the operating mechansim should be disassembled, cleaned, and repacked with GE lubricant D50H15 as described under Lubrication.

The stationary primary contact fingers should be disassembled and the silver-plated pivot area of the contact and contact support cleaned and lubricated with GE lubricant D50H47.

The breaker and operating mechanism should be serviced as described for every 2,000 operations and properly adjusted before being put back into service.

NOTE

Magne-blast breakers applied to repetitive operation, such as capacitor switching, should be cleaned as described for every 2,000 operations at intervals of not more than 500 operations.

LUBRICATION CHART

PART	LUBRICATION AT MAINTENANCE PERIOD	ALTERNATE LUBRICATION (REQUIRES DISASSEMBLY)
Sleeve Bearings - lings, trip shaft, etc. (Textolite bearings)	No lubrication required	Wipe clean and apply thin film of D50H15
Sleeve Bearings - main crank shaft, driving pawl lever. (Bronze or cast iron)	Light application of machine oil SAE 20 or SAE 30.	Remove bearings or kings, clean per instructions and apply D50H15 lubricant liberally.
Contact Arm Hinge Assembly Cup Bearing Loose rings between bushing and contact arm.	No lubrication required	Wipe Clean and apply D50H47.
Roller and Needle Bearings	Light application of machine oil SAE 20 or SAE 30.	Clean per instructions and repack with D50H15 lubricant.
Ground surfaces such as cams, ratchet teeth, etc., (Surfaces coated with MoS^2)	No lubrication required	No lubrication required
Ground surfaces such as latches, rollers, prop, etc.	Wipe clean and apply D50H15 lubricant.	Wipe clean and apply D50H15 lubricant.
Primary disconnect studs	Wipe clean and apply D50H47	Wipe clean and apply D50H47
Booster Cylinder	Wipe clean and apply thin film of D50H15	
Arcing contacts	Do not lubricate	Do not lubricate

CORRECTIVE MAINTENANCE

ADJUSTMENTS

All adjustments should be checked during periodic inspection and whenever it becomes necessary to repair or replace parts that have become worn or defective while in service. The following adjustments are listed in the order in which they are to be checked. First however, remove the breaker from the equipment cubicle and remove the box barriers and front cover.

OUTER POLE ARCING CONTACT WIPE

Refer to figure 8. Using the spring blocking device to allow manual closing of the breaker, close the breaker until the arcing contacts just touch. This can be determined with the use of the circuit continuity tester such as a light indicator or a bell set. In this position, the gap between the stationary primary contacts (1) and the moveable primary contacts (2) should be 5/16" or greater. This setting has been made in the factory and no adjustment is provided. A wipe of less than 5/16" is usually an indication that the arcing contacts need to be replaced. When making this check, also see that the moveable arcing contact (5) passes through the probes on the upper arc runner without touching.

OUTER POLE PRIMARY CONTACT WIPE

When the breaker is closed, as shown in figure 8, the stationary primary contacts (1) should rise 5/16", plus 0 minus 1/16". Before checking this dimension be sure the mechanism is reset so that the prop pin (13, figure 5) is resting on the prop. To obtain the proper contact adjustment, open the breaker and, referring to figure 9, loosen the check nut (4) and turn the adjusting nut (3). Screwing up on the adjusting nut will decrease the primary wipe, screwing down on it will increase it. Tighten the check nut, close the breaker and recheck the wipe. With the primary contact wipe correctly adjusted, the clearance between the contact arm (6, figure 8) and the buffer block (3) should be 1/32" or greater when the breaker is fully closed.

WARNING

DO NOT WORK ON EITHER THE BREAKER OR MECHANISM UNLESS THE CLOSING SPRINGS ARE BLOCKED AND THE OPENING SPRINGS HAVE BEEN TRIPPED OPEN OR MECHANICALLY BLOCKED. THIS MEASURE IS REQUIRED TO PREVENT ACCIDENTAL CLOSING OR TRIPPING.

OUTER POLE PRIMARY CONTACT GAP

Refer to figure 9. With the breaker closed, press the manual trip button, allowing the breaker to trip normally. Do not force the contacts open wider by hand. The gap between the stationary primary contacts (5) and the moveable contact (6) should be 3-1/16" minimum to 3-1/2" maximum. To change this gap, loosen the check nut (17, figure 5) and turn the adjusting nut (18) on the stud (19). Screwing the adjusting nut down will decrease the primary contact gap. Tighten the check nut and re-measure the contact gap (close and trip the breaker before rechecking the measurement).

CENTER POLE CONTACT OVERLAP

Refer to figure 8. With the closing springs blocked to allow manual closing of the breaker, close the breaker until the outer pole arcing contacts touch. In this position, measure the position of the moveable main contacts relative to the stationary portion of the breaker. Continue to close the breaker until the center pole contacts open. This can be determined with the use of a circuit continuity tester. Re-measure the position of the outer pole moving main contact and subtract this dimension from the previously measured position. This overlapping of the make of the outer pole arcing contacts and the break of the center pole contact should be a minimum of 3/16" to a maximum of 1/2". To adjust this overlap, refer to figure 54. Loosen the check nut (6) and turn the adjusting nut (7) on the operating rod stud. Turning the adjusting nut down the stud will increase the overlap of the outer and center pole contacts. Tighten the check nut and re-measure the contact overlap confirm that the correct adjustment has been completed.

CENTER POLE CONTACT GAP

Refer to figure 54. With the breaker in the fully closed position, with the closing springs blocked and the opening springs blocked, and with the mechanism resting on the props, measure the gap between the stationary center pole contact and the moving center pole contact (1, figure 54). This gap should be a minimum of 1-7/8" but is not adjustable independently. Adjustment of the center pole contact overlap effects this contact gap directly, and a balance must be obtained to have both adjustments within given limits.

TRIP LATCH WIPE

Refer to figure 5. The wipe of the trip latch (8) on the trip roller should be from 3/16 inch to 1/4 inch. This can be measured by putting a film of grease on the latch (8), closing the breaker part way, and tripping. The mechanism has the proper trip latch wipe when the latch rests against the stop in (23). No adjustment is provided

and a visual inspection is usually all that is required. If this setting is not correct, look for insufficient travel of the trip shaft (7).

WARNING
WHEN WORKING ON THE MECHANISM IN THE CLOSED POSITION, KEEP FINGERS CLEAR OF THE LINKAGE, AS ACCIDENTAL TRIPPING CAN CAUSE SEVERE INJURY.

PROP CLEARANCE
Refer to figure 5. With the breaker closed as far as possible, that is with the springs blocked and the cam (16) rotated so that the prop pin (13) is at its maximum height over the prop (14), the clearance between the prop and prop pin should be 1/16 inch to 5/32 inch. No adjustment is provided and a visual inspection is usually all that is required.

RELEASE LATCH WIPE
Refer to figure 6. The wipe between the release latch (3) and roller (2) should be 3/16 inch to 5/16 inch. If resetting is required, loosen, set, and re-tighten adjustment nut and screw (4).

RELEASE LATCH MONITORING SWITCH
The release latch must be fully re-set and the monitoring switch operated before the motor will start. The switch should be wiped by the striker so that the clearance between the striker and switch mounting bracket (20, figure 6) is 1/32 inch or less. To obtain this adjustment bend the switch striker. Be sure the latch is fully re-set before making any adjustments.

MOTOR AND RELAY SWITCHES
With the closing springs blocked rotate the switch cam (1, figure 6) until the switch striker (8) has travelled the maximum amount (about 180 degree rotation of cam). Loosen mounting bolt (14) and rotate switch support (15) until the gap between the striker (8) and support (15) is 1/32 inch or less.

AUXILIARY SWITCH
The auxiliary switch (9, figure 11) is mounted on the left side of the operating mechanism. The shaft of the position indicator (8) operates the auxiliary switch shaft which opens and closes and "a" and "b" contacts. The "a" contacts are open when the breaker is open and "b" contacts are open when the breaker is closed. The "a" contacts should close when the outer pole primary contact gap is a minimum of 3/8". The "b" contacts need only to be checked to see that they are open when the breaker is closed. The individual stages of the auxiliary switch may be adjusted independently of each other for various late or early contact closings. Adjustment is made by disassembling the switch and repositioning the switch cams in increments of 15° of switch shaft rotation.

DRIVING PAWL ADJUSTMENT
The driving pawl (5, figure 4) must advance the ratchet wheel (3, figure 3) sufficiently on each stroke to allow the latching pawls (1) to fall into the ratchet teeth. This should be checked with the maximum closing spring load against the driving members. With the mechanism unblocked, hand charge the closing springs with the manual charging wrench until they are slightly more than half charged. Slowly rotate the charging wrench until the driving pawl (5, figure 4) has travelled through its return stroke and check the maximum clearance between the pawl and the ratchet tooth. Rotate the charging wrench until the driving pawl has advanced the ratchet tooth to its maximum travel. Now check the clearance between the ratchet tooth and the latch pawl (1, figure 3). The clearance should be approximately equal for both the driving and latching pawls and not less than .015 inch in either case.

If adjustment is required for either pawl the springs must first be fully charged and blocked. Loosen seven motor support bolts (1, figure 14) and move entire motor assembly to the rear if the clearance is under the minimum at the driving pawl. Move the motor assembly approximately twice the dimensional increase required at the pawl. Be certain the motor assembly is moved straight forward or rearward and tighten the one bolt on the right side of the mounting frame first to assure proper alignment. After tightening the remaining bolts the springs should be released and the clearance again checked as described above.

AUXILIARY DEVICES
Latch Checking Switch
Refer to figure 12. Rotate the trip latch (4) clockwise (looking at the left side of the mechanism) by pressing the manual trip lever to open the latch checking switch operating arm (3). Allow the trip latch to reset slowly and determine the point at which the contacts make by using a circuit continuity tester, such as a light indicator or bell set. The contacts of the latch checking switch should just make when the gap between the trip latch (4) and the stop pin (5) located on the crank (7) is 1/16 inch. There should be a minimum of 1/64 inch clearance between the operating arm (3, figure 12) and the switch (2). To attain this clearance bend the latch checking switch operating arm (3).

Plunger Interlock
Refer to figure 13. With the breaker in the closed position, the vertical distance "A" from the top of the interlock bolt (1) to the bottom of the elevating pin (3) should be 11.82 inches plus or minus 1/16 inch. To change this adjustment, loosen checknut (2), raise or lower bolt (1) as required and tighten check nut to lock.

Inspection and Test
For ease of reviewing the adjustment, the following are recapitulated:

a) Outer pole arcing contact wipe: 5/16" or greater (gap at primary contacts).
b) Outer pole primary contact wipe: 5/16" plus 0 minus 1/16".
c) Outer pole contact gap: 3-1/16" minimum to 3-1/2" maximum.
d) Center pole contact overlap: 3/16" minimum to 1/2" maximum (outer pole arcing contact make to center pole break measured at outer pole main contacts).

e) Center pole contact gap: 1-7/8" minimum.
f) Trip latch wipe: 3/16" to 5/16" with the trip latch resting against stop pin.
g) Trip latch clearance: 1/32" to 1/16".
h) Prop clearance: 1/16" to 5/32".
i) Release latch wipe: 3/16" to 1/4".
j) Release latch monitoring switch: maximum clearance 1/32".
k) Motor and relay switch: maximum clearance 1/32".
l) Auxiliary switch: "a" contacts closed when the breaker primary contact gap is 3/8" or greater.
m) Driving and latching pawl: minimum clearance to latch teeth 0.015".
n) Latch checking switch contacts: make when the gap between the trip latch and the stop is 1/16".
p) Plunger interlock: 11.82" plus or minus 1/16".

Check all nuts, washers, bolts, pins and terminal connections for tightness. Inspect all the wiring to make sure that no damage has resulted during installation. Test for possible grounds or short circuits. See that all bearing surfaces of the mechanism have been lubricated. Refer to LUBRICATION. Operate the breaker slowly with the manual charging wrench and note that there is no excessive binding or friction and if the breaker can be moved to the fully-open and fully-closed positions. See that any place where the surface of the paint has been damaged is repainted immediately. Check the trip coil plunger and the release plunger to see that they move freely.

Control Power Check

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

Nominal Voltage	Closing Range		Tripping Range	
	Min.	Max.	Min.	Max.
48V DC	36 -	52V DC	28 -	60V DC
110V DC	80 -	115V DC	60 -	125V DC
125V DC	90 -	130V DC	70 -	140V DC
220V DC	160 -	230V DC	120 -	250V DC
250V DC	180 -	260V DC	140 -	280V DC
115V AC	95 -	125V AC	95 -	125V AC
230V AC	190 -	250V AC	190 -	250V AC

If the closed circuit voltage at the terminals of the coil or motor does not fall in the specified range, check the voltage at the source of power and line drop between the power source and breaker.

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 or motor 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 on the Enclosing unit. It is also possible to trip or close the breaker manually by pressing the manual trip level (11, figure 2) or the manual close button (7).

Before the breaker is finally raised into position in the Enclosing unit, rub a small amount of CGE contact lubricant D50H47 on the silvered portion of the breaker studs to form a thin coating for contacting purposes.

