

Type G-50

**Air
Circuit
Breakers**

**INSTRUCTION BOOK
and PARTS LIST**



ALLIS-CHALMERS

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1. General Information

A. INTRODUCTION TO ALLIS-CHALMERS EQUIPMENT

Type G-50 air circuit breakers constitute a line of low voltage air breakers which may be used in metal enclosed switchgear, in open type switchboards, or separately mounted in enclosed housings. The G-50 air circuit breaker has an interrupting capacity of 50,000 amperes and a maximum normal current rating of 1600 amperes at 600 volts, 60 cycles. For information on other frequencies consult factory. All G-50 breakers are completely assembled, tested and calibrated at the factory in a vertical position and must accordingly be mounted in a vertical position to operate properly. Customer's primary connections should be braced to prevent overstressing the breaker terminals.

B. WARRANTY

Allis-Chalmers G-50 air circuit breakers are warranted to be free of defects in material and workmanship for a period of one year after delivery to the original purchaser. This warranty is limited to the furnishing of any part which to our satisfaction has been proven defective. Allis-Chalmers will not in any case assume responsibility for allied equipment of any kind.

2. Receiving

A. UNLOADING

Each air circuit breaker is carefully inspected before leaving the factory. Breakers that are shipped separately are packed by men experienced in the proper handling and packing of electrical equipment. Breakers mounted in metal enclosed switchgear are usually shipped mounted in the circuit breaker compartments.

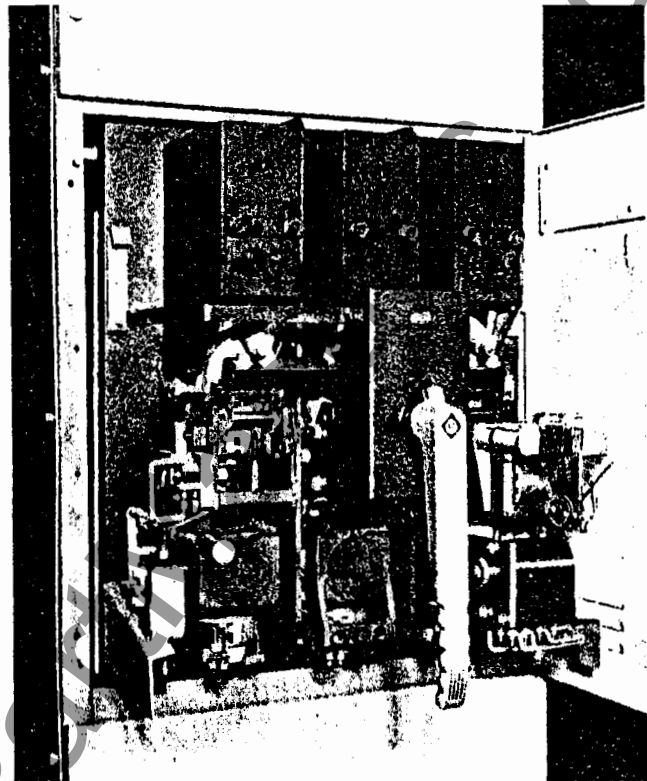
When unpacking crated breakers, boxing should be removed carefully to avoid bending, breaking or injuring of any parts. Check all parts with packing list. Clean all parts thoroughly and before disposing of packing box be sure all loose screws, bolts, nuts, etc. are removed. Keep instruction book and tags with the breaker.

INSPECTION FOR DAMAGE IN SHIPMENT

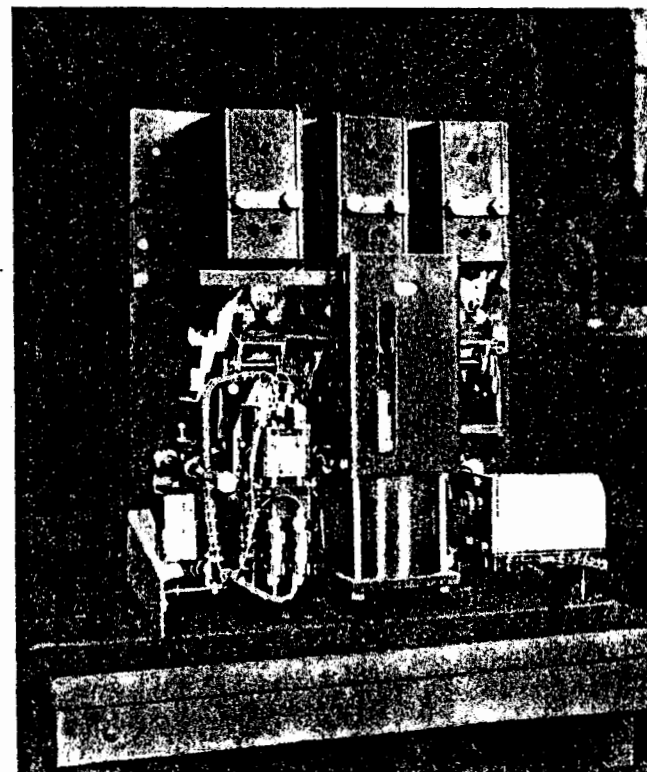
Carefully inspect the breaker for damage which might have been caused in shipment. If damage is found, claim should be made immediately with the carrier and Allis-Chalmers should be notified.

