ALLIS-CHALMERS

INSTRUCTION BOOK

TYPE "D" MOVABLE PORTION
MA-75/150/250B

RUPTAIR MAGNETIC POWER CIRCUIT BREAKER

AND AUXILIARY EQUIPMENT (STORED-ENERGY OPERATOR)

September 1, 1966

Book No. BWX-6657-2

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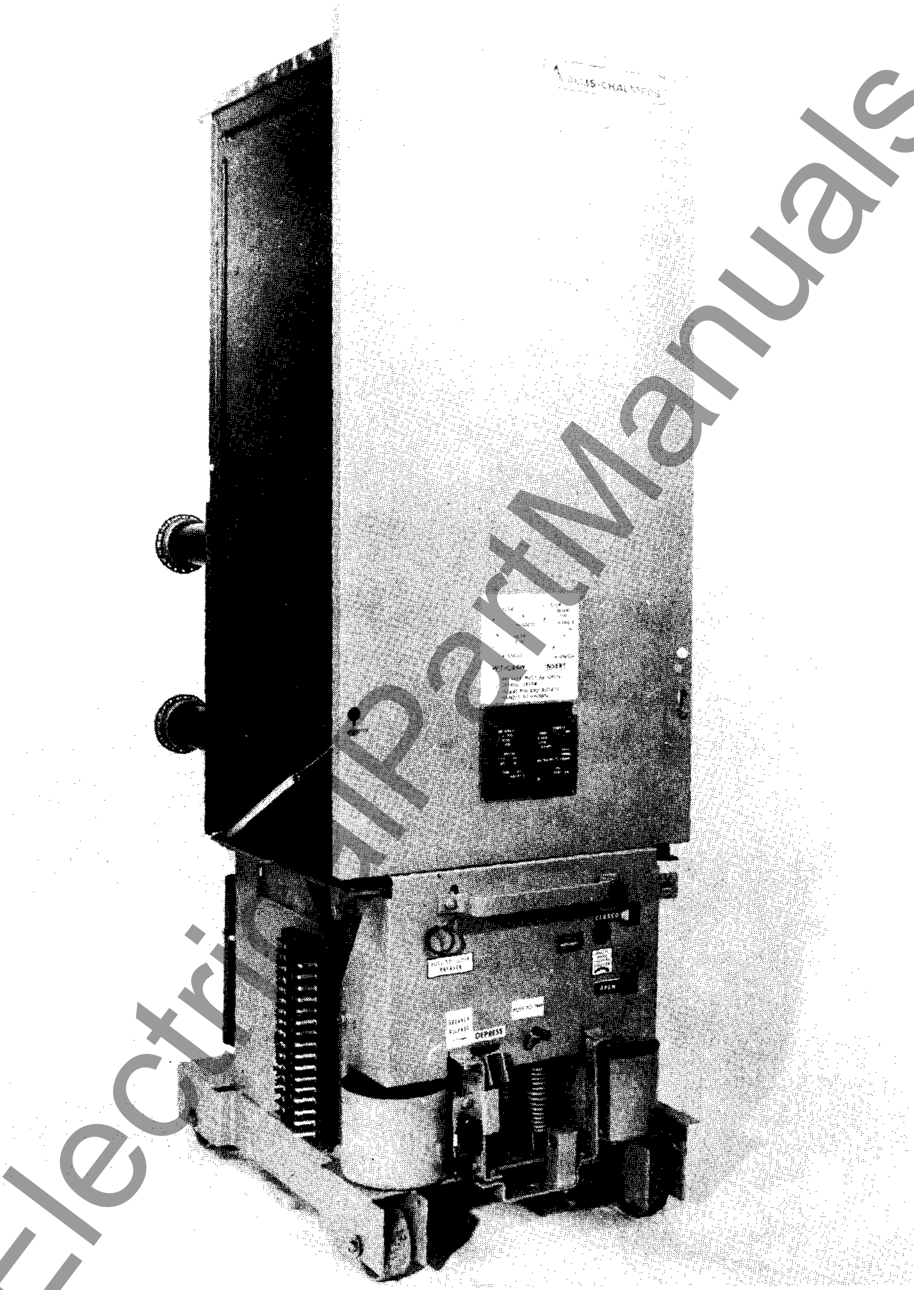

205395 Front side view of Type D 4.16 kv, 1200 Amp., Air Magnetic Circuit Breaker

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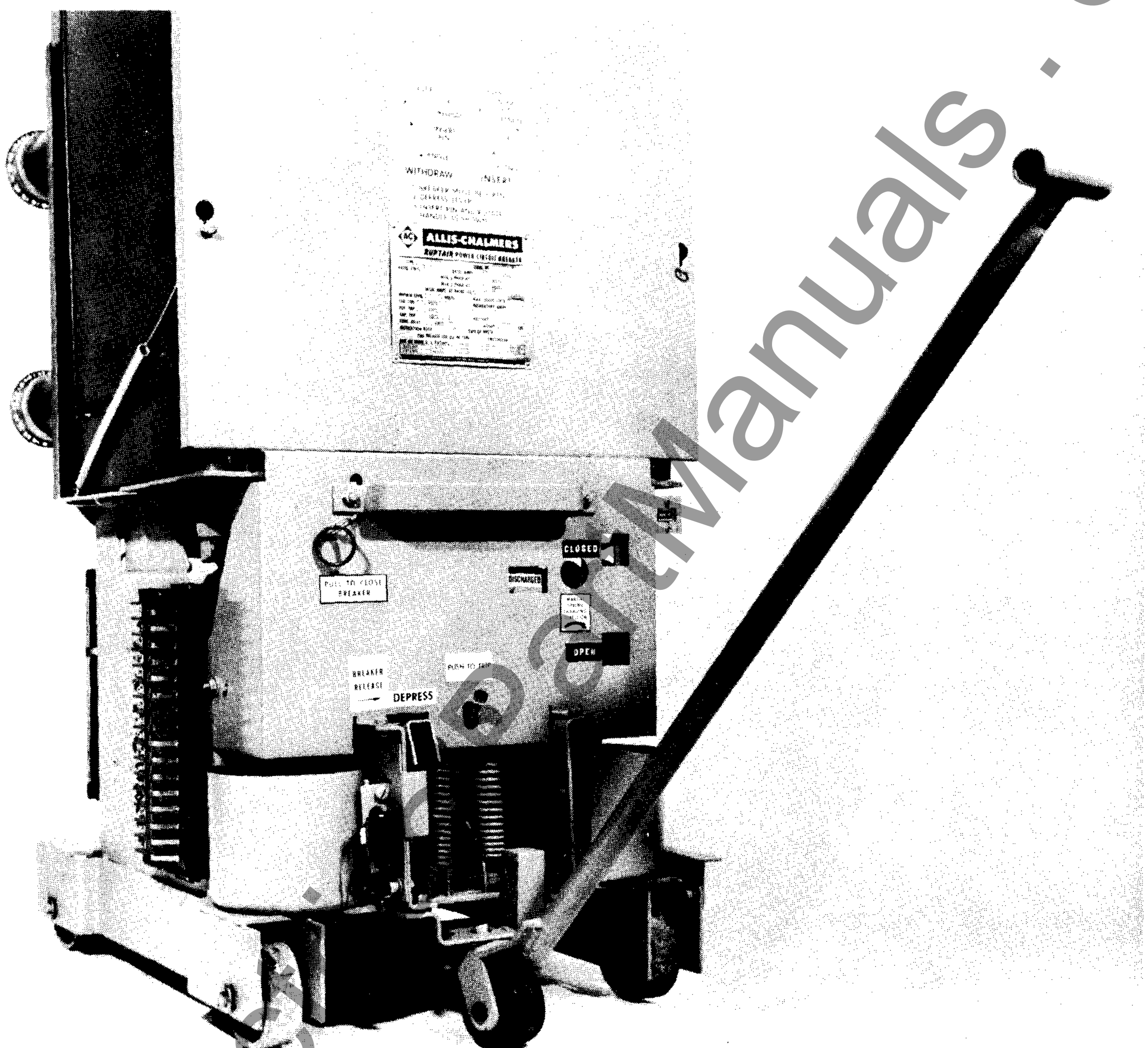

205389 View shows application of fifth wheel on Type D Air Magnetic Circuit Breakers

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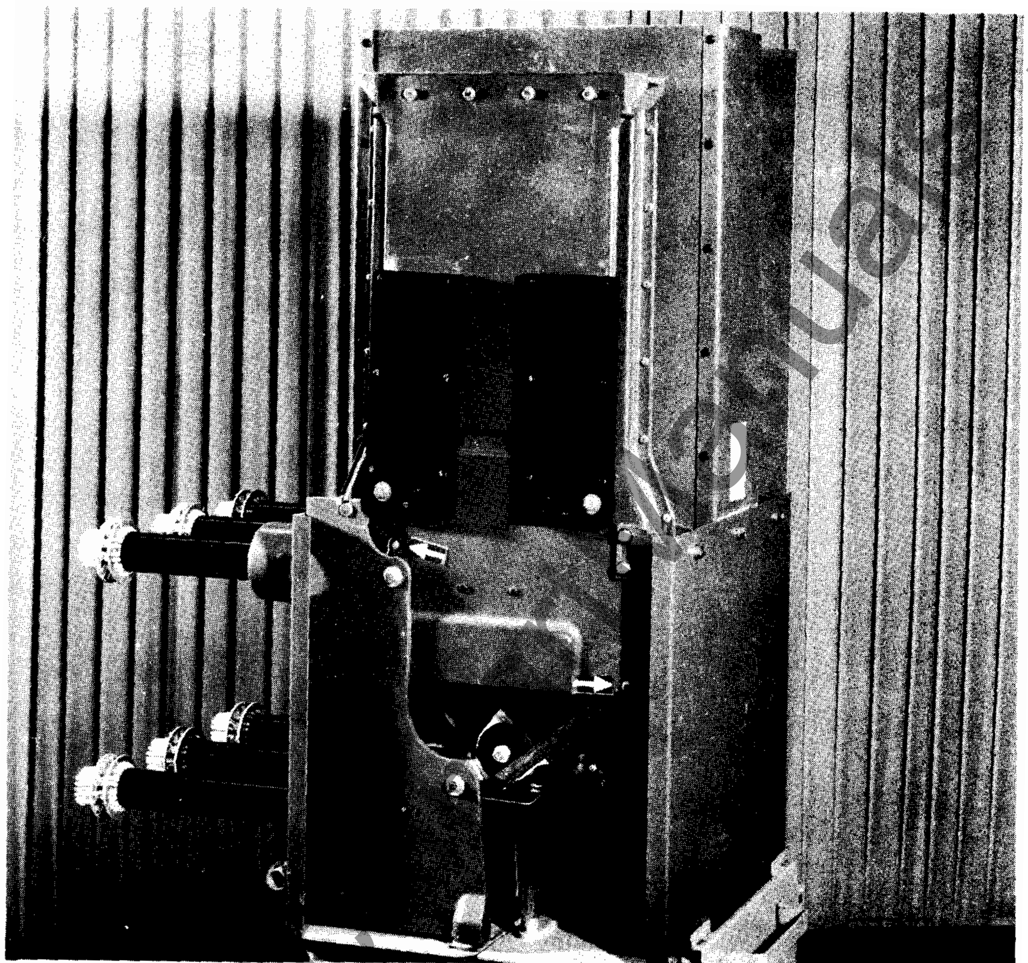

