SIEMENS-ALLIS

Switchgear

INSTRUCTIONS

TYPE "D"

GROUND AND TEST DEVICE

WITH

515-1T STORED ENERGY OPERATOR

FOR USE WITH

5-kv METAL-CLAD SWITCHGEAR

18X10253
October, 1978

INDEX

ILLUSTRATIONS

The information contained within is intended to assist operating personnel by providing information on the general characteristics of equipment of this type. It does not relieve the user of responsibility to use sound engineering practices in the installation, application, operation and maintenance of the particular equipment purchased.

If drawings or other supplementary instructions for specific applications are forwarded with this manual or separately, they take precedence over any conflicting or incomplete information in this manual.

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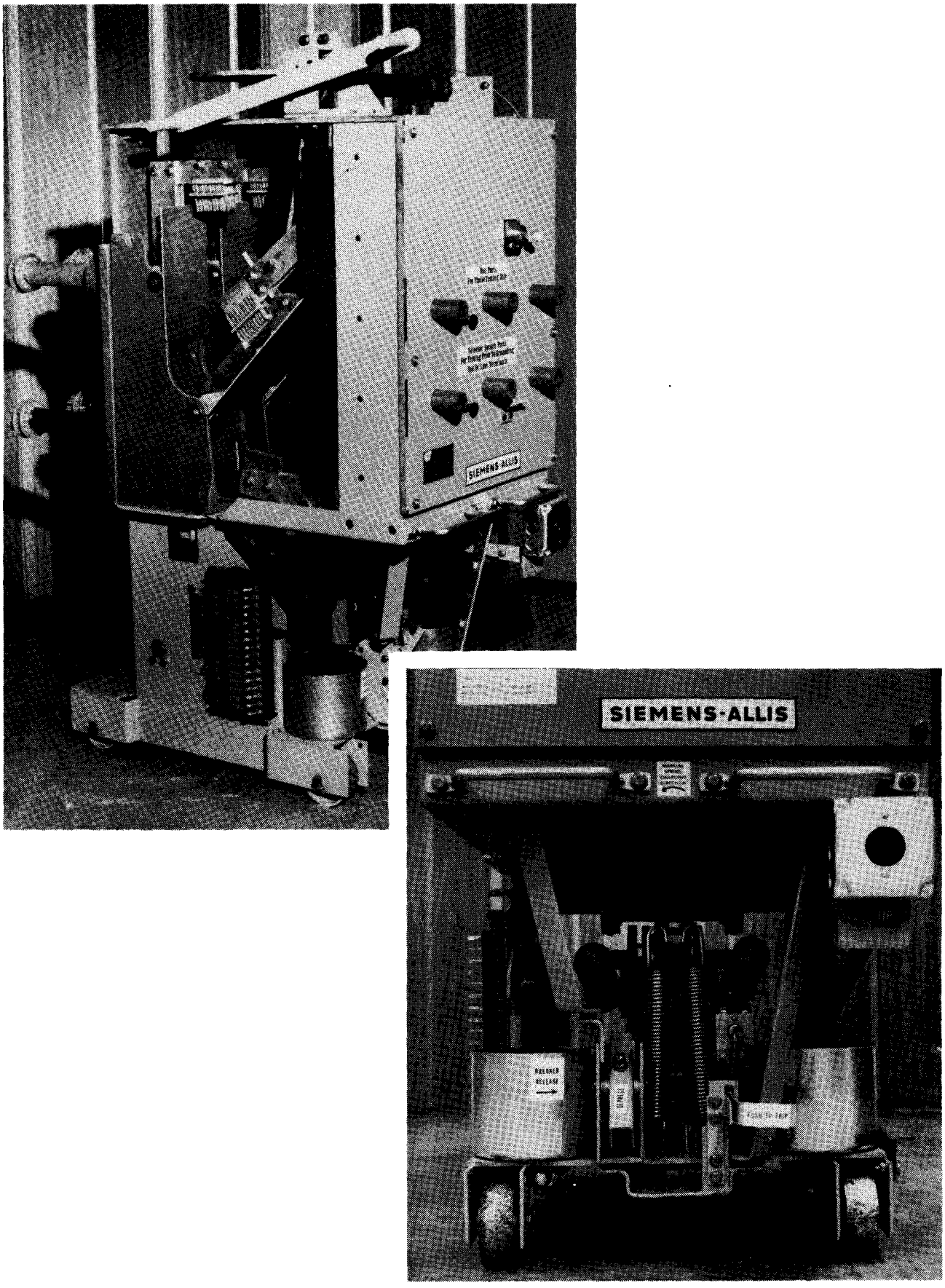


Fig. 1 – Typical Ground and Test Device Used with 5-kv Switchgear

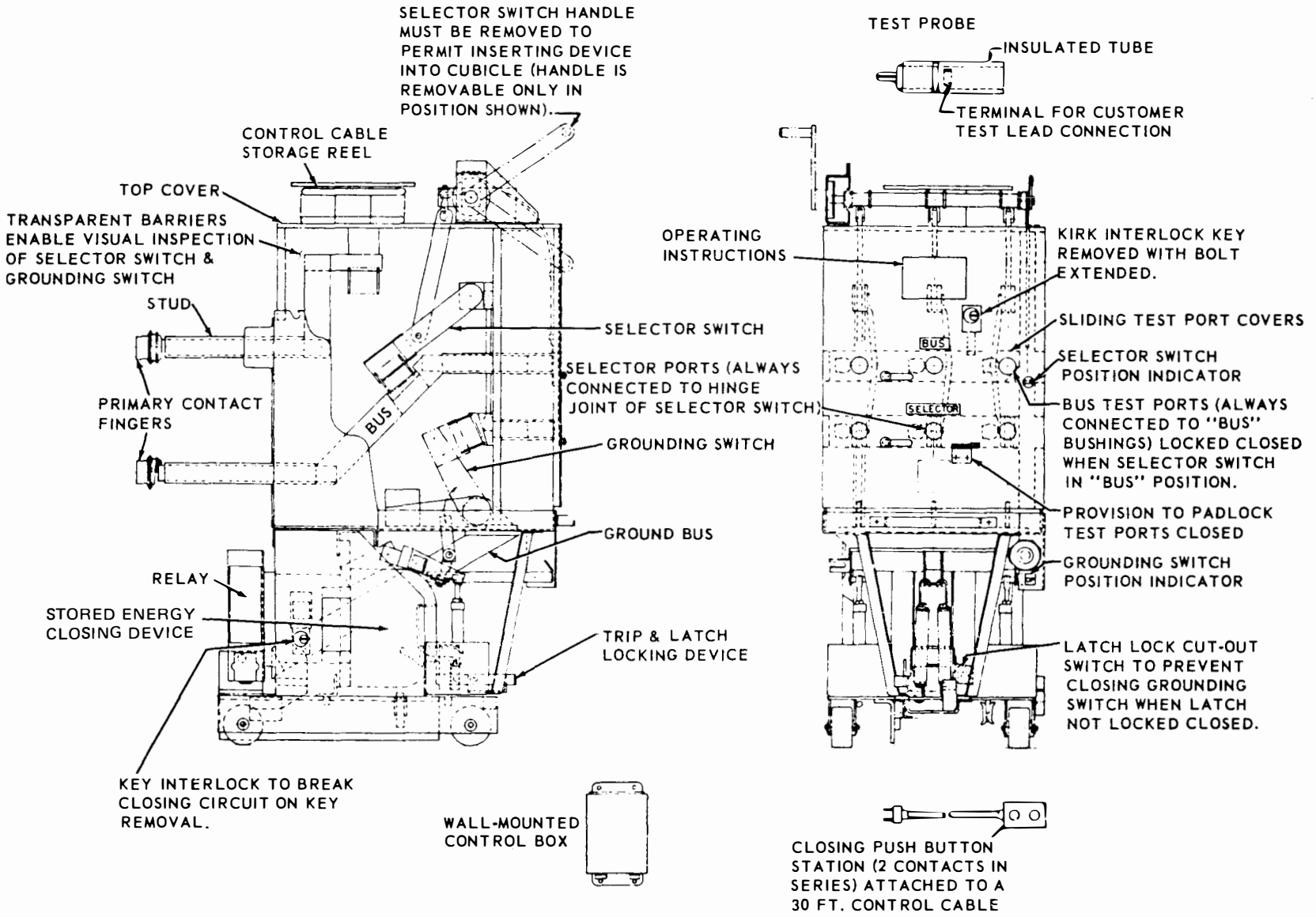


Fig. 2 – Typical 5-kv Ground and Test Device

INTRODUCTION

This instruction manual provides operation and maintenance information for power operated grounding and test devices used with 5-kv metal-clad switchgear.

WARRANTY

The sales contract carries all information on warranty coverage.

DESCRIPTION

GENERAL

This device is suitable for inserting in switchgear enclosures in the space normally occupied by circuit breakers. It contains power operated grounding contacts for grounding either the line or bus connections of the switchgear and manually operated selector switch contacts for pre-selection of line or bus. It also provides test ports for selector switch or bus access, and interlocks to assure maximum safety with convenience of use in any test function.

Furnished, as specified, are 1200 or 2000 amp primary disconnect contacts.

Outer and inner phase barriers are of transparent material to permit visual inspection of selector switch position on all phases.

Position indicator for ground and selector switches.

Top of device is covered to prevent entrance of foreign material or exposure to high voltage parts.

Large, clearly visible labels are used to identify the various parts of the test device.

Control – The selector switch is manually operated. The grounding switch is electrically closed. Tripping is accomplished by the manual "trip lever." Control power is obtained through the normal secondary contacts. Close control is by a portable switch at the end of a 30-foot cord (Fig. 3).

Test Ports – Two sets of test ports (Fig. 4) are provided on the front panel. The upper set is connected directly to the lower or bus studs. The lower set is connected to the hinge of the selector switch which may be in either bus or line position.

Test Probes – Test probes provide means of convenient connection of test leads to the device. Probes are pushed into test ports to establish an electrical connection through pressure contacts. Probes are self-aligning. They can be secured in position by sliding the test port cover to its third position, which also ensures that probes are fully inserted (Fig. 4).

Selector Switch – Operation of the selector switch is by means of a removable handle on the side of the device. This location ensures that the selector switch operation cannot be accomplished while the device is in the switchgear cubicle and that the operating handle must be removed before the device can be inserted in the cubicle. The selector switch shaft locks in each position when the operating handle is removed, assuring full contact pressure in the bus and line positions.

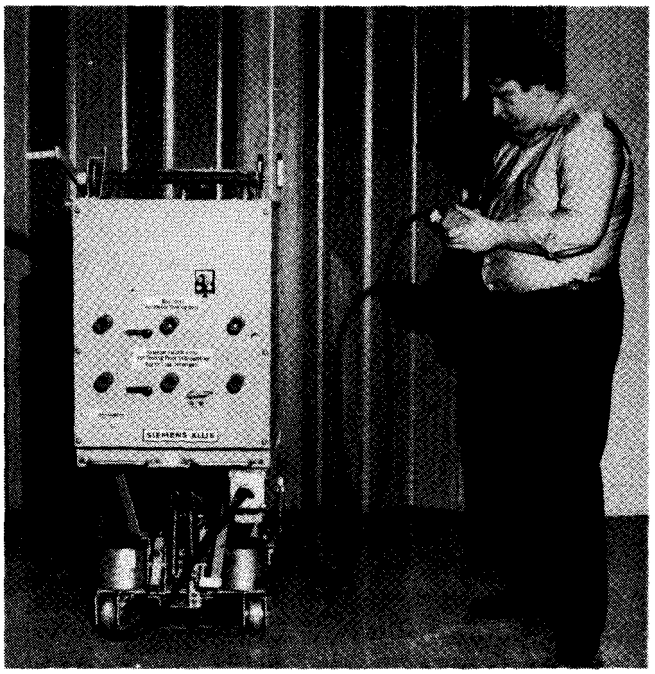


Fig. 3 – Portable Push Button is Used to Close the Switch

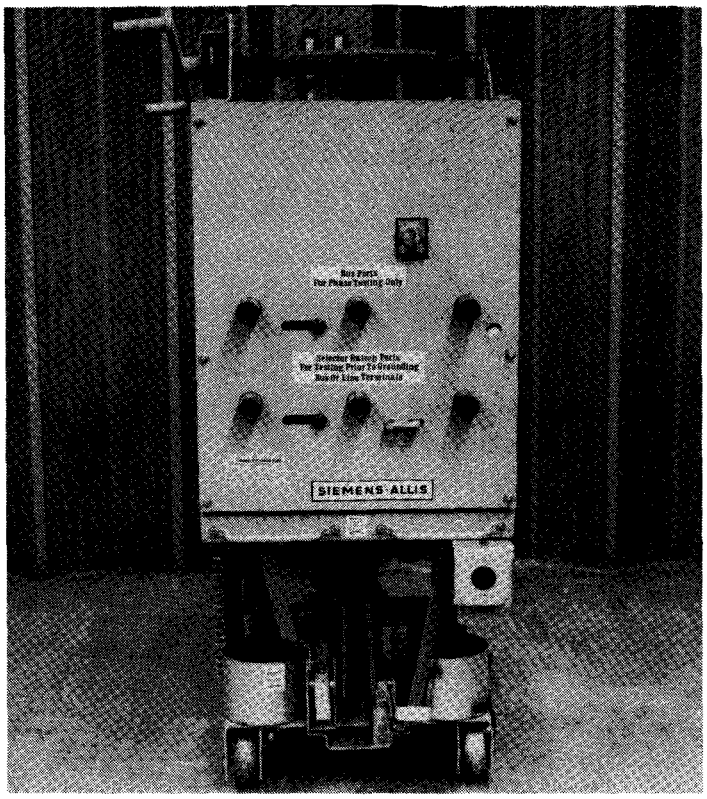


Fig. 4 – Test Ports are Located on Front of Unit

Trip & Latch Locking Device – This device provides a number of operational and safety functions:

Renders mechanism latch non trip-free when pulled fully out.