TROUBLESHOOTING

Failure of a breaker to operate properly will generally fall within four general classes; failure to trip, failure to close or latch closed, closing springs will not recharge, and overheating. The Troubleshooting Chart is a brief outline showing particular types of distress that might be encountered, together with suggestions for remedying the trouble.

REPAIR AND REPLACEMENT

The following information covers in detail the proper method of removing various parts of the breaker in order to make any necessary repairs. This section includes only those repairs that can be made at the installation on parts of the breaker that are most subject to damage or wear.

CAUTION

Upon completion of any repair work, all breaker and mechanism adjustments must be checked. Refer to the section on Installation, paying particular attention to Adjustments and Final Inspection.

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 break-downs and saves time and expense.

When continuous operation is a primary consideration, more renewal parts should be carried, the amount depending on the severity of the service and 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. The renewal parts list covers the AMF 1A and the AMF 1B breakers.

NOTE

The listed terms "right" and "left" apply when facing the breaker mechanism.

ORDERING INSTRUCTIONS

Always specify the breaker serial number and the complete type description.

Specify the quantity, catalogue number if listed, reference number and description of each part ordered and this bulletin number.

Standard hardware such as screws, bolts, nuts, washers, etc. is not listed in this bulletin and such items should be purchased locally. For prices on renewal parts refer to the nearest office of Canadian General Electric Company Limited.

PARTS RECOMMENDED FOR MAINTENANCE

The tabulations that follow list the parts which are recommended for normal maintenance.

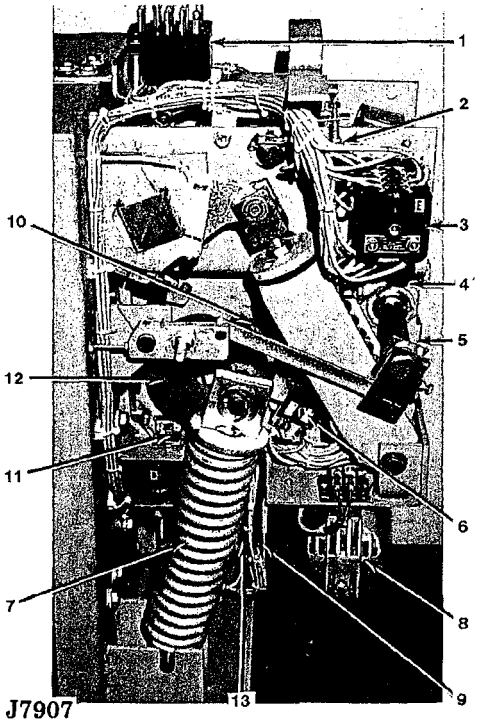
Customers, through their own experience, may fing they need to stock additional parts selected from the more extensive list of renewal parts to cover requirements of their particular application and operation.

TROUBLESHOOTING CHART

FAULT	CAUSE	CORRECTIVE ACTION
1. Failure to Trip	a. Mechanism binding or sticking caused by lack of lubrication.	Lubricate complete mechanism.
	b. Mechanism binding or sticking caused by being out of adjustment.	Check all mechanism adjustment, latches, stops, auxiliary devices, etc., in accordance with section on Adjustments. Examine latch and roller surfaces for corrosion.
	c. Damaged trip coil.	Replace damaged coil.
	d. Blown fuse in trip circuit.	Replace blown fuse after determining cause of failure.
	e. Faulty connections in trip circuit.	Repair broken or loose wires and see that all binding screws are tight.
	f. Damaged or dirty contacts in trip circuit.	Recondition or replace contacts.
2. Failure to Close or Latch Closed	a. Mechanism binding or sticking caused by lack of lubrication.	Lubricate complete mechanism.
	b. Mechanism binding or sticking caused by being out of adjustment.	Check all mechanism adjustments, latches, stops, auxiliary devices, etc., in accordance with section on Adjustment. Examine latch and roller surfaces for corrosion.
	c. Damaged or dirty contacts in control circuit including control relay.	Recondition or replace contacts.
	d. Damaged spring release coil.	Replace damaged coil.
	e. Defective latch-checking switch, or interlock switch.	Replace defective switch.
	f. Blown fuse in closing circuit.	Replace blown fuse after determining cause of failure.
	g. Faulty connections in closing circuit.	Repair broken or loose wires and see that all binding screws are tight.
	h. Insufficient control voltage caused by excessive drop in leads.	Install larger wires and improve electrical contact at connections.
	i. Insufficient control voltage caused by poor regulation (AC control).	Install larger control transformer.
3. Failure to Recharge Springs	a. Defective motor cut-off switch, interlock switch, or closing latch monitoring switch.	Replace switch.

TROUBLESHOOTING CHART (CONT'D)

FAULT	CAUSE	CORRECTIVE ACTION
	b. Damaged or dirty contacts in control circuit.	Recondition or replace contacts.
	c. Blown fuse in closing circuit.	Replace blown fuse after determining cause of failure.
	d. Faulty connection in charging circuit.	Repair broken or loose wires and see that all binding screws are tight.
4. Overheating	a. Poor condition of contacts due to lack of attention after severe duty or too frequent operation.	Recondition or replace burned and pitted contacts. (Contacts should be reconditioned very carefully and only when absolutely necessary.)
	b. Contacts not properly aligned or adjusted.	Check all adjustments in accordance with section on adjustments.
	c. Breaker kept closed or open for too long a period.	Operate breaker more often to wipe contacts clean. Replace contacts if necessary.
	d. Overloading	Replace breaker with one of adequate rating for present or future load, or re-arrange circuits so as to remove excess load.
	e. Primary connections of inadequate capacity.	Increase size or number of conductors or remove excess current.
	f. Loose connections or terminal connectors.	Tighten.
	g. Ambient temperature too high.	Relocate in a cooler place or arrange some means of cooling.



1. Secondary Coupler
2. Interlock Switches
3. Auxiliary Switch
4. Latch Checking Switch Location Only
5. Charge-Discharge Indicator
6. Power Switches
7. Closing Spring
8. Motor
9. Fuses (Location only - Fuses not shown)
10. Closing Latch Roller
11. Closing Latch
12. Switch Cam
13. Control Relay

Figure 1 Operating Mechanism - Left Side

1. Trip Coil
2. Open - Close Indicator
3. Auxiliary Switch
4. Counter (When Supplied)
5. Trip Latch
6. Charge-Discharge Indicator
7. Close Button
8. Motor
9. Fuse (when supplied)
10. Prop Spring
11. Trip Lever
12. Nameplate

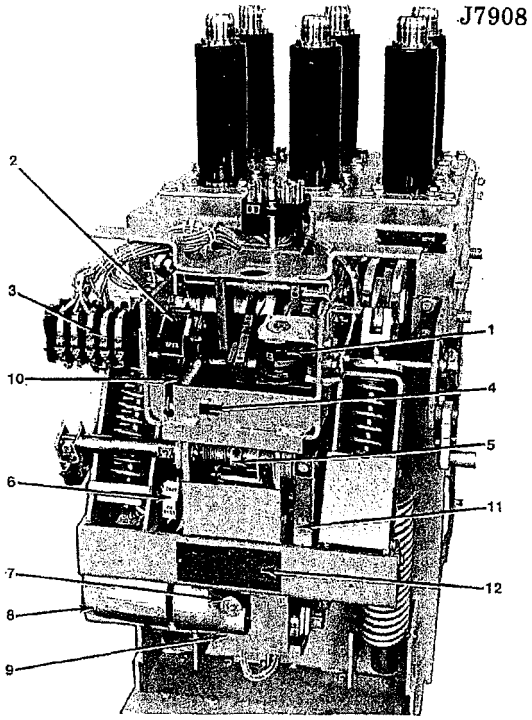
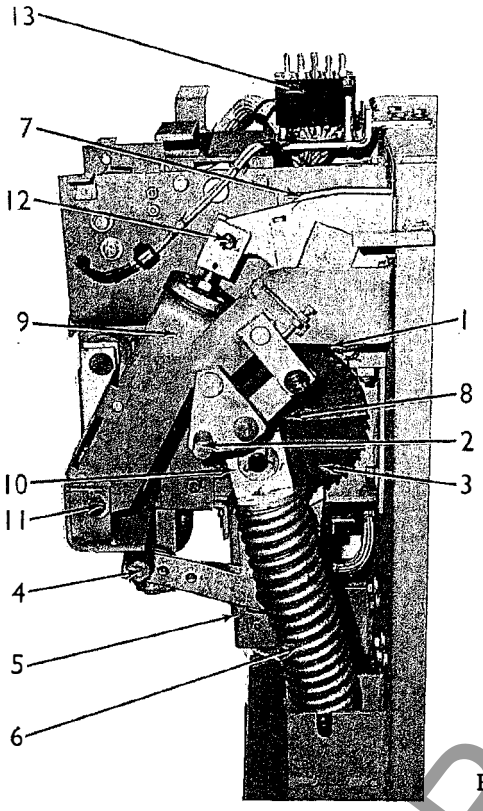


Figure 2 Operating Mechanism - Front



1. Latching Pawls
2. Positive Interlock Roller
3. Ratchet Wheel
4. Eccentric
5. Fuse (Location only - Fuse not shown)
6. Closing Spring
7. Main Shaft Bearing
8. Cam Shaft
9. Opening Spring
10. Guide Block
11. Lower Spring Pin
12. Upper Spring Pin
13. Secondary Coupler

Figure 3 Operating Mechanism - Right Side

1. Close Button
2. Motor
3. Fuse (when supplied)
4. Spring Blocking Device
5. Driving Pawl
6. Eccentric
7. Closing Spring
8. Manual Charging Wrench
9. Support Bolts

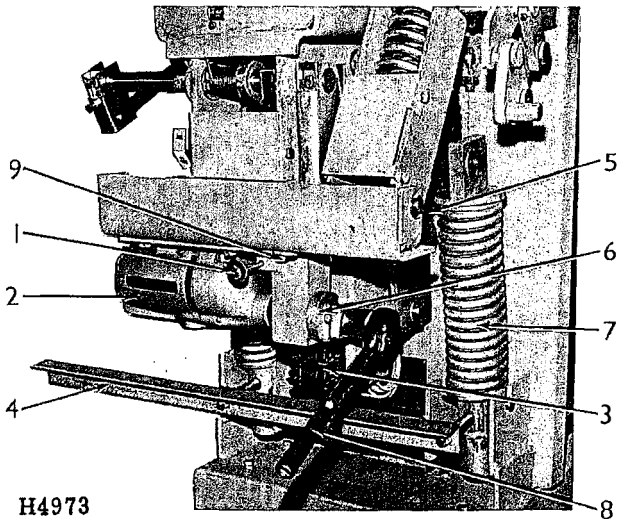
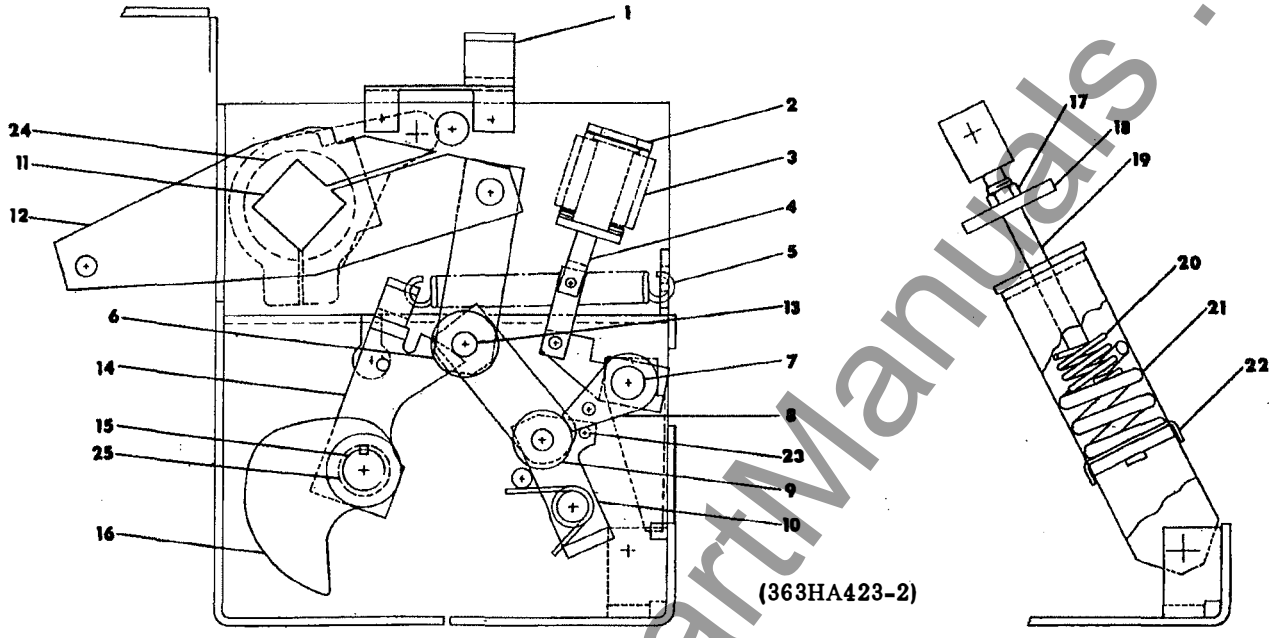