217530 Side view of Type D, 4.16 kv, 1200 Amp., Air Magnetic Circuit Breaker, Outer Phase Barrier Removed.

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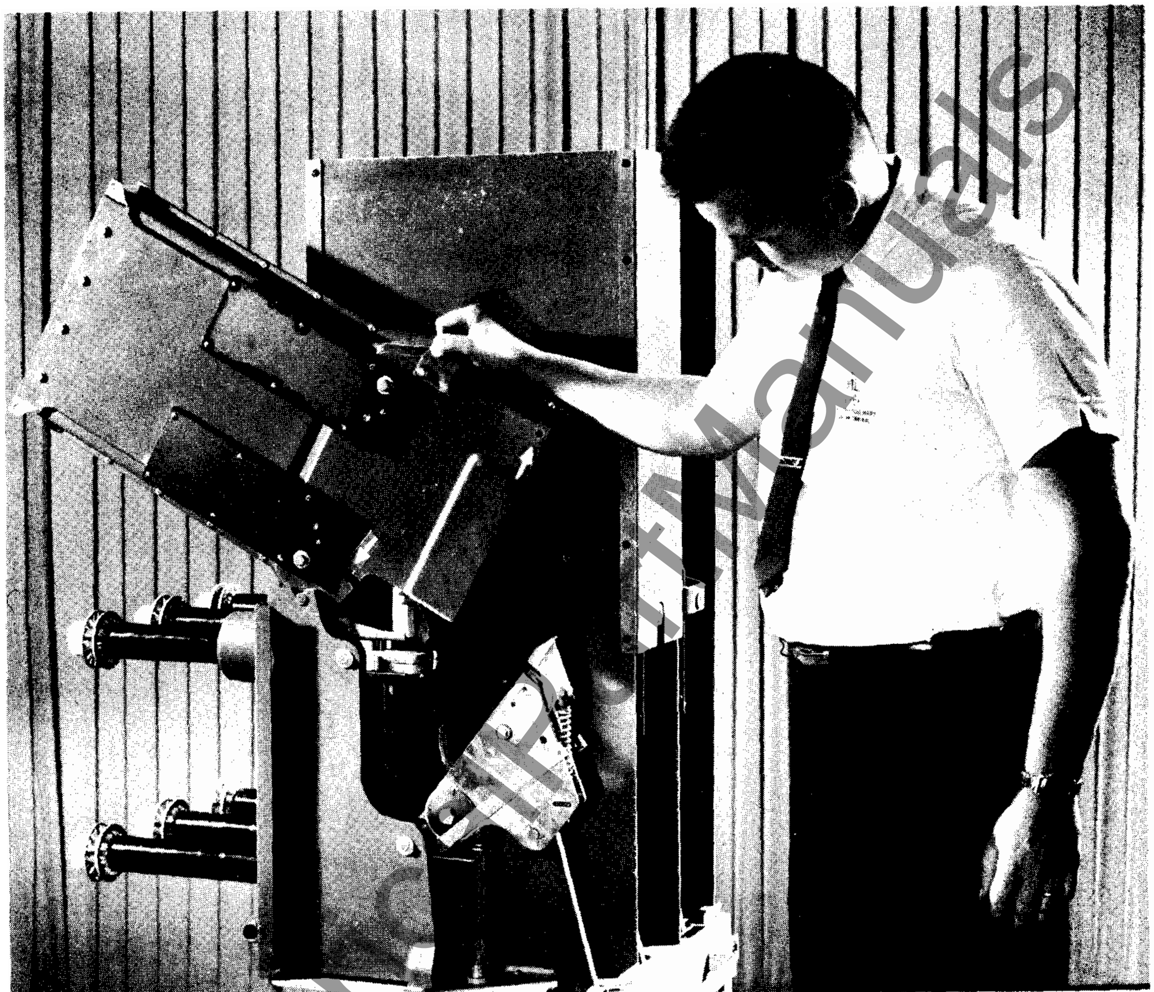

217525 Arc Chute Assembly of Type D, 4.16 kv, 1200 Amp., Air Magnetic Circuit Breaker is tilted back for easy assembly of contacts.

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MA-75/150/250B

RUPTAIR MAGNETIC POWER CIRCUIT BREAKER
AND AUXILIARY EQUIPMENT (STORED ENERGY OPERATOR)

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PART I. DESCRIPTION

1.1 GENERAL

The Allis-Chalmers RUPTAIR movable portion consists of a magnetic circuit breaker for metal-clad switchgear application, with auxiliary equipment suitably arranged for best function and easy installation. As part of standard equipment, each order is furnished with one maintenance closing device for solenoid operated breakers or a charging crank for stored energy operated units.

The RUPTAIR magnetic circuit breaker differs essentially from oil breakers and air-blast breakers in that it does not depend on any stored medium such as oil or compressed air for arc interruption. The component parts of the breaker are mounted in a structural steel frame. The operator, the operating shaft, and connecting links are mounted on the lower section of the breaker frame and are well shielded. The horizontal terminal studs, which are insulated with flame retardent tubing, extend through the breaker bracket and support the other parts of the electrical circuit. Interruption occurs within the arc chute assemblies which are mounted at the top, over the contact structures.

1.2 METHOD OF ARC INTERRUPTION

Interruption is accomplished in air at atmospheric pressure, with the aid of a self-induced magnetic blowout field and air draft. At the time the trip coil is energized, current is being carried through the main contacts. As the movable contact assembly separates from the stationary contact assembly, the current transfers very quickly from the main contacts to the arcing contacts, thus keeping the main contact erosion to a minimum. (For breakers equipped with tertiary contacts, the current transfers from the mains, to the tertiary and then to the arcing contacts.) As the movable contact assembly continues its stroke, the arcing contacts part, drawing a power arc, which is transferred first to the stationary end arc runner then to the moving end arc runner. The transfer of the arc to the arc runners establishes the full flow of current through the blowout coils, setting up the magnetic field which, in accompaniment with natural thermal effects of the heated arc, the configuration of the current carrying circuit, etc., tend to force the arc upward into the barrier stack. The cool surfaces of the barrier stack cool and deionize the arc, while the "Vee" slots in the stack reduce its cross section and elongate it.

The arc runners are made of wide, heavy material for maximum heat dissipation and to minimize metal vaporization. To facilitate interruption of low currents, a puffer assembly provides a movement of air through the contact area to aid the magnetic field in moving the arc into the barrier stack. All of the above effects work together to increase the resistance of the arc and enable it to be extinguished at an early current zero.

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PART 2. ADJUSTMENTS

2.1 GENERAL

The breaker has been completely set up, adjusted and tested at the factory.

Adjustments should not have to be made nor fastenings tightened when the breaker is received. If there is visible damage or breakage due to shipment, storage or installation, the adjustments should be checked and corrected, if necessary, before breaker is operated electrically.

Manual operation (use maintenance closing device) of breaker should be used for preliminary operation to see that all parts are free and work smoothly. The bushings and other insulating parts should be clean and dry. All contact surfaces should be inspected to see that they are clean and smooth. (Do not dress silver surfaces). Removal of all phase barriers and removal or raising of arc chute assemblies gives access to breaker for checking adjustments.

CAUTION: BEFORE REMOVING ANY PART, MAKE SURE THAT THE BREAKER AND ITS OPERATING MECHANISM IS DISCONNECTED FROM ALL ELECTRIC POWER AND THAT THIS BREAKER IS IN THE OPEN POSITION.

PART 3 - SE-4, STORED ENERGY OPERATOR

3.1 DESCRIPTION OF OPERATOR (Fig. 4)

The stored energy operator consists of three systems: (a) the driving system, (b) the spring linkage, and (c) the 4-bar closing linkage. The systems are disengaged from each other except while performing their specific function; thus, the driving system and spring linkage are completely free of each other except when the spring linkage is reset and ready to be charged. Similarly the spring linkage and closing linkage are free of each other except during a closing operation.

3.1(a) DRIVING SYSTEM

The driving system consists of a gearmotor driving a pinion (4-2) which, in turn, drives two spur gears (4-3). A free-swinging crank (4-4) is mounted on each spur gear shaft; it is driven by a pin (4-5) fastened to the spur gear; and it drives the spring linkage.

3.1(b) SPRING LINKAGE

This system consists of four closing springs (4-6), two links (4-7), two links (4-9), one link (4-10), two links (4-11) and crank (4-12).

When the linkage is reset, the springs can be charged by cranks (4-4) driving the rolls (4-24) fastened to link (4-10) until links (4-9 and 4-10) go over toggle. At the start of this operation, links (4-9) will be in tension, allowing a gap between latch (4-13) and its roll (4-19). However, part way through the charging operation, as the springs are being charged, the action of roll (4-19) coming against latch (4-13) will be heard. The action of links (4-9 and 4-10) going over toggle will be heard at the end of the charging operation.

Releasing closing latch (4-13) will free the closing springs to drive the breaker closing linkage (see below). During this operation, the spring charging linkage remains over toggle until near the end of its stroke when the toggle is broken by crank (4-12) striking the kick-off screw (4-32). The spring linkage immediately resets allowing the breaker closing linkage room to reset when tripped.