Provides space for two padlocks which can be used to prevent unauthorized opening of ground contacts or removal of device from switchgear.

Provides electrical cutout to prevent closing of ground contacts if latch is not locked closed by being pulled fully out.

Assures that device cannot be inserted or removed from cubicle unless trip and latch locking device is pushed fully in and ground switch is open.

Grounding Switch – The grounding switch is power closed by a spring operator. The unit is held non trip-free when closing the grounding switch and has the same close and latch capability as the breakers.

INTERLOCKS

Closing Circuit – The closing circuit key interlock is located on the left side of the device. It assures that the grounding blade closing circuit is open whenever the device is used for phasing, low potential testing and high potential phase rotation testing. For operation of the closing mechanism, the key must be turned to the fully engaged captive position. To gain access to the bus ports during phase testing, the key must be removed from the closing circuit key interlock and inserted in the bus port key interlock.

Bus Port – The bus port key interlock is located above the bus ports. It assures that tests made prior to grounding are always made through the selector switch ports which are connected to the selector switch hinge. This interlock prevents accidental testing of the wrong circuit prior to grounding.

1200/2000 – The 1200/2000 interlock is located at the rear of the device under the horizontal frame, about 2-3/4 inches above the floor. It is "C" shaped and is supplied in the 1200-amp position. To use the device with 2000-amp primary contacts, remove the two mounting bolts and mount the interlock turned 180 degrees with the "C" shape facing in the same direction as the letter C when looking at the device from the rear. If your operating safety procedures positively guarantee that the device will be used only in the proper switchgear cubicle, the interlock may be removed.

OPERATORS

The switch is closed by the operator straightening a toggle in the four-bar linkage (page). The operator is powered by precharged springs (stored energy).

STORED ENERGY OPERATOR

The stored energy operator uses charged springs to power the closing operation. Opening is spring-powered also, but not with the same springs used for closing. A stored energy operator consists of three systems: driving, spring linkage and four-bar toggle linkage. These systems are disengaged from each other except while performing their specific functions. For example – the driving and spring linkage systems are completely free of each other except when the spring linkage is being charged. Similarly, the spring linkage and four-bar toggle linkage systems are free of each other except during a closing operation.

Stored energy operated devices normally require a single commercial relay for control. This relay is furnished to match the control voltage.

OPERATION

OPERATING PROCEDURE

a) For Back-Feed Testing or Grounding –

1. Verify that proper primary contact fingers are in place and device interlock is set properly.
2. Set selector switch blades on studs to be grounded. To move switch, insert handle in socket and press in to unlock switch. Rotate handle to full stop position. Remove handle. Verify that shaft is locked in position.
3. Check closing circuit interlock key on lower left hand side of unit. Turn key to fully engaged captive position.
4. Push in trip and latch locking device.
5. Insert device in cubicle.
6. Pull trip and latch locking device fully out.
7. Test selector terminals with statiscope to be sure they are de-energized.
8. Energize cubicle control power circuit. (Stored energy closing springs will charge.)
9. Attach close control cable.
10. Depress both control buttons and unit will close grounding circuit.
11. Secure the trip and latch locking device in the grounded position. (Fully out).

b) To Unground and Remove Unit –

12. Remove all test probes if used.
13. Push in trip and latch locking device to full in position.
14. Depress trip lever to open ground switch.
15. Depress trip lever to full down position and remove unit from cubicle.

c) For Ungrounded Testing –

16. Same as steps 1 and 2, with selector on line setting.
17. Remove key from closing circuit interlock on lower left hand side of unit and unlock bus test port slide.
18. Same as steps 4 and 5.
19. Open test ports by moving slide to right until holes line up.
20. Test terminals with statiscope to be sure they are de-energized.
21. Insert probes.
22. Move slide to right to lock in probes.
23. Perform tests in accordance with approved procedures.

PRIMARY CONTACTS – 1200/2000

Test device shipped with 1200 amp primary contacts. When ordered 2000 amp primary contacts are supplied.

Care should be taken in assembly of the 2000 amp primary contacts. See figure below. Retaining cup (A) should be against insulation tube (B) holder (C) against retaining cup (A) brass washer (D) in recess of cup (E) larger steel washer (F) on top of brass washer (D) as shown on figure below. Proper assembly with bolt (G) tight will allow cup (E) to move freely for self alignment of fingers (H) to cubicle studs.

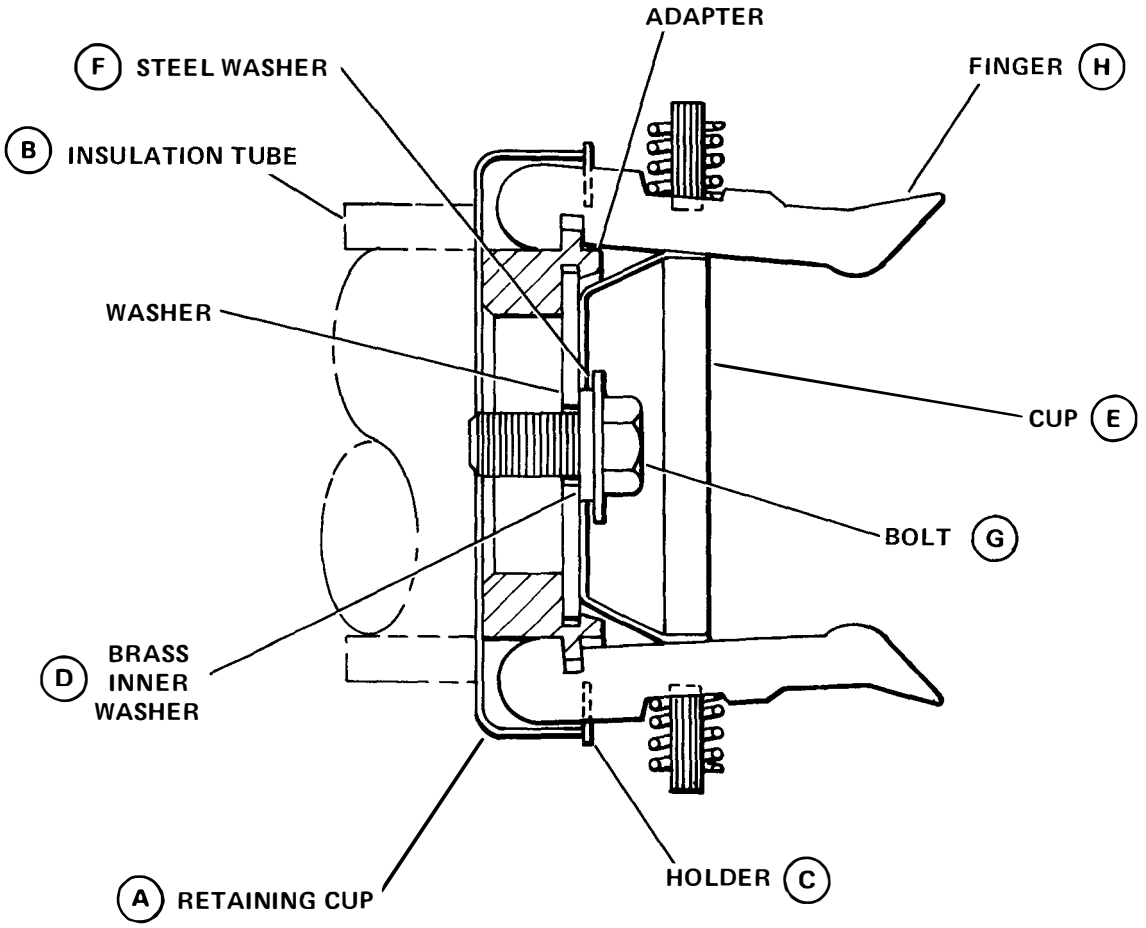


Fig. 5 – 2000 Amp Primary Contact

STORED ENERGY OPERATOR DESCRIPTION OF OPERATION

SPRING CHARGING CYCLE

Energization of the Control Circuit will cause the spring charging motor (1, Fig. 10), to start charging the closing springs (6, Fig. 7). The spring charging motor (1) will drive the driving pawl (2, Fig. 7), through an eccentric drive shaft (3, Fig. 7). The driving pawl (2) will turn the ratchet wheel (4, Fig. 7), counterclockwise one tooth at a time. The holding pawl (5, Fig. 7) will hold the ratchet in position between driving strokes of driving pawl (2). This charging operation will continue turning the ratchet wheel (4) counterclockwise a tooth at a time until the closing springs (6) are fully charged (dead center). The motor will drive the ratchet wheel past this dead center position and the closing springs (6) will aid rotation driving the ratchet wheel and cams counterclockwise until spring release rollers (8, Fig. 10), on the inside surfaces of cams (7, Fig. 10), engage the spring release latch (9, Fig. 10). This arrests the motion of the ratchet wheel (4) and the cams (7) and holds the operator in the fully charged position. As the cams and ratchet wheel go over center, the motor cutoff switch (10, Fig. 7), is actuated to de-energize the spring charging motor (1). The spring charging motor then coasts to a stop, driving pawl (2) oscillating in the toothless section of the ratchet wheel.

The motor cutoff switch (10) provides four functions:

1. It de-energizes the spring charging motor (1);
2. It opens a contact in the anti-pump relay circuit;
3. It sets up the closing coil circuit;
4. It can be used to energize an indicating light to indicate that the closing springs (6) are fully charged.

NOTE: A close latch check switch (16, Fig. 7), is in the motor circuit. The close latch check switch monitors the position of the spring release latch (9) and will prevent charging of the closing springs (6) electrically unless the spring release latch (9) is in the correct position.

As energy is stored in the closing springs, the four bar linkage (12, Fig. 10), will be positioned by the linkage reset spring (11, Fig. 11), which acts to cause cam follower rollers (13, Fig. 7), to follow the surface of cam (7, Fig. 10), until the links are in a reset position, and allowing latch rollers (20, Fig. 7), to be positioned in front of trip latch (18, Fig. 7).

The charged position of the operator is shown in Fig. 10.

GROUNDING CONTACTS CLOSING CYCLE

Energizing the spring release solenoid (13, Fig. 10), will drive the spring release latch (9, Fig. 10), away from the spring release rollers (8, Fig. 10), on the cams (7, Fig. 10), releasing the stored energy in the closing springs (6, Fig. 7). The closing springs (6) will drive the ratchet wheel (4, Fig. 7), and the cams (7, Fig. 10), counterclockwise at a high rate of speed. The cams (7) will engage the cam follower rollers (14, Fig. 7), of the four bar linkage (12, Fig. 10), and drive them forward causing the four bar linkage to become straight. As the four bar linkage (12) becomes straight, it drives the radius arm (15, Fig. 10), upward causing the grounding contacts to close and the opening springs to be charged. The cams (7) drive the four bar linkage (12) over toggle and against the frame thereby latching the grounding contacts in the closed position.

SPRING RECHARGE AFTER CLOSING

When the closing cycle has been initiated and the cams (7, Fig. 10), begin to turn, the motor cutoff switch (10, Fig. 7), resets itself. A "b" aux. switch opens de-energizing the spring release solenoid (13, Fig. 10). The spring release latch (9, Fig. 10), returns to its reset position and the close latch check switch (16, Fig. 7), closes and energizes the spring charging motor (1). The closing springs (6) are then recharged as described earlier.

TRIPPING CYCLE

Depressing of the trip lever, will drive the trip latch (18, Fig. 7), away from latch roller (20, Fig. 7), on the four bar linkage (12, Fig. 10). This allows the four bar linkage to collapse and the grounding contacts will open. If the closing springs (6) are in the charged position, the linkage reset spring (11, Fig. 11), will immediately reset the four bar linkage (12). If the closing springs (6) are not charged, the linkage reset spring (11) will not reset the four bar linkage (12) until just before the closing springs (6) are completely charged.

STORED ENERGY OPERATOR-COMPONENTS NOMENCLATURE

To be used with "Description of Operation" Figures 7, 10 and 11.

1. Spring Charging Motor
2. Driving Pawl
3. Eccentric Drive Shaft
4. Ratchet Wheel
5. Holding Pawl
6. Closing Springs
7. Cams
8. Spring Release Rollers
9. Spring Release Latch
10. Motor Cutoff Switch
11. Linkage Reset Spring
12. Four Bar Linkage
13. Spring Release Solenoid
14. Cam Follower Rollers (Main Toggle Roll)
15. Radius Arm
16. Close Latch Check Switch
18. Trip Latch
20. Latch Roller
22. Spring Discharge Roller Free Height Adjustment
23. Spring Discharge Close Latch Yoke End Adjustment
24. Spring Discharge Roller
25. Charge-Discharge Indicator
26. Discharge Indication Adjustment
27. Charge Indication Adjustment
28. Mechanical Charging Interlock Adjustment
29. Manual Charging Shaft (515-1 Operator)
30. Anti-Pumping Relay
31. Trip Latch Bite Adjusting Screw
32. Trip Latch Bite Adjusting Locking Nut
33. Close Latch Bite Adjusting Screw
34. Close Latch Bite Adjusting Locking Nut
35. Motor Cutoff Switch Actuator
36. Lower Link Stop
37. Roll Pin Striker
38. Aluminum Spring Drive Blocks

ELECTRICAL CONTROL

The normal control for this operator is contained upon a control panel mounted at the rear of the unit. It consists of the motor cutoff switch (10, Fig. 7), anti-pumping relay (30, Fig. 7), and the close latch check switch (16). The typical control arrangements elementary diagram is shown in Fig. 12. (Check schematics furnished with switchgear as wiring arrangements may vary.)

