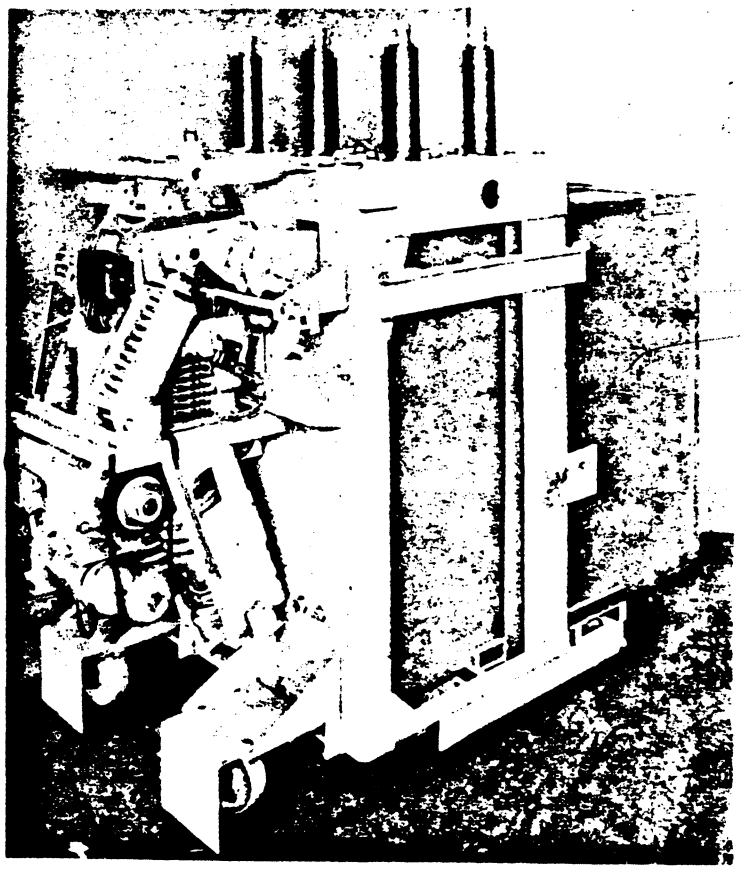
INSTRUCTIONS
AND
RENEWAL PARTS

GEI-50143F
SUPERSEDES GEI-50143E

STORED ENERGY OPERATOR

Types

ML-11
ML-11A
ML-11B
ML-11C
ML-11D



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MEDIUM VOLTAGE SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

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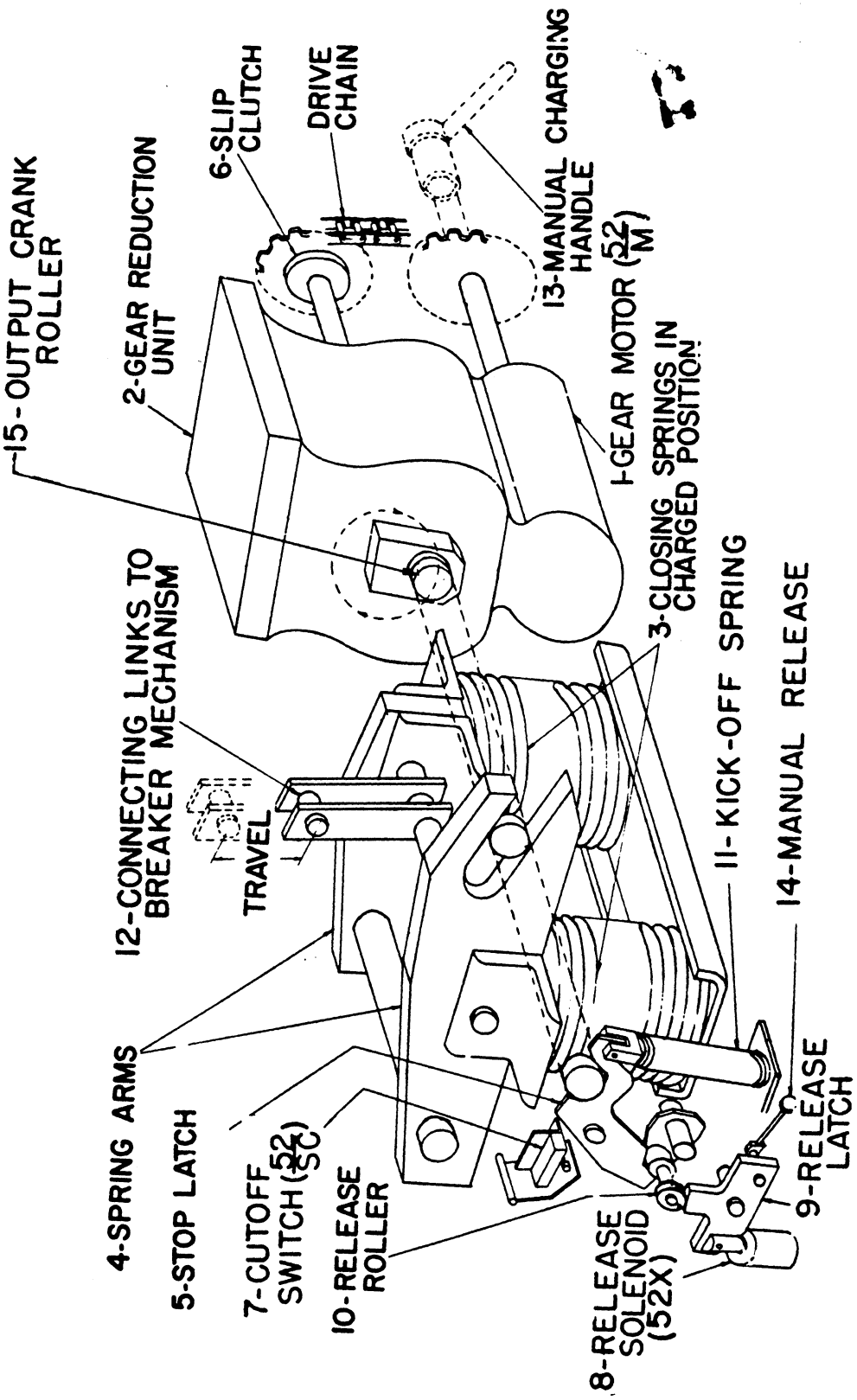


Fig. 1 Exploded Schematic of Stored Energy Operator Cover (8028590)

STORED-ENERGY OPERATOR
FOR
MAGNE-BLAST CIRCUIT BREAKER

INTRODUCTION

The new charged-spring stored-energy mechanism will close and latch magne-blast breakers with momentary current ratings up to and including 70,000 amperes in voltages from 4.16 kv to 13.8 kv and in interrupting ratings from 150 mva to 750 mva, inclusive. The operating force for the mechanism is supplied by a high speed 1/2 hp gear motor. See Fig. 1. The energy from the motor is stored in powerful springs which are capable of closing the circuit breaker at its required speed under all conditions. Only after the mechanism is fully charged can it be released to close the breaker. As soon as the circuit breaker has been closed by the mechanism, the motor immediately recharges the springs for another closing operation. The spring charging time of approximately seven seconds and the fast circuit breaker closing time provides ample time margin for all normal duty cycles.

INSTALLATION

The following instructions explain the necessary steps to be taken before the mechanism is placed in the metal-clad unit. Reference should also be made to the connection diagram as well as the magne-blast breaker instruction book that is furnished with each breaker.

"DO NOT WORK ON EITHER THE BREAKER OR THE 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."

At installation of the equipment add a 10 amp fuse in the closing and charging circuit. When the equipment is finally installed, change the fuse to the size recommended on the connection diagram.

Charge the breaker closing springs manually using the manual charging handle as described under "MANUAL CHARGING". With springs fully charged, unloosen bolt (1), Fig. 3 used to retain the block plate (2), Fig. 3. Move blocking plate (2), Fig. 3 (approx. 1-1/2") from right to left (facing mechanism) until the right flange is against the spring frame upright (3), Fig. 2. Release the closing springs against this blocking plate by pushing the manual release button (3), Fig. 3. THE SPRINGS ARE NOW BLOCKED. The closing springs will now be confined in this position and the gear motor, reduction unit, mechanism linkage and breaker contacts are free to move, and the breaker contacts now may be cranked slowly closed and a check of the adjustments may be made.

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

a. Primary contact wipe.
b. Primary contact gap. (Refer to Magne-Blast Circuit Breaker book for description.)
c. Prop clearance. (Page 4 this book)

After these adjustments have been checked the springs can be unblocked. To unblock the springs, manually charge the closing springs as described in "MANUAL CHARGING" operation. Move the BLOCKING PLATE (2), Fig. 3 from left to right (facing mechanism) approximately 1-1/2". Make gage plate secure by tightening bolt (1), Fig. 3. The mechanism is now free to operate both mechanically and electrically.

Attach test coupler to 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 of the motor leads from the terminal board. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

DESCRIPTION OF OPERATION

ELECTRICAL CHARGING
(Ref. Fig. 1)

When the high speed gear motor (1) is energized, power is transmitted through a chain to the gear reduction unit (2). The torque is then increased so that the output crank of the reduction unit will compress the closing springs (3) through action of the spring arms (4) to the fully charged position. When the closing springs (3) are fully compressed, a cut-off switch (7) de-energizes the motor (1). In this position the output crank roller (15) is mechanically stopped against stop latch (5), and the semaphore reads "CHARGED".

ELECTRICAL RELEASE
(Ref. Fig. 1)

When the release solenoid (8) is energized, its action rotates release latch (9) and permits release roller (10) link assembly to be forced free of stop latch (5). The overrunning clutch in the reduction unit allows the output crank to rotate freely so that the closing springs (3) can discharge their energy to the breaker mechanism through the connecting links (12). Immediately upon its release the cut-off switch (7) starts the motor (13) and the springs are again charged.

MANUAL CHARGING
(Ref. Fig. 1)

Closing the breaker may be accomplished by manual operation of the mechanism if control voltage is lost. The closing springs may be charged manually by using a standard 1" socket and a standard ratchet handle. Attach the handle (13) to the right side of the motor sprocket and using a pumping action rotate the handle counter-clockwise until the semaphore reads "CHARGED" and the handle becomes snug. 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 takes over again and continues to charge the mechanism.

MANUAL RELEASE
(Ref. Fig. 1)

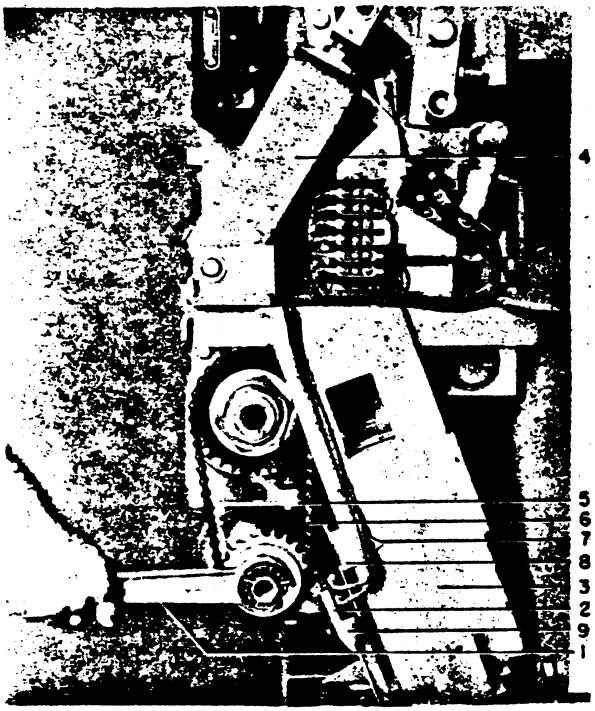
The closing speed of the breaker is independent of the method of charging the springs or release of the control mechanism, and the breaker closes at the same speed for a manual release as it does for an electrical release. To manually release the closing springs and close the breaker, press manual release plunger (14). This actuates release latch (9) and the linkage operation is the same as stated in the "Electrical Release" description.