3.1(c) 4-BAR BREAKER CLOSING LINKAGE

This system consists of two links (4-20), two links (4-21) and arm (4-22). It is always free to operate in any of its functions as it is not secured to the spring charging linkage.

In the closing operation the spring charging linkage drives toggle roll (4-15) over toggle against stop (4-59), thus closing the breaker through arm (4-23). Depressing latch (4-27) during a closing operation prevents the breaker from closing, thereby making it trip free.

3.2 CHARGING SPRINGS

The closing springs (4-6) will charge as soon as the breaker control bus is energized. Should the springs not charge, check the motor cutoff adjustment (see Section 3.13).

The springs can be manually charged by inserting the charging handle down guide tube (1-27) to engage the gearmotor. Rotate the handle in the direction shown until the spring linkage is heard to go over toggle (see Section 3.1(b).

REMOVE CHARGING HANDLE FROM BREAKER BEFORE ENERGIZING BREAKER CONTROL CIRCUIT.

3.3 CLOSING BREAKER

When the springs are fully charged, the breaker can be closed manually by pulling lanyard (1-26) or electrically by energizing the closing circuit. This rotates latch (4-13) allowing the springs (4-6) to close the breaker.

3.4 OPENING BREAKER

The breaker can be tripped manually by depressing trip rod (1-43) or electrically by energizing the trip circuit. This rotates latch (4-27) allowing the closing linkage to collapse and reset.

The tripping action described above can take place at any time during a closing operation, either manual or electrical, and regardless of whether or not the armature is energized. Thus the mechanism is electrically and mechanically trip-free in any position.

3.5 MANUALLY SLOW-CLOSING BREAKER

In order to check and make contact adjustments, the breaker can be closed slowly and mechanically held in any position of the closing stroke. The following procedure should be followed:

a) Remove breaker from cubicle and tilt arc chutes back.

b) Be certain that control circuit is open and closing springs are discharged.

c) Insert mechanism locking pin into hole (1-28). It will be necessary to rotate lever (1-29) to allow pin to pass through hole. The pin should pass behind crank (1-30) and through hole in opposite side of operator frame.

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d) Insert spring charging handle into guide tube (1-27) and engage with gearmotor. Turn handle in direction opposite to direction indicated on shield until resistance is felt. Pull manual closing lanyard (1-26) and continue turning handle. The breaker contacts will slowly close.

CAUTION: AS THE CONTACTS APPROACH THE BREAKER CLOSED POSITION, OBSERVE THE POSITION OF CRANKS (4-4) ON ROLLS (4-24). CARE SHOULD BE TAKEN THAT THE CRANKS DO NOT PASS BY THE ROLLS, ALLOWING THE CONTACTS TO SNAP OPEN.

Since the motor gears are self locking, the contacts can be cranked to any position and held for adjustment checks.

e) To prepare for normal operation:

Trip breaker open.

Remove spring charging handle.

Remove mechanism locking pin.

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3.6 MAIN TOGGLE ROLL (Fig 4)

When the breaker is in the closed position with toggle roll (4-15) against stop (4-59) the center of the toggle roll (4-15) should be 3/16 to 5/16 beyond the line of centers of the latch roll (4-14) and pin (4-30). Adjustment is made by adding or removing shims (4-60).

3.7 TRIP LATCH (Fig. 4)

The trip latch (4-27) should engage its roll (4-14) 1/8 to 3/16 above the lower edge of the latch face. Adjustment is made by screw (4-65). Note that this adjustment affects the clearance between the trip pin (4-17A) and the trip latch (4-27) (see Section 3.9).

When the breaker is open, the trip latch (4-27) should clear its latch roll by 1/64 to 3/64 Adjustment is made by screw (4-75).

3.8 CLOSING LATCH (Fig. 4)

The closing latch (4-13) should engage its roll (4-19) 1/8 to 3/16 above the lower edge of the latch face. Adjustment is made by screw (4-28). Note that this adjustment affects the clearance between the trip pin (4-8A) and the arm (4-29) (see Section 3.9).

3.9 TRIPPING AND CLOSING SOLENOID

The tripping solenoid (4-36) and the closing solenoid (4-37) action and adjustments are identical. Each solenoid has been adjusted in the factory and should require no further adjustment. If readjustment is required it should be made only when the trip and closing latch bites are in correct adjustment (see Sections 3.7 and 3.8).

The armature should move freely and have no binds. The travel of the armature should be such that slow manual actuation will trip the latch and have 1/16 to 3/32 aftertravel. Adjustment is made by shimming the solenoid with washers on the mounting screws.

With the coils deenergized there should be 3/32 to 5/32 clearance, between the trip latch (4-27) and the trip pin (4-17A) on the tripping solenoid, and between the closing arm (4-29) and the trip pin (4-8A) on the closing solenoid. Adjustments are made by raising or lowering the respective hex nuts (4-34) and (4-35).

3.10 AUXILIARY EQUIPMENT

The auxiliary equipment consists of a secondary transfer device, control relay, auxiliary switch and closing rectifier as required. These are mounted on the lower portion of the breaker. The secondary finger contacts are wired such that when movable portion is moved into test or operating position in the cubicle the finger contacts engage the stationary contacts to complete the control circuit for operation of the breaker.

3.11 AUXILIARY SWITCH (Fig. 11)

The auxiliary switch (1-15) has been adjusted at the factory and should normally not require further adjustment. Each rotor (11-3) can be adjusted individually in steps of 15 degrees merely by pressing the contact to one side against the spring and rotating it within its insulated rotor housing until it snaps into the desired position.

3.12 INTERLOCK PLUNGER (Fig. 1)

The foot lever (1-20) operates the interlock plunger (1-18) as well as the trip latch and the closing latch. Depressing the lever trips the breaker, releases the closing spring and raises plunger (1-18) sufficiently to release the breaker allowing it to be moved in the cubicle. The interlock is in proper adjustment when the plunger (1-18) is positioned to 1-11/16 to 1-13/16 above the floor line, and causes tripping of breaker contacts when it is raised to a level not more than 2-1/16 above the floor line.

The latch tripping rod associated with the foot lever should be clear of the trip latch (4-27) by 1/32 to 1/16. Adjustment is made by changing the effective length of the yoke attaching the foot lever to the interlock plunger.

The interlock rod (4-31) should not touch the closing arm (4-29) until after the breaker is trip free. Adjustment is made by changing the effective length of the eyebolt connecting the foot lever to the interlock rod.

3.13 OPERATOR CONTROL (Fig. 8)

The normal control for this operator has been incorporated in one switch assembly located at the rear of the unit. It consists of two heavy duty toggle switches (6) operated by a common linkage (1) from the main closing springs and one heavy duty toggle switch (6) operated by a cam (2) driven by the main gear.

Referring to the breaker wiring diagram furnished with the installation, the 88-1 and 88-2 switches are shown with the main closing springs discharged. The 88-3 switch is operated by the cam (2) on the main gear.

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As the charging linkage charges the main closing springs the motor switch cam rotates with the left hand large gear (4-3). Just before the springs are fully charged the cam (2) throws the 88-3 switch and when the springs are fully charged the 88-1 and 88-2 switches are thrown by lever (1) which is operated by pin (5).

To adjust these switches loosen lock nuts (4) and turn adjusting screws (3) in or out with a screwdriver. Proper operation sequence is as follows.

When the control is energized the motor starts to charge the springs. The 88-1bb switch opens when the springs are fully charged, however, before this switch opens the 88-3aa switch closes connecting the resistor into the motor circuit. The motor continues to drive the gears until the free swinging cranks (4-4) on the main gears are almost to the top of the gears. The motor then shuts off (cut by the cam operating the 88-3aa switch), and allows the cranks to go over center, and drop out of the way.

The resistor is adjusted to limit the speed of the unloaded motor. It is factory set to operate the motor at rated and minimum voltage and limit the coast of the motor so that the pin on the gear coasts past top center but not beyond 10 o'clock. With too much resistance the motor will stall. With too little resistance the motor will coast too far and the cam will reclose the 88-3aa switch and the motor will continue to run.

3.14 RESET RELAY (For Instantaneous Reclosure Service Only)

The ALLIS-CHALMERS Reset Relay designed for use in circuit breaker control is a rugged electronic solid state time delay which operates a small relay. The relay contacts are rated at 15 amperes.

The relay closing time is not affected by broad variance of voltage and current well beyond the standard circuit breaker control limits. The time delay error caused by temperature is minor being less than 3% from -20°C to +80°C and not over 5% to -40°C.

The voltage regulator and timing circuits are mounted on a printed circuit board and encapsulated in a resilient material for shock resistance.

The controlled supply voltage charges the capacitor (C_1) through the time rate determining resistor R_1 to the triggering voltage of the unijunction transistor (UJT) which activates the SCR energizing the relay coil.

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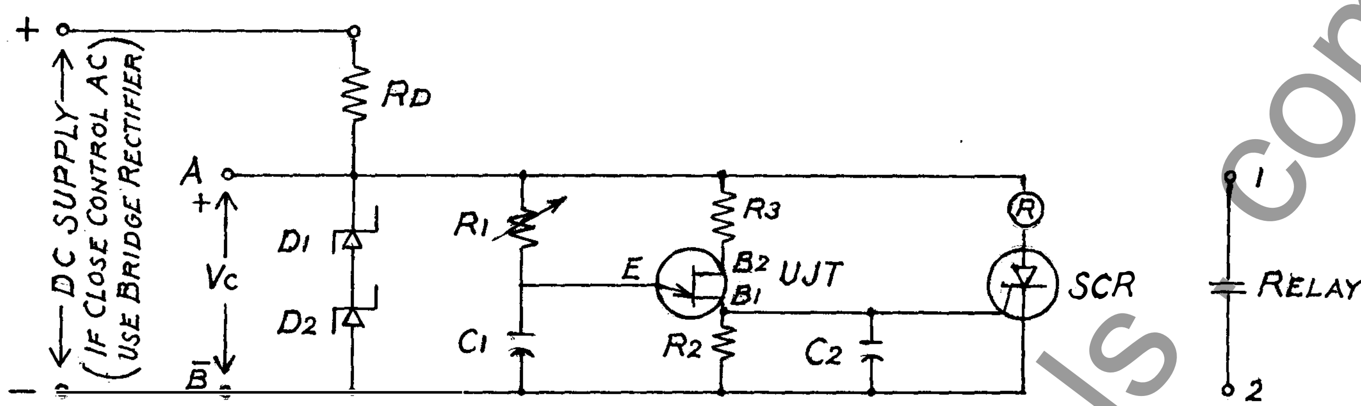

TYPICAL RESET RELAY CIRCUIT

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A constant voltage V_c is maintained across the terminals AB by the two zener diodes D_1 and D_2. Resistor R_d drops the supply voltage to a value above the diode control voltage and the diodes further reduce the voltage to the control voltage value, V_c. The control voltage V_c causes the diodes to conduct and an increase or decrease in supply voltage will produce a corresponding change in the current which causes a change in the voltage drop across R_d equal to the change in supply voltage. To summarize, an increase or decrease in supply voltage will not affect the constant voltage drop V_c across the diodes. Two diodes in series are used because they provide more precise voltage regulation than one diode.