Figure 4 Spring Blocking Device

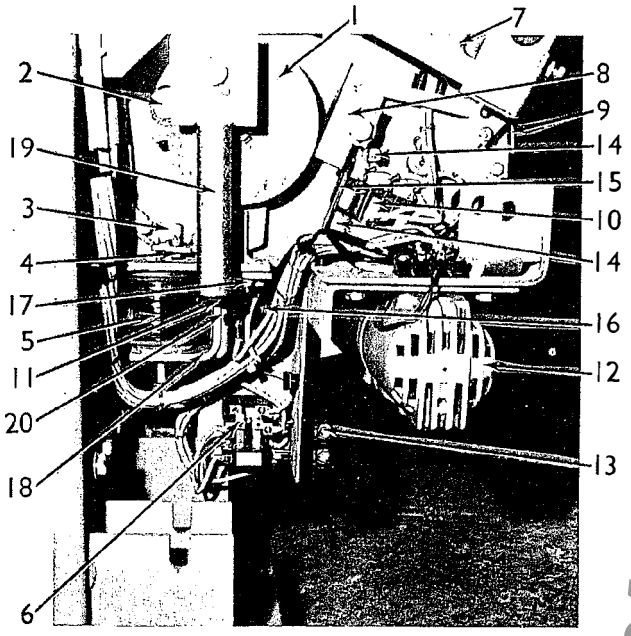


Sectional Side View

Opening Spring

1. Handle
2. Trip Coil Support
3. Trip Coil
4. Trip Armature
5. Prop Reset Spring
6. Cam Follower Roller
7. Trip Shaft
8. Trip Latch
9. Trip Latch Roller
10. Trip Latch Roller Support
11. Crank Shaft
12. Cranks
13. Prop Pin
14. Prop
15. Drive Shaft
16. Cam
17. Check Nut
18. Stop Plate
19. Spring Rod
20. Spring
21. Spring
22. Spring Guide
23. Stop Pin
24. Main Shaft Bearing
25. Cam Shaft Bearing

Figure 5 Operating Mechanism



1. Switch Cam
2. Closing Latch Roller
3. Closing Latch
4. Latch Adjusting Screw
5. Spring Release Solenoid
6. Control Relay
7. Latch Checking Switch
8. Switch Striker
9. Charge-Discharge Indicator
10. Power Switches
11. Latch Monitoring Switch
12. Motor
13. Fuse
14. Switch Support Bolts
15. Switch Support
16. Closing Latch Spring
17. Release Coil Bolts
18. Release Coil Support
19. Closing Latch Shaft
20. Switch Mounting Bracket

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Figure 6 Control Mechanism

1. Box Barrier Support
2. Box Barrier
3. Arc Chute
4. Arc Runner, Upper
5. Blow Out Coil, Upper
6. Blow Out Core, Upper
7. Movable Arcing Contact
8. Arc Runner, Lower
9. Blow Out Coil, Lower
10. Blow Out Core, Lower
11. Pole Piece
12. Front Bushing
13. Rear Bushing
14. Upper Horizontal Barrier
15. Main Operating Crank
16. Arc Chute Support
17. Spring Retainer
18. Lower Horizontal Barrier
19. Operating Rod
20. Stationary Arcing Contact
21. Stationary Primary Contact
22. Movable Primary Contact
23. Movable Contact Arm Assembly
24. Cup Bearing
25. Booster Tube and Piston
26. Front Vertical Barrier
27. Check Nut
28. Connection Bar
29. Booster Cylinder

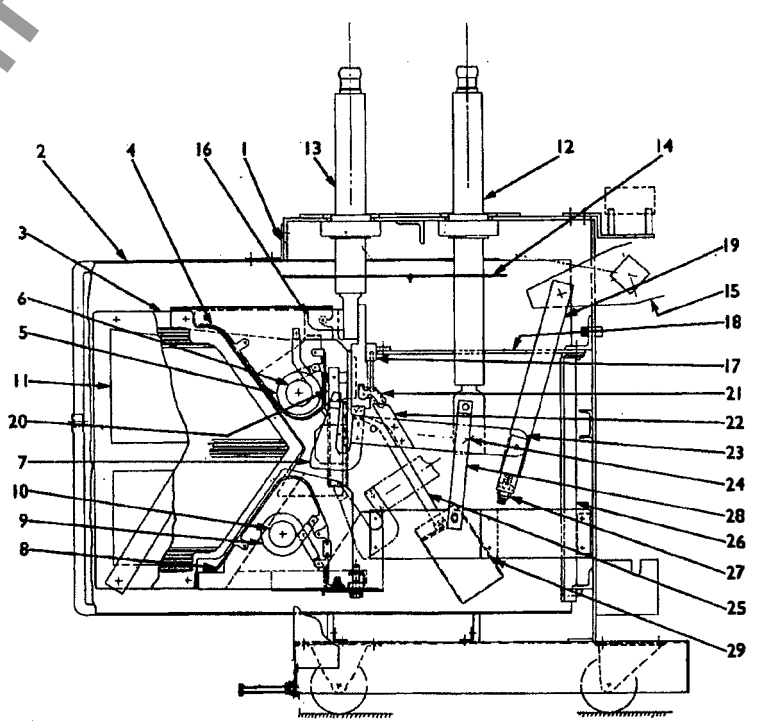

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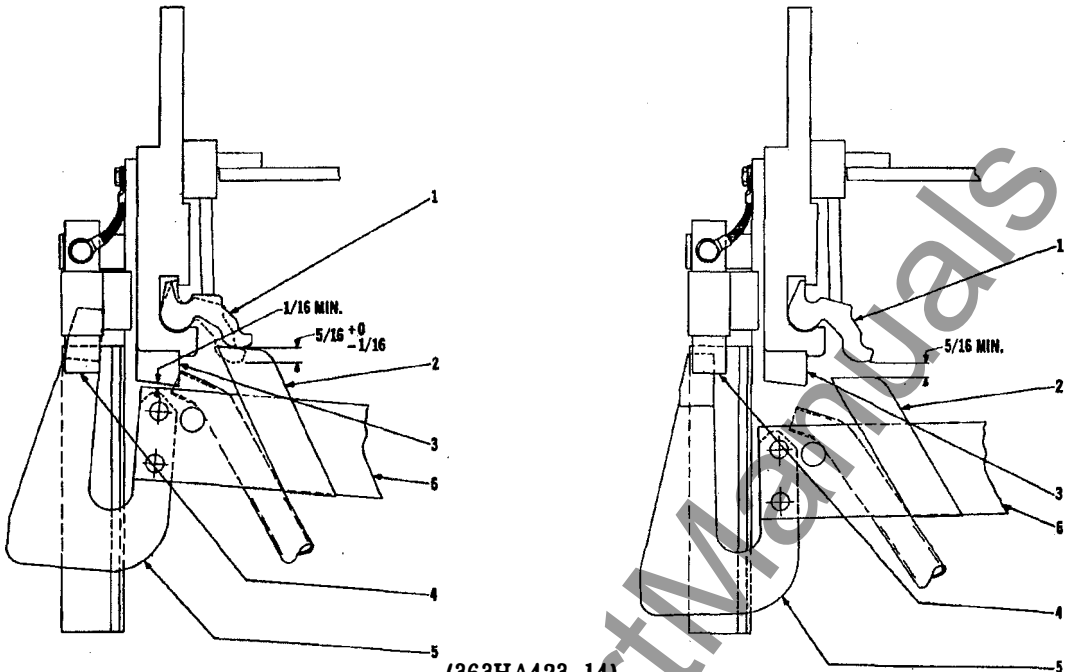
Figure 7 Breaker Outer Pole Unit - Cross Section



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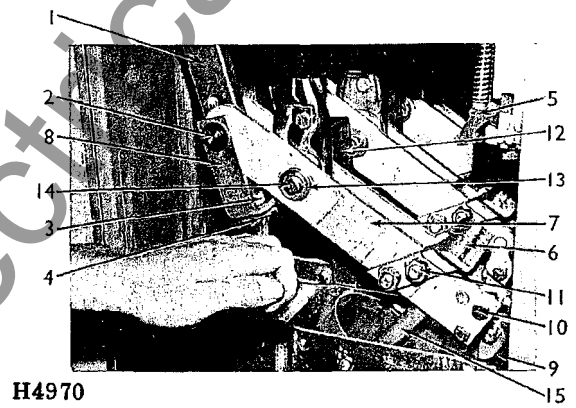
Outer Pole
Primary Contact Wipe

Outer Pole
Arcing Contact Wipe

1. Stationary Primary Contacts
2. Movable Primary Contacts
3. Buffer Block
4. Stationary Arcing Contacts
5. Movable Arcing Contacts
6. Contact Arm

Figure 8 Contact Adjustments



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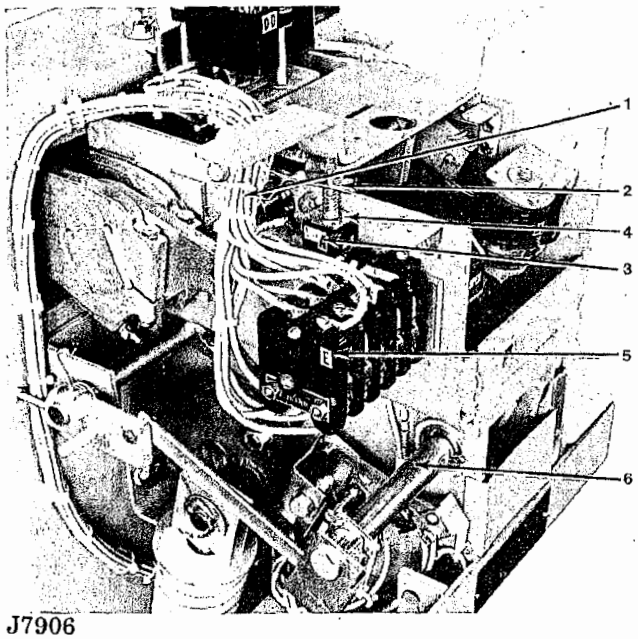
1. Operating Rod
2. Operating Rod Pin
3. Adjusting Nut
4. Check Nut
5. Stationary Primary Contacts
6. Movable Primary Contacts
7. Contact Arm
8. Yoke
9. Movable Arcing Contact
10. Assembly Bolts
11. Assembly Bolts
12. Connection Bar
13. Bearing
14. Hinge Pin
15. Piston Assembly

Figure 9 Adjustable Coupling for Making Primary Contact Wipe Adjustments



1. Positive Interlock Shaft
2. Switch Arm
3. Interlock Switch
4. Switch Support
5. Auxiliary Switch
6. Trip Shaft

Figure 10 Positive Interlock Switch

1. Trip Coil Support
2. Trip Coil
3. Mounting Bolts
4. Counter (When Supplied)
5. Trip Latch
6. Trip Arm Screw
7. Manual Trip Lever
8. Open-Close Indicator
9. Auxiliary Switch
10. Handle
11. Latch Set Screw
12. Cotter Pin
13. Prop Spring

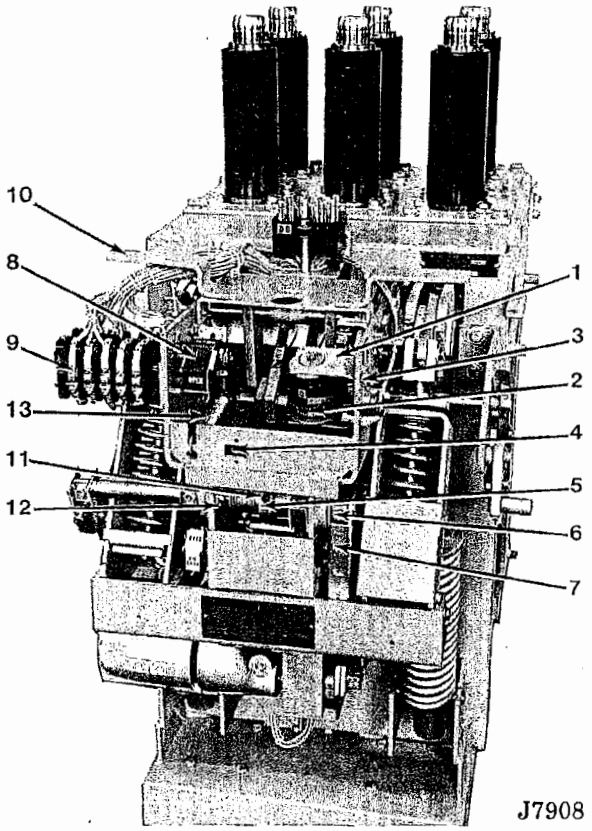
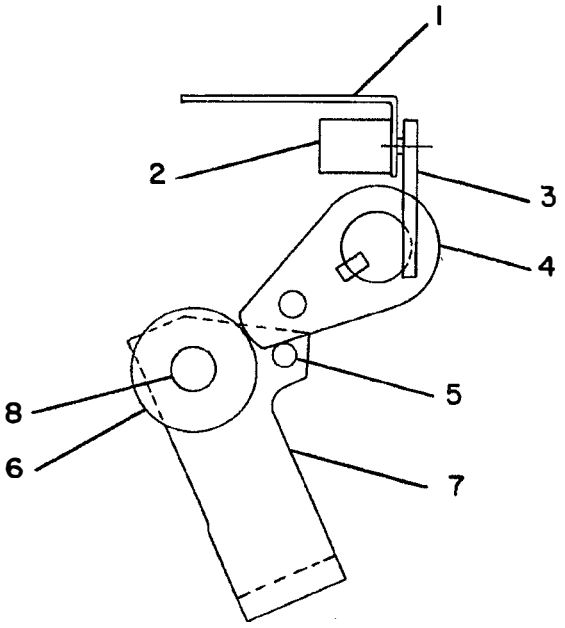