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.

ADJUSTMENTS

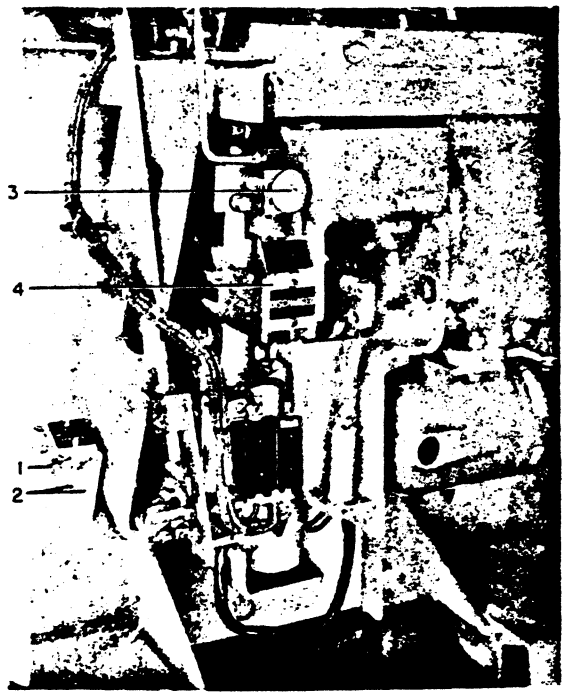
Adjustments should be checked during periodic inspections and whenever it becomes necessary to repair or replace parts that have become worn or defective while in service.

"DO NOT WORK ON EITHER THE BREAKER OR THE 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."



1. Charging Handle
2. Spring Blocking Plate Switch
3. Frame
4. Opening Spring
5. Motor Shims
6. Chain
7. Mounting Bolts
8. Switch Bracket
9. Switch Actuator Paddle

Fig. 2



1. Blocking Plate Retaining Bolt
2. Blocking Plate
3. Manual Release Button
4. Semaphore

Fig. 3

TRIP LATCH CLEARANCE (Ref. Fig. 4)

With the breaker in the tripped position, check the clearance between the trip latch (4) and trip roller (6). It should measure 1/32" to 1/16". This should be measured with the closing springs gagged, and after the breaker has been tripped out.

TRIP LATCH WIPE (Ref. Fig. 4)

The wipe of the trip latch (4) on the trip roller (6) .should be from 3/16" to 1/4". This can be measured by putting a film of grease on the latch (4), closing the breaker part way, and tripping. The mechanism has the proper trip latch wipe when the latch rests against the stop pin (5). No adjustment is provided and a visual inspection is usually all that is required.

Fig. 2 (8028593)

PROP CLEARANCE (Ref. Fig. 4)

All Designs

Block the closing springs (Using the manual charging handle (1), Fig. 2 rotate the prop pin (8) to a position over the prop (10) as far as possible.

ML-11 Design

Measure this clearance with a feeler gage. The clearance should measure between .040" to .070" for the AM-4.16-150-250; AM-7.2-250; AM-13.8-250-500 breakers and .060" to .100" for the AM-7.2-500 and AM-13.8-750 breakers. In conjunction with this measurement, when the breaker is in the unblocked position, manually close the breaker and measure the distance the prop pin comes to rest over the prop. (NOTE: It is possible that in some breakers it will rest on the prop). Rotate the prop pin back over the props the distance measured + 1/16". At this point the breaker must trip both manually and electrically.

Fig. 3 (8028592)

ML-11A, 11B and 11C Design

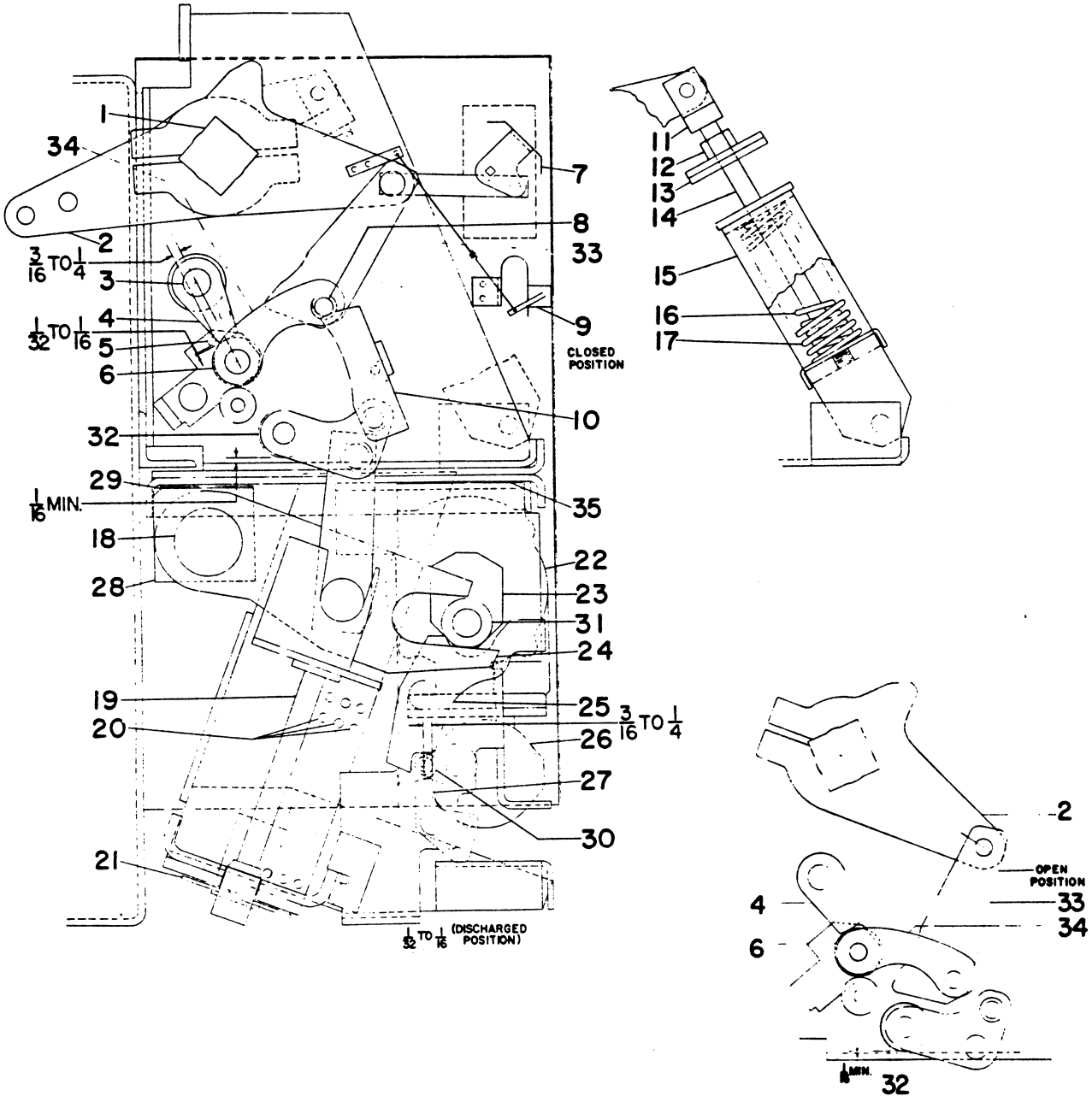
The clearance for all rated breakers should be 1/16" minimum measured when the springs are blocked. (This clearance may measure 3/8" over the prop pin when the mechanism is unblocked and fully closed).

On All Designs

On all designs the allowable difference between sides of the prop pin (8) measured from the top of the prop (10) to the underside of the prop pin (8) is 1/16". If adjustment is required remove the bolts holding the bearing blocks (28) and add or remove shims (29) as required. Loosen

Fig. 4 (958C659)

Fig. 4 (542E742)



1. Main Operating Shaft
2. Main Crank
3. Trip Shaft
4. Trip Latch
5. Trip Latch Stop
6. Trip Roller
7. Position Indicator
8. Closing Pin
9. Counter
10. Prop
11. Clevis
12. Check Nut
13. Adjusting Nut
14. Adjusting Stud
15. Opening Spring Housing
16. Opening Spring, Inner
17. Opening Spring, Outer
18. Main Spring Shaft
19. Spring Yoke Assembly
20. Closing Springs
21. Maintenance Spring Blocking Plate
22. Gear Reduction Unit
23. Output Crank
24. Spring Compression Arm
25. Stop Latch
26. Gear Motor
27. Close Latch
28. Bearing Block
29. Pillar Block Shims
30. Latch Reset Roller
31. Output Roller
32. Roller
33. Canoe Link
34. Banana Link
35. Gear Box Shim

Fig. 4 Cross Section of ML-11 Mechanism

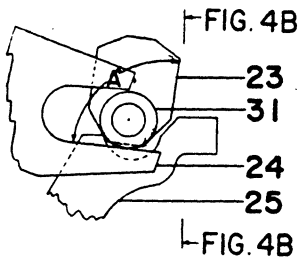


Fig. 4A

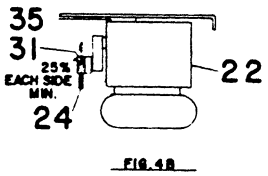
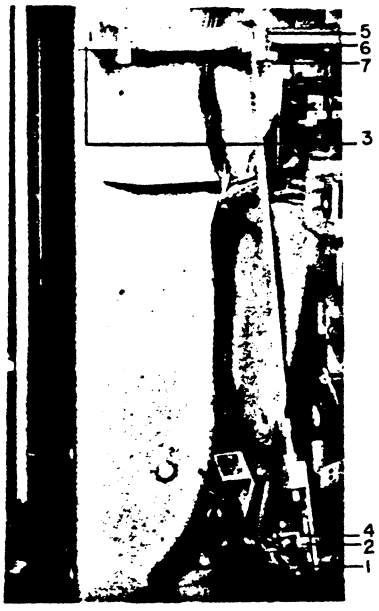


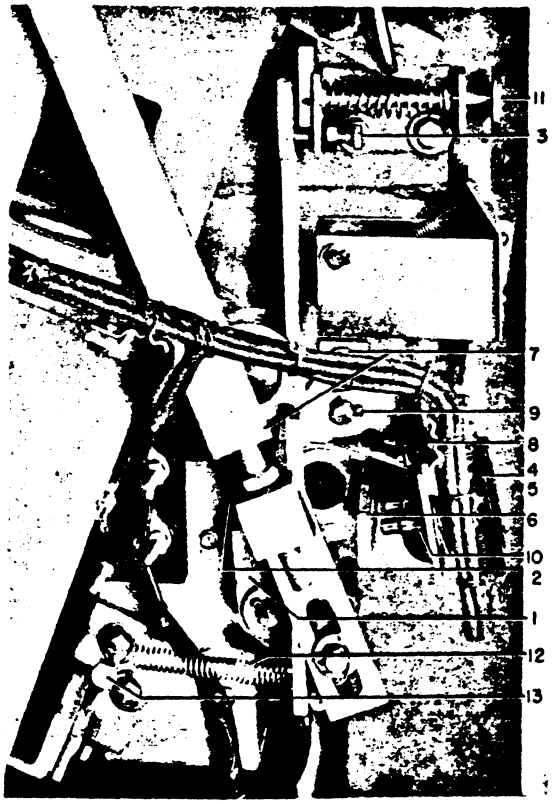
FIG. 4B

Fig. 4A and 4B



1. Spring Release Link
2. Release Latch Pin
3. Spring Release Pin
4. Cotter Pin
5. Latch Shaft Actuator Pin
6. Spring Release Link Bolt
7. Lock Nut

Fig. 6



1. Release Latch
2. Release Latch Roller
3. Adjustment Bolt
4. Auxiliary Switch (Inboard)
5. Auxiliary Switch (Outboard)
6. Switch Actuator Paddle
7. Switch Bracket Bolts
8. Switch Bracket
9. Pin
10. Switch Lock Nut
11. Manual Release Button
12. Reset Spring
13. Bolt

Fig. 5

bolts and adjust only one bearing block (29) at a time. The addition of a 1/64" shim will decrease the clearance approximately .010". Conversely removing a 1/64" shim will increase the clearance approximately .010".