The unijunction transistor (UJT) is a switch which when turned on will allow a short pulse of relatively high current to flow and will then shut off. The terminals EB_1, of the UJT are an open circuit until the voltage at E exceeds a precise level V_F. In other words the UJT does not allow current to flow from point E to point B_1 until the UJT is turned on by the firing voltage V_F. The voltage drop V_c across the terminals AB charges the capacitor C_1 through the variable resistor R_1. The time that it takes the capacitor C_1 to charge to the firing voltage (V_F) of the UJT is the time delay, and is controlled by the variable resistor R_1

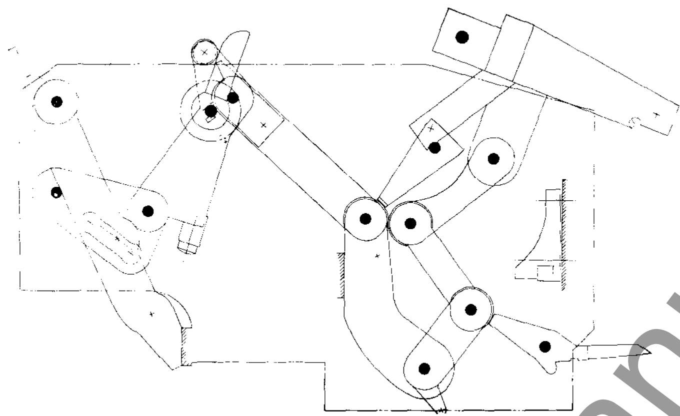
R_1 is preset in the factory for a delay of ten cycles and locked in place by the stem locking nut. A 5^o change in resistor setting would mean a change in delay of approximately 1/2 cycle. The unit is adjustable from an approximately instantaneous to a 60 cycle delay. Any readjustment should be made using a cycle counter or equivalent for timing.

When the voltage drop across the capacitor and therefore at point E, exceeds V_F the terminals EB_1, act as a short circuit and the UJT discharges the capacitor through R_2 and the gate terminal of the silicon controlled rectifier (SCR). That is, the UJT allows current to flow from the capacitor at point E to point B_1 and into the gate terminal of the SCR.

The SCR is a latch type switch. Normally it blocks the flow of current through the relay R. When the gate terminal receives a current pulse from the capacitor discharging through the UJT, the SCR allows current to flow through the relay R. The SCR conducts even after the pulse is removed. The relay contacts R close allowing current to flow through the spring release coil circuit.

The gate terminal of the SCR is protected from random high frequency pulse by capacitor C_2 which provides a short circuit to ground for these pulses. In other words the reactance of the capacitor C_2 is negligible at high frequencies and the capacitor allows current to flow through it.

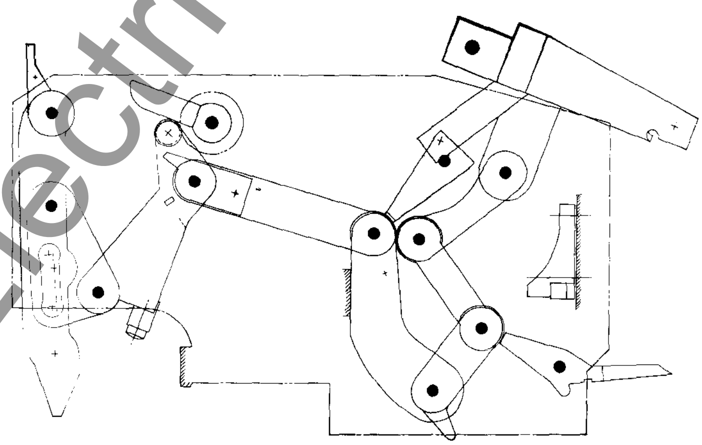
I



For Parts Identification See Figure 4

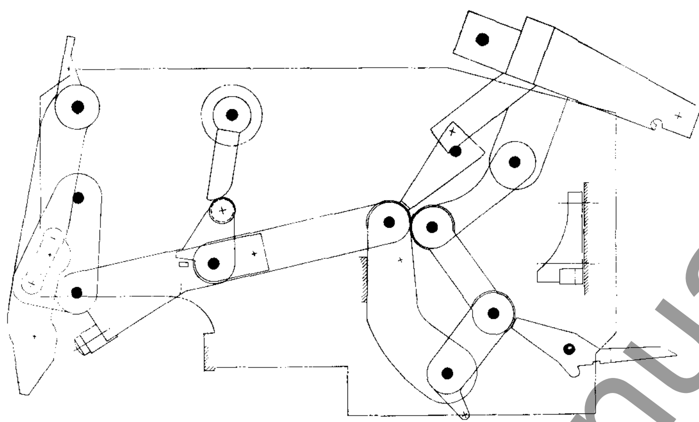
I. Shows breaker open - springs discharged. Motor starting springs charge with the driving cranks (4) picking up the rolls (24) throwing links (9) into tension and pulling latch roll (19) back of closing latch (13).

II



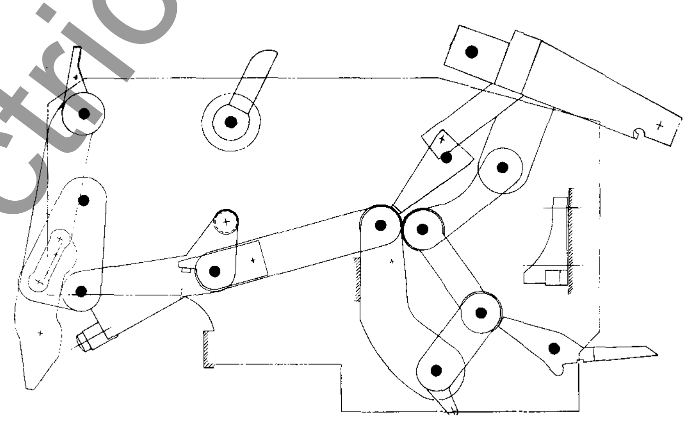
II. Driving cranks (4), turning counterclockwise, have gone overcenter throwing links (9) into compression with latch roll (19) against closing latch (13). If latch (13) does not pick up the load, link (9) will move forward allowing roll (24) to go around driving crank (4) to position as shown in I.

III



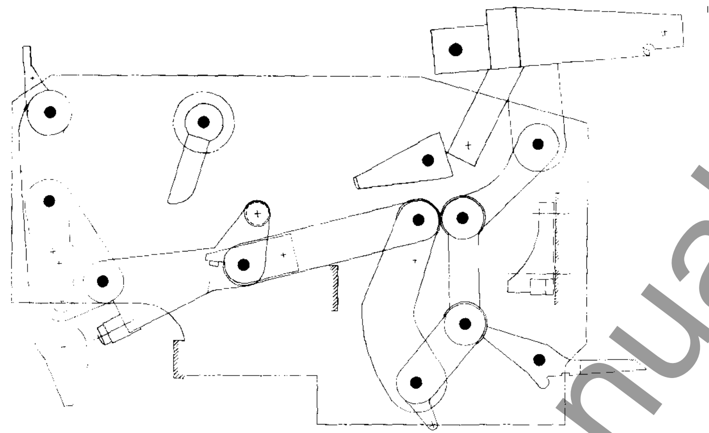
III. Driving cranks (4) have forced rolls (24) to the point that links (9) and (10) are slightly overtoggle, springs are fully charged and will snap links (9) and (10) overtoggle against the stop.

IV



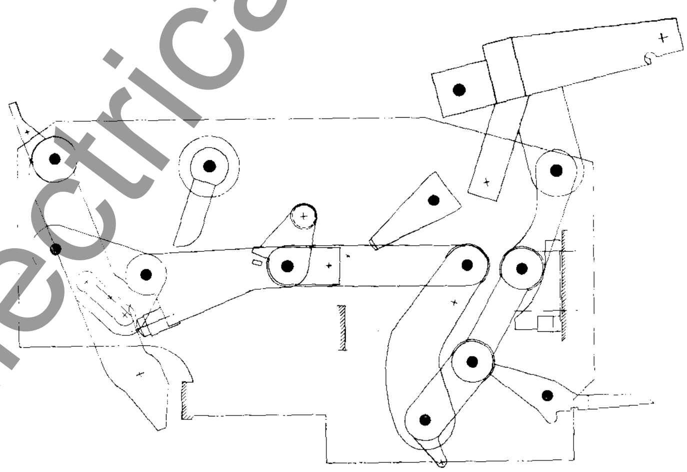
IV. Driving cranks (4) have rotated free, links (9) and (10) are overtoggle, springs fully extended ready for close when closing latch (13) is released.

V



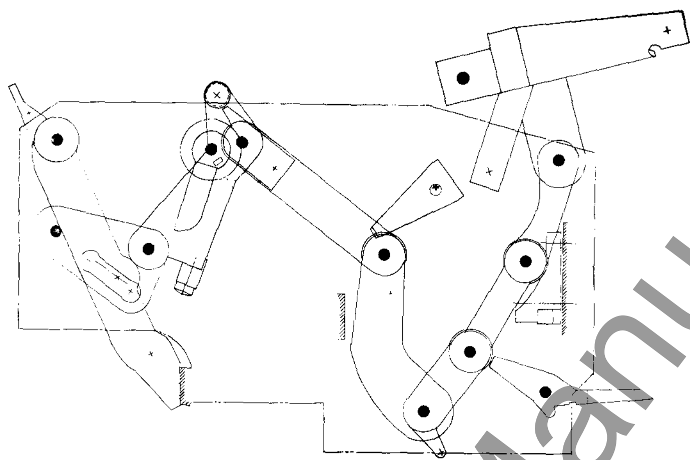
V. Closing latch (13) has been released freeing latch roll (19) and allowing springs to drive links (9) and (10) forward as a unit. Latch roll (19) forces toggle roll (15) forward with latch roll (14) held by trip latch (27) the breaker will close.