Figure 11 Auxiliary Switch and Trip Coil



1. Switch Support
2. Latch Checking Switch
3. Switch Arm
4. Trip Latch
5. Reset Pin Stop
6. Latch Roller
7. Latch Roller Link
8. Latch Roller Pin

Figure 12 Latch Checking Switch

1. Plunger Bolt
2. Check Nut
3. Breaker Lifting Pins
4. Plunger Shield

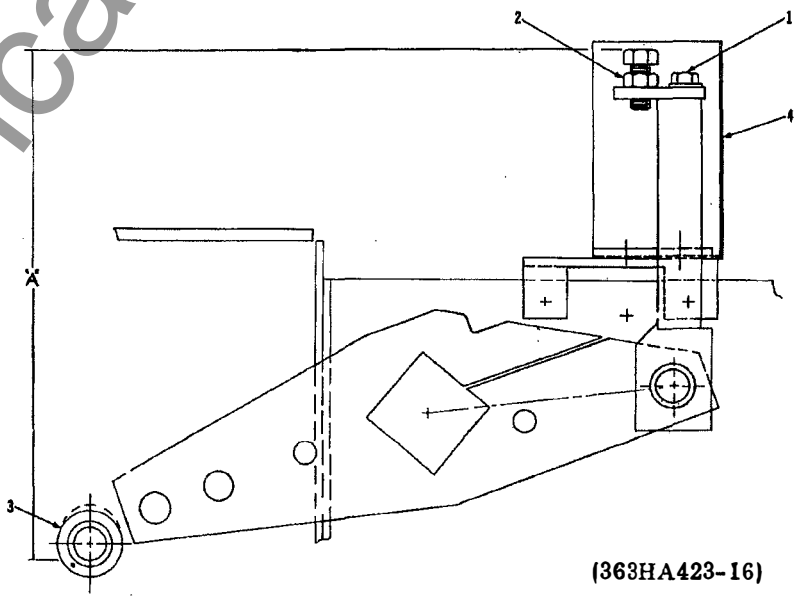


Figure 13 Plunger Interlock

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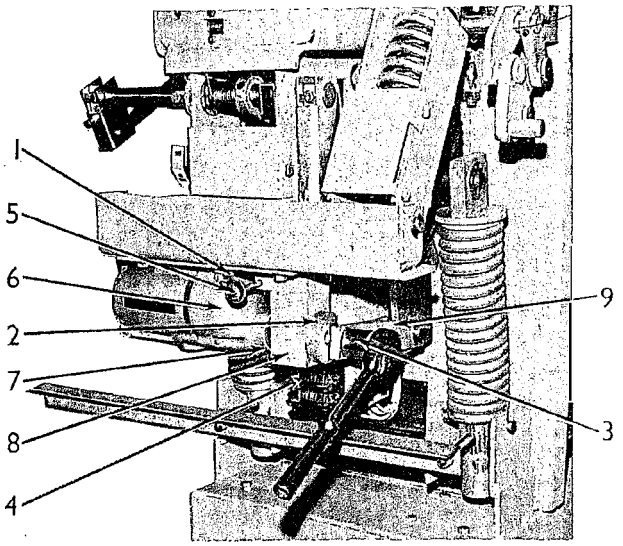

1. Mounting Bolts
2. Eccentric
3. Hex Charging Stud
4. Fuse Block (when supplied)
5. Manual Close Button
6. Motor
7. Retaining Ring
8. Motor Support
9. Driving Link

Figure 14 Driving Elements

1. Assembly Bolt and Bushing
2. Assembly Bolt
3. Upper Pole Piece
4. Assembly Bolt
5. Side Brace
6. Assembly Bolt
7. Lower Brace
8. Assembly Bolt
9. Upper Mounting Support
10. Insulating Cap
11. Side Shield
12. Assembly Bolt
13. Lower Mounting Support
14. Assembly Bolts
15. Assembly Bolts
16. Lower Pole Piece
17. Upper Insulation

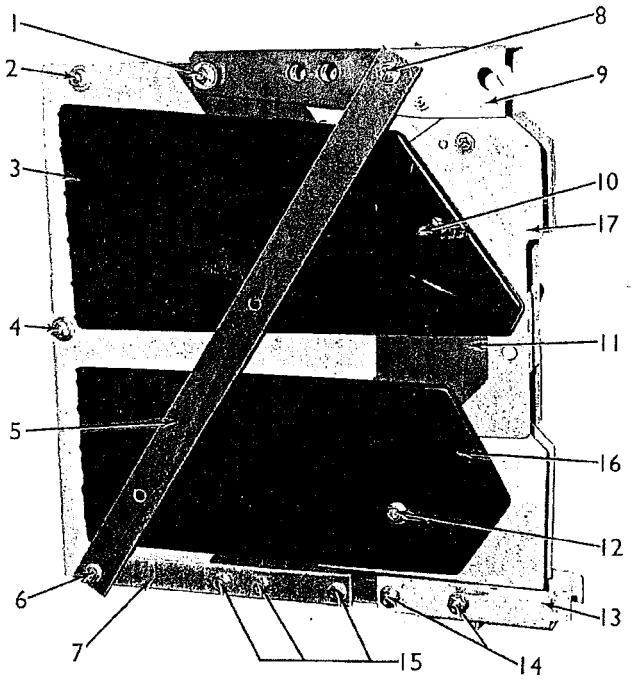

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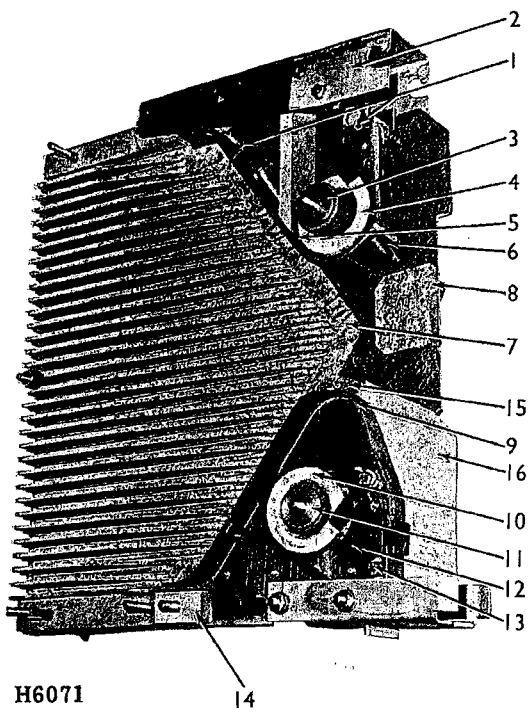
Figure 15 Arc Chute Assembly



1. Upper Arc Runner Spacers
2. Upper Arc Runner Assembly
3. Blowout Core
4. Blowout Coil
5. Insulation
6. Upper Arc Runner
7. Arc Chute Side
8. Throat Piece Assembly
9. Lower Arc Runner
10. Blowout Coil
11. Blowout Core
12. Lower Arc Runner Assembly
13. Lower Coil Connection
14. Lower Arc Runner Spacers
15. Lower Shield
16. Lower Insulation

Figure 16 Arc Chute Assembly With Side Removed

1. Upper Mounting Support
2. Connection Bolt
3. Upper Blowout Coil
4. Upper Arc Runner Assembly
5. Upper Arc Runner
6. Throat Piece Assembly
7. Lower Arc Runner Assembly
8. Lower Coil Connection
9. Connection Nut
10. Lower Mounting Support

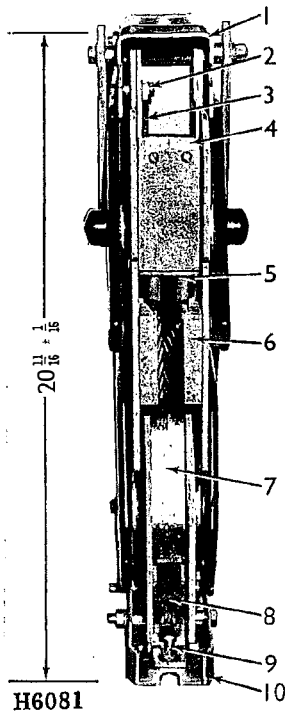
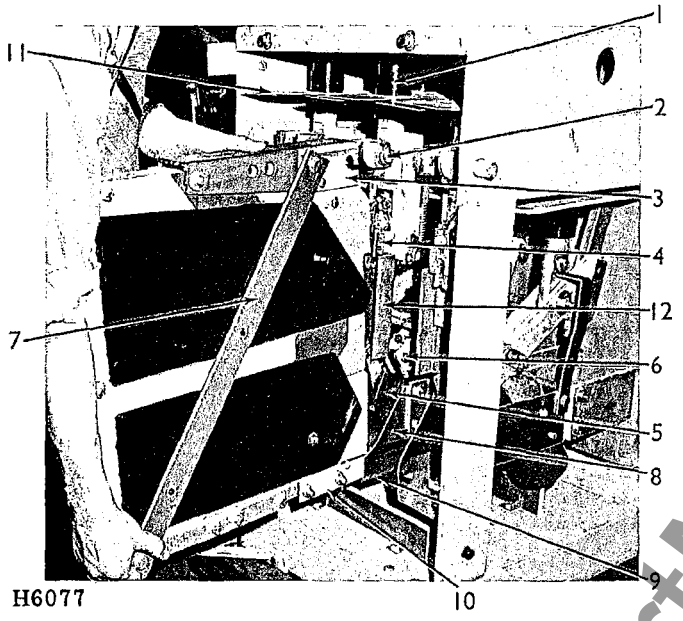


Figure 17 Front View Arc Chute Assembly



1. Rear Bushing
2. Supporting Bolt
3. Upper Mounting Support
4. Stationary Arcing Contact Assembly
5. Movable Arcing Contact
6. Assembly Bolts
7. Brace for Arc Chute
8. Arc Chute Mounting Bracket
9. Lower Supporting Bolt
10. Lower Mounting Support
11. Upper Horizontal Barriers
12. Baffle

Figure 18 Arc Chute Partially Removed

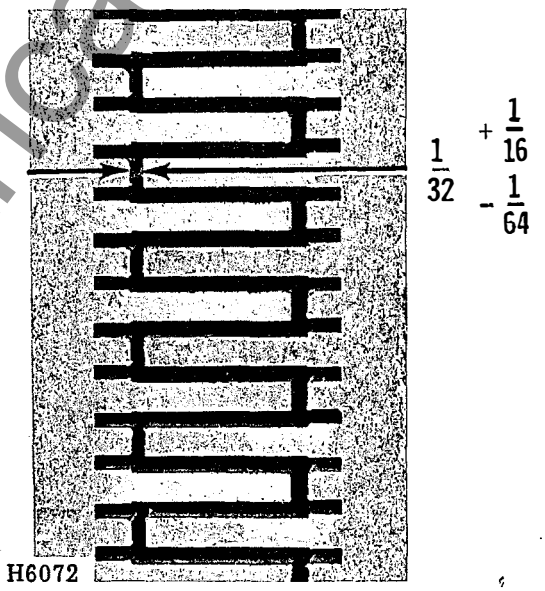
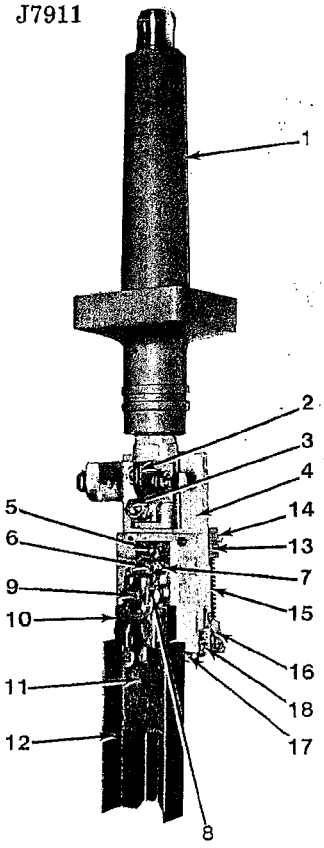