RELEASE LATCH CLEARANCE (Ref. Fig.5)

If the latch (1) fails to reset, check to see that the latch reset roller (2) has a clearance between the reset latch (1) top surface and the bottom of the roller (2) of 1/32" to 1/16". No adjustment is provided and a visual inspection is all that is required. To make latch (1) respond faster add tension to spring (12) by rotating bolt (13) counterclockwise.

RELEASE LATCH WIPE (Ref. Fig. 5)

The wipe between the right top latch surface edge and the center of the release latch roller should be between 3/16" to 1/4". If the setting is incorrect adjust wipe by rotating adjustment bolt (3) clockwise or counterclockwise. Recheck above setting.

AUXILIARY SWITCHES (Ref. Fig. 5)

The auxiliary normally closed (4) inboard and normally open (5) outboard switches are set to have both switch buttons operated together initiated by the switch actuator paddle (6). They are operated by the action of paddle (6) and are indexed with the gear box crank (23) Fig. 4 to operate before the gear box crank roller (31) Fig. 4 comes to rest against stop latch (25) Fig. 4. They are adjusted and set at the factory by applying the minimum operating voltage to the motor and should require no additional adjustments. They are set properly when the crank roller (31) Fig. 4A is resting against stop latch (25) Fig. 4A and the "A" angle Fig. 4A as measured between the output crank (23) Fig. 4A and spring compression arm (24)

Fig. 4A & B (542E742)

Fig. 5 (8028594)

Fig. 6 (8025980)

Fig. 4A cam surface measures 90° to 94° on the ML-11 design and 95° to 102° on the ML-11A, ML-11B and ML-11C design. However, if adjustment of the switches is required, first block the closing springs, unscrew bolts (7) Fig. 5 and rotate complete switch bracket (8) and both switches (4 & 5) about pin (9). When the bracket (8) and switches (4 & 5) are moved toward the switch actuator paddle the switches will operate earlier in the charging cycle. When the bracket and switches are moved away from the switch actuator paddle the switches will operate later in the closing spring charging cycle.

After the setting has been made check to see that the switches have a minimum of 1/16" overtravel on the switch buttons. If not, adjust switches (4 & 5) on bracket (8) either individually or together by loosening switch lock nuts (10) and moving switches out. Tighten switch lock nuts and recheck adjustment. Charge the closing springs manually and check the operation of the switches with a bell set. Remove block from the closing springs and close the mechanism manually by pressing manual release button (11). Wind up mechanism electrically by applying minimum control voltage (see control power range) to the motor. The switches should cut off and allow the output crank (23), Fig. 4 to coast against latch (24), Fig. 4. The mechanism should then close manually and electrically. When the above is finished and checked the switches are adjusted properly.

SPRING RELEASE (Ref. Fig. 6)

Check the clearance between the closing spring release link (1) and the pin on the release latch (2). This should be 1/2" to 5/8" measured from the bottom of the actuator slot to the bottom surface of the pin. To check this adjustment, charge the closing springs of the breaker and rotate the spring release pin (3) counterclockwise. The breaker should trip out before the closing springs discharge giving a "Trip-free" operation. If adjustment is necessary, remove one cotter pin (4) and disassemble link. Rotate link (1) clockwise or counterclockwise. Assemble and recheck. On ML-11 design check the clearance between the latch shaft actuator pin (5) and spring release link pin. The clearance should measure 1/32" + 1/64". No adjustment is supplied and a visible check is all that is required. On the ML-11A and ML-11B design check the clearance between the latch shaft actuator pin (5) and spring release link bolt (6). It should measure 1/4" to 5/16". To adjust, rotate bolt (6). Tighten locknut (7) and remeasure.

FRICTION CLUTCH (Ref. Fig. 7)

The friction clutch should be tested with a torque-meter (1) to have a break away torque of 300 to 350 inch-pounds on the AM-4.16-100/150, 250, AM-7.2-250, AM-13.8-250/500 breakers and 350 to 400 inch pounds on the AM-7.2-500 & 13.8-750 breakers. Rest wrench (2) against frame (3) and apply torque to the torque meter (1) until the clutch breaks away and note the value on the torque meter dial. Do not continue to turn if the value exceeds that as stated above. If adjustment is required, refer to Fig. 8, loosen 2 set screws (1) in the hexagon head nut (2) and apply clutch adjustment wrench (3) to hexagon head nut (2) and wrench (4) to the square coupling (5). Tighten or loosen the hexagon head nut (2) and tighten the set screws (1) in the nut and recheck the torque.

INTERLOCK SWITCH WIPE (Ref. Fig. 7)

Rotate the interlock shaft manually clockwise to release the interlock switch arm (4). The point at which the contacts make can be determined with a circuit continuity tester such as a light indicator or bell set. To obtain adjustment on the interlock switch (5), bend the interlock switch arm (4). The roller and crank on the interlock switch (5) should have 1/32" to 1/16" overtravel after final adjustment. No attempt should be made to interrupt the motor current with this switch as damage to the switch will result.

BLOCKING PLATE SWITCH (Ref. Fig. 2)

The blocking plate switch (2) is connected in the motor circuit and located such that when the closing springs are blocked the switch opens. When the closing springs are not blocked the switch is closed. When the switch is closed there should be an overtravel of 1/32" to 1/16" on the switch arm. If adjustment is necessary first check bolts (7) for tightness, then bend the switch actuator paddle slightly to give the required overtravel.

DRIVE CHAIN (Ref. Fig. 2)

The chain is set snug at the factory and should require no additional adjustment. However, as is common on chain drives after numerous operations the chain will set lower in the sprockets and show signs of looseness. To check the chain, measure the horizontal distance between the inside edges of the chain in the normal position. Pull both sides together and measure the distance. Rotate the sprocket 180° and measure both distances again. If the difference between dimensions on each set of dimensions is greater than 5/8" add shims (7) between the motor mounting base and the gear box base.

OUTPUT ROLLER (Fig. 4, 4A & 4B)

The output roller (31) and the spring compression arm (24) should have at least 50% minimum engagement. The 50% engagement should be taken from the center portion of the output roller (31) as shown in Fig. 4B. This engagement should be checked when the mechanism is in the charged position. To adjust to this condition add or remove shims (35) between the frame and gear reduction unit (22).

AUXILIARY DEVICES

Refer to the magne-blast circuit breaker instruction book for adjustment of all auxiliary devices.

CONTROL POWER CHECK (Ref. Fig. 2)

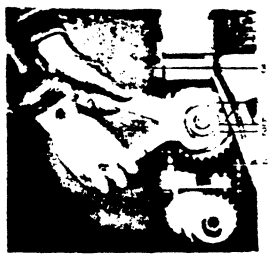
After the mechanism has been closed and opened slowly several times with the maintenance closing handle (1) Fig. 2 and the mechanism adjustments checked as described, the operating voltages should

Fig. 7 (8025983)

1. Torque Meter
2. Wrench
3. Frame
4. Interlock Switch Arm
5. Interlock Switch
6. Latch Checking Switch Arm
7. Latch Checking Switch

Fig. 7

Fig. 8 (8025986)



1. Set Screws
2. Hex Head Nut
3. Clutch Adjustment Wrench
4. Wrench
5. Coupling

Fig. 8

be checked at the release coil, trip coil, and motor terminals. For electrical operation of the mechanism 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	
	Min.	Max.	Min.	Max.
48v d-c	34 -	50v d-c	28 -	60v d-c
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

INSULATION TEST

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 board. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

INSPECTION AND TEST

1. For ease in reviewing the adjustments, the following are recapitulated.
   (a) Primary contact wipe, arcing contact wipe, primary contact gap, plunger interlock and auxiliary devices - refer to magne-blast circuit breaker instruction book.
   (b) Trip latch clearance - 1/32" to 1/16". (Fig. 4)
   (c) Trip latch wipe - 3/16" to 1/4". (Fig. 4)
   (d) Prop clearance - See prop clearance section. (Fig. 4)
   (e) Release latch clearance - 1/32" to 1/16". (Fig. 5)
   (f) Release latch wipe - 3/16" to 1/4" (Fig. 5)
   (g) Spring release lower adjustment 1/2" to 5/8". Upper ML-11 1/32" ± 1/64". ML-11A, ML-11B and ML-11C 1/4" to 5/16". (Fig. 6)
   (h) Auxiliary switches - 1/16" over travel - Angle. ML-11 92° to 94° ML-11A, ML-11B and ML-11C 95° to 102°. (Fig. 5)
   (i) Friction clutch - 300 to 350 inch-pounds torque. AM-7.2-500, AM-13.8-750, 350 to 400 inch-pounds torque. (Fig. 7 & 8)
   (j) Blocking plate switch - 1/16" overtravel. (Fig. 2)
   (k) Interlock switch - 1/16" overtravel. (Fig. 7)
2. Check all nuts, washers, bolts, cotter pins, and terminal connections for tightness.
3. Inspect all wiring to make sure that no damage has resulted during installation, and test for possible grounds or short circuits.
4. See that all bearing surfaces of the mechanism have been lubricated. Refer to section on LUBRICATION.
5. Operate the breaker slowly with the manual charging handle and note that there is no excessive binding or friction and that the breaker can be moved to the fully opened and fully closed positions.
6. See that any place where the surface of the paint has been damaged during installation is repainted immediately.
7. Check the trip coil plunger and release coil plunger to see that they move freely.

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 succesful operation of the breaker.

BEFORE ANY MAINTENANCE WORK IS PERFORMED, MAKE CERTAIN THAT ALL CONTROL CIRCUITS ARE OPENED AND THAT THE BREAKER IS REMOVED FROM THE METAL-CLAD 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 ACCIDENTAL 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 PLATE.

During maintenance of the mechanism substitute a 10 amp fuse in the closing and charging circuit. When the equipment is placed back in operation, change the fuse to the size recommended on the connection diagram.