Spring Charging – The spring charging motor power is supplied through terminals 15 and 16, Fig. 12. The mechanical interlock is a switch operated by the trip lever (foot lever) which opens the motor circuit when the lever is depressed. The close latch check switch is closed when the spring release latch (9, Fig. 7) is in the reset position. The latch lock switch is closed when the trip and catch locking device is fully pulled out. The MCO switches are shown with the closing springs discharged. When the control is energized, the motor starts to charge the springs. The MCO switch is operated by a roll pin striker (37, Fig. 15) mounted in the ratchet wheel (4, Figs. 7 and 15). As the ratchet wheel and drive blocks charge the springs, the ratchet wheel revolves to the position of full compression, dead center. Beyond dead center position, the springs aid rotation and cause the motor cutoff switch striker to depress the actuator (35, Fig. 7) of the MCO switch, opening the motor circuit and the MCO contact in the anti-pumping relay circuit. At this instant, the spring charging motor coasts to a stop with the driving pawl (2, Fig. 7) oscillating freely on the smooth portion of the ratchet wheel.

Closing Circuit – The standard control circuit for a stored energy operator is shown in Fig. 12. When the close push buttons are closed, the circuit from terminal 16 through key interlock switch, latch lock switch, MCO, 52Y1, and 52B to energize the spring release coil, closing the device. As soon as the closing springs are discharged, the MCO switch contact closes to energize the 52Y relay. If the push button switch remains closed, the 52Y relay remains picked up through contact 52Y2. Push button switch has to be released to reset control for another closing operation. If control power is momentarily lost during closing, upon re-energization, the 52Y relay picks up instantaneously through contact MCO maintaining the anti-pumping relay circuit prior to complete spring charging.

Spring Release Latch – Mechanical and Electrical Interlocks – The spring release latch must be fully reset to receive the cam mounted spring release rollers at the end of the charging cycle. To insure the spring release latch is in this fully reset position, an electrical and mechanical interlock is provided.

The close latch check switch (16, Figs. 7 and 16) consists of a snap-action type switch mounted in close proximity to the spring release latch. A striker plate at the tail of the spring release latch engages the switch's actuator slightly before the fully reset position is achieved, and actuates the switch prior to the latches reaching the fully reset position. At the time of actuation, a contact closes enabling the charging sequence. The switch operates with very small differential, and this sensitivity coupled with the spring release latch biased engagement of the spring release rollers provides a positive sensitive interlock.

The mechanical interlock (Fig. 18) prevents manual charging of the springs if the spring release latch is not adequately reset. A linkage attached by a clevis to the spring release latch extends down the side of the operator frame to the driving pawl mechanism. An extension of the interlocks linkage passes above the driving pawl's constant force return spring. If the spring release latch fails to return to a fully reset position, the linkage extension thrusts the driving pawl's return spring downward preventing the driving pawl's engagement of the ratchet wheel, thus mechanically inhibiting either manually or electrical spring charging.

ADJUSTMENTS

Adjustments are factory set and checked before and after numerous mechanical operations on every breaker to insure correctness. No adjustment checking should be necessary on new breakers. If a malfunction occurs, check for hidden shipping damage.

The following will help you make the correct adjustments when replacing a broken or worn part.

AUXILIARY SWITCH

The type Q-10 auxiliary switch has been tested and adjusted at the factory. Contacts used in the control circuit should not require further adjustment.

The switch (Fig. 9) is designed so that the individual contacts may be repositioned in fifteen degree steps without disassembling the switch.

Using long-nosed pliers, move the rotor contact (16) in the slot of the shell (14), compressing spring (15). This will free the rotor from the retainer (17). Rotate the rotor to the desired position and release. Be sure the rotor springs solidly back against the retainer to fully engage the rotor and retainer teeth.

INTERLOCK PLUNGER

The trip lever breaker release (20, Fig. 2) operates the interlock plunger (18, Fig. 2) as well as the trip latch. Depressing the lever trips the device and raises the plunger. **CAUTION**: The trip lever cannot be depressed unless the trip and latch locking device is in the full in position. This frees the device so that is can be moved in its cubicle. The interlock system is in proper adjustment when the plunger is positioned 1-11/16 to 1-13/16 inch above the floor line, and causes tripping of grounding contacts when it is raised to a level not more than 2-1/16 inch above the floor line. The latch tripping rod associated with the foot lever should be clear of the trip latch by 1/32 to 1/16 inch in the relaxed position (18, Fig. 7).

The foot lever can be padlocked by matching holes in the breaker frame with those in the lever arm. In the padlocked position, the foot lever will be halfway down; the device will be trip-free; the interlock plunger will be between 2 and 2-1/4 inches from the floor line and will hold the breaker in any of the three positions within the cubicle.

TRIP LATCH ADJUSTMENTS

Trip Latch Clearance Adjustment (Fig. 13) – CAUTION: this adjustment can only be checked with springs charged and is to be performed after completing the arcing contact touch and main contact penetration adjustments referenced above.

The adjustment is necessary to insure proper clearance between the trip latch and trip latch rollers. The puffer (or snubber) height adjustment (Fig. 13) will accomplish this purpose, and in no way will affect the penetration adjustment.

Loosen Lower Link Stop and rotate to permit maximum Lower Trip Link movement. Adjust puffer (or snubber) height to rotate radius arm and four bar linkage until a .030 to .060 gap appears between the trip latch and latch roller. Lock in place. Rotate Lower Link Stop until it touches lower link and lock in place.

Trip Latch Bite Adjustment – trip latch bite is established by setting the latch tails top surface 5/16 below surface of self clinching nut as shown in Fig. 14. Lock securely with jam nut. One turn of the adjusting screw will alter the gap 0.062 inches. This adjustment should produce 0.259 to 0.111 inches of latch bite as shown in Fig. 14.

MANUAL CHARGING OF CLOSING SPRINGS

To charge the closing springs manually, disconnect control power before inserting the manual charging crank in the socket at the lower left-hand corner of the breaker. Turn the crank in a counterclockwise direction to charge the springs. The effort to charge the closing springs will fluctuate and will increase to a peak and then decrease. At the point of least effort an audible click will be heard and the effort to turn the crank will drop to near zero. The mechanism is now fully charged. The breaker may be closed by pulling the manual close pull rod.

CAUTION !!
MAINTAIN A FIRM GRIP ON CRANK

The closing springs are charged through the driving pawl and ratchet wheel and are thereby indexed by the holding pawl. Some springback can occur between tooth positions on the ratchet wheel.

REMOVAL OF CLOSING SPRINGS (Springs Must Be Discharged)

The Closing Springs may be quickly and safely removed from the device. Remove two of the four bolts holding the spring bearing block at the rear of the breaker. These bolts should be diagonally opposite each other. Insert studs approximately 6" long in place of bolts. Remove the remaining two bolts by shifting the spring load to the 6" long studs. The spring bearing block can then be backed off by alternating backing off the studs. To install the closing springs the reverse procedure should be used. The spring bearing block top surface should be even with the bracket of the frame. The four bolts should be torqued to 50 ft. lbs.

If charging ratchet and cams are to be revolved with springs removed, it is advisable to remove two aluminum spring drive blocks (Item 38, Fig. 11) secured to the ratchet and cam crankpins by retaining rigs. These pins if not removed or held essentially in a horizontal position may jam while revolving the cam and ratchet assembly.

Motor Cutoff Switch – The MCO motor control switch assembly (Fig. 15) is factory adjusted. If it should become inoperative, entire unit must be removed and inspected for contact wear. Replacement may be necessary.

Motor Cutoff Switch Adjustment – This adjustment is most conveniently performed before installing the charging springs.

Advance ratchet and cam assemblies to position shown (Fig. 15). The holding pawl must occupy the ninth (9) tooth position on the ratchet as counted counterclockwise from "area" on ratchet periphery which lacks two teeth.

With ratchet in the position described above, adjust the motor cutoff switch vertically until its actuator makes positive contact with the "rollpin striker". Lock switch assembly in this position.

Check lateral movement of actuator. Lateral play at end of actuator (tip) should be no more than 1/16" max. If adjustment is necessary, snug pivot screw to just bind actuator, and then back off 1/16 to 1/8 turn. Rotate ratchet and cam assembly to insure actuator rides in gap between ratchet and cam without striking or binding.

Spring Release Latch Bite Adjustment – free jam nut and place latch in horizontal position (Fig. 16). Visual accuracy. Measure "D" directly above latch pivot. Reproduce this dimension plus 0.062" at the latch face as shown in the figure above by rotating the adjustment screw. Secure jam nut. This adjustment should produce a latch bite of 0.151 to 0.216 inches.

Close Latch Check Switch Adjustment (Fig. 16) – This adjustment is to be performed only after completing the latch bite adjustment described above.

A clearly audible "click" should be heard from the switch with latch spaced 1/32" from latch adjustment screw. The latch switch actuator may be bent slightly to obtain switch operation at this point. Maximum permissible bend is 1/8" as shown.

If switch actuator is bent, observe latch fully closed against adjusting screw and make certain the switch actuator has not contacted the switch body. A 1/64" clearance should exist as shown above.

Free Height Adjustment (Fig. 17) – is achieved by blocking the actuating roller to the indicated height and adjusting a pair of jam nuts, located on the manual closing pull rod, to maintain the roller in this position with blocking removed. Return spring adjusting nut should be set to produce 0.5 ± .06 inch deflection in return spring.

The following adjustments are to be made only after completing the spring release latch bite adjustment described on the previous page and after adjusting connecting link as shown on Fig. 17.

Trip Adjustment (Fig. 17) – is made by varying the penetration of the "curved actuating rod" in its attachment clevis. A 5/16" (.312) drill is placed between the upper latch surface and the latch adjusting bolt. A 2.906" block is to be inserted between the actuating roller and floor. The "curved" rods upper yoke is nested against a forward roll pin in the closing latch and the lower clevis is adjusted to insure the closing latch will not move when the 5/16" (.312 drill is removed more than 1/16 (.062) inches as measured between adjusting screw and latch surface.

Overtravel (Fig. 17) – no adjustment required. Check with 3.125" blocking below actuating roller. Closing solenoid link should provide freedom of latch movement without jamming.

Spring Release Latch Mechanical Interlock – this adjustment is to be undertaken only after completing the spring release latch bite adjustment described above, Fig. 16.

Adjust actuator rod displacement from support angle to 1.06 ± .015 inches. See detail of adjusting nut "A" (Fig. 18).

Insert a 1/4 (.250) drill between upper surface of close latch and latch adjustment screw.

Check guide bushings to insure they stand off the frame 1/4" as shown.

Free Nut "B" below attachment clevis, and adjust Nuts "B" and "C" to depress pawl return spring and pawl until 1/16 to 3/32 clearance is obtained between tip of pawl and ratchet teeth. This clearance is measured during the clockwise rotation of the pawl as its tip advanced toward the ratchet (power stroke).

The pawl must be rotated using a 1/2" square insert in the eccentric drive shaft or by low voltage (slow rotation) of drive motor or manual charging.

Return the jam nut "C" attachment clevis to bottom on bracket, and tighten external jam nut "B" securely. MAINTAIN CLEVIS PARALLEL TO FRAME.

Remove 1/4 (.250) drill, restoring latch to its normal position. Again rotate eccentric drive shaft. The tip of the drive pawl should engage the full face of each ratchet tooth with a clearance of .030 between the base of the tooth and the engaged tip of the drive pawl.

MAINTENANCE AND TESTING

GENERAL

Thorough, periodic inspection is important to satisfactory operation. Inspection and maintenance frequency depends on installation, site, weather and atmospheric conditions, experience of operating personnel and special operation requirements. Because of this, a well-planned and effective maintenance program depends largely on experience and practice.

"AS FOUND" TESTS

Some users perform "As Found" insulation tests using a megger or Doble testing to give an "As Found" value for future comparative indication of insulation change. This is desirable for new circuit breakers if they are to be stored for extended periods, and may absorb moisture and contaminates. Contact resistance tests can also be made using a ductor.

Since wide variations can occur in insulation values and contact resistance because of atmospheric conditions, contamination and test equipment, discrete values cannot be given. However, making and recording these tests on new equipment, and at regular intervals will give a comparative indication of insulation and/or contact resistance change. Maintaining a permanent record of these values for each circuit breaker should be part of the Maintenance Program.

PERIODIC INSPECTION AND MAINTENANCE

Prior to performing any maintenance work, make certain all control circuits are open, and that the breaker has been completely withdrawn from the metal-clad unit.

> CAUTION
>
> DO NOT WORK ON THE DEVICE OR OPERATING MECHANISM WHILE THE DEVICE IS IN THE CLOSED POSITION. DO NOT WORK ON THE BREAKER OR OPERATOR WHILE THE CLOSING SPRINGS ARE CHARGED.

Mechanism – Stored Energy Operator – The operator mechanism should be inspected at 1000 operation intervals. This inspection should check for loose hardware and any broken parts. The control wiring should be checked for loose connections and frayed or damaged insulation. The "spring release latch check switch", and "mechanical interlock" switch should be checked for mounting tightness. The satisfactory operation of each switch element should be assured with a continuity meter and manual manipulation of the switching element, and adjusted if necessary. Verify that operation of "Spring Release Latch Mechanical Interlock" is proper (Refer to Page 11 and Fig. 18).

After 5000 operations, the operating mechanism should be given a general overhaul and all worn parts replaced. Excessive wear will usually be indicated when adjustments can no longer be satisfactorily made. The general overhaul will require disassembly of the operating mechanism. All bearings and surfaces receiving wear should be examined carefully and re-lubricated in accordance with lubrication instructions which follow.