Figure 19 Arc Chute Fin Spacing



1. Rear Bushing
2. Guide and Support for Arc Chute
3. Bolts for Contact Support
4. Contact Support
5. Bolt for Flexible Braid
6. Mounting Bolt
7. Flexible Braid
8. Connection Bolt
9. Stud for Mounting Arcing Fingers
10. Stationary Arcing Contact Assembly
11. Insulating Plate
12. Baffle
13. Spring Retainer
14. Barrier Support
15. Contact Springs
16. Stationary Primary Contact
17. Buffer
18. Contact Retainer

Figure 20 Outer Pole Rear Bushing Assembly

1. Crank
2. Link
3. Crank
4. Clevis (upper)
5. Clevis (lower)
6. Crank
7. Crank (front)
8. Adjusting Bolts

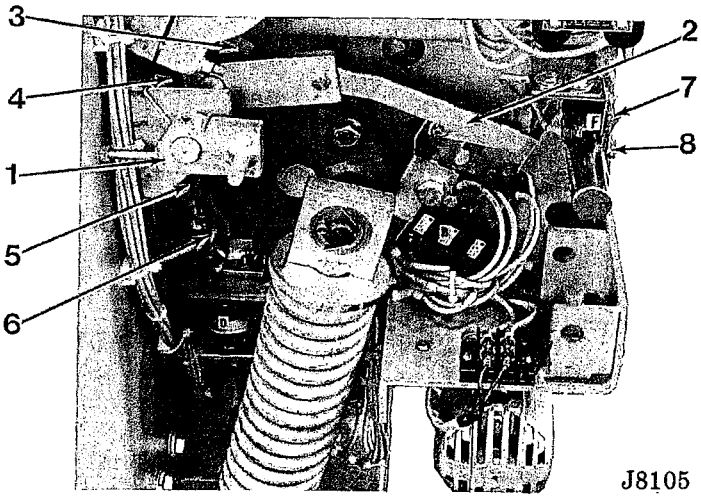
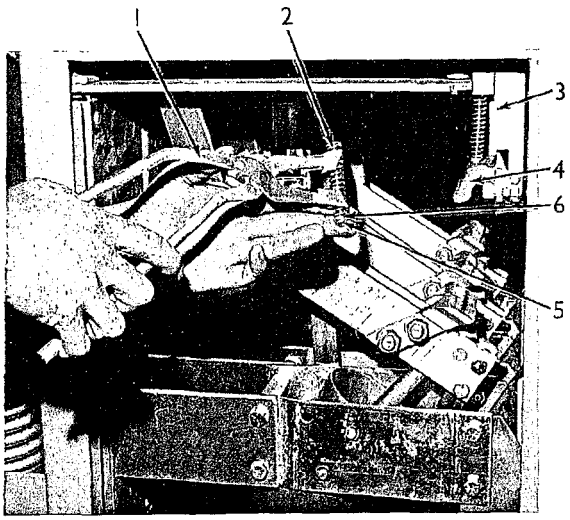


Figure 21 Spring Release Interlock



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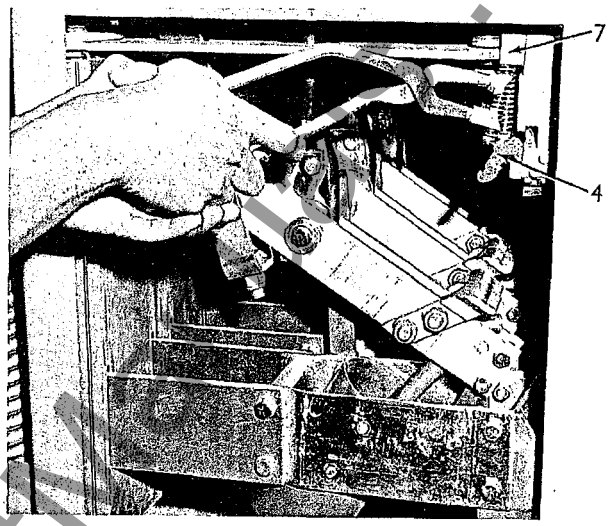

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1. Spring Compressor
2. Contact Spring
3. Contact Block
4. Stationary Main Contact
5. Spring Guide
6. Spring Spacer
7. Spring Retainer

Figure 22 Method of Replacing Primary Contact Springs

RECOMMENDED PARTS FOR MAINTENANCE

FOR

MAGNE-BLAST FIELD DISCHARGE
CIRCUIT BREAKER

TYPE AMF-1A
TYPE AMF-1B

RECOMMENDED PARTS FOR MAINTENANCE

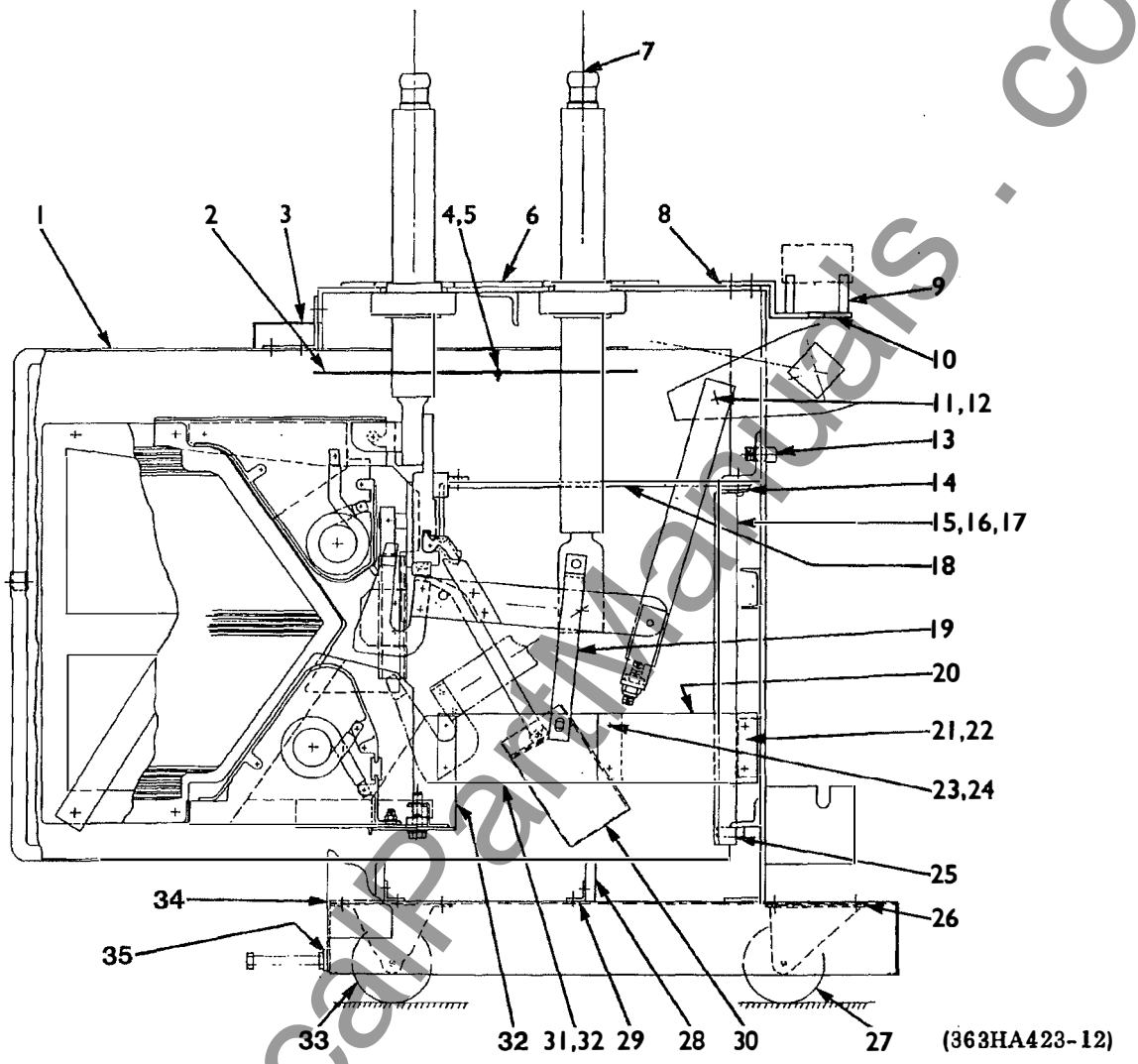
Fig. & Ref. Numbers	Type	Catalogue Number	No. Per Bkr.	Pole	Description
25 - 72	ALL	0197A1564 G-001	2	Outer	Throat Barrier Assembly
26 - 114	ALL	0136B8912 G-001	2	Outer	Right Hand Throat Piece Assembly
26 - 115	ALL	0136B8912 G-001	2	Outer	Left Hand Throat Piece Assembly
26 - 124	ALL	0168B2465 P-001	2	Outer	Arc Shield
26 - 128	ALL	0197A1532 P-001	4	Outer	Lower Mycalex
30 - 9	ALL	0197A1132 P-001	1	—	Prop Spring
30 - 25	ALL	25782 - 7	1*	—	Trip Coil 24V dc
		25782 - 5	1*	—	Trip Coil 48V dc
		25782 - 4	1*	—	Trip Coil 110V dc - 125V dc
		25782 - 3	1*	—	Trip Coil 250V dc
		25782 - 5	1*	—	Trip coil 230V dc
31 - 101	ALL	0132B3131 G-002	5	—	Switch Normally Open
31 - 105	ALL	0132B3131 G-001	1	—	Switch Normally Closed
31 - 107	ALL	0105C9393 P-001	1*	—	Motor 48V dc
		0105C9393 P-002	1*	—	Motor ac and dc 110V to 125V
		0105C9393 P-003	1*	—	Motor ac and dc 230V to 250V
31 - 109	ALL	0169B4663 G-001	1*	—	Relay 48V dc
		0169B4663 G-002	1*	—	Relay 110V, 125V dc
		0169B4663 G-003	1*	—	Relay 220V-250V dc
		0169B4663 G-004	1*	—	Relay 230V ac
		0169B4663 G-005	1*	—	Relay 115V ac
31 - 130	ALL	25782 - 5	1*	—	Spring Release Coil 48V dc
		25782 - 4	1*	—	Spring Release Coil 110-125V dc
		25782 - 3	1*	—	Spring Release Coil 250V dc
		25782 - 5	1*	—	Spring Release Coil 230V dc
23 - 30	ALL	0197A1576 G-001	2	Outer	Booster Cylinder
25 - 64	1A	0338V0270 P-001	12	Outer	Primary Contact Finger Spring
	1B	0188A9257 P-001	16	Outer	Primary Contact Finger Spring
25 - 67	1A	0197A1557 P-001	12	Outer	Primary Contact Finger
	1B	0534A0851 P-001	16	Outer	Primary Contact Finger
25 - 81	ALL	0238A1220 G-001	2	Outer	Stationary Arcing Contact Assembly
39 - 1	ALL	0238A1220 G-001	1	Center	Stationary Contact Assembly
26 - 108	ALL	0216A6098 P-001	4	Outer	Insulation Cap
26 - 131	ALL	0197A1545 P-001	4	Outer	Lower Barrier
27 - 171	ALL	0169B4560 P-002	2	Outer	Movable Arcing Contact
3 - 2	ALL	0185B7843 P-001	1	Center	Movable Contact
27 - 173	1A	0197A1560 P-001	4	Outer	Movable Primary Contact
27 - 174	1B	0534A0850 P-001	4	Outer	Movable Primary Contact (L)
	1B	0534A0850 P-002	4	Outer	Movable Primary Contact (R)
27 - 178	ALL	0168B2466 G-003	2	Outer	Buffer Tube and Piston Assembly
37 - 4	ALL	0265A7115 G-001	2	Outer	Operating Rod
37 - 9	ALL	0265A7114 G-001	1	Center	Operating Rod
31 - 102	ALL	0266A6351 G-001	1	—	Auxiliary Switch
31 - 116	ALL	0136B8505 P-001	1	—	Outside Latching Pawl
31 - 117	ALL	0136B8505 P-002	1	—	Inside Latching Pawl
	ALL	0216A7438AB P-005	2	—	Latching Pawl Bushing
31 - 118	ALL	0136B8504 P-001	1	—	Driving Pawl
	ALL	0216A7438AC P-006	1	—	Driving Pawl Bushing
31 - 120	ALL	0473L0111 G-015	1	—	Ratchet Wheel & Stop