C. STORING

Where equipment is not to be put into immediate use, breakers should be carefully wrapped or covered so that they are protected from plaster and other dust particles. Abrasive dust in the breaker mechanism will eventually cause excessive friction and rapid wear. Breakers should not be exposed to the action of corrosive gasses and moisture. In high humidity areas, space heaters or the equivalent should be provided. G-50 air circuit breakers should be handled carefully at all times. Shock or jars in rough handling can cause serious damage.



MANUALLY OPERATED TYPE G-50 AIR CIRCUIT BREAKER with bell alarm, undervoltage attachment and capacitor trip.



ELECTRICALLY OPERATED G-50 AIR CIRCUIT BREAKER. Front view. Arcing contacts are in the open position.

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3. Installing

A. MOUNTING

The G-50 breaker is completely adjusted and checked at the factory and no additional adjustment should be necessary when installing.

Indoor circuit breakers should be installed in a clean, dry, well-ventilated place in which the atmosphere is free from

destructive acid or alkali fumes. Mount open type breaker high enough to prevent injury to the operator either from arcing or from moving parts during automatic opening of the breaker. Allow sufficient space so that breaker is accessible for cleaning and inspection. Also allow sufficient clearance to other apparatus above the breaker to prevent damage from arcing.

4. Operating

A. INSPECTION

1. General

Breaker should be given a final inspection before putting into service to see if any adjustments or connections have loosened in shipment or handling. Breaker should be installed in its compartment if it is the drawout type, or on its fixed mounting if it is the stationary type. Before installing a drawout type breaker, make certain that it is in the open position. This is good practice, even though standard switchgear is provided with mechanical interlocks which will automatically trip a closed breaker. After mounting a drawout type breaker it should be carefully racked into position by cranking the pantograph frame into its compartment. After either type of breaker is in position, manually close it cautiously to check if there is any damage to the mechanism or the contact arm. (CAUTION: Make sure circuit is not energized.) Breaker should close smoothly with increasing resistance until fully closed. In closing the manually operated breaker, the handle (see figure 1, item 20) is first turned counter clockwise as far as it will go to relatch mechanism and then it is rotated clockwise until the breaker closes. Handle is removed by pulling up on the pin assembly (Figure 1, Item 15) at the top of the handle and pulling the handle out. It may then be inserted at any of four angles most convenient for operator to close breaker.

When closing the electrically operated breaker manually, the emergency closing handle, one of which is provided with each installation, should be inserted through the slot on the bracket that holds the position indicator, and into the slot of the operating lever casting. This breaker is already in the relatch position due to the relatching spring in the solenoid. To close the breaker, push downward on this handle until breaker closes.

B. PANTOGRAPH AND INTERLOCK TRIP ADJUSTMENT FOR DRAWOUT TYPE BREAKERS

After the drawout type has been closed, the breaker should be racked out until the interlock trip device trips the breaker. Primary contact fingers on the back of the breaker should not be disconnected at this point. If contact fingers are disconnected, the proper adjustment has been lost and the trip cam in the bottom of the cubicle should be adjusted upwards. Rack breaker all the way in, then close and rack out until breaker trips. If contacts are still open, repeat adjustment upwards on trip cam until contact fingers maintain contact when breaker is thus tripped. If cam is adjusted too

high, it will not be possible to close breaker and cam may be lowered, keeping in mind that contact fingers must maintain contact when cam trips breaker. The cam is adjusted by loosening the lock nut under the round cam button and turning the threaded button up or down as required and then relocking.