The removal of the closing springs will be necessary in order to permit overhaul of the device. These springs may be removed as described on Page 10.

Lubrication – NOTE: The lubricant supplied with the accessories is intended to be used exclusively on the contacts and must not be used on any part of the operating mechanism.

Recommended circuit breaker lubrication points are shown in Fig. 19 & 20. The chart (Fig. 21) outlines two methods of lubrication. Refer to this chart for recommended lubricant and points of application. The first method requires no disassembly and is suggested for the prevention of problems which could be created by severe environmental or operating conditions. The second method follows procedures similar to those performed on the device at the factory. Follow this procedure only in case of a general overhaul or disassembly.

Needle and roller bearings are factory lubricated for life and should not require attention. However, the best of greases are affected by time and atmospheric conditions and may require service.

To lubricate these bearings when parts are disassembled, the following procedure is recommended. Clean in solvent, wash in alcohol, spin in light machine oil, drain and repack with Beacon P-325 grease. DO NOT REMOVE NEEDLE BEARINGS FROM THE RETAINING PART.

"AS LEFT" TESTS

a. Insulation resistance tests should be made to verify the insulation integrity. These can include megger or Doble tests. If possible, a high-potential test should be made for one minute at 14,300 volts a.c. or 20,200 volts d.c. With the device open, check each phase across the open contacts by connecting from the upper to the lower primary disconnects. With the circuit breaker closed, check phase-to-phase and each phase-to-ground.

b. A dielectric test on secondary and control circuits should be made at 1200 volts.

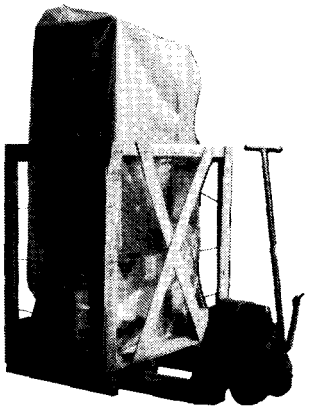
c. If desired, contact resistance tests can be made using a Ductor.

d. Make a permanent record of all tests performed.

e. Compare with prior tests. (See "As Found" Tests on Page 11).

Inspect the Primary Disconnect Contact Finger Assemblies, Fig. 2 – The main contact surfaces should be clean and bright. However, discoloration of the silvered surfaces is not usually harmful unless caused by sulfide (insulating) deposits. These should be removed with alcohol or a silver cleaner. Slight impressions on the contacts will be caused by the pressure and wiping action of the contacts. Minor burrs or pitting can be allowed and projecting burrs may be removed by dressing. Nothing more abrasive than crocus cloth should be used on the silvered contact surfaces. Where serious overheating is indicated by discoloration of metal and surrounding insulation, the contacts and spring assemblies should be replaced. In this case, also investigate the cubicle mounted stationary disconnects, (with the switchgear de-energized) determine the cause of overheating, and take corrective action.

CIRCUIT BREAKER HANDLING INSTRUCTIONS

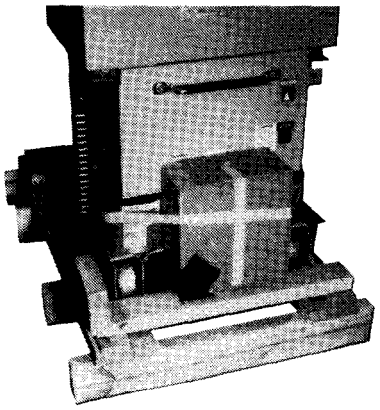


(A)

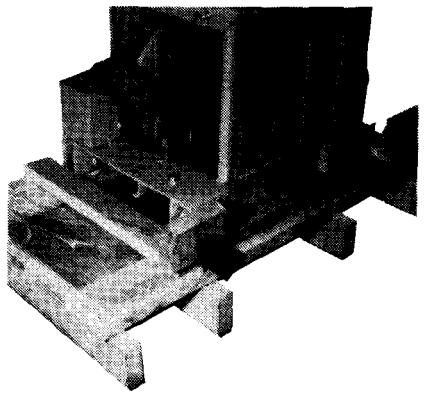
- Move 5 kv breaker to installation location with fork lift (A) or crane (B).
- Carefully remove protective plastic cover or crate.
- Remove t-shaped pieces nailed to the pallet, in front of the rear and front wheels of the breaker (C & D).
- Place t-shaped pieces in front of the pallet in line with breaker wheels (E) and nail to pallet as shown by arrows in (E).
- Slowly roll breaker off pallet (F & G).

CAUTION – REMOVE PACKAGING. BREAKERS ARE SHIPPED IN CLOSED POSITION WITH THE TRIP ROD AND FOOT LEVER ENCLOSED BY PACKAGING TO PREVENT OPENING DURING SHIPMENT (C).

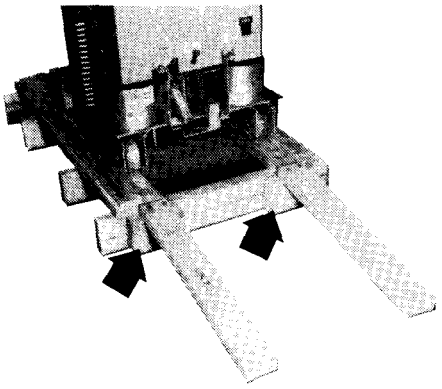
(B)



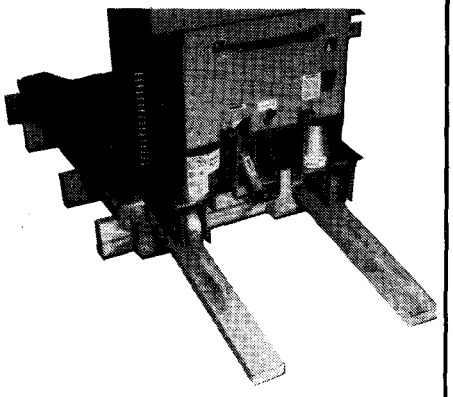
(C)



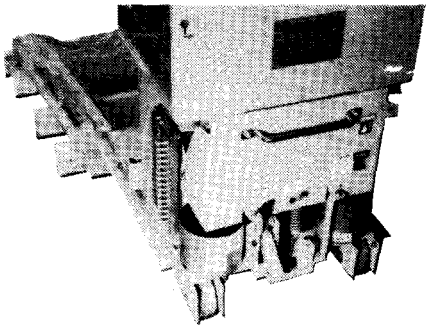
(D)



(E)

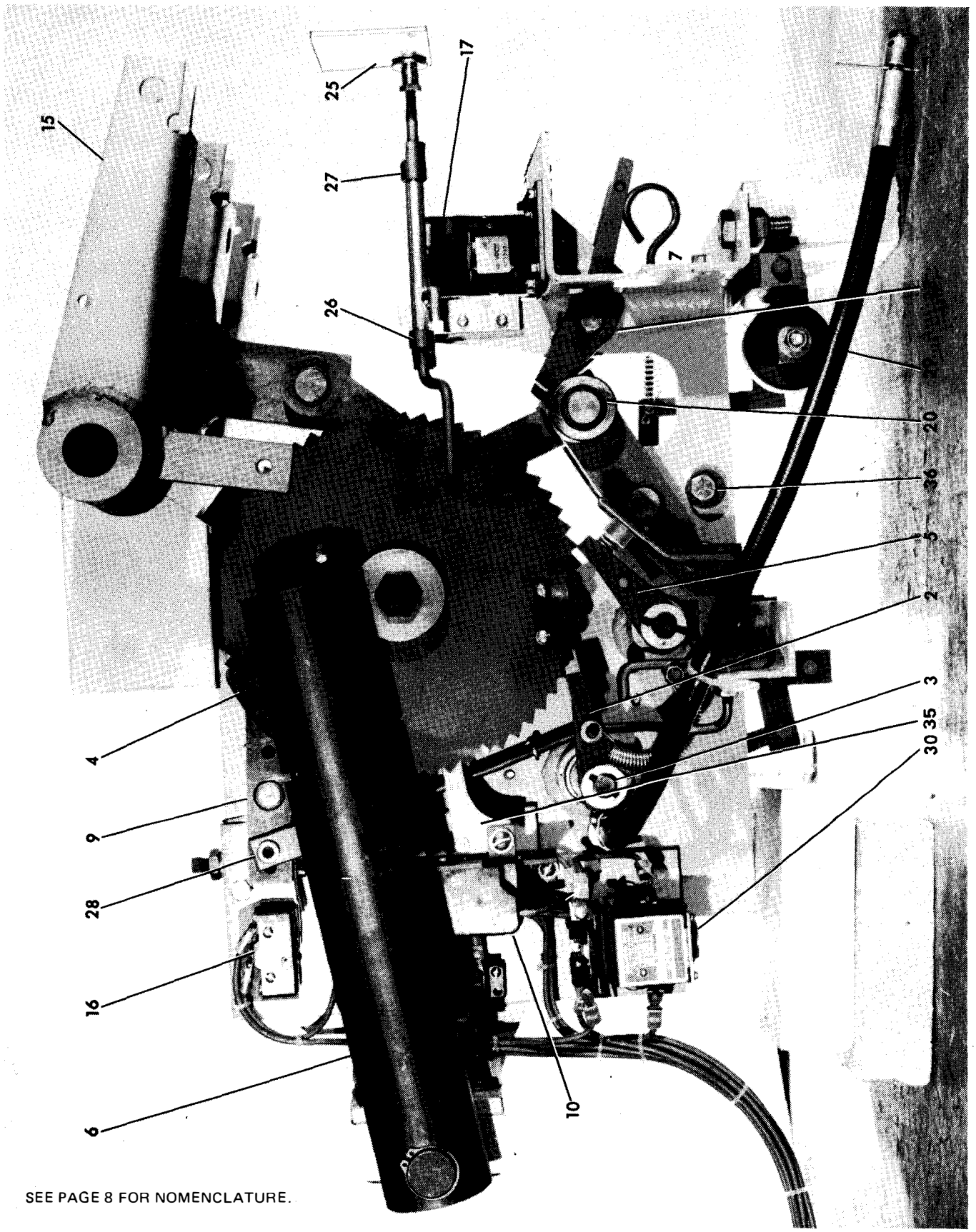


(F)



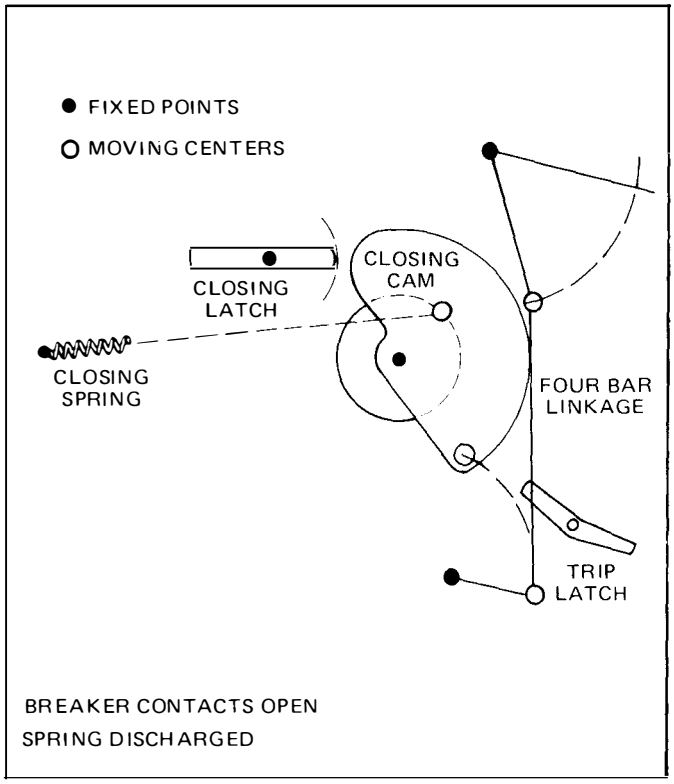
(G)

Fig. 6 – Handling Instructions

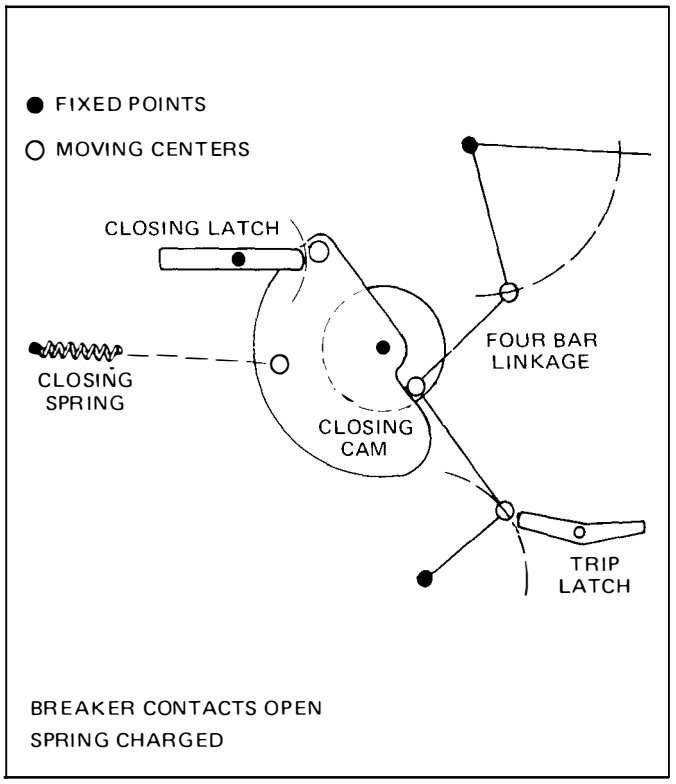


SEE PAGE 8 FOR NOMENCLATURE.