VI



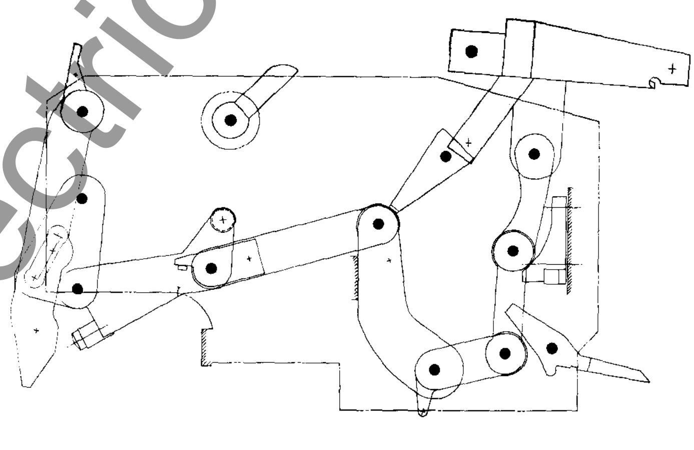
VI. The toggle roll (15) is overtoggle against stop (59). Screw (32) has come in contact with crank (12) forcing link (10) to rotate breaking the toggle between links (10) and (9).

VII



VII. With the toggle broken between links (9) and (10) they snap back as shown.

VIII



VIII. Springs are recharged ready for next close operation. Breaker has just been tripped. Trip latch (27) has released latch roll (14) allowing it to rotate. Links (20) and (21) drop almost vertically until stop (59) forces toggle roll (15) back to break the link 20-21 toggle and allowing the 4-bar linkage to return to normal position as shown in III. IV.

6631-4, 6657-2, 6611-1, 6679-1, 6699-1, 6651-1, 6652-1, 6603-2, 6630-1, 6632-3, 6700-1

PART 4. DISCONNECT SECTION

4.1 BREAKER MECHANISM

The breaker mechanism consists essentially of movable contact arms and insulating links which connect the contact arms to the operator mechanism.

4.2 CONTACTS (Fig. 3)

The stationary contact structure of each phase is made up of two sets of contacts; main current carrying, and arcing, which are mounted on the upper bushing stud. The movable contacts are attached to contact arms that pivot from the end of the lower bushing stud. Transfer areas of current carrying contacts are silver plated and contact surfaces are of silver-tungsten alloy. The main current carrying contacts are finger type and engage with a wiping action. The arcing contacts are butt type. All contacts are backed by steel springs giving positive contact pressure when engaged.

4.2A SERVICING CONTACTS

The frequency of contact inspection depends on the severity of service to which the breaker is subjected. There are two areas which normally require service inspection:

A. Stationary and moving main and arcing contacts. Badly pitted or burned contacts should be replaced.

B. Hinge joints. Remove the disconnect arms as a unit by removing screw (3-24), nut (3-14) and spring washers (3-23). Carefully inspect all contact surfaces. Silver washers (3-25) and adjacent surfaces should be clean and free of roughness or galling. Lubricate washers (3-25) and mating surfaces by rubbing in microfine dry graphite, used sparingly. Remove excess graphite. Reassemble, adjusting hinge joint pressure as described in Section 4.5.

4.3 BREAKER TIMING

Check the contact adjustment and breaker timing, also check adjustments of auxiliary equipment and see that it functions properly. A comparison of breaker timing at any period of maintenance with that taken when the breaker was new will immediately indicate a condition of maladjustment or friction should the timing vary more than 1/2 cycle on opening or 2 cycles on closing with the same coils. A hole is provided in the movable contact arm for the purpose of attaching a speed analyzer connection.

4.4 ARCING CONTACT HINGE JOINT (Fig. 3)

The arcing contact hinge joint is in proper adjustment when each spring washer (3-15) is deflected approximately 0.015 inches.

This adjustment is obtained by tightening nut (3-4) until all parts just touch, then tighten the nut 3/4 to 1 turn more.

4.5 CONTACT PRESSURE OF HINGE JOINT (Fig. 3)

The hinge joint contact pressure is in proper adjustment when a pull of from 7 to 9 pounds on the 5 kv, and from 5 to 7 pounds on the 15 kv is required to move the disconnect toward the open position. This measurement is obtained as follows:

Remove pin (1-46) and detach link (1-47) from the disconnect arms (3-18) and (3-19). Move the disconnect to a position just short of "contact make". Attach a spring scale to the disconnect 8-1/2 inches on the 5 kv, and 10-1/2 inches on the 15 kv, above screw (3-24), and in a direction perpendicular to the longest edge of the disconnect arm. Measure the pull to move the disconnect toward the open position.

Adjustment is made by tightening (or loosening) nut (3-14).

Before attaching link (1-47) to disconnect arms (3-18) and (3-19), check contact alignment (section 4.6) and contact lead (section 4.7).

4.6 CONTACT ALIGNMENT (Fig. 3)

The contacts are an integral part of the bushing assemblies and are carefully aligned with the upper and lower bushings before shipment and no further adjustment should normally be necessary.

The horizontal pairs of main contact fingers in each phase should "make" with the moving contact simultaneously. (Note: Contacts on different phases should not necessarily "make" simultaneously, they can vary as much as 1/32 inches.)

If not already detached, remove pin (1-46) and detach link (1-47) from disconnect arms (3-18) and (3-19).

On MA-75/150B and FC-150/250/500 Breakers - Detach arcing contact (3-10) from yoke (3-2) by removing pin (3-26). Move the disconnect toward the closed position until it just touches a main contact finger (See Fig. 3, View A-A, main contacts engaging). Dimension c should then be no greater than .020 inches, with one contact touching.

On MA-250/350B, FB-250/500 and FC-750 Breakers - Remove pin (1-46) and detach link (1-47) from disconnect arms (3-18) and (3-19) of two phases only. With the maintenance closing device, move the disconnects of the remaining phase toward the closed position until a main contact finger (3-11) is touched. Dimension c should then be no greater than .020 inches, with one contact touching.

Adjustment is made by loosening two nuts (3-22) and rotating the contact assembly. Alignment (dimension c) should be checked after tightening nuts (3-22).

6631-4, 57-2, 11-1, 79-1, 54-1, 52-1, 03-2, 30-1, 32-3, 6700-1

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Alignment is checked and adjusted on each phase separately. Be sure there are no binds between contacts (3-11) preventing proper wiping action with the disconnect arms.

Attach arcing contact (3-10) to yoke (3-2), if detached, but check contact lead (section 4.7), before attaching link (1-47) to disconnect arms (3-18) and (3-19).

4.7 CONTACT LEAD (Fig. 3)

Contact lead is adjusted on breakers in the factory and should normally not require further adjustment. It should, however, be checked on each phase separately and only with contact alignment on the phase in correct adjustment (see section 4.6).

The arcing contacts (3-9, 10, 27, 28) should "make" before the main contacts. Measure and adjust each phase separately as follows:

If not already detached, remove pin (1-46) to detach link (1-47) from disconnect arms (3-18) and (3-19). Move the disconnect toward the closed position until the arcing contacts just touch (See Fig. 3, View A-A, arcing contact engaging.)

The shortest gap between the bottom contact fingers (3-11) and the contact on the disconnect arms (3-18) and (3-19) should be 7/32 to 1/4 inches. (Dimension b in View A-A of Fig. 3.) Adjustment is made by opening or closing the gap with nut (3-1).

Reconnect link (1-47) to disconnect arms (3-18) and (3-19) using pin (1-46).

4.8 CONTACT STROKE (Fig. 3)

Contact stroke should be checked and adjusted only when the contacts are in proper alignment (see Section 4.6).

In order to ensure proper wiping action and contact pressure, the stroke of the disconnect must be maintained in proper adjustment. Check and adjust as follows:

With the breaker latched, dimension a in View A-A of Fig. 3, on the top pair of fingers should be 1/8 to 3/16". Adjustment is made with the breaker in the open position by increasing or decreasing the effective length of link (1-47) by means of nuts (1-10). Each phase is adjusted individually.

Trip the breaker open and check to see that dimension d is 4 ± 1/8 inches on the 5 kv, and 6 ± 1/8 inches on the 15 kv on all three phases. (On breakers with more than four contacts per phase, dimension d is still measured to the second from top contact.)

Adjustment for dimension d is made by first removing pin (1-33) on each puffer. After loosening nut (1-42), increase (or decrease) effective length of rod end (1-40) by screwing (or unscrewing) it into piston stem (1-44). Adjust rod ends (1-40) on both puffers the same amount. Tighten nuts (1-42), replace pin (1-33), and check dimension d.

PART 5. ARC CHUTE ASSEMBLY

5.1 ARC CHUTE ASSEMBLY (Fig. 2 & 3)

Each arc chute consists of a flame retardent envelope which provides phase isolation for interruption and venting of the by-product gases of interruption. The arc chute contains:

a) The transfer stack consisting of refractory plates. It aids the transfer of the arc terminal from the stationary end arcing contact (3-9) to the stationary end runner (2-4).

b) The stationary end arc runner (2-4) and moving end arc runner (2-3) to which the arc terminals transfer from the arcing contacts. The arc runners form paths for the arc terminals to travel up the arc chute.

c) The stationary end blowout coil (2-15) and moving end blowout coil (2-13) which connect their respective arc runners to the top and bottom bushings. The current in these coils creates the magnetic flux which passes through cores (2-18), pole pieces (2-22) and the space between the pole pieces. The action of this flux on the arc forces the arc up the barrier stack.

d) The barrier stack (2-23) consisting of a number of refractory plates with "Vee Shaped" slots cemented together. The barrier stack cools, squeezes and stretches the arc to force a quick interruption.

e) The barrier (2-1) containing coolers (2-28) through which the by-product gases of interruption pass. The barrier completes the cooling and deionizing of the arc products.