PERIODIC INSPECTION

The frequency of periodic inspections should be determined by each operating company on the basis of the number of operations and any unusual operations which occur from time to time. Even with a limited number of operations, the breaker should be inspected regularly and cleaned and lubricated to insure trouble free operation. The following instructions list the main points to be included in an inspection, and a number of general recommendations.

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 handle, 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.

LUBRICATION

In order to maintain reliable operation it is important that all circuit breakers be properly lubricated at all times. During assembly at the factory, all bearing surfaces, machined surfaces, and all other parts of the breaker and mechanism subject to wear have been properly lubricated using the finest grade 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

PART	LUBRICATION AT MAINTENANCE PERIOD	ALTERNATIVE LUBRICATION (Requires Disassembly)
Ground surfaces such as cams, rollers, latches, etc.	Wipe clean and apply D50H15	Wipe clean and apply D50H15
Sleeve bearings (Mechanism and Breaker linkage)	Very light application of light machine oil SAE-20 or -30.	Remove pins and links and clean as per the following cleaning instructions. Apply D50H15 liberally.
Removable Seal and Open Type Ball, Roller and Needle Bearings	Light application of light machine oil SAE-20 or -30.	Clean as per the following cleaning instructions and repack with D50H15.
Gear Reduction Unit	Sealed unit does not normally require additional lubrication.	Clean as per the following instructions and lubricate with approximately 2 ounces of SAE 20 or SAE 30. NOTE: DO NOT FILL GEAR BOX WITH OIL. High internal pressures will cause the oil to leak at the seals and gaskets.

Fig. 9 Lubrication Chart

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 Lubricant 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

Wherever cleaning is required, as indicated in the lubrication chart, the following procedures are recommended:

Sleeve Bearings

The pins should be removed and all old oxidized grease removed by immersion in clean petroleum solvent or similar cleaner. DO NOT USE CARBON-TETRACHLORIDE. Wipe the bearing clean. Apply a small amount of G.E. Lubricant D50H15 to the entire surface of the bearing and pin just before reassembling.

Removable Seal and Open Type Ball, Roller and Needle Bearings

The bearings should be first removed from the mechanism and disassembled by the removal of the seals or inner face in the case of needle bearings. They should then be placed in a container of clean petroleum solvent or similar cleaner. 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. Do not handle the bearings with bare hands as deposits from the skin onto the bearings are inducive to corrosion. If the bearings are touched, the contamination can be removed by washing in alcohol. 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 G.E. Lubricant D50H15 being sure all metal parts are greased. The removable seals should then be replaced.

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 light oil and draining should follow immediately, then apply the lubricant.

Gear Reduction Unit (Ref. Fig. 19)

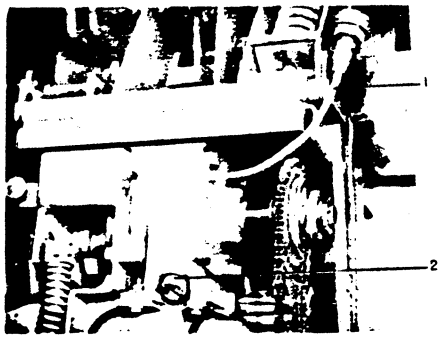
The gear reduction unit should be removed from the frame after disconnecting the chain drive and motor, and blocking the springs with the maintenance blocking plate.

Removal of the cotter pin and washers from the end of the shaft, and the four bolts holding the end bell (221) on the casting will allow enough of the unit to be disassembled for a thorough cleaning. Remove the pinion (211) ring gear (237) and eccentric (210) and place them in a container of clean petroleum solvent or similar cleaner. DO NOT USE CARBON-TETRACHLORIDE. The housing and remaining parts can usually be cleaned with a stiff brush and petroleum solvent. Inspect all gears, spacers and internal parts for cracks or any sign of unusual wear. Inspect the oil seal rings on the shafts and the gasket on the bell end cover to insure a tight fit.

In some cases, small metal chips may appear in the oil. This is not unusual and is to be expected from new gears.

Reassemble gears, spacers, etc. in the opposite order of their removal and add 2 ounces of SAE 20 or SAE 30 oil as shown in Fig. 10. Do not use more than 2 ounces of oil as high internal pressure caused by the rotating gears will force the oil past the gaskets and oil seal rings.

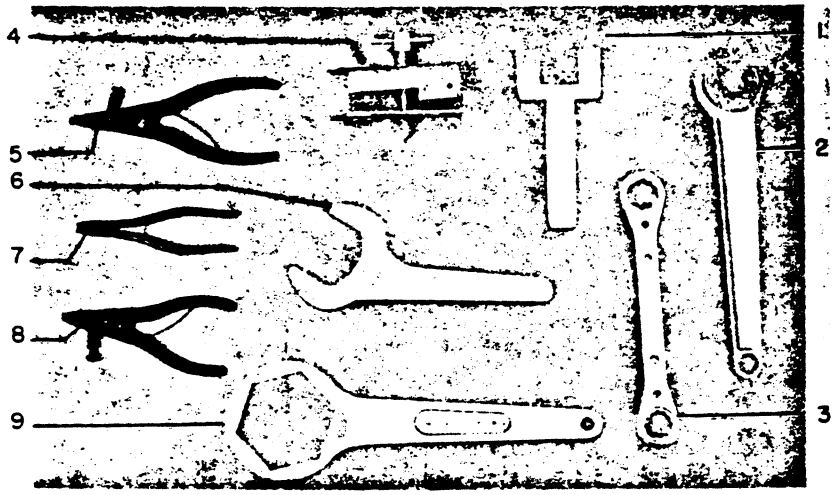
Reassemble gear reduction unit, motor and chain drive on mechanism. Before applying power to the motor, check all clearances as indicated in adjustments.



1. Oil Funnel 2. Oil Drain

Fig. 10

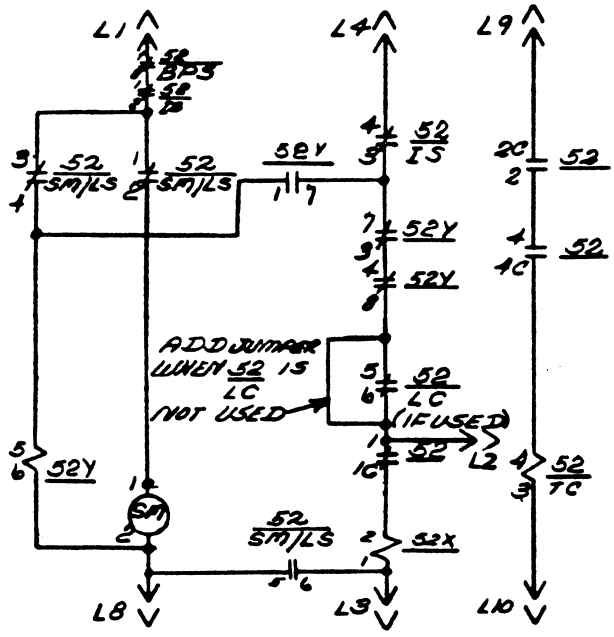
Fig. 10 (8025979)



1. Spanner Wrench
2. 1" Snap-on Wrench
3. 3/4" and 7/8" Snap-on Wrench (Supplied With 13.8kv Bkr. Only)
4. Spring Compressor
5. Retaining Ring Pliers
6. Square Nut Wrench
7. Retaining Ring Pliers
8. Retaining Ring Pliers
9. Hex Nut Wrench

Fig. 11 (8028557)

Fig. 11 Tool Set for ML-11 Mechanism



52 BPS SWITCH OPEN WHEN SPRING BLOCKING PLATE IS IN BLOCKING POSITION

52X SPRING RELEASE COIL OPERATES LATCH WHICH RELEASES CLOSING SPRINGS TO CLOSE 52.

52/IS INTERLOCK SWITCH CLOSED WHEN 52 IS IN FULLY RAISED OR FULLY LOWERED POSITION

52/SM/LS LIMIT SWITCHS FOR SPRING CHARGING MOTOR, CONTACTS (1-2) & (3-4) OPEN AND CONTACTS (5-6) CLOSED WHEN SPRINGS ARE FULLY CHARGED.

Fig. 12 (121A5926)

Fig. 12 Typical Breaker Wiring Diagram

PARTS RECOMMENDED FOR NORMAL MAINTENANCE

In tabulation below are listed parts which are recommended for stock for normal maintenance. Other parts are listed on the following pages.

FIG. NO.	REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
14	108	6517087 G-7	1	Motor (48v d-c)
14	108	6517087 G-5	1	Motor (125v d-c)
14	108	6517087 G-6	1	Motor (250v d-c)
14	108	6517087 G-6	1	Motor (230v a-c)
16	109	12HGA11H54	1	Relay (48v d-c)
16	109	12HGA11H52	1	Relay (125v d-c)
16	109	12HGA11H51	1	Relay (250v d-c)
16	109	12HGA11H71	1	Relay (230v a-c)
13	119	254D738 P-64	1	Spring Blocking Plate Switch
18	204	104A2451 P-2	1	Clutch Spring Washer
18	207	265C189 P-6	2	Clutch Friction Washer
20	212	258C626 P-10	2	Gasket
20	216	215D472 P-12	1	Gear Box "O" Ring
20	217	215D472 P-11	1	Gear Box "O" Ring
20	218	215D472 P-38	1	Gear Box "O" Ring
20	225	258C626 P-12	2	Drain Plug Gasket
19	239	258C626 P-19	4	Motor Shims 1/64" Thk.
19	239	258C626 P-14	4	Motor Shims 1/32" Thk.
19	239	258C626 P-13	4	Motor Shims 1/16" Thk.
*	240	258C642 P-12	AR	Pillar Block Shims 1/64" Thk.
*	240	258C642 P-11	2	Pillar Block Shims 1/32" Thk.
*	240	258C642 P-10	2	Pillar Block Shims 1/16" Thk.
*	241	265C189 P-9	3	Gear Box Shims
23	257	104A2456	1	Release Latch Reset Spring (ML-11B)
23	257	414A135 P-1	1	Release Latch Reset Spring (ML-11 & ML-11A)
23	257	104A2456	1	Release Latch Reset Spring (ML-11 & ML-11A)
23	279	9921661 P-1	1	Motor Switch (Norm. Open)
24	280	104A2455	1	Release Roller Spring
23	281	9921661 P-2	1	Motor Switch (Norm. Closed)
23	292	6174582 G-1	2 △	Release & Trip Coils 125v d-c
23	292	6174582 G-2	2 △	Release & Trip Coils 250v d-c
23	292	6174582 G-14	2 △	Release & Trip Coils 230v a-c
23	292	6275070 G-2	2 △	Release & Trip Coils 48v d-c
23	292	6275070 G-1	1	Trip Coil 24v d-c

△ Use one for Spring Release Circuit and one for Trip Circuit.

* Not Shown

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.

Note: The listed terms "right" and "left" apply when facing the 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.