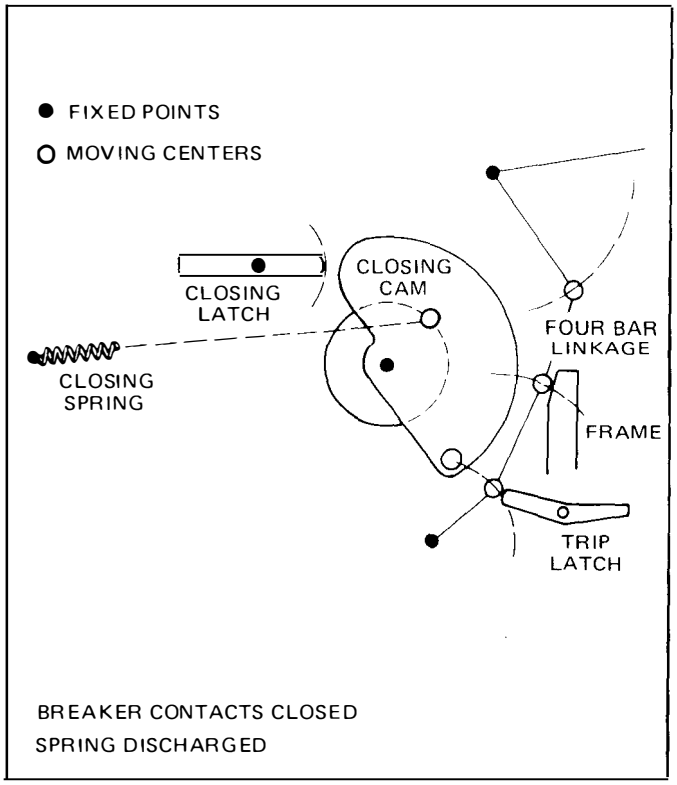
Fig. 7 — 515-1T Stored Energy Operator — L.H. View



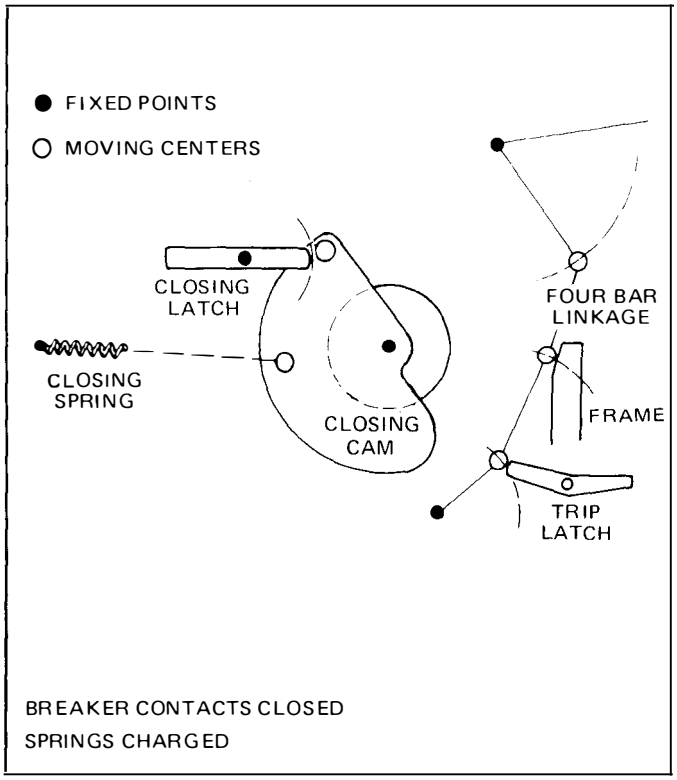
– A –



– B –



– C –



– D –

Fig. 8 – Sequence of Operation

AUXILIARY SWITCH

Mounted on the breaker, the auxiliary switch is normally used to open the trip circuit when the circuit breaker is opened. As this multi-stage switch operates from the breaker disconnect blades, circuitry dependent on the position of the breaker, such as indicator lights, etc., is wired through this switch. The individual stages are easily converted to "a" or "b" without disassembling the switch (Figure 9).