C. MECHANISM ADJUSTMENT CHECK

The operating mechanism is factory adjusted and tested. Most of its pins are locked in place with dog point set screw. Some of those set screws are held in place with red glyptolacquer. If for any reason any of these set screws are loosened or removed, they should be reset with glyptolacquer or some similar material.

Following is a description of the possible adjustments of the mechanism. Item 10, Fig. 10A is an adjusting screw locked with a nut which limits the closing lever motion (Item 11) in the relatching operation. If this adjusting screw is set too short the mechanism over travels its relatch position and does not stay latched on the rebound. If the adjusting screw is set too long it will prevent the mechanism from relatching. The setting, however, is not too critical and can be easily adjusted.

D. CONTACT ARM ADJUSTMENT

To check the contact arm adjustment, first remove arc chute by loosening the two mounting bolts (Figure 1, Item 7) which are threaded into bolt inserts (Item 33) on panel approximately $\frac{5}{8}$ inches. It is not necessary to withdraw the mounting bolts from the arc chutes. After mounting bolts are disengaged from the bolt inserts, arc chutes may be pulled back being partially restrained by the flexible cable (Item 8) connected to the arc runner (Item 6). With arc chutes pulled back in this fashion, a view of the contact arms is possible. Cautiously start manual closing operation until arcing contacts (Figure 4, Items 2 and 14) just touch. In this position all three arcing contacts should be touching simultaneously. If this is not the case, adjustment has been lost and the arcing contacts should be realigned by adjusting the two jam nuts (Item 19) on the back of the contact arm in or out until all arcing contacts make contact with the stationary portion at approximately the same instant. (Check with .005" feeler). Caution: do not completely close breaker or use manual trip in this adjusting operation because the flexible cable (Item 8) is not in its proper position and may be seriously mutilated or possibly sheared off if caught between a moving part in the tripping operation. With the arcing contacts just touching, the tertiary or intermediate contacts (Fig. 4, Items 9 and 10) should be within $\frac{1}{8}$ " touching. To check use $\frac{1}{8}$ " thick feeler and if necessary

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adjust locknuts (Item 29) in or out until all three pole tertiary contacts are within $\frac{1}{8}$ " of touching. The main contacts (Fig. 4, Items 11 and 41) should be within $\frac{5}{32}$ inches of touching at the upper main contact. Use a $\frac{5}{32}$ inch feeler to check all main contacts and if necessary adjust elastic stop nut (Item 13) in or out until this spacing is maintained. This elastic stop nut should be set with glyptol lacquer or similar material after any adjustment. To further check sequence, continue to close breaker until tertiary contacts just touch. At this point main contacts should be within $\frac{1}{8}$ inches of being closed at the upper main contact. Cautiously allow contact arms to move back into the completely open position by letting the handle rotate counterclockwise. Arc chutes may now be reassembled by placing into position and engaging the mounting bolts with the bolt inserts. Care should be exercised in tightening mounting bolts by applying just slightly more pressure than obtained by hand pull up. After arc chutes are in place, start closing operation slowly to see that moving parts clear the arc chutes.

E. TRIP ARMATURE AND SUCTION CUP ASSEMBLY ADJUSTMENT AND CALIBRATION

Now check the series trip mechanisms. Release the cup (Fig. 6, Item 8) and armature (Item 2) by loosening the wing nut (Item 12). Swing wing nut out to allow cup holder (Item 13) to drop. Hold cup in position until cup holder is swung out of the way. Cup with armature in it will then slide out. Be careful not to drop or jar the cup and armature for the lapped surfaces of the oil sucker discs (Items 9 and 10) may be damaged.

Insert armature back into position aligning slot of armature with tongue projecting from upper cup housing (Item 4). See that armature moves up and down freely. Remove wax paper washer from cup and clean cup, armature, and

discs by washing with alcohol. Be sure all parts are dry and free from dust, lint and foreign particles. Fill cup (Item 8) with dashpot oil (18-682-504) to level indicated by groove (about $\frac{1}{4}$ " from bottom) inside of cup. Set armature carefully into cup and insert into position on the breaker. Bring cup holder and wing nut back into position to hold cup. Be sure that gasket (Item 5) is in position over the flange of the cup. Before tightening the wing nut, rotate cup so that the desired TTL (inverse time lag) marking on the cup is in line with the indicating pointer (Item 11); tighten wing nut. A bottle containing enough oil (18-140-204) for the first filling is attached to the breaker. Do not interchange parts of one series trip mechanism with that of another pole on breaker. The series trip device is calibrated at the factory with its individual pole piece and an interchange of parts may result in calibration errors.