Arc chutes are normally tilted (see Section 5.3) to expose contact area of the breaker and/or to replace parts such as barrier stacks (2-23). The arc chutes may also be removed from breaker if necessary, to replace parts not exposed when tilted by removing fastenings per Section 5.3.

5.2 PHASE BARRIERS (Fig. 1)

Full size barriers of high dielectric flame retardent material isolate each phase.

To remove phase barriers on 5 kv breakers - lift panel spring assembly (1-13) out of slots (1-14) to release panel (1-32). Lift and remove panel. Remove center phase screw (1-23). The phase barrier assemblies (1-5) and (1-7) can now be lifted and removed from the breaker. Note: On MA 250/350B breakers remove screw (1-2) and remove barrier (1-25) prior to above instructions.

6631-4, 5712, 11-1, 74-1, 51 52-1, 03-2, 30-1, 6700-1, 6632-3

To remove phase barriers on 15 kv breakers - remove screws (1-13) and channels (1-9) on rear of breaker. Lower panel (1-32) and loosen three screws (1-23); remove three screws (1-24) and panel (1-22) on front of breaker. The phase barrier assemblies (1-5) can now be removed from the front of the breaker.

Replace the above parts in reverse order taking care that barriers are seated properly and that channels (1-9) are located inside of washers (1-8).

5.3 TILTING ARC CHUTES

Remove phase barriers (see Section 5.2).

On the 5 kv breakers remove screws (1-23) and (1-37) of each phase. Remove screws (1-39) and (1-17) to remove barriers (1-19) and (1-22).

On the 15 kv breakers remove screws (1-1 and 1-37) on each phase. Loosen screws (1-23) and remove screws (1-24) and (1-39) to remove panel (1-22).

With arc chute support in place, at the rear of the breaker, tilt back the arc chutes.

After tilting arc chutes upright, and replacing barriers, be sure all screws are tightened securely on all three phases.

5.4 BARRIER STACKS (Fig. 2)

The barrier stacks are fragile and should be handled carefully. The barrier stacks should be inspected for erosion of the plates in the areas of the slots. The stacks should be replaced when a milky glaze is observed on the full length of the edges of most of the slots. They should be likewise replaced if plates are broken or cracked. When cleaning the breaker and cubicle, inspect for pieces of barrier stack refractory material which would obviously indicate breakage.

To remove the barrier stacks tilt back the arc chutes (see Section 5.3).

On the 5 kv breakers remove four screws (2-2), (five screws on MA-250B), barrier (2-1), from each arc chute. Slide barrier stack (2-23) through top of arc chute.

On the 15 kv breakers remove four screws (1-26), two barriers (2-1) and if applicable, two screws (2-6) and two tubes (2-5) from each arc chute. Slide barrier stack (2-23) through top of arc chute.

When sliding a barrier stack into the arc chute, care should be taken to see that the end containing the Vee-shaped slots goes in first.

6631-4, 57-1, 11-1, 79-1, 51-1, 52-1, 03-2, 30-1, 32-3, 6700-1

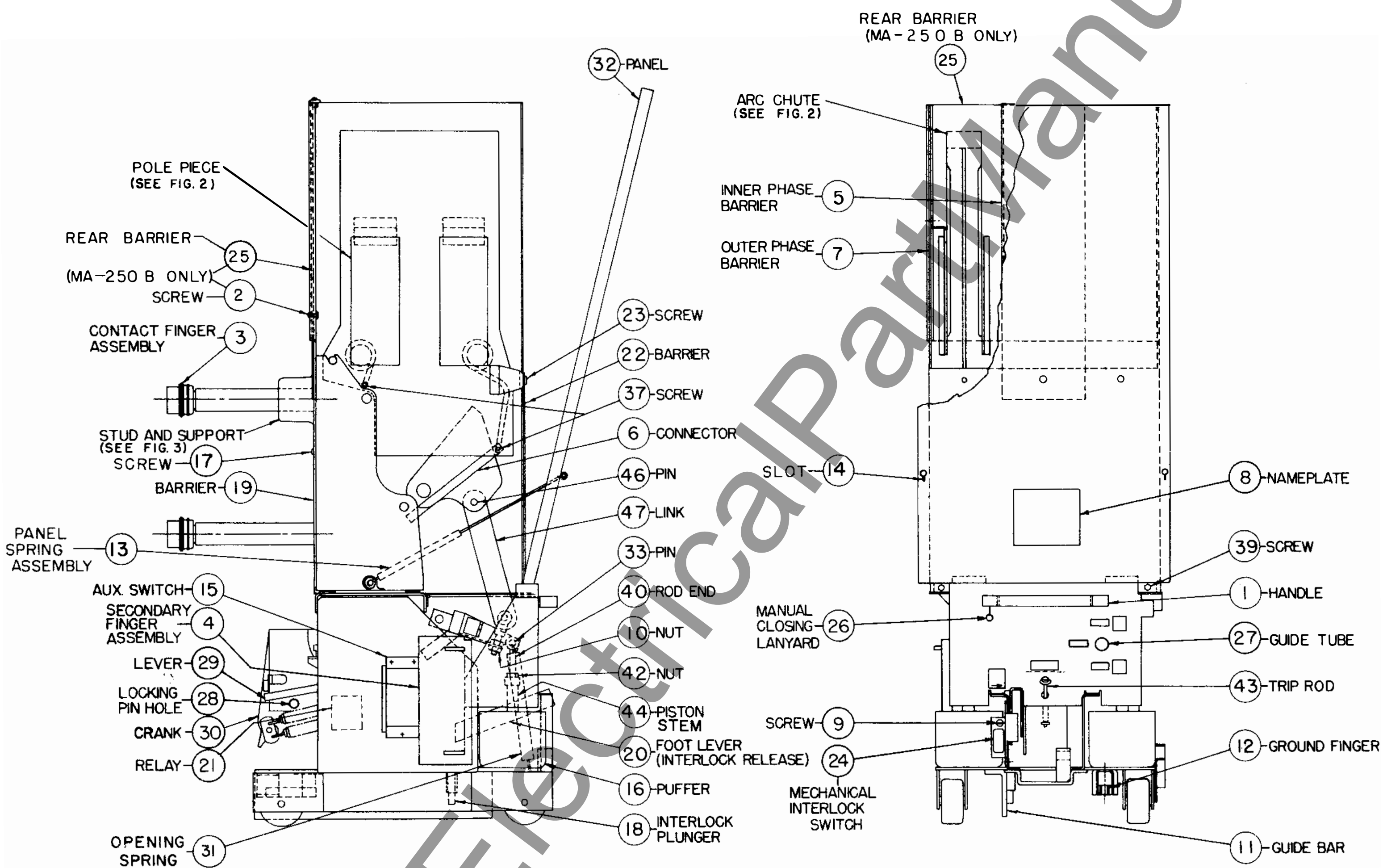
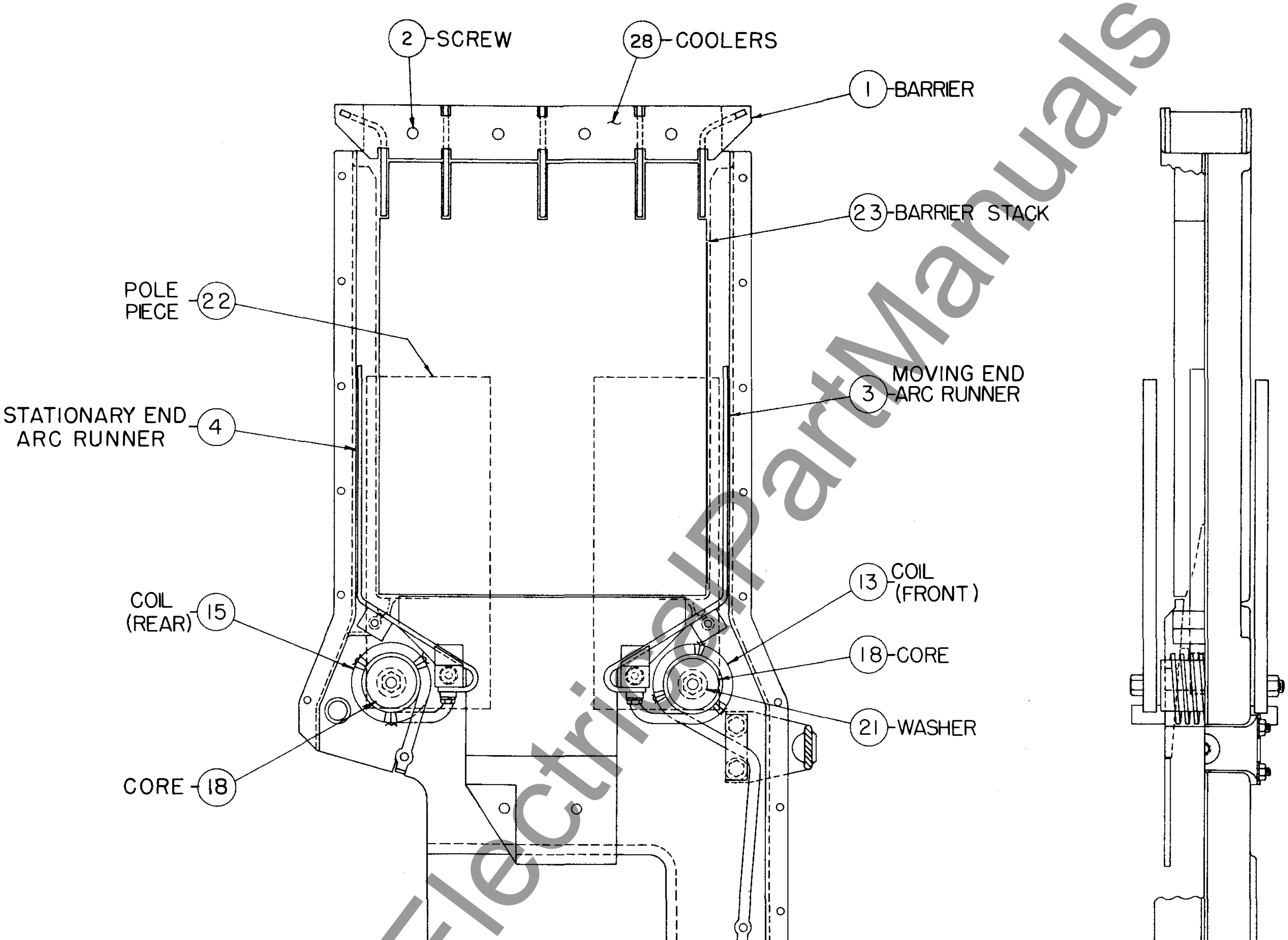