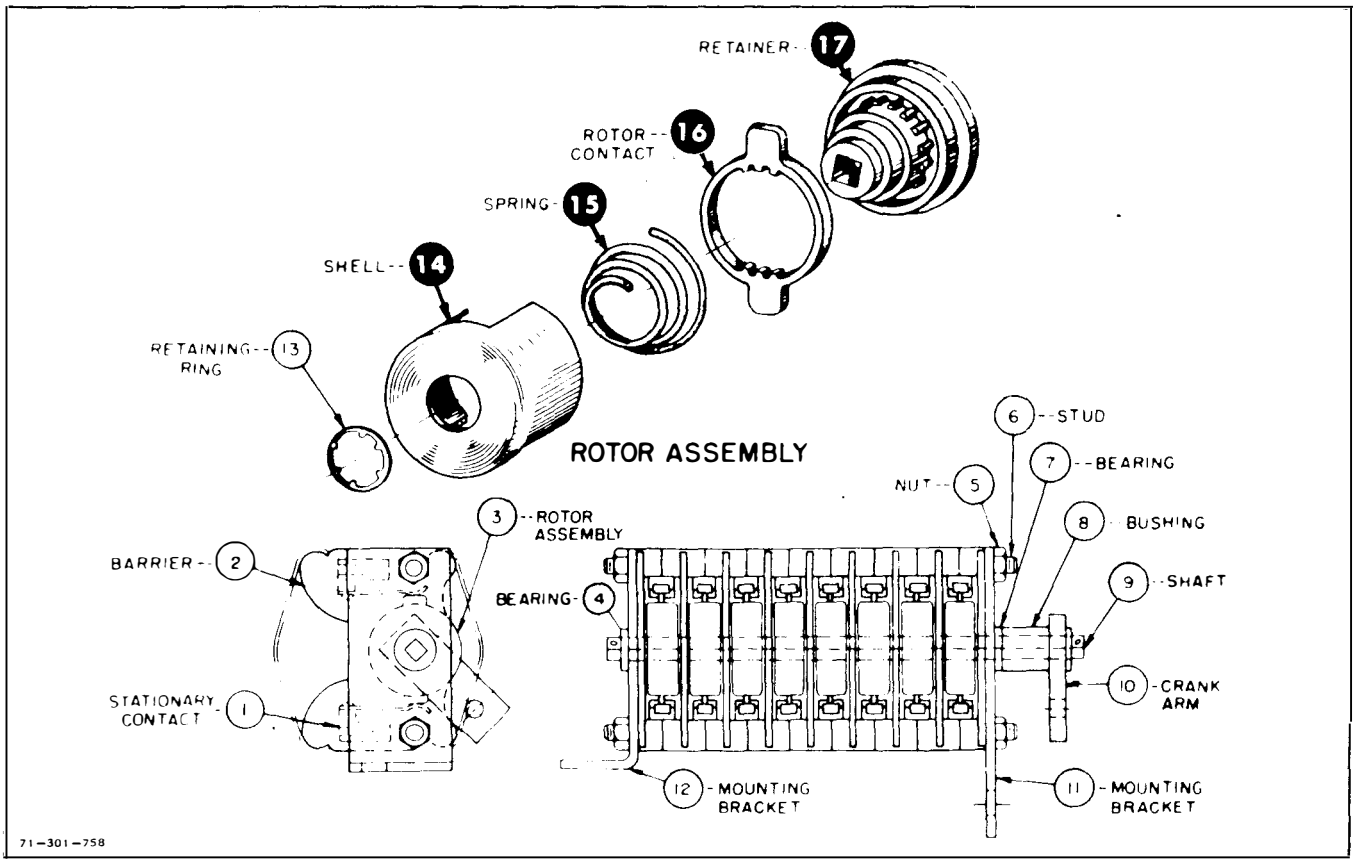


Fig. 9 – Type Q-10 Auxiliary Switch

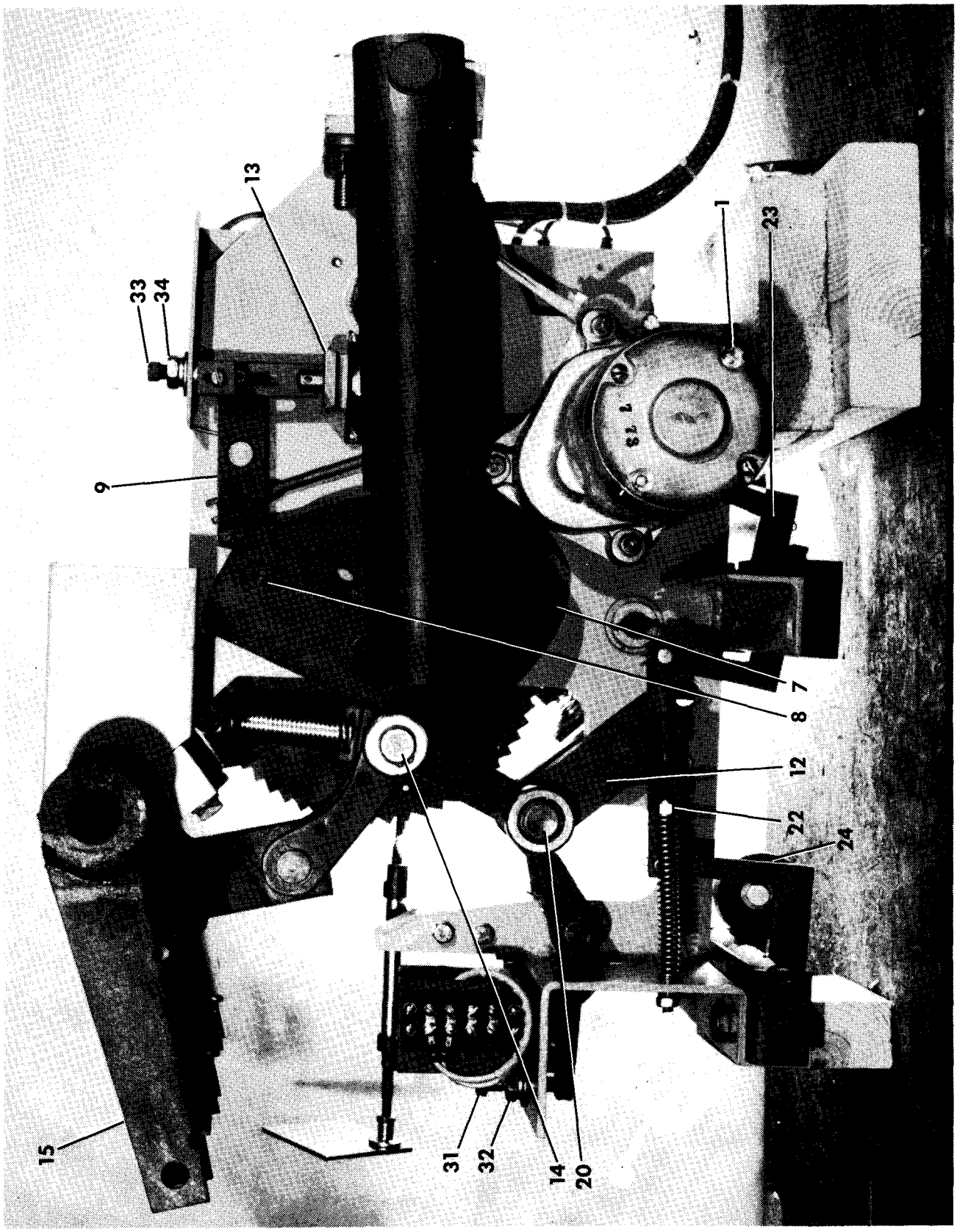


Fig. 10 – 515-1T Stored Energy Operator – R.H. View

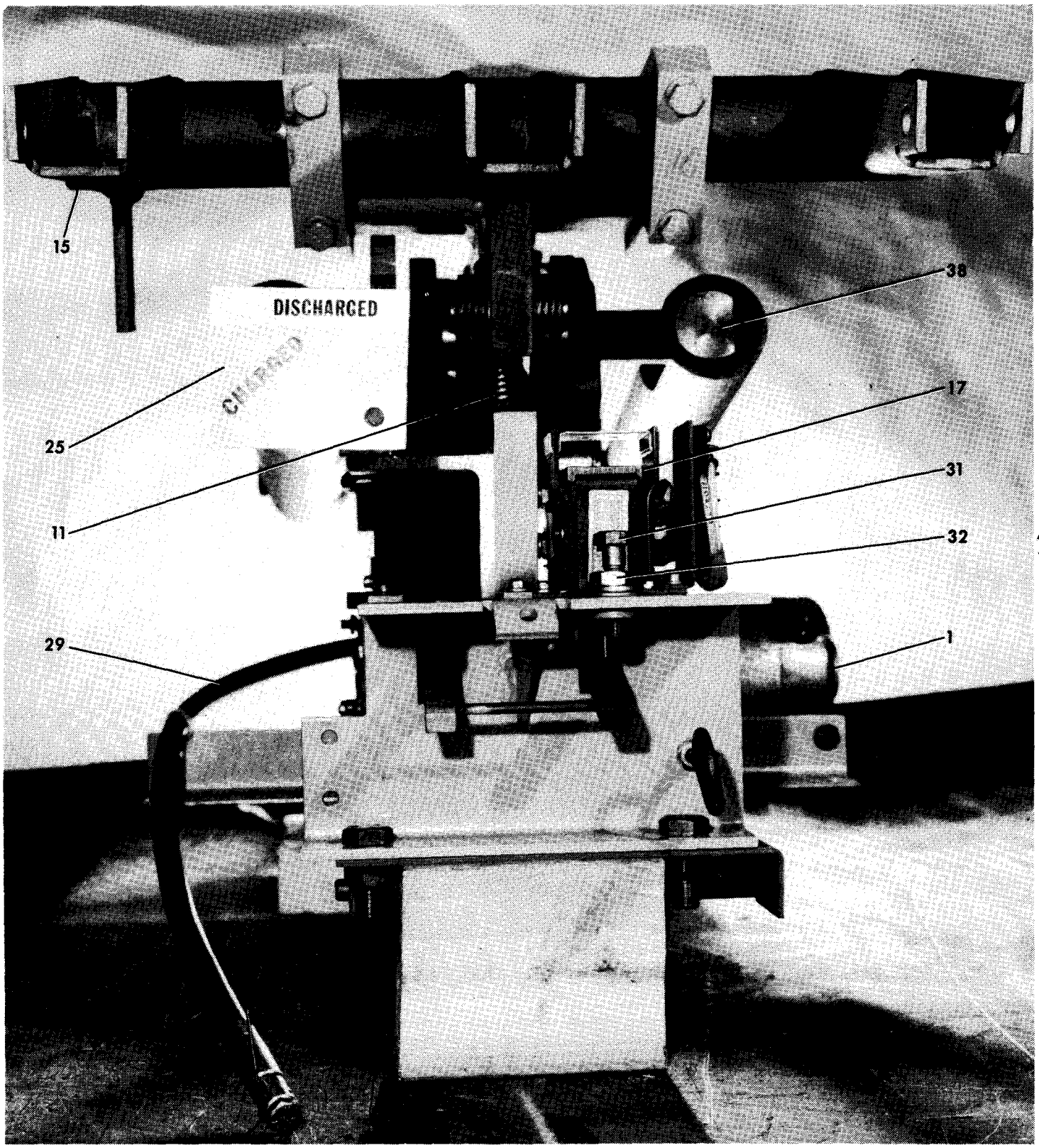
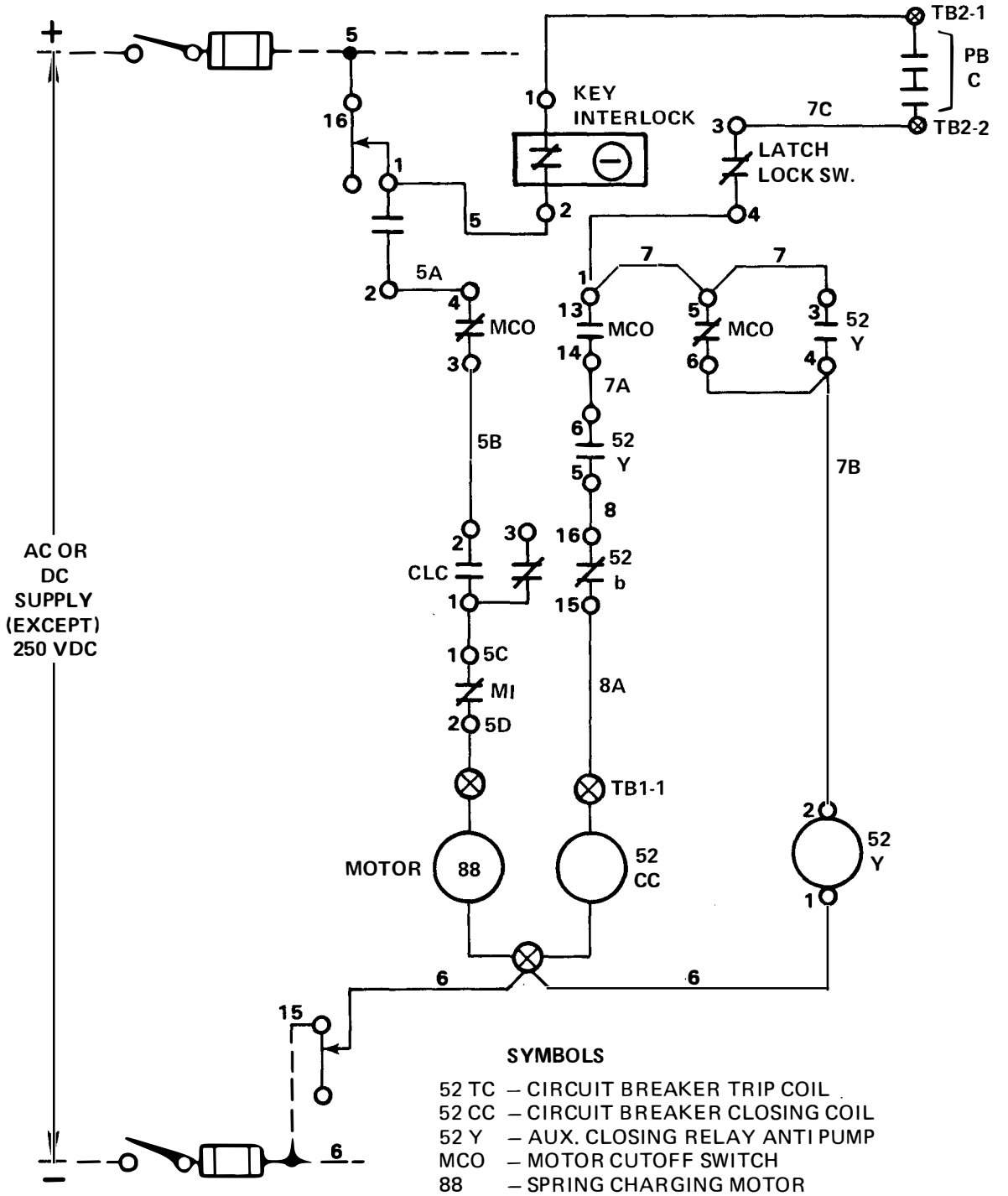


Fig. 11 – 515-1T Stored Energy Operator – Front View



SYMBOLS

52 TC	– CIRCUIT BREAKER TRIP COIL
52 CC	– CIRCUIT BREAKER CLOSING COIL
52 Y	– AUX. CLOSING RELAY ANTI PUMP
MCO	– MOTOR CUTOFF SWITCH
88	– SPRING CHARGING MOTOR
CLC	– CLOSE LATCH CHECK SWITCH
CSC	– CONTROL SWITCH – CLOSE CONTACT
CST	– CONTROL SWITCH – TRIP CONTACT
R	– RED INDICATING LAMP
G	– GREEN INDICATING LAMP
a	– AUX. SWITCH – OPEN WHEN BR'KR. IS OPEN
b	– AUX. SWITCH – CLOSED WHEN BR'KR. IS OPEN
LLS	– LATCH LOCK SWITCH
W	– WHITE INDICATING LAMP
MI	– MECHANICAL INTERLOCK