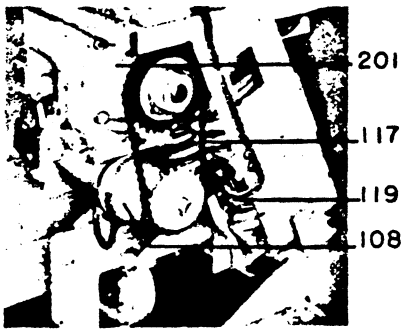


Fig. 13

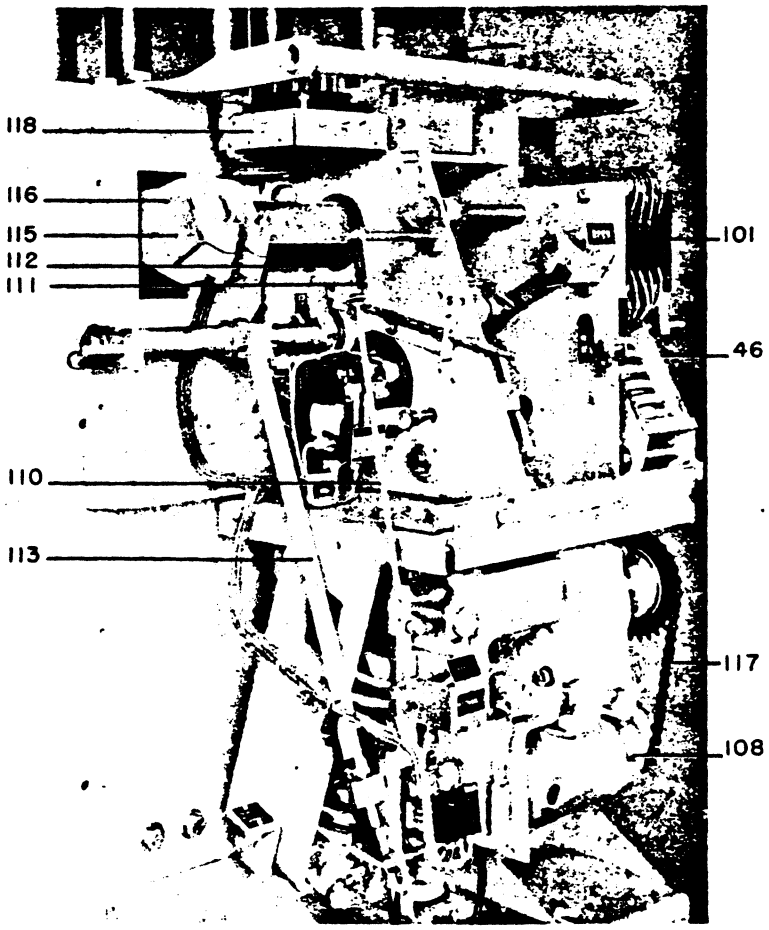


Fig. 14

Fig. 13 (8028590)

Fig. 14 (8028595)

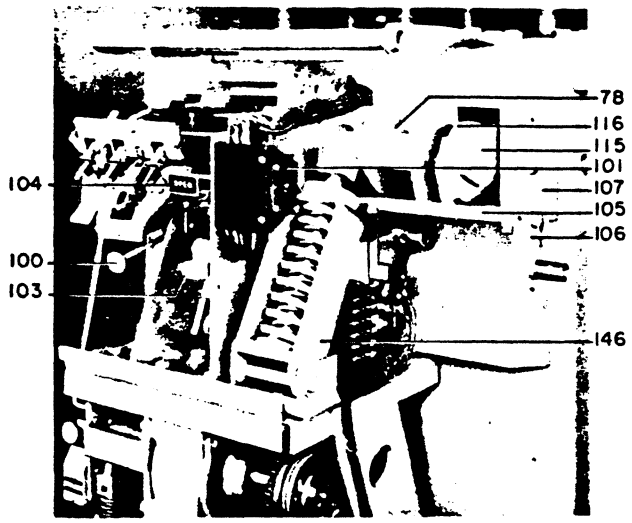


Fig. 15 (8024971)

Fig. 15

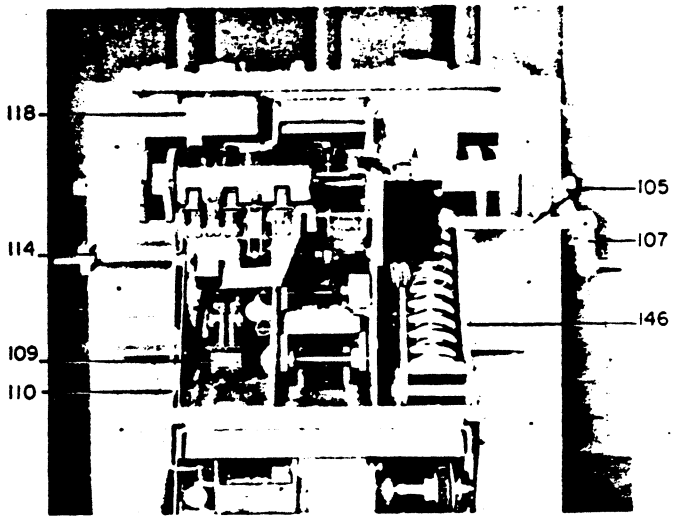
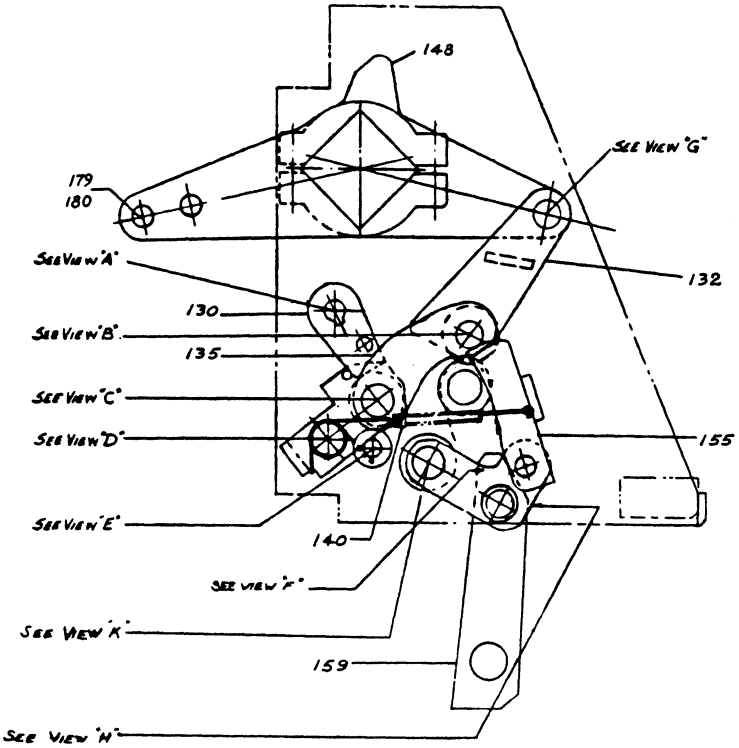


Fig. 16

Fig. 16 (8024970)

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
100	258C604 G-4	1	Manual Trip Assembly
101	415A489 G-1	1	Auxiliary Switch
103	6192382AB P-1	1	Operation Counter
104	281B711 G-1	1	Indicator Assembly
105	258C601 P-14	1	Shaft (4.16)
105	258C601 P-15	1	Shaft (13.8 & 7.2)
106	236C788 G-10	1	Crank Assembly
107	258C601 G-3	1	Bearing Bracket
108	6517087 G-5	1	Motor (125v d-c)
108	6517087 G-6	1	Motor (250v d-c & 230v a-c)
108	6517087 G-7	1	Motor (48v d-c)
109	12HGA11H54	1	Relay (48v d-c)
109	12HGA11H52	1	Relay (125v d-c)
109	12HGA11H51	1	Relay (250v d-c)
109	12HGA11H71	1	Relay (230v a-c)
109	12HGA11H56	1	Relay (24v d-c)
110	619C421 P-6	1	Trip Lock Rod
111	619C421 P-4	1	Trip Lock Link
112	619C421 G-3	1	Trip Lock Pin & Crank (4.16, 7.2 & 13.8-500)
112	619C421 G-4	1	Trip Lock Pin & Crank (13.8-750)
113	688C511 G-2	1	Trip Interlock Complete (4.16)
113	688C511 G-1	1	Trip Interlock Complete (13.8 & 7.2)
114	688C511 G-6	1	Trip Interlock Crank Only (4.16)
114	688C511 G-3	1	Trip Interlock Crank Only (13.8 & 7.2)
115	6443518 P-2	1	Shaft (4.16)
115	6443518 P-1	1	Shaft (13.8 & 7.2)
116	836C190 P-1	6	Crank
117	215D472 P-13	1	Chain
118	802B795 G-3	1	Secondary Disconnect Device Complete (#14 Wire)
118	802B795 G-4	1	Secondary Disconnect Device Complete (#12 Wire)
119	254D738 P-64	1	Spring Blocking Plate Switch (N. O.)



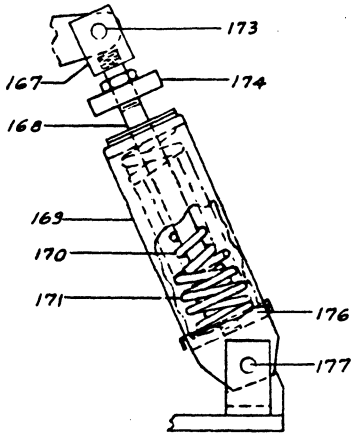
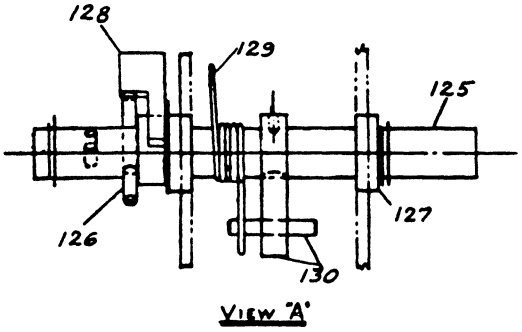
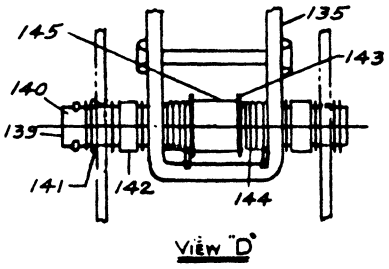
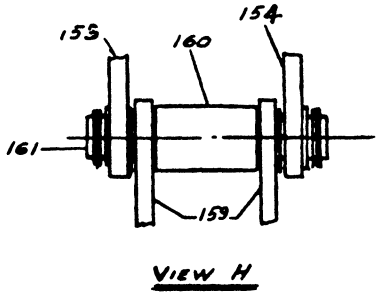


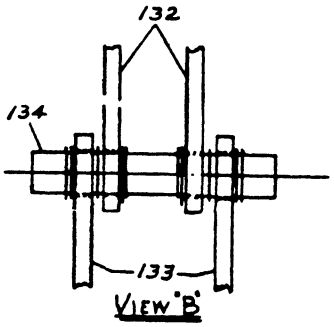
Fig. 17A (0105C9391)

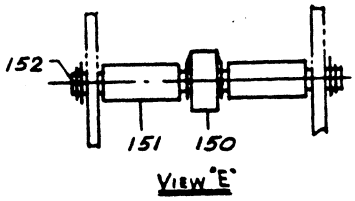
Fig. 17A Complete Opening Spring Assembly Ref. 146