RENEWAL PARTS

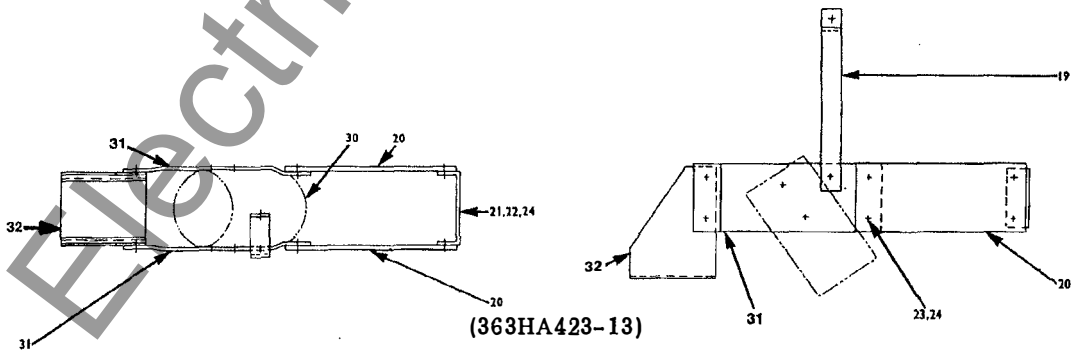
OF

ML-13 STORED ENERGY MECHANISM

Fig. & Ref. Numbers	Type	Catalogue Number	No. Per Bkr.	Description
23 - 1	ALL	0137C3120 G-001	1	Box Barrier Assembly
23 - 2	1A	0197A1585 P-001	4	Upper Horizontal Barrier Outer
	1B	0197A1585 P-002	4	Upper Horizontal Barrier Outer
23 - 3	ALL	0115V0938 P-001	1	Ground Connection
23 - 4	ALL	0188A9769 P-001	2	Nylon Nut (1/4 - 20)
23 - 5	ALL	0188A9769 P-002	2	Nylon Screw (RD. HD. 1/4-20 × 1/2)
23 - 6	1B	0216A6030 P-001	1	Top Plate
23 - 7	1A	0216A6196 P-001	6	Bushing Plug
23 - 8	ALL	0216A6376 P-001	2	Sec. Disc. Shim
23 - 9	ALL	A184858 P-316	3	Pipe Spacer (1/8" pipe, 1.88 lg.)
23 - 10	ALL	0136B8976 G-001	1	Sec. Disc. Support
23 - 11				See figure #31
23 - 12				See Figure #31
23 - 13	ALL	0191A7397 P-001	2	Aligning Pin
23 - 14	ALL	0188A9773 G-001	3	Nut Plate
23 - 15	ALL	0136B8945 G-001	1	Vertical Barrier Ph. 3, R.H.
23 - 16	ALL	0136B8945 G-002	1	Vertical Barrier Ph. 2, Ctr.
23 - 17	ALL	0136B8945 G-003	1	Vertical Barrier Ph. 1, L.H.
23 - 18	1A	0265A7431 P-001	2	Lower Horizontal Barrier Outer
	1B	0265A7431 P-002	2	Lower Horizontal Barrier Outer
23 - 19	ALL	0197A1591 P-001	2	Connecting Bar
23 - 20	ALL	0197A1572 P-001	6	Support
23 - 21	ALL	0197A1577 G-001	3	Support
23 - 22	ALL	0188A9761 P-011	6	Plug Nut (1/2-13 × 0.123)
23 - 23	ALL	0188A9753 P-004	3	Spacer
23 - 24	ALL	0188A9739 P-001	3	Locknut (3/8-16 ESNA)
23 - 25	ALL	0197A1582 P-001	3	Block
23 - 26	ALL	0335V0449 P-002	4	Front Wheel Shim
23 - 27	ALL	0188A9105 P-004	2	Front Wheel
23 - 28	ALL	0216A6016 P-001	2	Box Barrier Support
23 - 29	ALL	0188A9777 G-001	4	Box Barrier Support Angle
23 - 30	ALL	0197A1576 G-001	3	Booster Cylinder
23 - 31	ALL	0197A1571 P-001	6	Support
23 - 32	ALL	0137C3152 G-001	2	Interrupter Clamp Outer
23 - 33	ALL	0188A9105 P-005	2	Rear Wheel
23 - 34	ALL	0335V0448 P-002	4	Rear Wheel Shim
23 - 35	ALL	0137C3737 P-004	1	Stop Buffer Bar



Outer Pole Breaker Side Section



Outer Pole Booster Cylinder Support

Figure 23 Cross Section

Fig. & Ref. Numbers	Type	Pole	Catalogue Number	No. Per Bkr.	Description
24 - 40	ALL	ALL	0338V0272 P-001	6	Hinge Washer
24 - 41	1A	Outer	K8517002 P-041	2	Washer
	1B	Center	K8517002 P-041	1	Washer
24 - 42	1A	Outer	0335V0121 P-001	2	Bearing
	1B	Center	0335V0121 P-001	1	Bearing
24 - 43	1A	Outer	0108V0217 P-001	2	Spring
	1B	Center	0108V0217 P-001	1	Spring
24 - 44	1A	Outer	0169A1504 P-001	2	Bolt
	1B	Center	0169A1504 P-001	1	Bolt
24 - 45	1A	ALL	0216A6370 P-001	3	Slotted Nut
	1B	ALL	0216A6370 P-001	5	Slotted Nut
24 - 46	1B	Outer	0108V0120 P-001	2	Washer
24 - 48	1B	Outer	0238A1280 P-001	4	Spacer 2.00 dia
24 - 49	1B	Outer	0238A1471 P-001	2	Bearing
24 - 50	1B	Outer	0108V0219 P-001	2	Spring
24 - 51	1B	Outer	0108V0162 P-001	2	Stud
25	1A	Outer	0473L0125 G-002	2	Rear Bushing Assembly Complete
	1A	Center	0473L0125 G-015	1	Rear Bushing Assembly Complete
	1B	Outer	0473L0125 G-009	2	Rear Bushing Assembly Complete
	1B	Center	0473L0125 G-016	1	Rear Bushing Assembly Complete
25 - 60	1A	ALL	0169B4587 G-001	3	Rear Bushing
	1B	ALL	0136B8960 G-001	3	Rear Bushing
25 - 61	1A	ALL	0136B8938 P-001	3	Contact Support 6 Wide
	1B	ALL	0169B4555 P-001	3	Contact Support 8 Wide With Jumpers
25 - 62	1A	Outer	0136B8939 G-001	2	Spring Retainer 6 Wide
	1B	Outer	0101A1230 G-001	2	Spring Retainer 8 Wide
25 - 63	ALL	Outer	0149A8908 P-001	4	Eye Bolt
25 - 64	1A	Outer	0338V0270 P-001	12	Contact Spring
	1B	Outer	0188A9257 P-001	18	Contact Spring
25 - 65	1A	Outer	0108V0172 P-001	12	Spring Guide
	1B	Outer	0238A1283 P-001	18	Spring Guide
25 - 66	1A	Outer	A184858 P-005	12	Spring Spacer
	1B	Outer	A184858 P-005	18	Spring Spacer
25 - 67	1A	Outer	0197A1557 P-001	12	Primary Contact Finger
	1B	Outer	0534A0851 P-001	18	Primary Contact Finger
25 - 68	ALL	Outer	0216A6125 P-001	4	Contact Finger Retainer
25 - 69	ALL	Outer	0241V0980 P-001	16	Self Tapping Screw (10-32 x 3/8)
25 - 70	ALL	Outer	0243V0466 P-001	4	Buffer Clamp
25 - 71	ALL	Outer	0243V0468 P-001	2	Buffer
25 - 72	ALL	Outer	0197A1564 G-001	2	Barrier Assembly
25 - 73	1A	Outer	0216A6095 P-017	2	Arc Chute Support
	1B	Outer	0169B2928 P-001	2	Arc Chute Support
25 - 74	1B	Outer	0238A1285 P-001	2	Jumper
25 - 75	1B	Outer	0238A1285 P-002	2	Jumper
25 - 76	1B	Outer	0238A1285 P-003	2	Jumper
25 - 77	1B	Outer	0238A1285 P-004	2	Jumper
25 - 78	ALL	ALL	0136B8936 G-001	3	Stud & Support
25 - 79	ALL	ALL	0197A1567 G-001	6	Flexible Connection
25 - 80	ALL	ALL	0108V0979 P-001	6	Locking Plate
25 - 81	ALL	ALL	0136B8933 G-001	3	Finger Cage
25 - 82	ALL	ALL	0108V0218 P-001	6	Outer Finger Spring
25 - 83	ALL	ALL	0108V0328 P-001	6	Inner Finger Spring
25 - 84	ALL	ALL	0101A1253 G-001	6	Arcing Contact Finger
25 - 85	ALL	ALL	238A1220 G-001	3	Arcing Contact Assembly
25 - 86	1B	Outer	0238A1285 G-001	3	Jumper

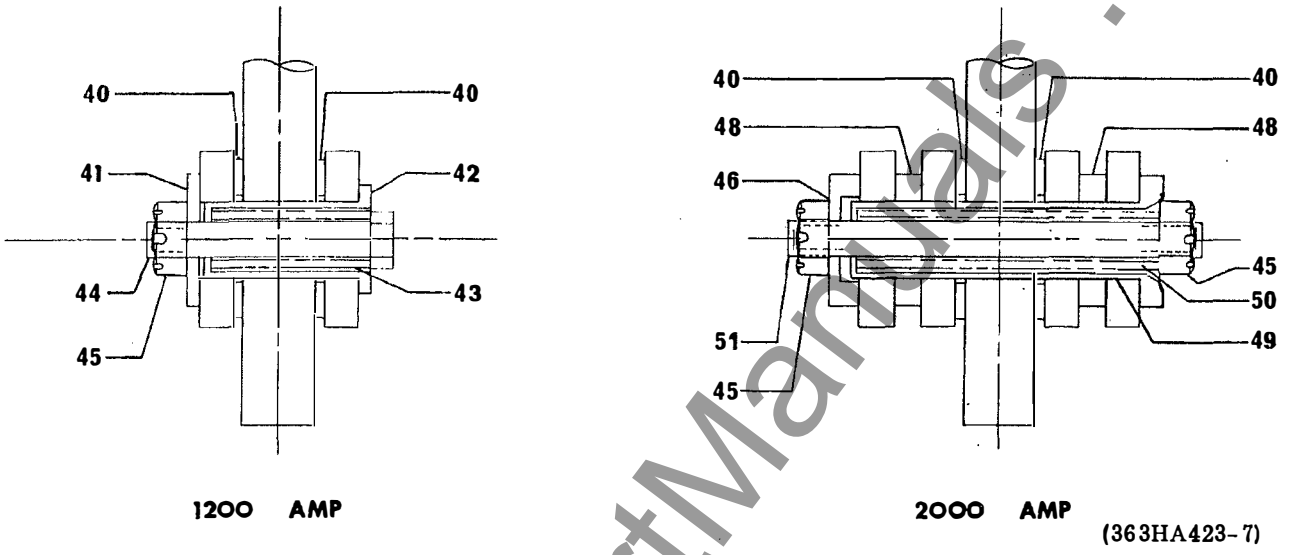


Figure 24 Hinge Cross Section

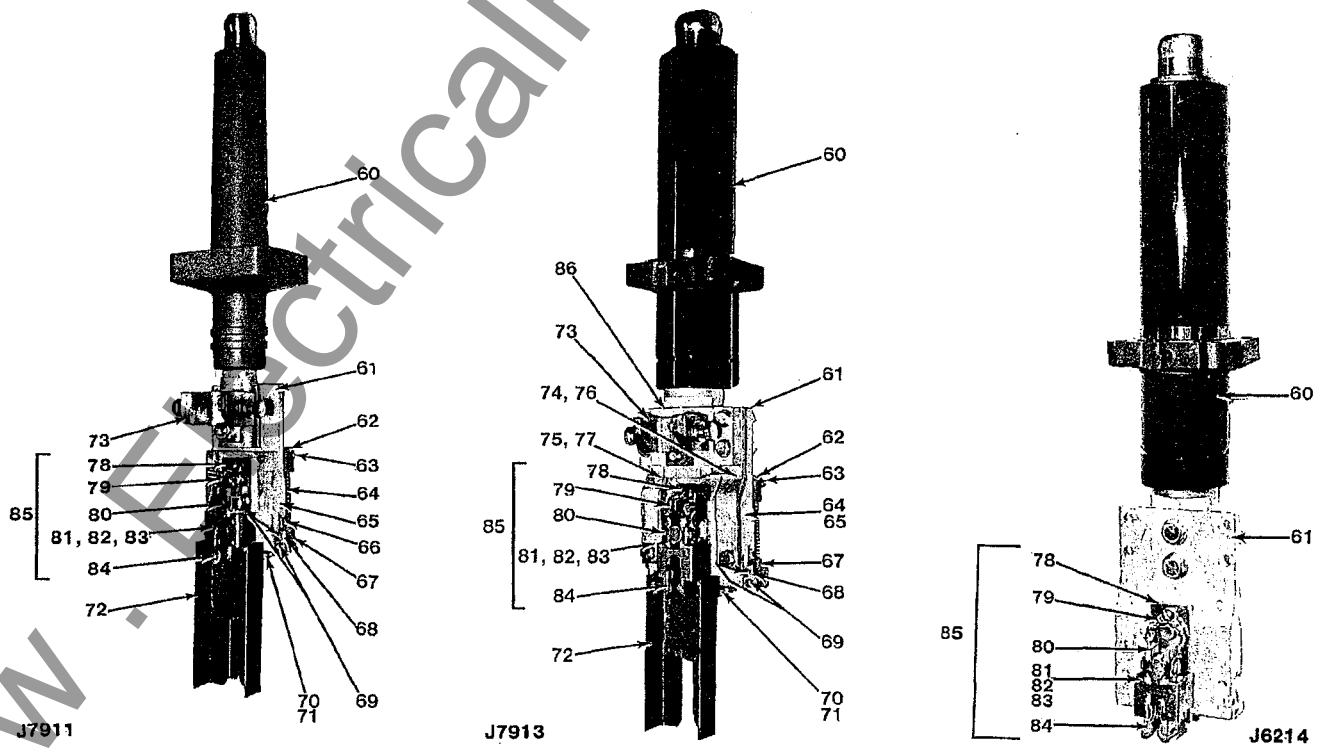
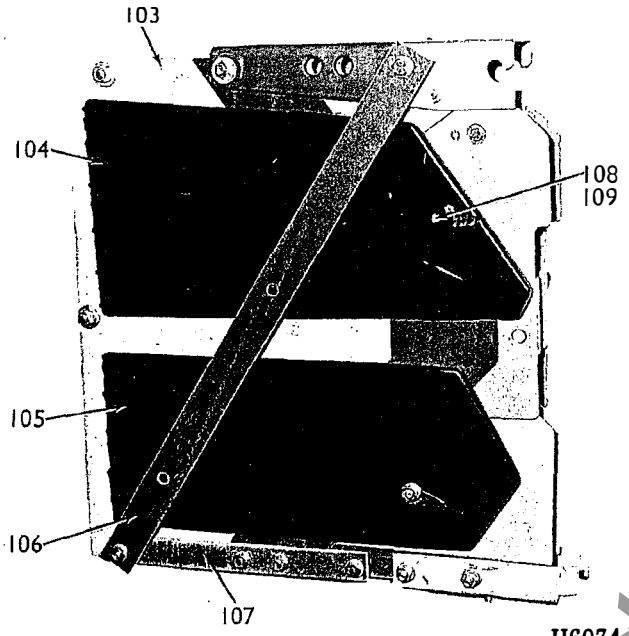