FIG. 1

TYPICAL MAGNETIC BREAKER

JULY 9, 1966 71-401-645-401



ALLIS-CHALMERS

FIG. 2

TYPICAL ARC CHUTE

JUNE 11, 1962 71-401-520-401

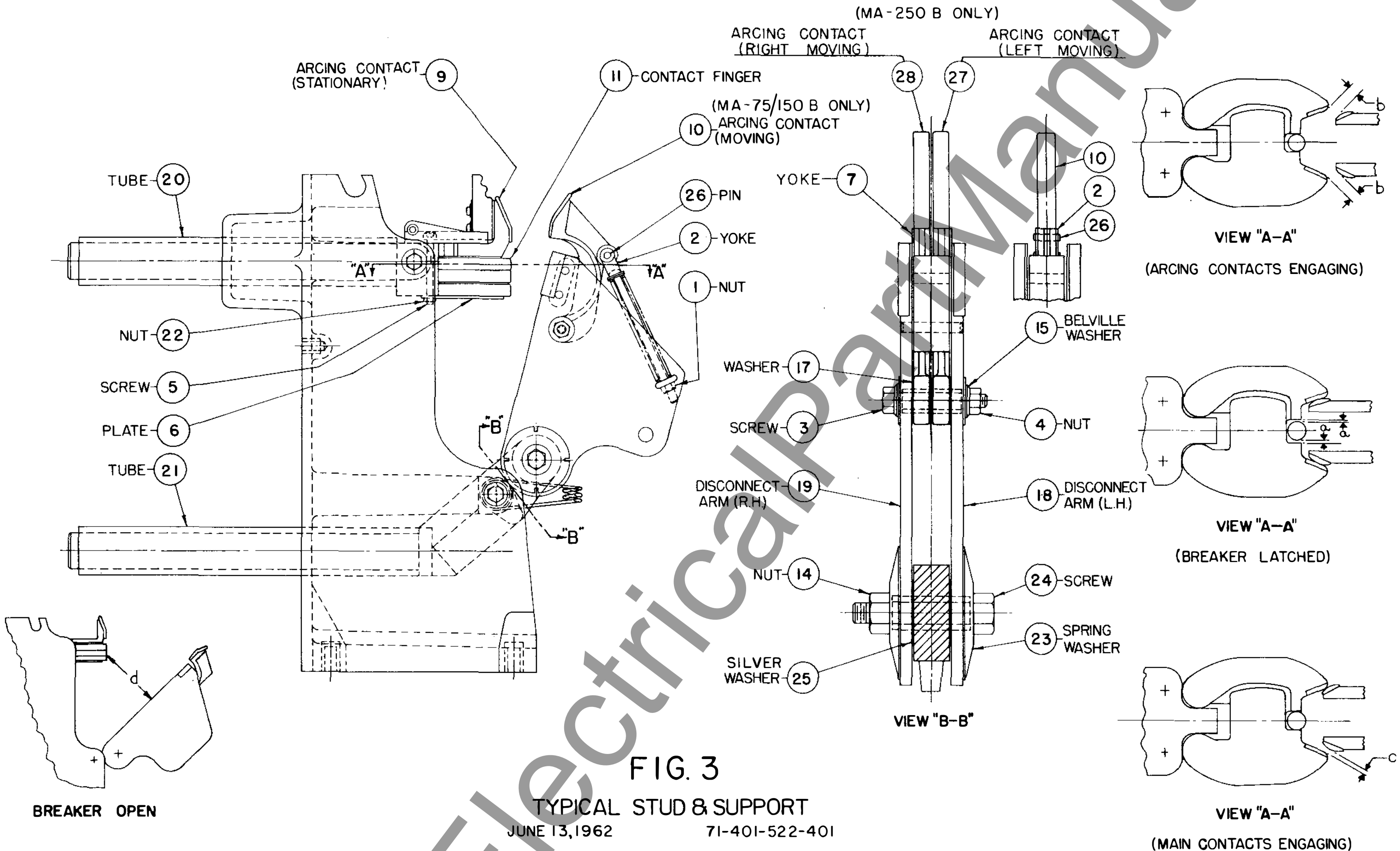


FIG. 3

TYPICAL STUD & SUPPORT

JUNE 13,1962   71-401-522-401

ALLIS-CHALMERS

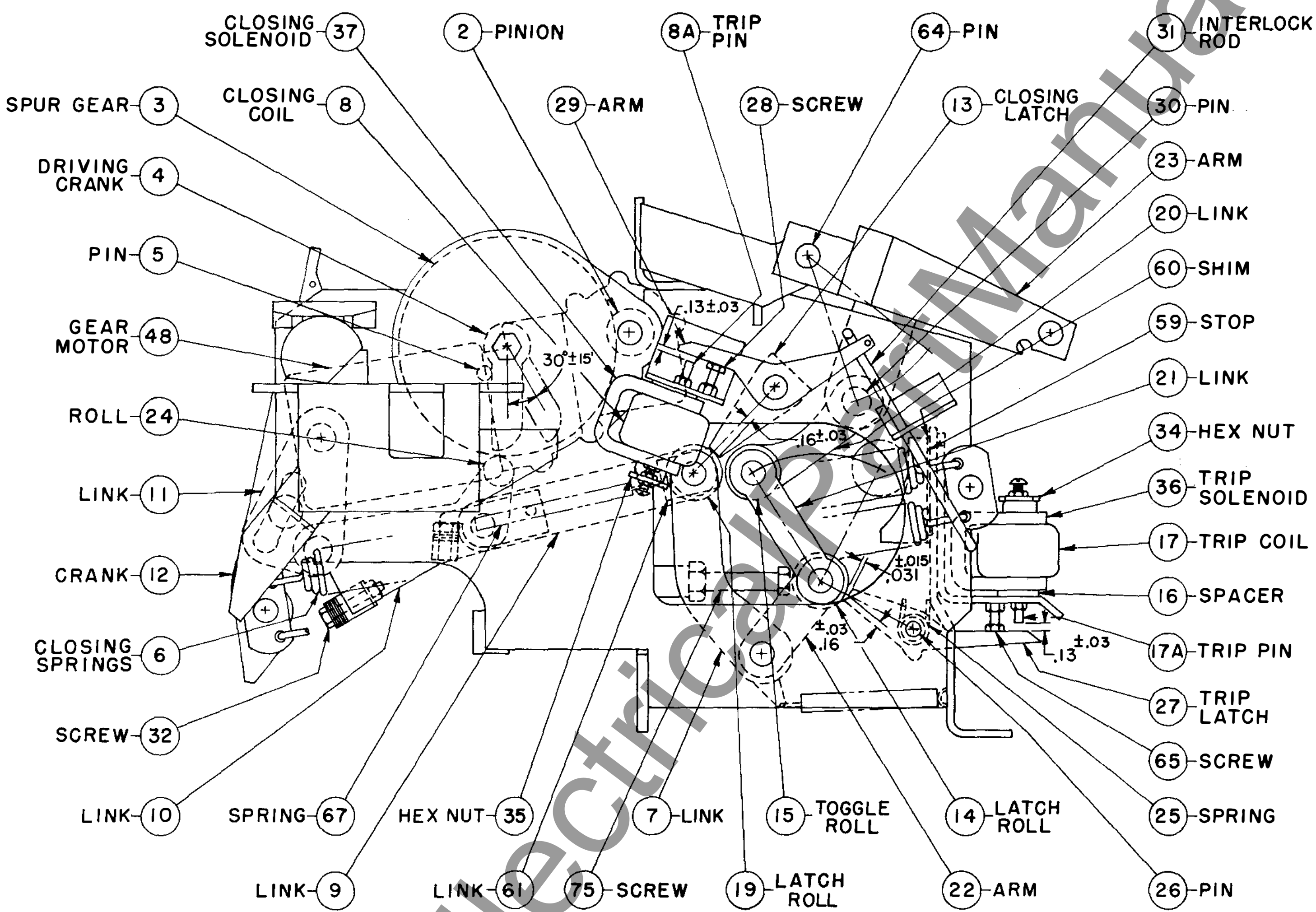


FIG. 4

SE-4, STORED ENERGY OPERATOR

MAY 19, 1966 72-320-030-401

ALLIS-CHALMERS

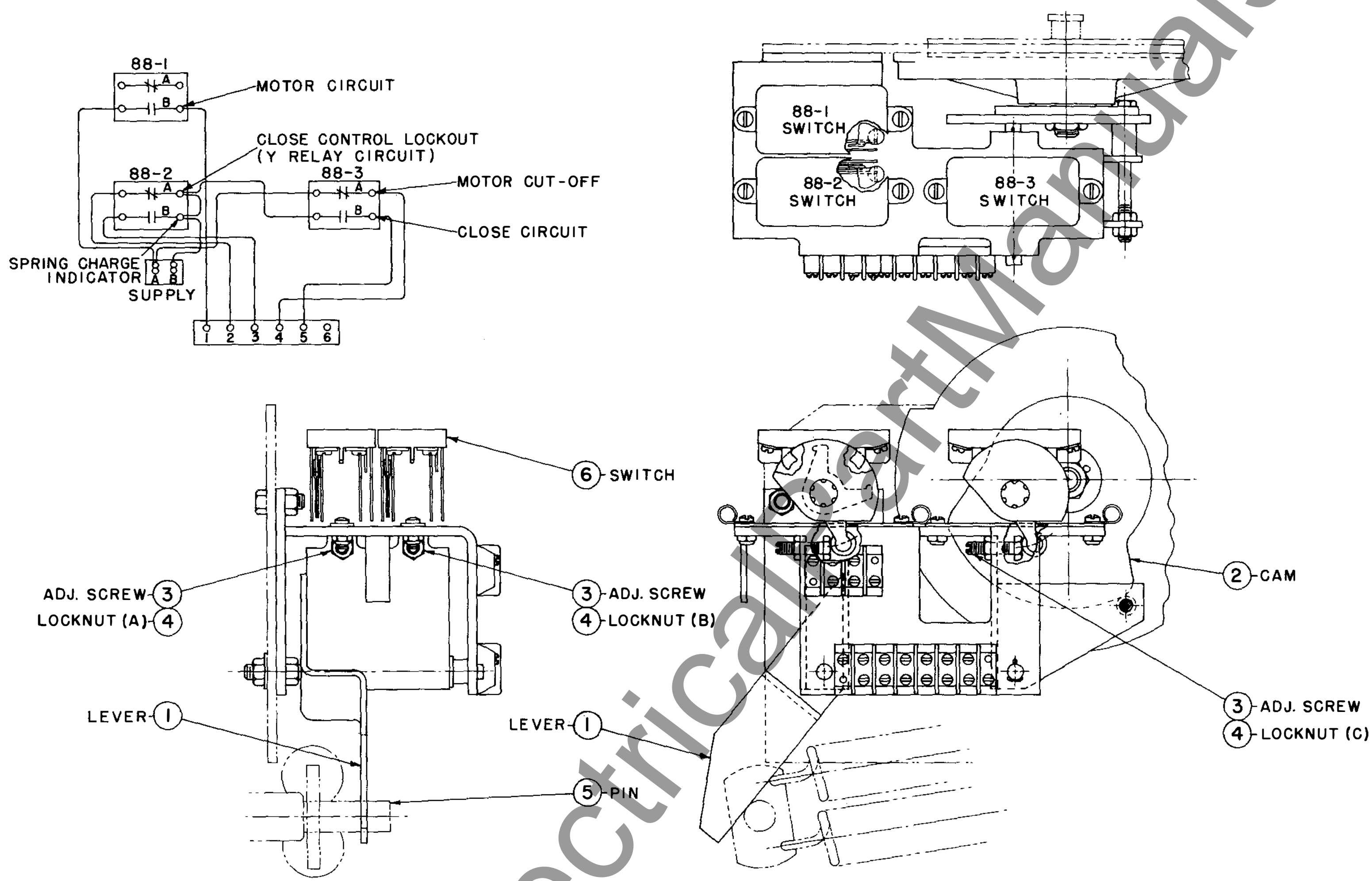