Fig. 12 – Control Scheme for Stored Energy Operator

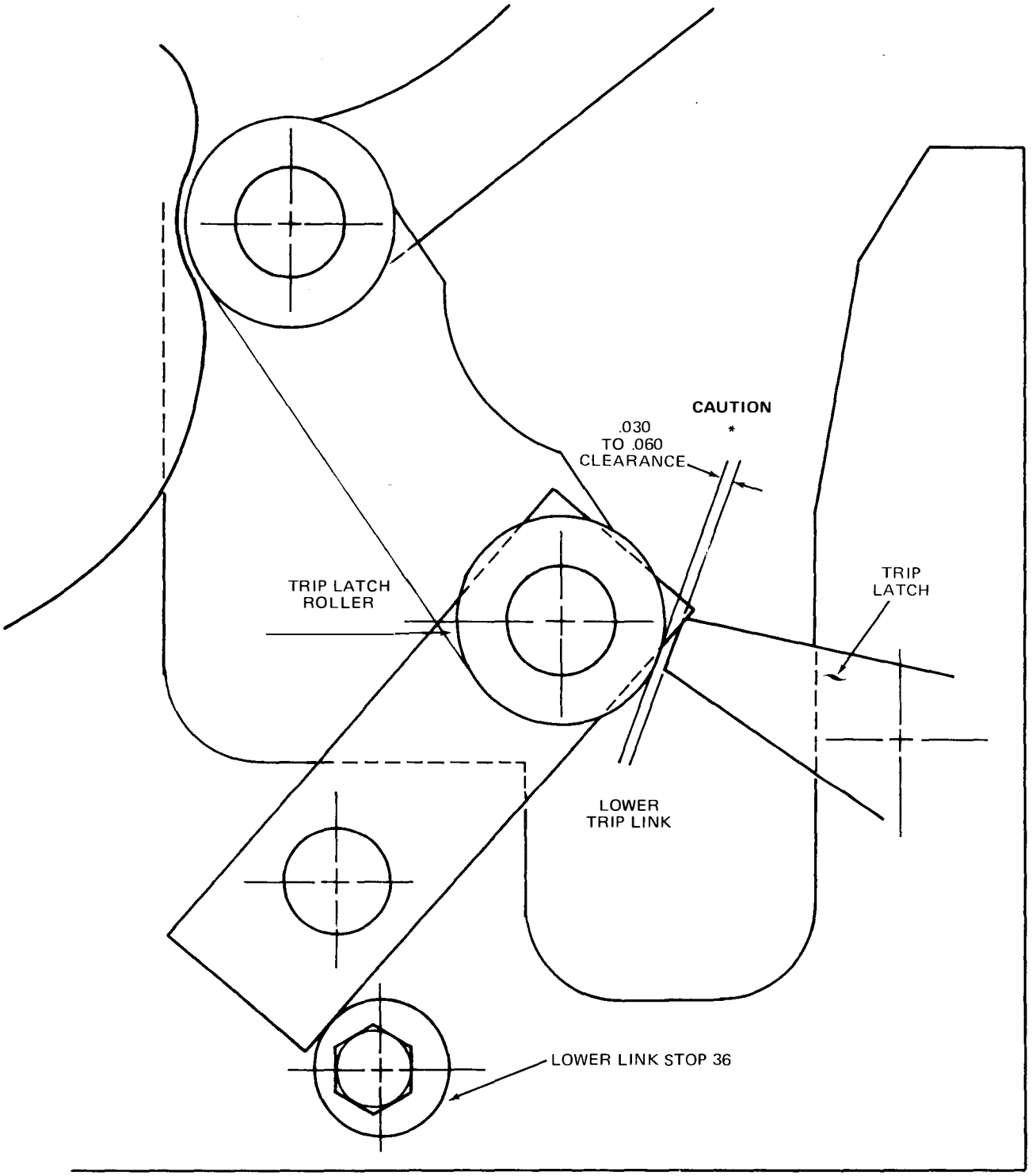


Fig. 13 – Trip Latch Clearance Adjustment

CAUTION:
***Measure with springs charges**

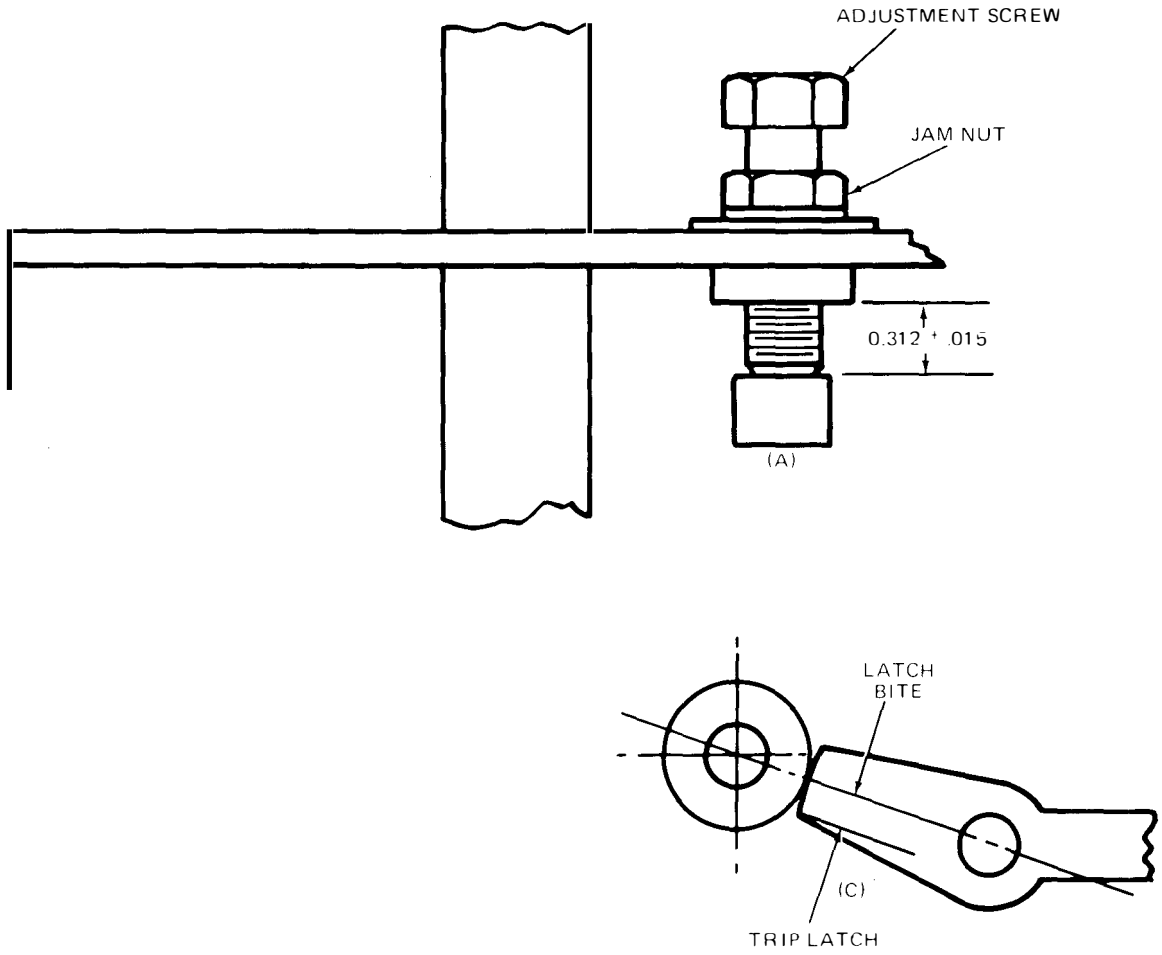


Fig. 14 – Trip Latch Bite and Check Switch Adjustments

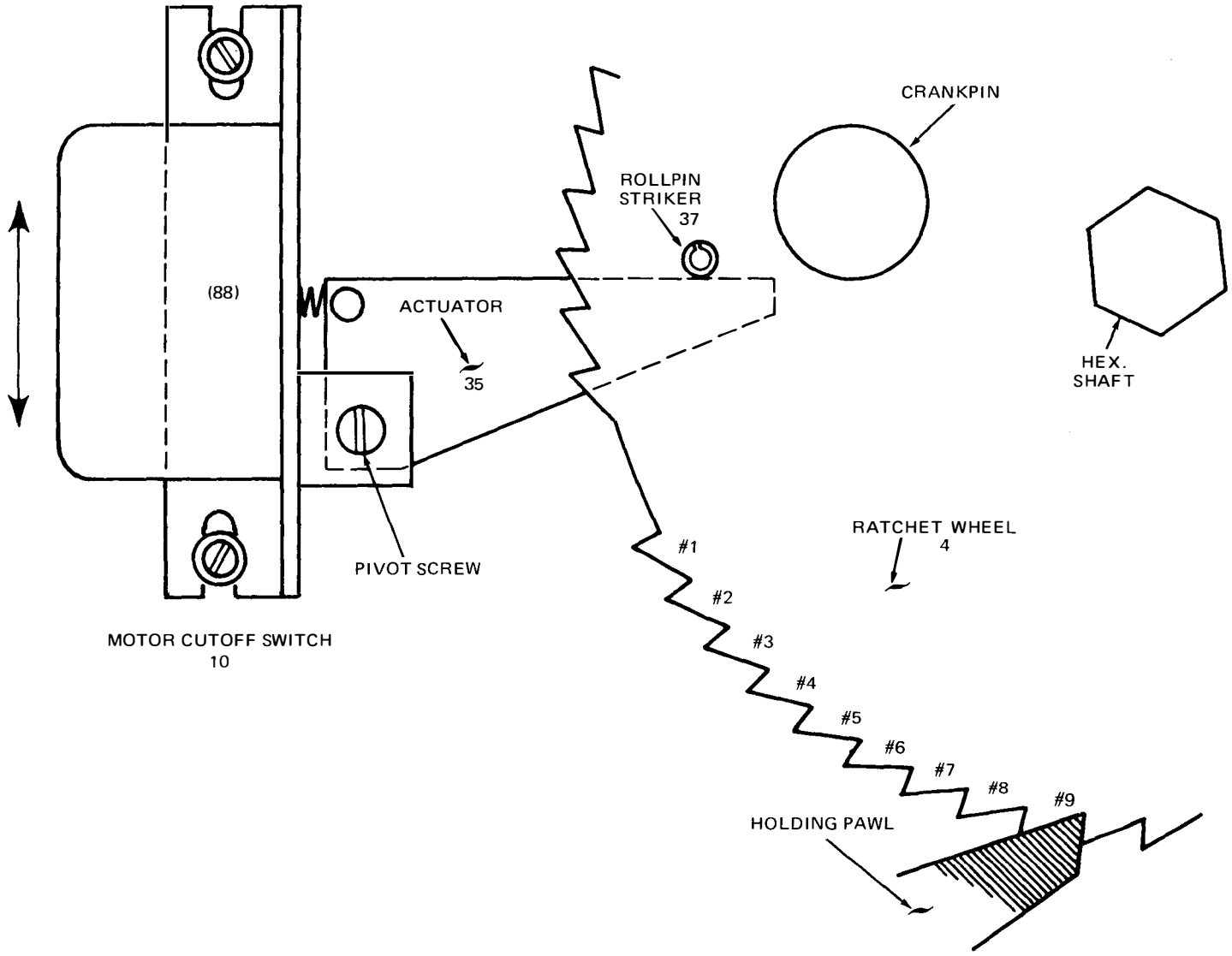


Fig. 15 – Motor Cutoff Switch

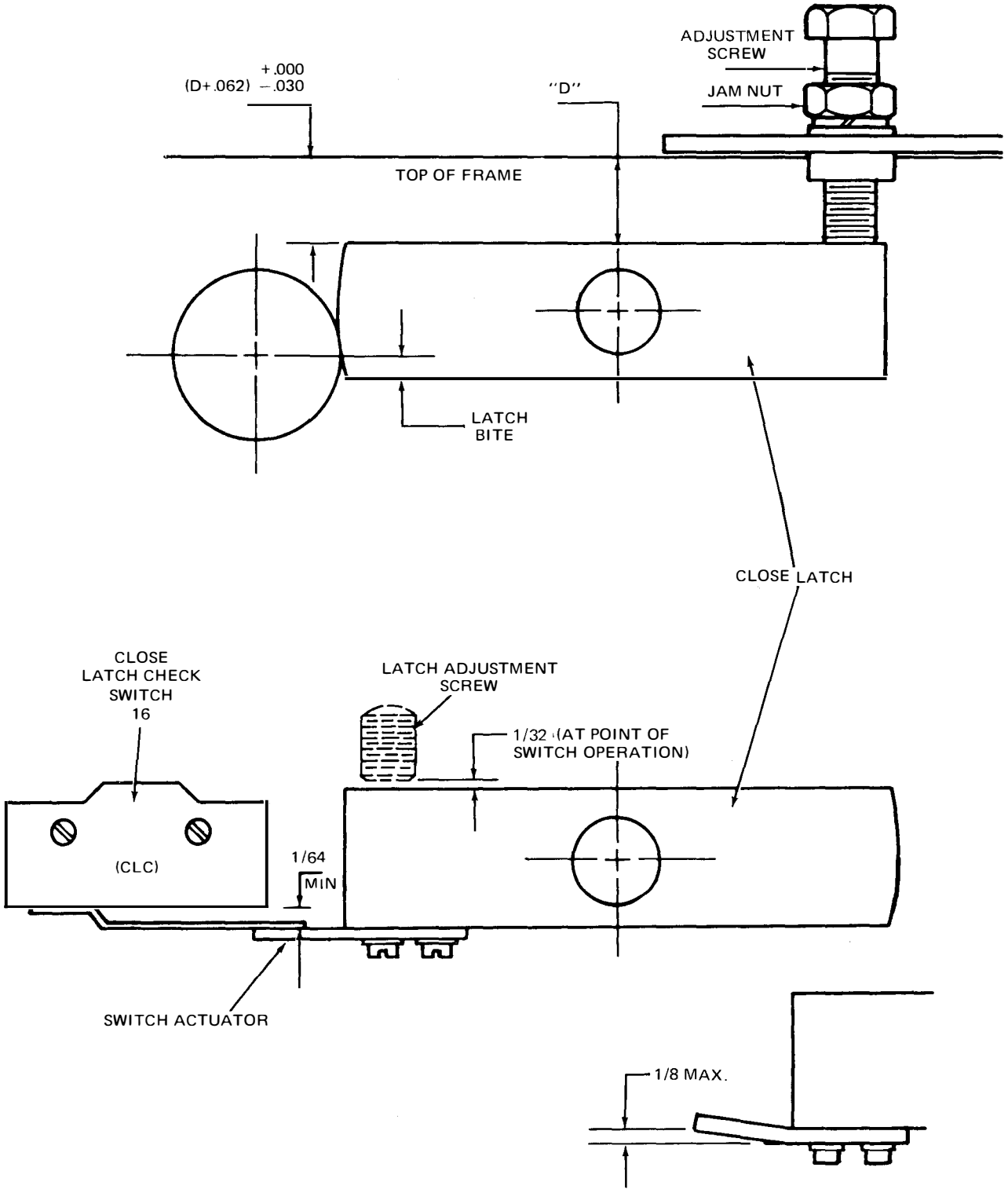


Fig. 16 – Spring Release Latch Bite and Check Switch Adjustments

This adjustment is to be performed only after completing the close latch bite adjustment.

The purpose of this adjustment is to establish an armature gap of 3/16 to 1/4 inches. (4.8-6.4mm) A suitable feeler gage of optimum thickness, .218" (5.56 mm) should be inserted in the armature gap. That is, the space between the ground surfaces of the solenoid frame and ground "T" shaped extensions of the solenoid plunger.

The connecting link between the solenoid plunger and close latch should be adjusted to maintain the plunger in this position. The locking screw is released and the adjusting cap shifted until the effective length of the link supports the plunger within the indicated range.