Figure 25 Outer Poles Bushing Assembly

Fig. & Ref. Numbers	Type	Catalogue Number	No. Per Bkr.	Description
26 - 100	1A	0473L0124 G-001	2	Arc Chute Complete
26 - 100	1B	0473L0125 G-001	2	Arc Chute Complete
26 - 101	ALL	0473L0124 G-002	2	Upper Arc Runner Assembly
26 - 102	ALL	0473L0124 G-003	2	Lower Arc Runner Assembly
26 - 103	ALL	0264B0100 G-003	2	Arc Chute Core Assembly
26 - 104	ALL	0136B8525 G-001	2	Upper Pole Piece Left Hand
26 - 104A	ALL	0136B8525 G-002	2	Upper Pole Piece Right Hand
26 - 105	ALL	0136B8525 G-003	2	Lower Pole Piece Left Hand
26 - 105A	ALL	0136B8525 G-004	2	Lower Pole Piece Right Hand
26 - 106	ALL	0197A1531 P-001	4	Brace
26 - 107	ALL	0197A1540 P-001	4	Lower Support
26 - 108	ALL	0216A6098 P-001	4	Insulation Cap
26 - 109	ALL	CV167814 P-001	4	Threaded Washer
26 - 110	ALL	0197A1547 P-001	4	Shield
26 - 111	ALL	0216A6097 P-001	4	Insulating Bushing
26 - 112	ALL	0197A1536 P-002	2	Upper Core
26 - 113	ALL	0197A1537 P-002	2	Upper Core Insulation
26 - 114	ALL	0136B8912 G-001	2	Right Hand Throat Piece Assembly
26 - 115	ALL	0136B8912 G-002	2	Left Hand Throat Piece Assembly
26 - 116	ALL	0197A1537 P-001	2	Lower Core Insulation
26 - 117	ALL	0197A1536 P-001	2	Lower Core
26 - 118	ALL	0188A9753 P-002	2	Core Spacer
26 - 119	ALL	K8517002 P-028	4	Core Spacer Shim
26 - 120	ALL	0197A1541 P-001	4	Core Shims (Part not shown. Location only if required).
26 - 121	ALL	0136C8524 P-001	4	Upper Coil Support
26 - 122	ALL	0197A1548 P-001	2	Upper Runner Spacer
26 - 123	1A	0137C3583 P-001	2	Upper Support
26 - 123	1B	0137C3583 P-004	2	Upper Support
26 - 124	ALL	0168B2465 P-001	2	Arc Shield
26 - 125	ALL	0136B8915 G-001	2	Upper Blowout Coil
26 - 126	ALL	0137C3104 G-001	2	Upper Arc Runner
26 - 127	ALL	0197A1548 P-002	2	Upper Coil Protector
26 - 128	ALL	0197A1532 P-001	4	Lower Mycalex
26 - 129	ALL	0127C3806 P-001	2	Lower Arc Runner
26 - 130	ALL	0197A1548 P-003	2	Lower Coil Protector
26 - 131	ALL	0197A1545 P-001	4	Lower Barrier
26 - 132	ALL	0136B8917 G-001	2	Lower Blowout Coil
26 - 133	ALL	0197A1538 P-001	2	Runner Spacer
26 - 134	ALL	0127C3806 P-002	2	Coil Connection
26 - 135	ALL	0168B2948 G-001	2	Lower Support
26 - 136	ALL	0197A1497 P-001	6	Fibre Spacer
26 - 137	ALL	0137C3542 P-002	2	Lower Coil Support Right Hand
26 - 138	ALL	0137C3542 P-001	2	Lower Coil Support Left Hand
26 - 139	ALL	0197A1544 P-001	2	Lower Runner Spacer
26 - 140	ALL	0197A1546 P-001	2	Mycalex Insulation Seal
26 - 141	ALL	0197A1542 P-001	2	Lower Runner Spacer
26 - 142	ALL	A184858 P-078	4	Steel Spacer (.44 long)
26 - 143	ALL	0199A0791 P-023	18	Steel Spacer (.88 long)
26 - 144	ALL	0197A1535 P-001	2	Upper Coil Connection
26 - 145	ALL	0197A1540 P-001	4	Lower Support
26 - 146	ALL	A184858 P-071	4	Steel Spacer (.22 long)
26 - 147	ALL	K8583644 P-053	4	Spacer Washer (.12 thick)
26 - 148	ALL	0197A1544 P-002	2	Spacer Block
26 - 149	ALL	0136B8893 P-001	4	Upper Insulation
26 - 150	ALL	0216A6096 P-001	4	Cup Washer (Not Shown - Location Only)
26 - 151	ALL	0197A1548 P-001	2	Gasket Seal (Not Shown - Location only).



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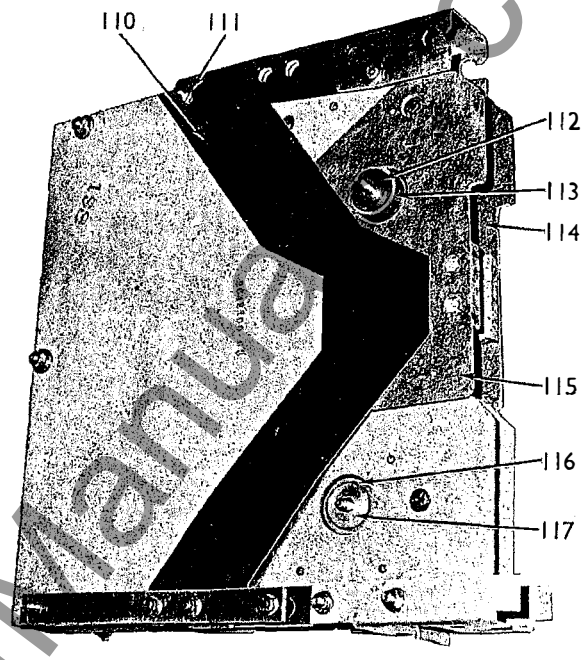
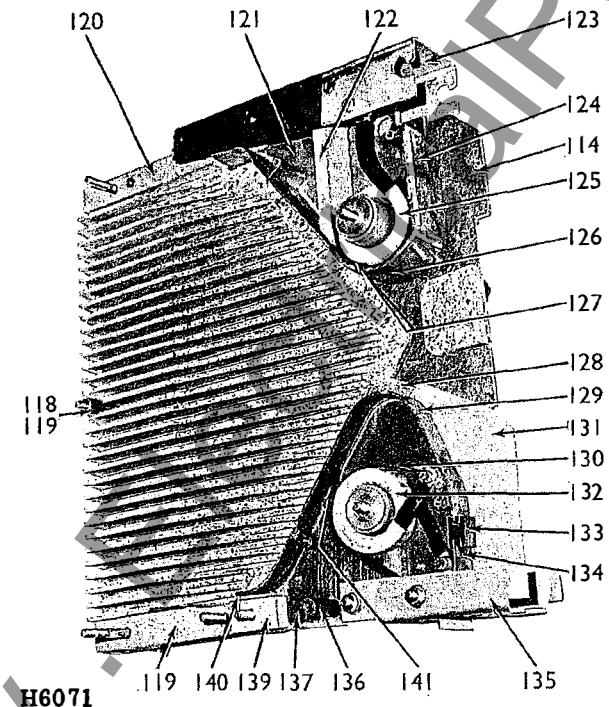
Complete Arc Chute