FIG. 8

TYPICAL CONTROL SWITCH

JULY 27, 1966 72-420-020-401

ALLIS-CHALMERS

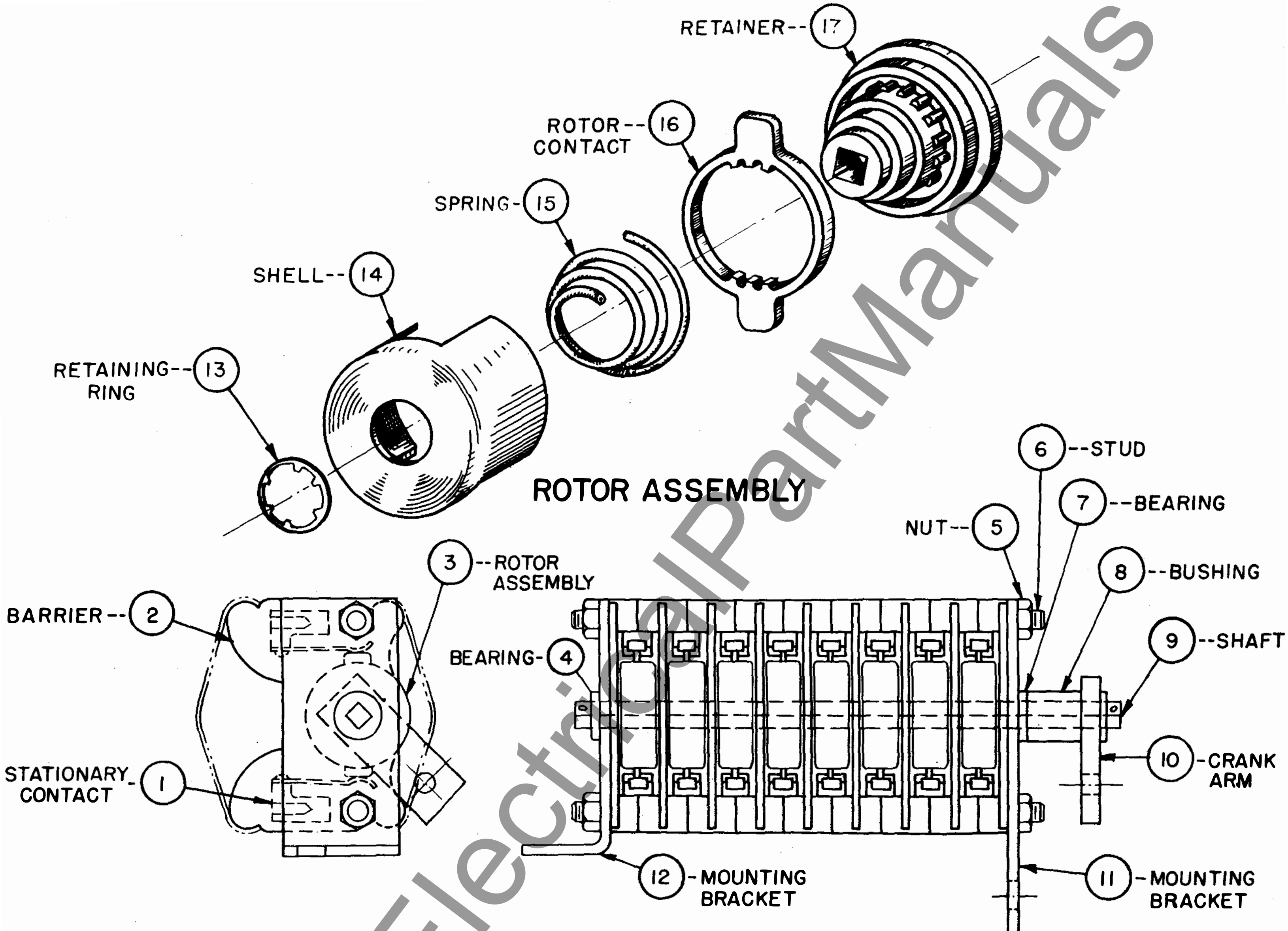
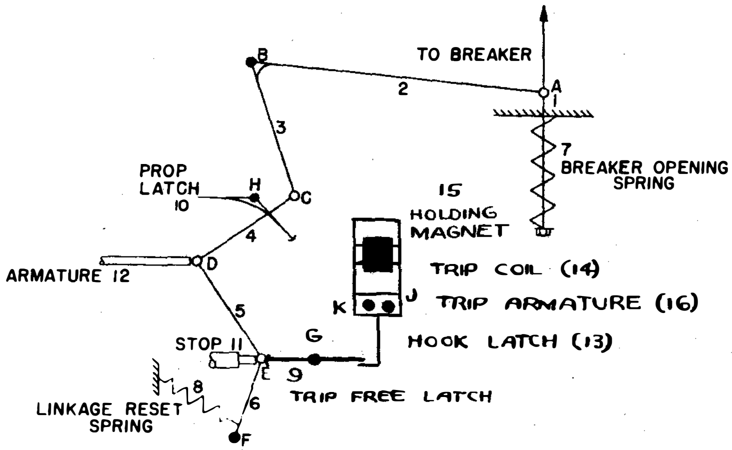


FIG. 11

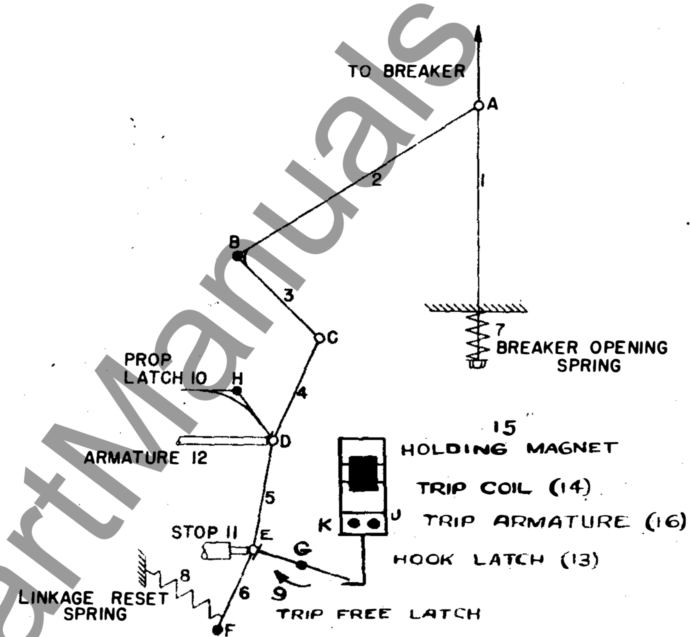
TYPICAL AUXILIARY SWITCH

JULY 16, 1958 71-301-758



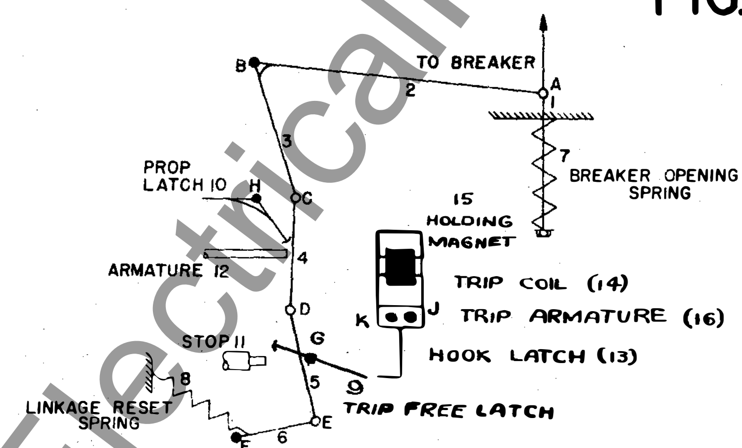
OPEN

FIG. 13



CLOSED

FIG. 14



TRIP FREE

FIG. 15

TYPICAL OPERATOR LINKAGE DIAGRAM

SEPTEMBER 9, 1953 71-400-246