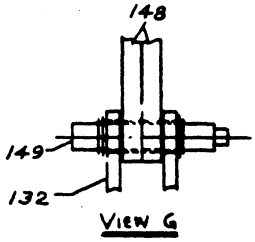


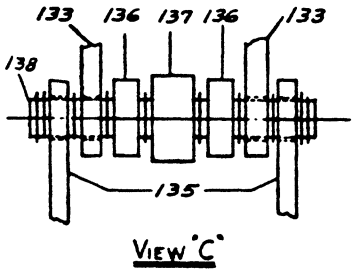


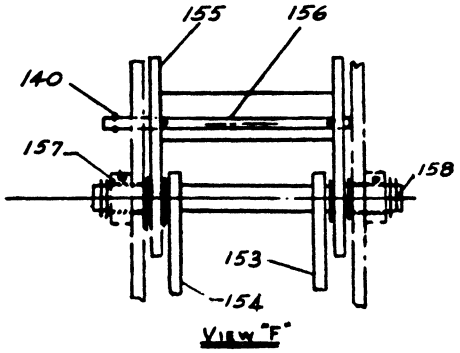












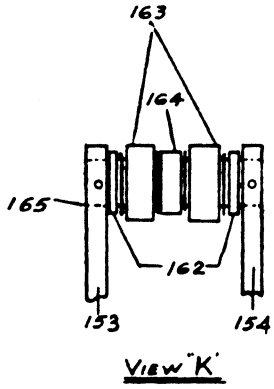


Fig. 17 (0105C9391)

Fig. 17 Cross Section

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
125	215D465 P-34	1	Latch Shaft (4.16)
125	215D465 P-35	1	Latch Shaft (13.8 & 7.2)
126	258C635 P-11	1	Stop Bar
127	121A7436 G-1	2	Dry Bearing Assembly
128	104A2472 G-1	1	Stop Bar
129	421A244	1	Spring
130	828C758 G-1	1	Latch & Pin
132	215D473 G-53	1	Link & Bushing
133	215D473 G-52	2	Link & Bushing
134	258C627 P-10	1	Prop Pin
135	215D473 G-51	1	Link & Bushing
136	456A876 P-102	2	Spacer
137	414A112 P-1	1	Needle Bearing
138	414A110 P-5	1	Pin
139	258C628 P-4	1	Pin
140	456A820	1	Spring
141	6370567 P-51	2	Bushing
142	456A876 P-104	2	Spacer
143	414A105 P-10	4	Washer
144	6509799	2	Spring
145	456A876 P-105	1	Spacer
146	258C630 G-4	1	Spring Assembly Complete
146	258C630 G-6	2	Spring Assembly Complete (13.8 - 750)
148	215D473 G-54	2	Crank & Bushing
149	258C609 P-9	1	Pin
150	828C758 P-7	1	Roller
151	421A209 P-101	2	Spacer
152	383A926AE P-39	1	Pin
153	215D473 G-55	1	Crank & Bushing
154	215D473 G-56	1	Crank & Bushing
155	265C189 G-1	1	Prop
156	258C627 P-13	1	Pin
157	456A885 P-1	2	Bushing
158	688C553 P-10	1	Pin
159	258C627 P-4	2	Link
160	456A876 P-19	1	Spacer
161	258C627 P-11	1	Pin
162	6176109 P-168	2	Spacer
163	414A112 P-8	2	Needle Bearing
164	6176109 P-174	1	Spacer
165	258C627 P-12	1	Pin
167	258C630 P-7	*	Clevis
168	258C630 P-8	*	Rod
169	258C630 P-3	*	Spring Retainer
170	456A808	*	Inner Spring
171	456A807	*	Outer Spring
172	258C630 P-4	*	Spring Base
173	383A926AE P-1	*	Pin
174	258C630 G-3	*	Plate
175	414A109 P-8	*	Buffer
176	258C630 P-5	*	Retaining Plate
177	383A926AF P-20	*	Pin
178	258C609 P-4	*	Crank
179	619C478 P-19	2	Pin for End Pole
180	688C568 P-8	1	Pin for Center Pole
181△	0258C0611 P-15	1	Opening Spring Cover (Left Hand Spring Only)
182	215D473 G-57	1	Closing Crank & Roller Assembly Complete

* (1) For Std. (2) For 13.8-750

△ Not Shown

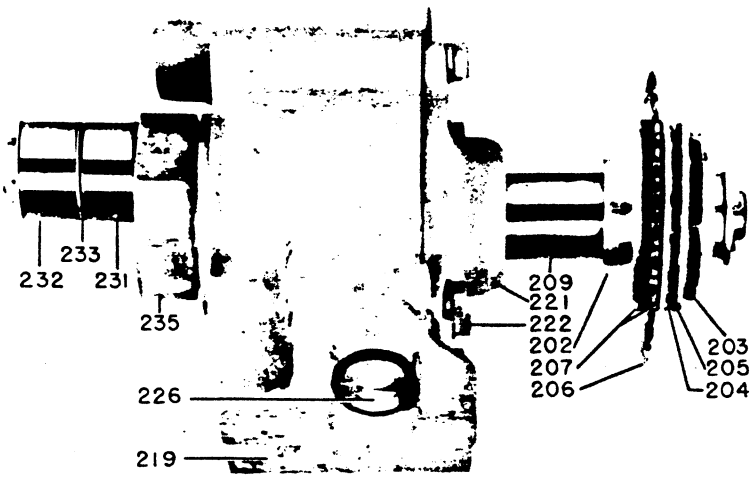


Fig. 18 Complete Gear Unit Ref. 201

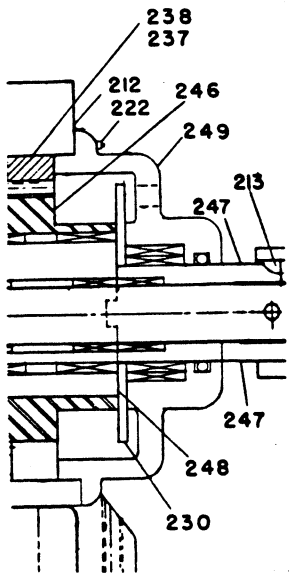


Fig. 19A Reduction Gear Unit ML-11D
(Otherwise Same As Fig. 19)

Fig. 18 (8024680)

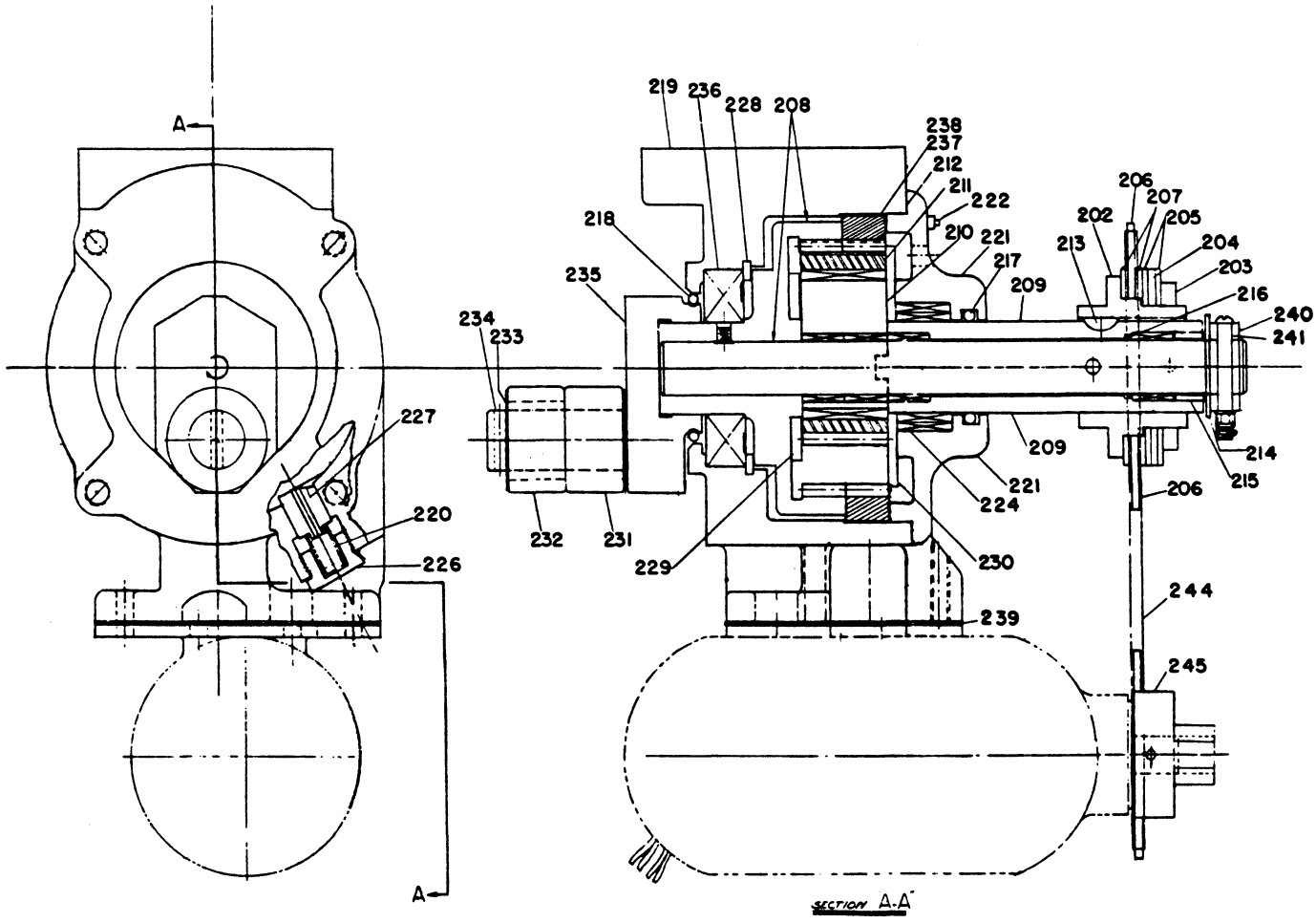
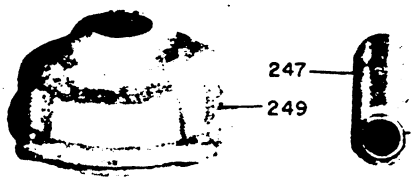
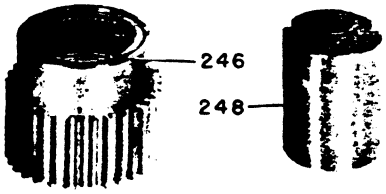


Fig. 19 Reduction Gear Unit

Fig. 19 (634D322)

Fig. 19A (635D364)





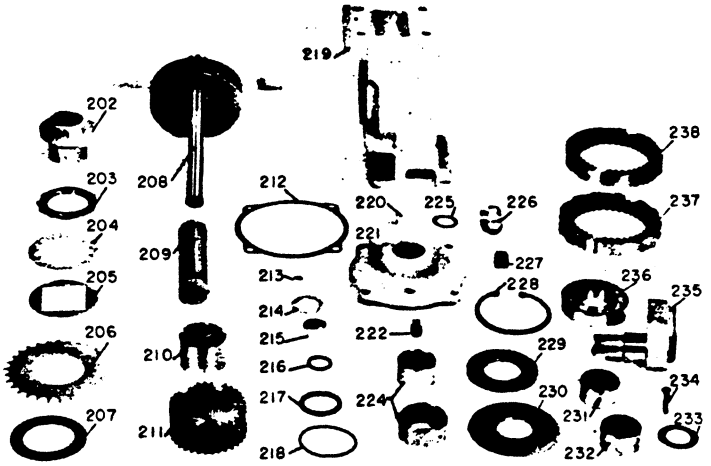


Fig. 20

Fig. 20 (8026378 and 8031890)