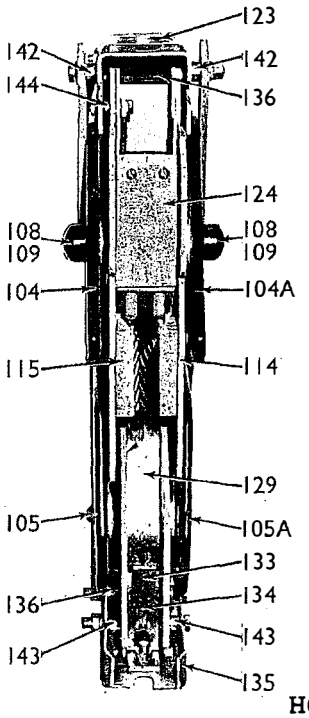
H6073

Arc Chute, Pole Pieces Removed



H6071

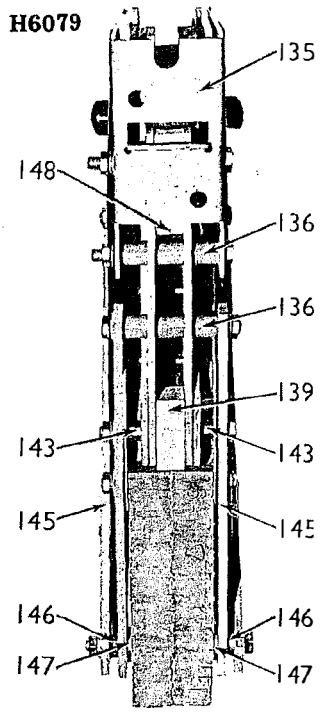
Arc Chute, Side Removed



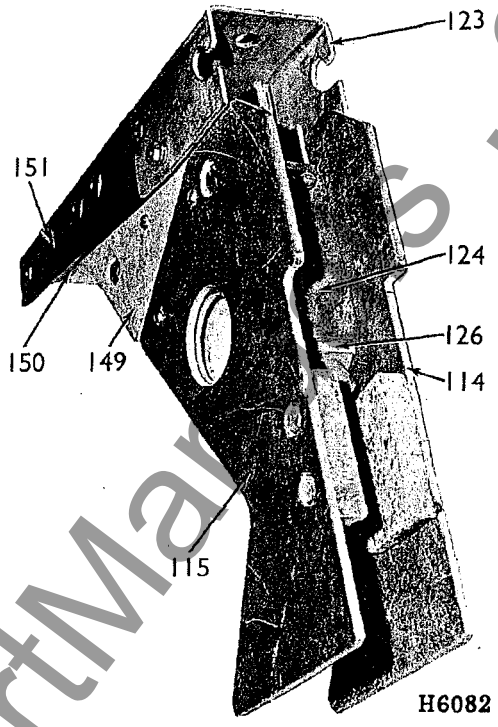
H6081

Arc Chute, Front View

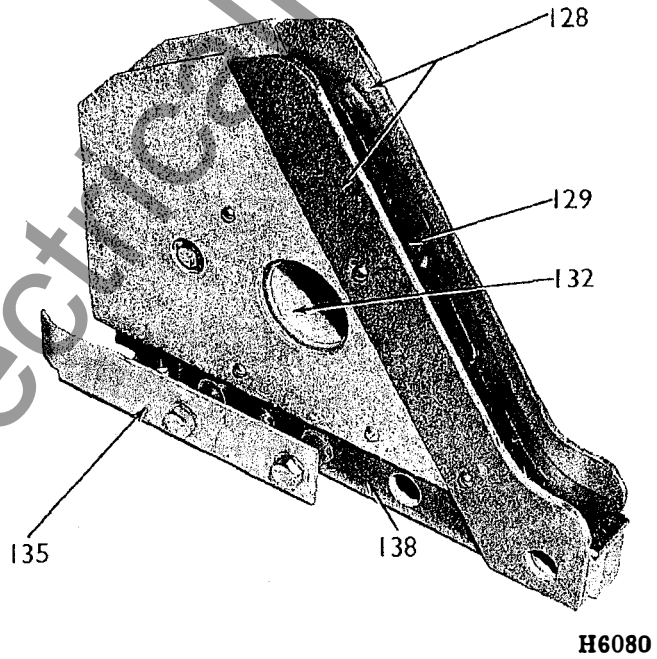
Figure 26 (1 of 2) Arc Chute



Arc Chute, Bottom View



Upper Runner Assembly

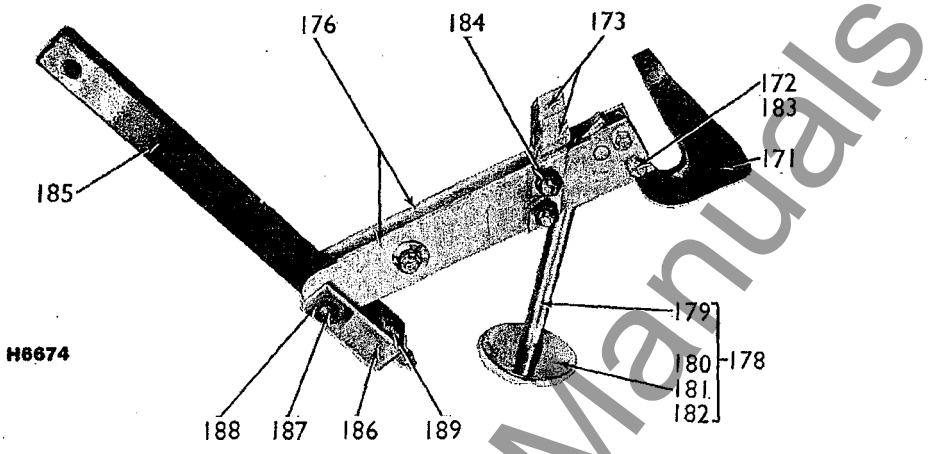


Lower Runner Assembly

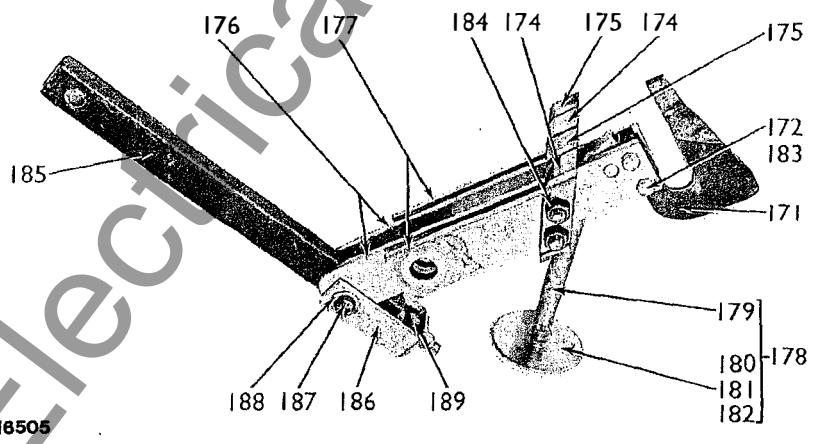
Figure 26 (2 of 2) Arc Chute

Fig. & Ref. Numbers	Type	Pole	Catalogue Number	No. Per Bkr.	Description
27 - 170	1A	Outer	0473L0126 G-023	2	Bushing & Contact Arm Assembly*
	1A	Center	0473L0126 G-024	1	Bushing & Contact Arm Assembly*
	1B	Outer	0473L0126 G-025	2	Bushing & Contact Arm Assembly*
	1B	Center	0473L0126 G-026	1	Bushing & Contact Arm Assembly*
27 - 171	ALL	Outer	0169B4560 P-002	2	Movable Arcing Contact
27 - 172	ALL	Outer	0197A1566 P-001	12	Contact Spacer
27 - 173	1A	Outer	0197A1560 P-001	4	Movable Primary Contact
27 - 174	1B	Outer	0534A0850 P-001	4	Movable Primary Contact
27 - 175	1B	Outer	0534A0850 P-002	4	Movable Primary Contact
27 - 176	ALL	Outer	0185B7841 P-001	4	Contact Arm Long
27 - 177	1B	Outer	0154B0158 P-001	4	Contact Arm Short
27 - 178	ALL	Outer	0168B2466 G-003	2	Puffer Tube Assembly Complete
27 - 179	ALL	Outer	0136B8931 G-001	2	Puffer Tube and Piston
27 - 180	ALL	Outer	0101A1769 P-001	2	Piston Ring
27 - 181	ALL	Outer	0188A9738 P-001	2	Piston Ring Equalizer Smooth
27 - 182	ALL	Outer	0188A9740 P-001	2	Piston Ring Expander Corrugated
27 - 183	ALL	ALL	0188A9739 P-001	6	Lock Nut 3/8 - 16
27 - 184	ALL	Outer	0188A9739 P-002	8	Locknut 1/2 - 13
27 - 185	ALL	Outer	0265A7115 G-001	2	Operating Rod
27 - 186	ALL	ALL	0105V0745 P-001	3	Yoke
27 - 187	ALL	ALL	K8585051 P-031	3	Pin
27 - 188	ALL	ALL	K8584554 P-034	6	Washer
27 - 189	ALL	ALL	0105V0995 P-001	3	Knurl Adjusting Nut
27 - 190	ALL	Center	0185B7842 P-001	2	Contact Arm
27 - 191	ALL	Center	0185B7843 P-001	1	Movable Contact
27 - 192	ALL	Center	0265A7114 G-001	1	Operating Rod

*Complete with bushing, contact arm assembly and operating rod.

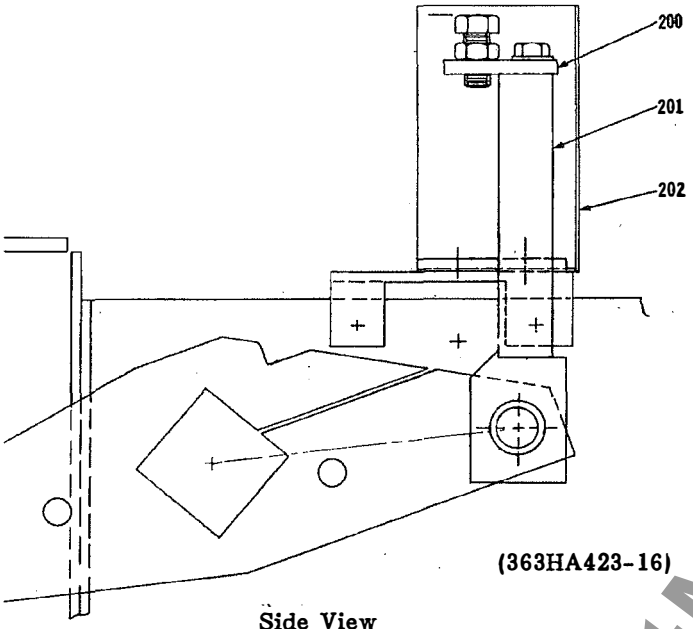


AMF1A
Outer Pole



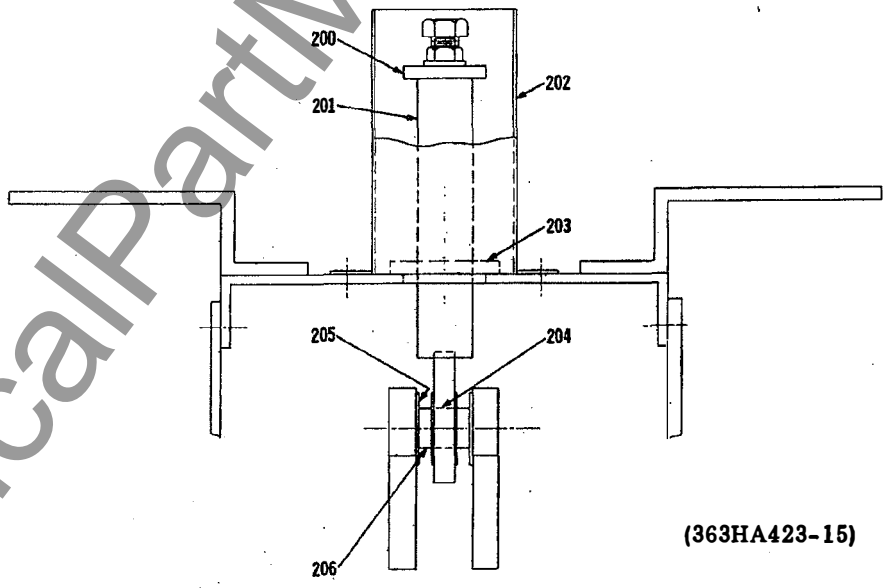
AMF1B
Outer Pole

Figure 27 Movable Contact Arm Assembly



(363HA423-16)

Side View



(363HA423-15)

Front View

Figure 28 Plunger Interlock For ML-13 Mechanism

Fig. & Ref. Numbers	Catalogue Number	No. Per Bkr.	Description
28 - 200	0216A6027 P-001	1	Plunger
28 - 201	0136B8989 G-001	1	Rod
28 - 202	0136B8988 G-001	1	Shield
28 - 203	0216A6420 P-002	1	Guide Plate
28 - 204	0216A7438AD P-004	1	Textolite Bushing
28 - 205	0197A1208 P-004	2	Washer
28 - 206	A184858 P-135	2	Steel Spacer (.22 long)

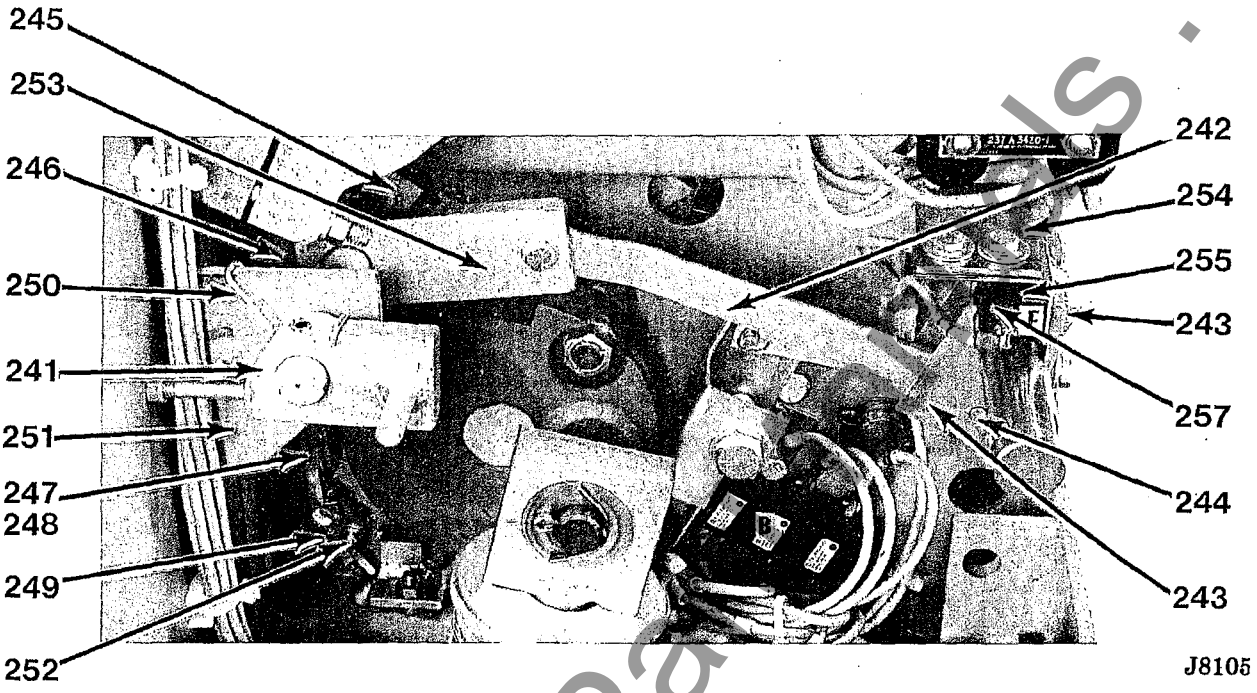


Figure 29 Spring Release For ML-13 Mechanism

Fig. & Ref. Numbers	Catalogue Number	No. Per Bkr.	Description
29 - 240	0473L0111 G-002	1	Spring Discharge Assembly
29 - 241	0136B8543 G-002	1	Crank
29 - 242	0197A1211 P-002	1	Link
29 - 243	0136B8589 P-002	1	Crank
29 - 244	0197A1401 P-003	1	Pin
29 - 245	0136B8541 P-007	1	Crank
29 - 246	0136B8541 G-002	1	Clevis
29 - 247	0197A1205 P-001	1	Rod
29 - 248	0136B8541 G-001	1	Clevis
29 - 249	0136B8541 P-009	1	Crank
29 - 250	0197A1136 P-001	1	Spring
29 - 251	0197A1211 P-001	1	Support
29 - 252	0136B8541 P-005	1	Pivot Pin
29 - 253	0136B8543 P-008	1	Crank
29 - 254	0265A7432 P-001	1	Switch Support
29 - 256	0136B8536 P-001	1	Switch Bracket
29 - 257	0132B3131 G-002	1	Latch Check Switch