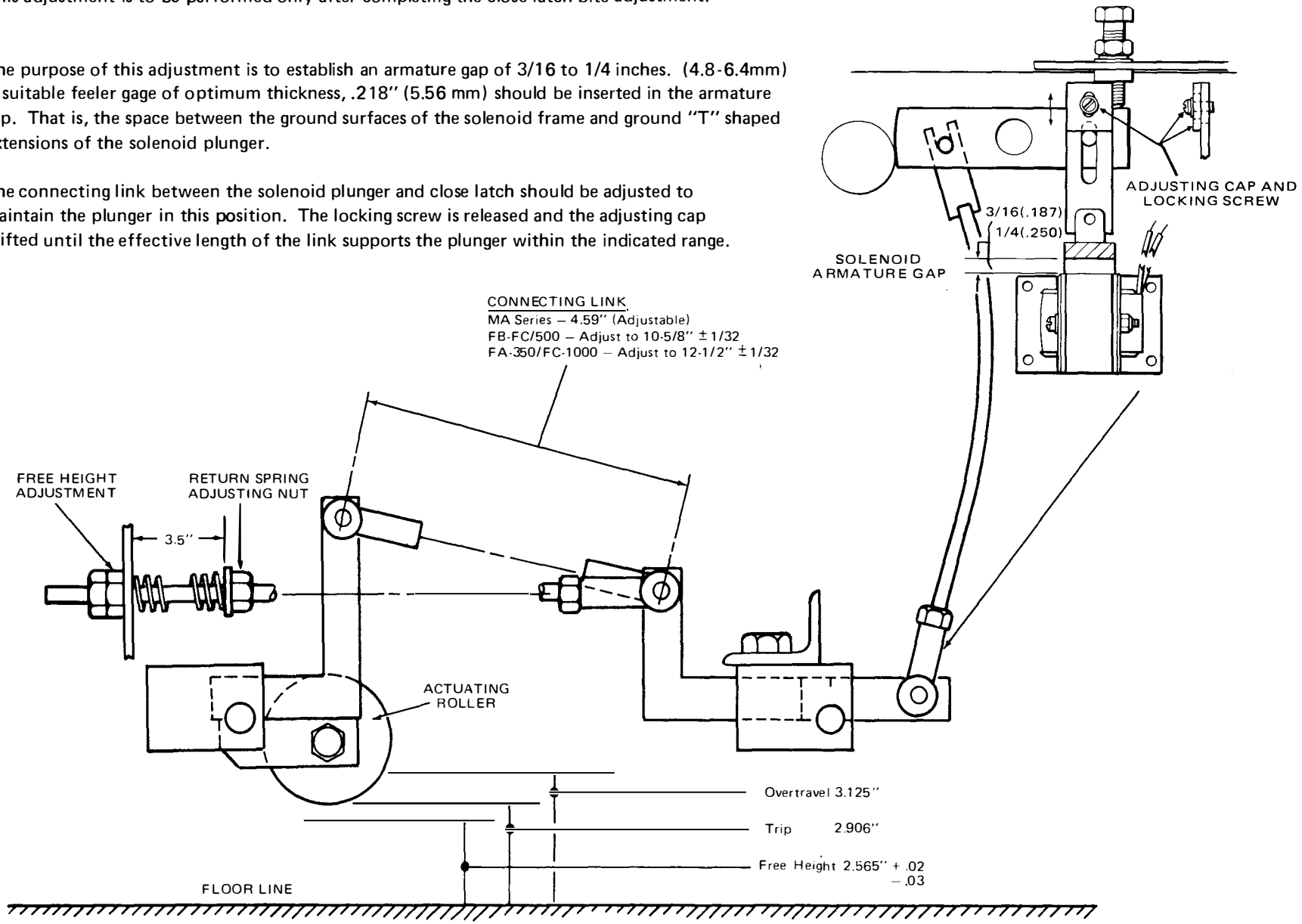


Fig. 17 – Closing Spring Dump Mechanism

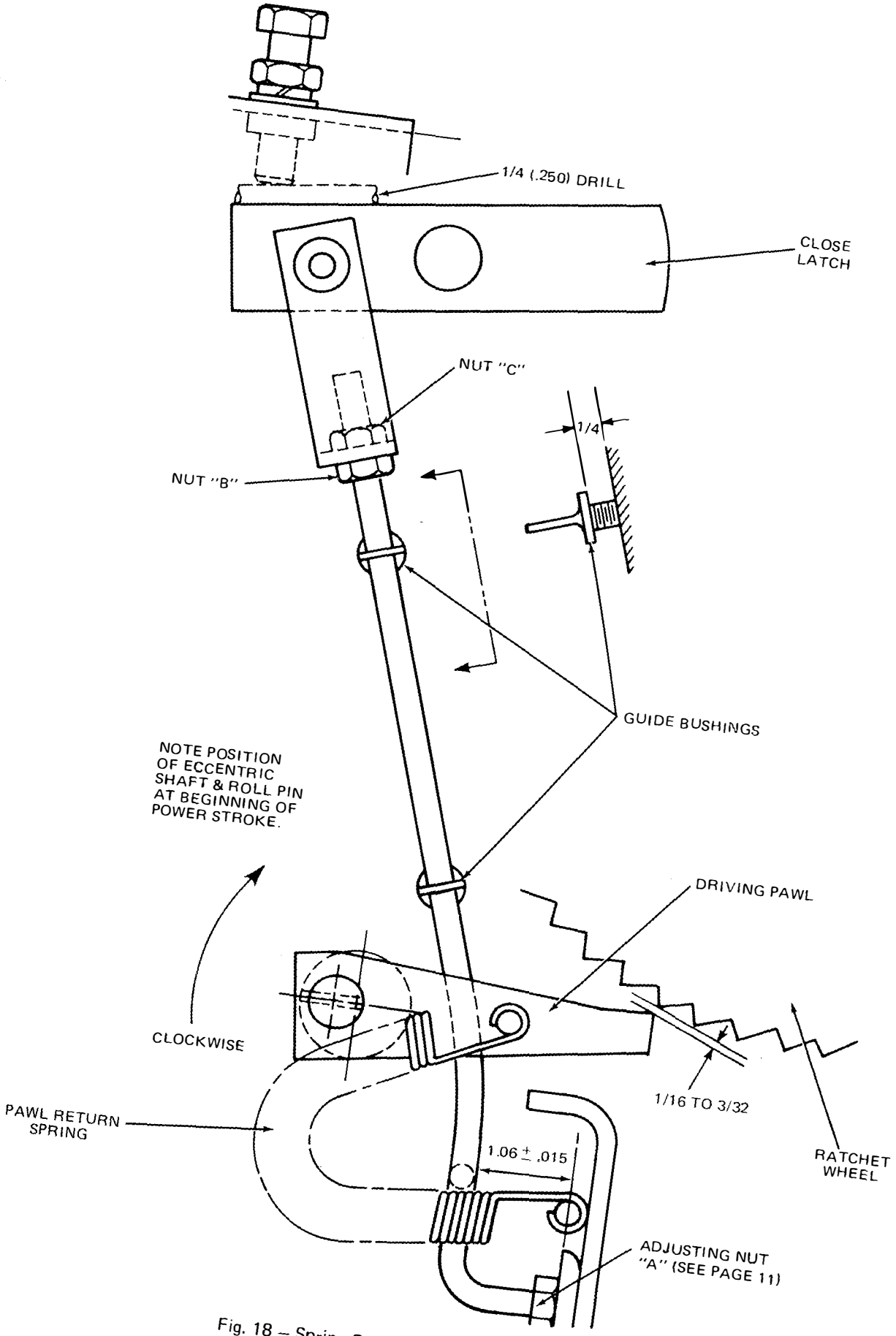


Fig. 18 – Spring Release Latch Mechanical Interlock

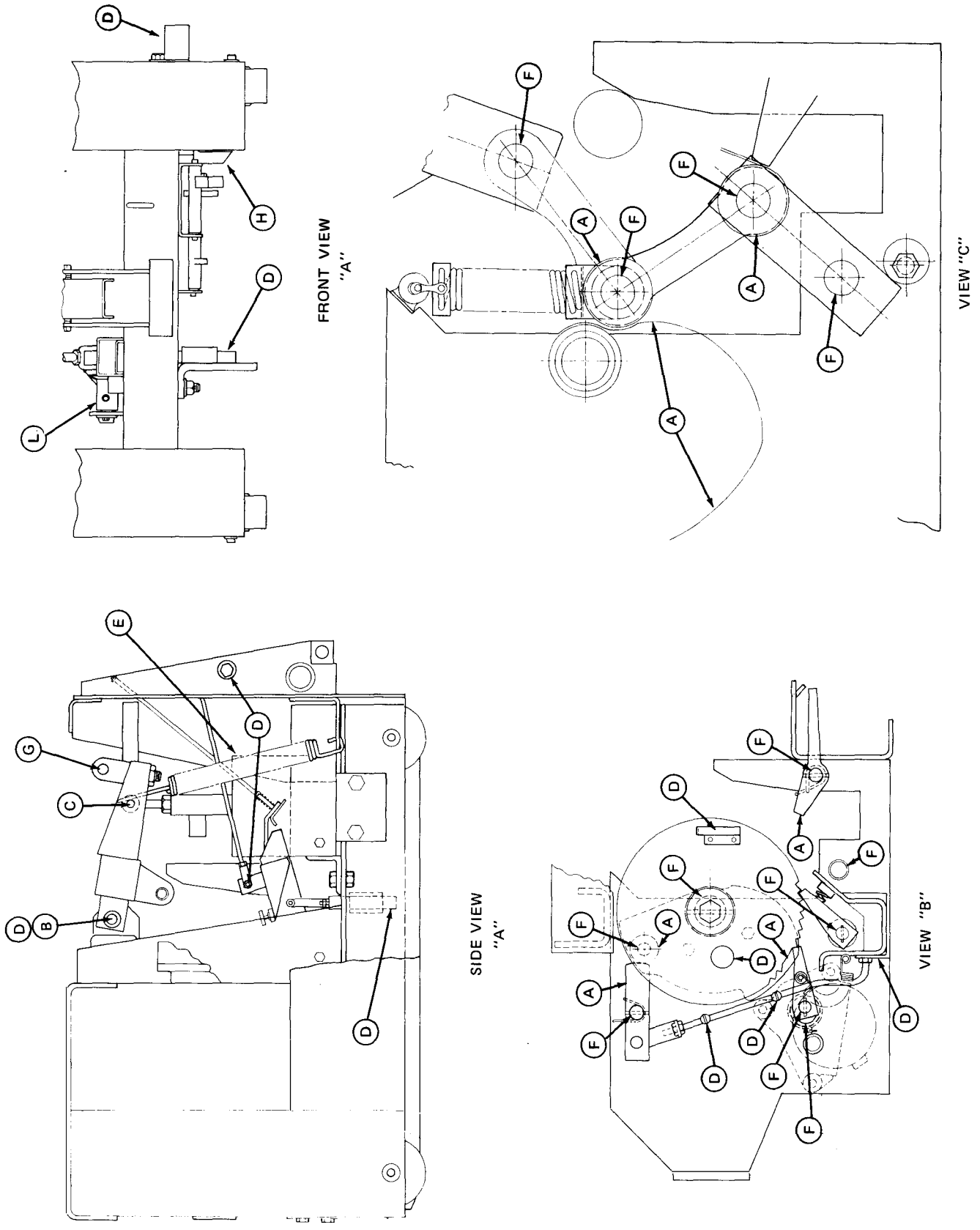


Fig. 19 – Frame and Operator, Drive Assembly, and Linkage Assembly

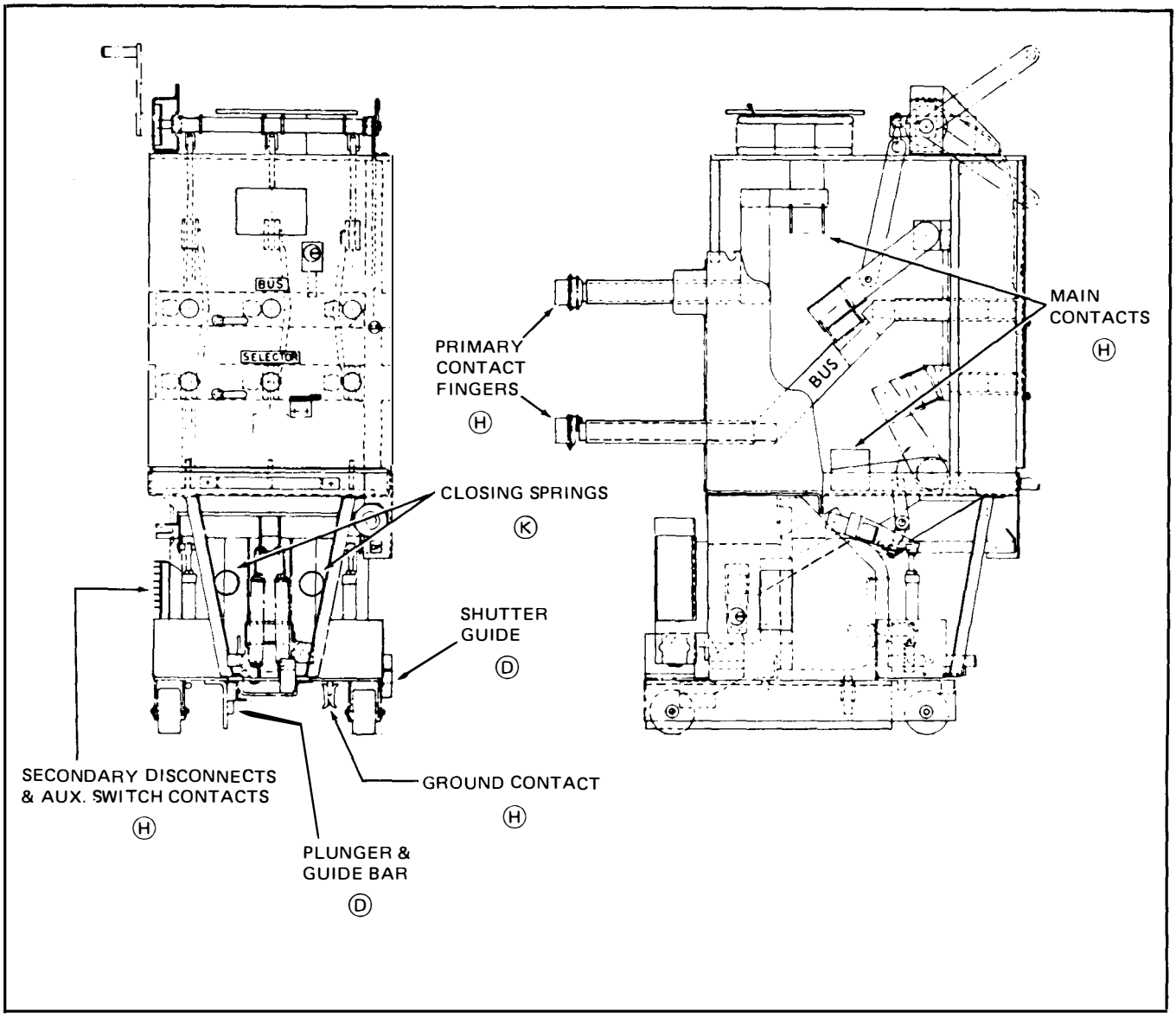


Fig. 20 — Lubrication Points on Breaker

LUBRICATION KEY	PART DESCRIPTION	SUGGESTED LUBRICATION AT EVERY 1000 OPERATIONS OR ONCE EVERY YEAR.	ALTERNATE LUBRICATION (REQUIRES DISASSEMBLY) RECOMMENDED AFTER EVERY 5,000 OPER.
A	GROUND SURFACES SUCH AS LATCHES, ROLLERS, PROPS, ETC.	WIPE CLEAN AND SPRAY WITH *MOLYCOTE 557* 15-171-270-001.	WASH CLEAN AND SPRAY WITH *MOLYCOTE 557* 15-171-270-001.
B	NYLON SLEEVE BEARINGS, SUCH AS THE CONTACT ARM HINGE PIN.	NO LUBRICATION REQUIRED.	NO LUBRICATION REQUIRED.
C	SLEEVE BEARINGS AND PIVOT PINS, ROTATING PARTS SUCH AS DRIVE PINION, DRIVING CRANKS, WALKING BEAM PIVOT PIN, SLIDE AND PIVOT PIN.	LIGHT APPLICATION OF *MOLYCOTE PENELUBE* 15-171-270-002.	REMOVE PINS OR BEARINGS. CLEAN PER INSTRUCTIONS AND APPLY *BEACON P-290* 00-337-131-001.
D	SLIDING SURFACES.	LIGHT APPLICATION OF *MOLYCOTE 557*.	WIPE CLEAN AND APPLY LIBERAL COAT OF *MOLYCOTE 557*.
E	AIR PUFFER CYLINDERS.	WIPE CLEAN AND APPLY TRANSFORMER OIL #3 TO FELT.	WASH CLEAN AND WET FELT RING IN TRANSFORMER OIL #3.
F	ROLLER AND NEEDLE BEARINGS.	NO LUBRICATION REQUIRED.	CLEAN INSTRUCTIONS AND REPACK WITH *BEACON P-325*.
G	DRY PIVOT POINTS.	NO LUBRICATION REQUIRED.	NO LUBRICATION REQUIRED.
H	PRIMARY DISCONNECT FINGERS, GROUNDING CONTACT.	WIPE CLEAN AND APPLY A FILM OF SIEMENS-ALLIS CONTACT LUBRICANT 15-171-370-002.	
J	GROUNDING ARM HINGE JOINT, SILVER WASHER BETWEEN BUSHING AND THE CONTACT ARM.	WIPE CLEAN AND APPLY A FILM OF SIEMENS-ALLIS CONTACT LUBRICANT 15-171-370-002.	
K	CHARGING SPRINGS & SPRING RETAINERS	NO LUBRICATION REQUIRED	WIPE CLEAN AND COAT WITH BEACON P-325.
L	MANUAL CHARGING BEVEL GEAR TRAIN FB & FC SERIES ONLY.	REMOVE SNAP ON COVER & COAT TEETH LIGHTLY WITH BEACON P-325.	REMOVE SNAP ON COVER & COAT TEETH LIGHTLY WITH BEACON P-325, 15-337-131-001.

Fig. 21 — Lubrication Chart

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