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
201	215D472 G-1	1	Reduction Gear Unit Complete (ML-11A, ML-11B) 4.16-150, 250; 7.2-250; 13.8-150, 250, 500
201	215D472 G-2	1	Reduction Gear Unit Complete (ML-11A, ML-11B) 7.2-500, 13.8-750
201	215D472 G-3	1	Reduction Gear Unit Complete (ML-11C) 4.16-150, 250; 7.2-250; 13.8-150, 250, 500
201	215D472 G-5	1	Reduction Gear Unit Complete (ML-11D) 7.2-500; 13.8-750
202	265C189 P-4	1	Retainer
203	265C189 P-7	1	Nut
204	104A2451 P-2	1	Spring Washer
205	265C189 P-5	2	Washer
206	258C625 P-7	1	Sprocket
207	265C189 P-6	2	Clutch Washer
208	215D472 G-50	1	Gear Assembly
209	215D472 G-51	1	Shaft, Bearing & "O" Ring (ML-11, ML-11A, ML-11B, ML-11C)
210	215D472 G-53	1	Eccentric (ML-11, ML-11A, ML-11B, ML-11C)
211	215D472 G-52	1	Pinion Gear & Bearing (ML-11, ML-11A, ML-11B, ML-11C)
212	258C626 P-10	1	Gasket
213	215D472 P-37	1	Woodruff Key
214	414A105 P-10	2	Washer
215	258C625 P-10	1	Spacer
216	121A5998 P-4	1	"O" Ring
217	121A5998 P-5	1	"O" Ring
218	121A5998 P-6	1	"O" Ring
219	258C622 P-1	1	Gear Housing 4.16-150, 250; 7.2-250; 13.8-150, 250, 500
219	258C622 P-3	1	Gear Housing 7.2-500 & 13.8-750
220	104A2470	1	Spring
221	258C624 P-1	1	Cover (ML-11, ML-11A, ML-11B, ML-11C)
222	215D472 P-26	1	Plug
224	414A112 P-5	1	Bearing (Inner & Outer Race)
225	258C626 P-12	2	Gasket
226	688C553 P-8	1	Plug
227	258C626 P-20	1	Rachet Pin
228	N901P334	1	Retaining Ring
229	137A6028 P-1	1	Spacer
230	137A6028 P-2	1	Spacer
231	414A112 P-7	1	Bearing (ML-11, ML-11A, ML-11B)
231	414A112 P-44	1	Bearing (ML-11C, ML-11D)
232	215D472 G-54	1	Roller & Bearing
233	414A105 P-18	1	Washer
234	1/8 Dia X 1/2 Lg	1	Cotter Pin
235	258C625 P-1	1	Latch Prop
236	414A112 P-9	1	Bearing
237	6404419 P-1	1	Ring Gear (ML-11)
238	104A2407 P-2	1	Ring Gear (ML-11A, ML-11B, ML-11C, ML-11D)
239	258C626 P-19	4	Motor Shims 1/64" Thk.
239	258C626 P-14	4	Motor Shims 1/32" Thk.
239	258C626 P-13	4	Motor Shims 1/16" Thk.
240	258C626 P-21	1	Spacer
241	258C626 P-22	1	Screw
243 *	265C189 P-9	3	Gear Box Shims
244	456A864 P-50	1	Chain
245	258C626 G-2	1	Sprocket
246	215D472 G-56	1	Pinion Gear & Bearing (ML-11D)
247	215D472 G-55	1	Shaft, Bearing & "O" Ring (ML-11D)
248	215D472 G-57	1	Eccentric (ML-11D)
249	258C624 P-1	1	Cover (ML-11D)

* Not Shown

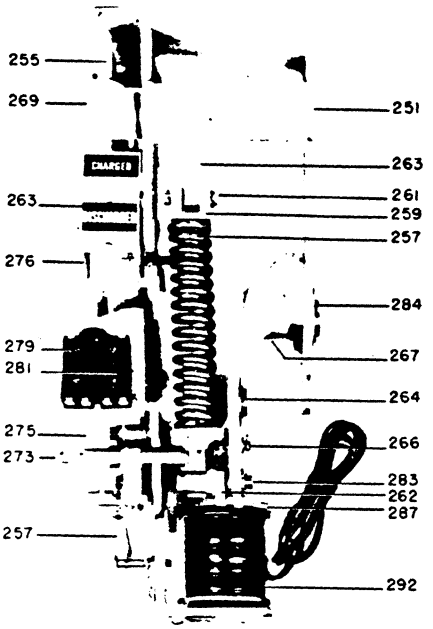
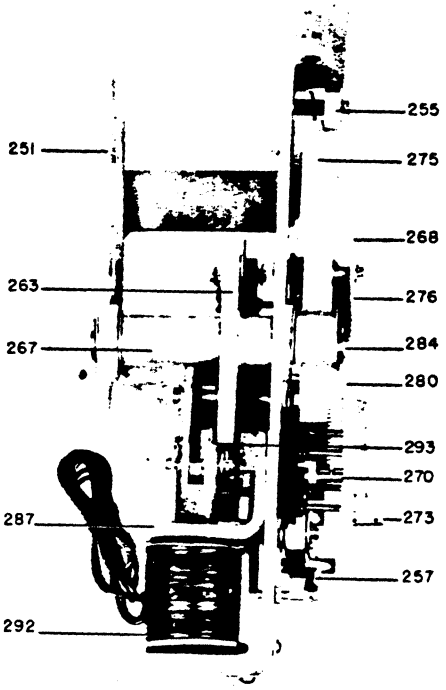


Fig. 21 Ref. 250



ML-11 and ML-11A

Fig. 22 Ref. 1

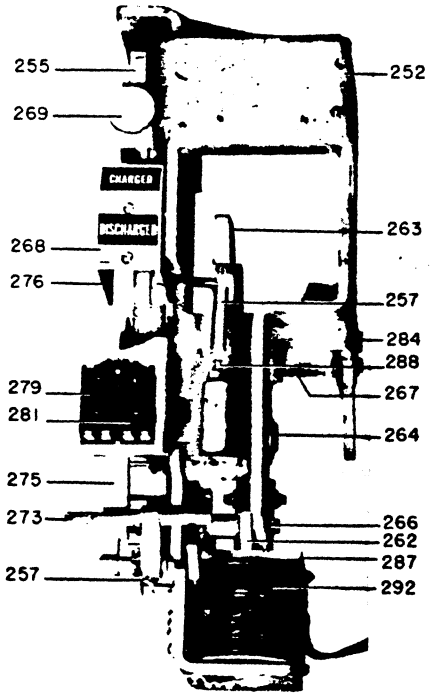
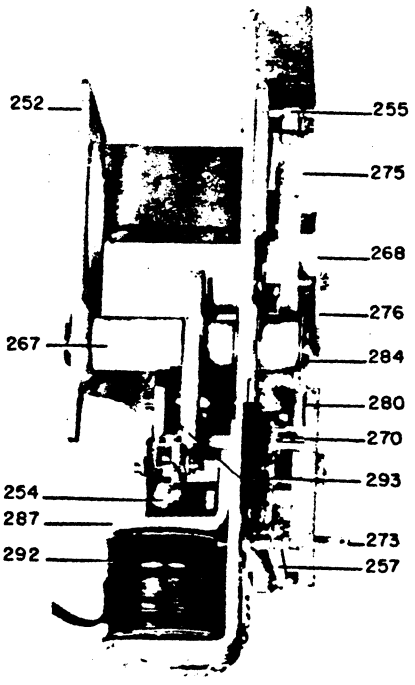


Fig. 23 Ref. 1



ML-11B

Fig. 24 Ref. 1

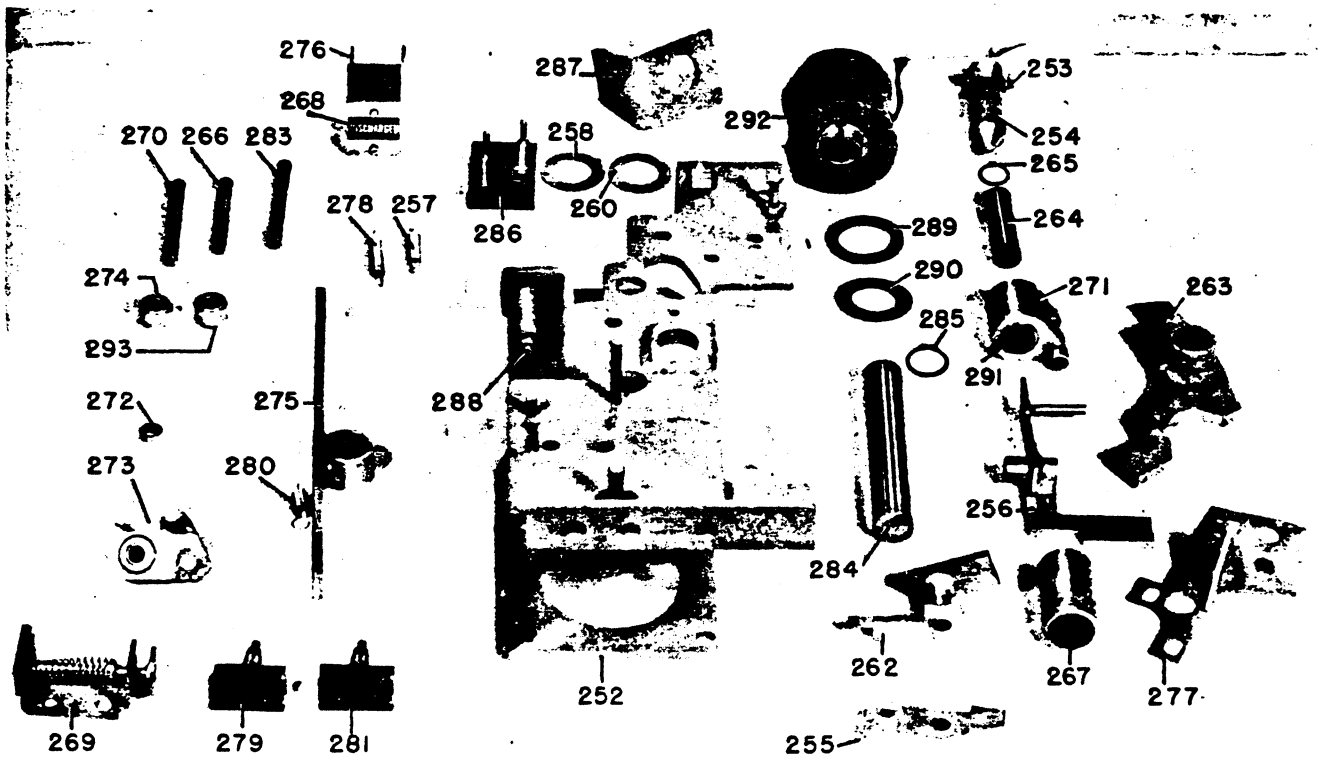


Fig. 25 (8026370)

Fig. 25 ML-11B

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
250	215D466 G-1	1	Control Mechanism Complete (Less Coil) (4.16-150, 250)
250	215D466 G-1	1	Control Mechanism Complete (Less Coil) (7.2-250, 500; 13.8-150, 250, 500, 750)
251	688C592 G-1	1	Control Frame
253	215D465 P-32	1	Pin for Plunger
254	215D465 P-15	1	Plunger
255	619C421 P-3	1	Crank
256	215D464 G-3	1	Switch Trip Assembly
257	414A135 P-1	1	Spring (ML-11 & ML-11A)
257	104A2456	1	Spring (ML-11 & ML-11A)
257	104A2456	2	Spring (ML-11B)
*258	215D465 P-49	1	Spring Retaining Washer
259	215D464 P-13	1	Spring Rod (ML-11 & 11A)
260	414A105 P-10	3	Washer
261	215D465 P-38	1	Pin (ML-11 & 11A)
262	688C553 G-1	1	Crank Assembly
263	215D464 G-2	1	Prop
264	215D465 P-31	1	Pin
265	N900P-75	2	Retaining Ring
266	215D465 P-23	1	Pin
267	6176110 P-201	1	Spacer
268	NP 166999A	1	Nameplate (Indicator)
269	215D466 G-3	1	Rod Assembly
270	215D465 P-36	1	Pin
271	215D465 P-1	1	Trigger Assembly
272	6176109 P-77	1	Spacer
273	215D465 G-2	1	Prop Assembly
274	414A112 P-2	1	Bearing
275	688C592 G-2	1	Paddle Assembly
276	215D465 P-27	1	Support for NP
277	215D465 G-7	1	Support
278	104A2410	1	Spring
279	9921661 P-1	1	Switch (Open)

* Not Shown

(Continued on Next Page)

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
280	104A2455	1	Release Roller Spring
281	9921661 P-2	1	Switch (Closed)
282	258C611 P-9	1	Pole Piece
283	215D464 P-21	1	Pin
284	215D465 P-33	1	Pin
285	N900P100P	2	Retaining Ring
286	1438640	1	Terminal Board
287	215D465 P-30	1	Coil Support
288	215D464 P-30	1	Pin (For ML 11-B)
289	414A109 P-3	2	Washer
290	414A109 P-5	5	Washer
291	414A112 P-3	2	Bearing
292	6174582 G-1	1	Release Coil (125v d-c)
292	6174582 G-2	1	Release Coil (250v d-c)
292	6275070 G-1	1	Release Coil (24v d-c)
292	6275070 G-2	1	Release Coil (48v d-c)
292	6174582 G-14	1	Release Coil (230v a-c)
293	121A7436 G-3	1	Dry Bearing

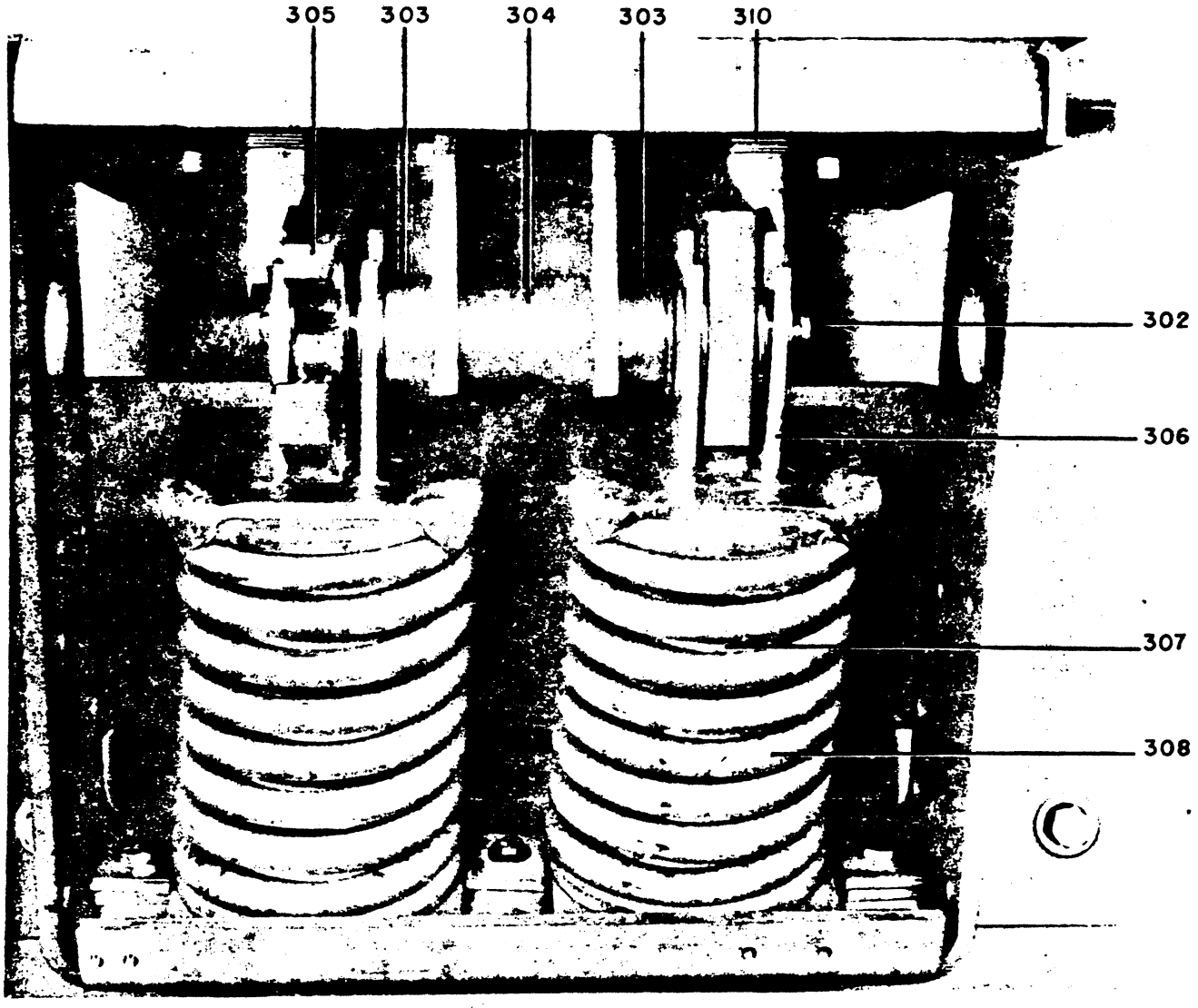


Fig. 26. (8025400)

Fig. 26 Spring Assembly Ref. 301

REF. NO.	4.16 STD.	7.2 & 13.8 STD.	13.8 - 750 7.2 - 500	NO. REQ. PER. MECH.	DESCRIPTION
301	258C638 G-1	258C638 G-2	258C638 G-7	1	Spring Assembly Complete
302	258C628 P-3	258C628 P-3	258C628 P-3	1	Pin
303	6176109 P-285	6176109 P-285	6176109 P-285	2	Spacer
304	6176109 P-639	6176109 P-639	6176109 P-639	1	Spacer
305	254D738 G-50	254D738 G-50	254D738 G-50	1	Crank & Bushing Assembly (ML-11A, ML-11B)
305	254D738 G-51	254D738 G-51	254D738 G-51	1	Crank & Bushing Assembly (ML-11C)
306	258C638 G-3	258C638 G-3	258C638 G-3	2	Rod & Guide
307	383A982	383A982	383A982	2	Spring (Inner)
308	383A983	383A983	383A983	2	Spring (Outer)
*309	△	△	456A809	2	Spring (Inner)
310	258C642 P-12	258C642 P-12	258C642 P-12	2	Pillar Block Shims 1/64"
310	258C642 P-11	258C642 P-11	258C642 P-11	2	Pillar Block Shims 1/32"
310	258C642 P-10	258C642 P-10	258C642 P-10	2	Pillar Block Shims 1/16"

△ Not Required
* Not Shown

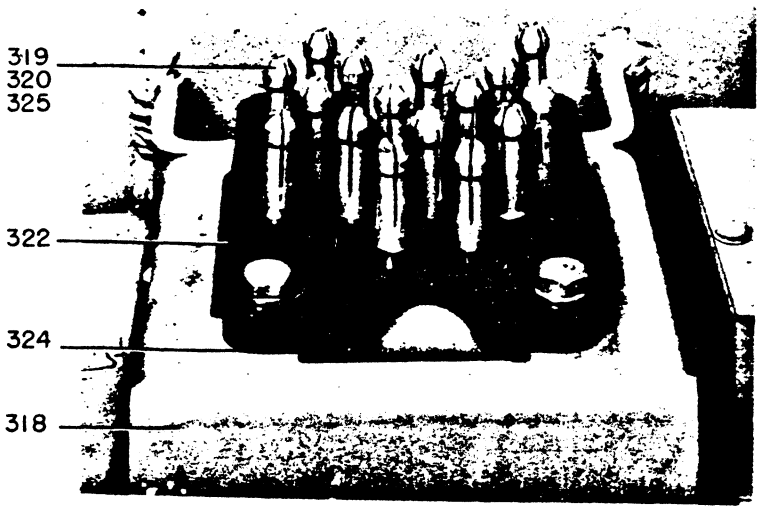


Fig. 27 (8026035)

Fig. 27 Ref. 118

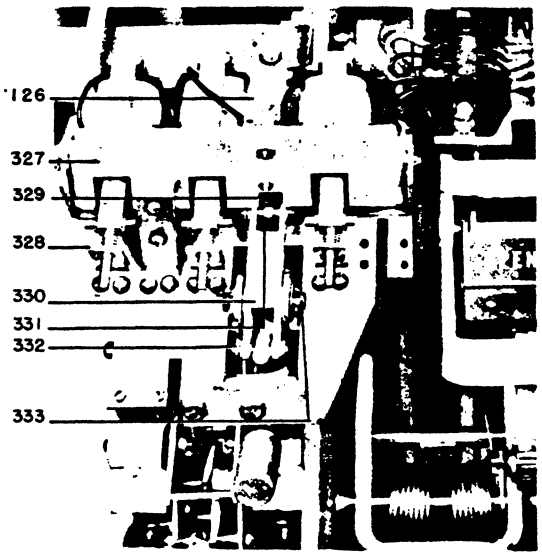


Fig. 28 (8020216)

Fig. 28 Current Trip Mechanism Ref. 119

REF. NO.	CAT. NO. FOR ML-11	NO. PER MECH.	DESCRIPTION
118	802B795 G-3	1	Secondary Disconnect Device Complete (#14 Wire)
118	802B795 G-4	1	Secondary Disconnect Device Complete (#12 Wire)
319	6319964 P-2	16	Plug
320	848768 P-1	16	LK Washer for Plug
322	6505244 P-1	1	Socket
324	3663094 P-38	3	Spacer
325	366A234 P-1	2	Contact Nut
325	366A234 P-2	14	Contact Nut (#14 Wire)
325	366A234 P-3	14	Contact Nut (#12 Wire)
326	6551725	1	Spring
327	366A611 G-1	1	Trip Pan
328	6558748 P-1	3	Bracket
329	6558756 P-1	1	Trip Latch
330	366A600 P-1	1	Trip Arm
331	6477418AA P-10	1	Ball Bearing
332	6076401 P-307	1	Pin
333	6477427AA P-8	1	Pin

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