F. TRIP BAR ADJUSTMENT

The trip bar consists of three bakelite pieces (Fig. 3, Item 7) interlocked so that a tripping action of any pole will always trip the center pole mechanism. Each end pole has an adjusting screw, (See Fig. 5, Item 3 for L.H. pole adjustment) to adjust the sensitivity of the tripping action. These adjusting screws are locked in place with a jam nut and are factory adjusted. When breaker is closed there should be a slight play in the trip bar on each end pole. If the play is too great the breaker may not trip out on low overcurrents. If the play is not sufficient the breaker may not latch in.

G. ENERGIZING BREAKER

The breaker is now ready to be energized. The drawout type may be cranked into position and the stationary type may be hung in its permanent position.

Once the breaker is energized it should not be touched, except for operating, because most parts are hot.

5. Maintenance

A. GENERAL

Occasional checking and cleaning of breaker will insure continuous satisfactory operation. If any oiling or greasing is done it should be done with care because excess oil and grease only tends to collect dirt which adheres to the breaker and may cause flashovers.

B. PERIODIC INSPECTION

A periodic inspection should be included in the breaker maintenance routine. An annual inspection is sufficient but in cases where unfavorable atmospheric or climatic conditions exist, more frequent inspections are recommended. Inspect complete breaker for foreign material, dirt, etc. Make certain that dashpot oil is clean and at the proper level.

C. MOVABLE ARCING CONTACT REPLACEMENT AND ADJUSTMENT

1. Replacement

Should replacement of arcing contact be necessary, remove cotter pin on side of pin (Fig. 4, Item 15) and remove pin. Loosen set screw (Item 7) and remove pin (Item 22). Swing arcing contact forward so that screws (Item 24) can be removed. Replacement is in reverse sequence of removal. Jam nuts (Item 19) are threaded in or out so that arcing contact makes at the same instant as those of the other two poles, and in proper relation to tertiary and main contacts.

2. Adjustment

See contact arm adjustment. The arcing contacts (Item 14) are factory adjusted to provide proper contact and sequence of operation. The arcing tips consist of a silver tungsten alloy to resist mechanical wear and arc erosion. With normal maintenance, tips should give long and satisfactory operation.

D. MOVABLE TERTIARY CONTACT REPLACEMENT AND ADJUSTMENT

1. Replacement

Should replacement of movable tertiary contact be necessary, remove jam nuts (Fig. 4, Item 29) and by using a wrench across the flats of the backing head of the contact tip the tertiary contact can be screwed out of the special nut (Item 26) and pulled out. If care is taken, all the remaining parts will remain in position, due to compression of spring (Item 28) and the replacement contact can be threaded back into position in reverse sequence of removal. The jam nuts are adjusted in or out so that the contact makes at the same instant as the other two poles and in proper relation to the arcing and main contacts.

2. Adjustment

See contact arm adjustment. The tertiary contacts (Item 10) are factory adjusted to provide proper contact pressure and sequence of operation. The con-

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tact tips consist of a silver, tungsten carbide alloy to resist mechanical wear and arc erosion and with normal maintenance should give long satisfactory operation.

E. MOVABLE MAIN CONTACT REPLACEMENT AND ADJUSTMENT

1. Replacement

In order to replace the movable main contacts it will be necessary to first remove the complete contact arm assembly (Fig. 4, Item 37). Contact arm assembly can be removed by loosening set screw (Item 38) and removing pin (Item 39). Then loosen set screw (Item 30) and remove eccentric pin (Item 31). Disconnect the flexible connector (Item 33) by removing the hexagon head screws (Item 36). Disconnect the two springs (Fig. 1, Item 19). The contact arm assembly is now free and can be separated from the breaker assembly.

The movable main contacts can now be removed from the contact arm assembly by removing hexagon elastic stop nuts (Fig. 4, Item 13) by using a socket wrench.

Replacement is in reverse sequence of dismantling.

When new main contacts are placed on the contact arm assembly customer must provide means of overcoming spring compression so that elastic stop nuts (Item 13) can be started on studs. After complete reassembly the elastic stop nut is adjusted in or out so that contacts will make at the same instant all remaining main contacts on breaker make and in correct relation to the tertiary and the arcing contacts of its pole.

2. Adjustment

See contact arm adjustment. The movable main contacts (Fig. 4, Item 11) are factory adjusted to provide proper contact pressure and sequence of operation. The contact tips consist of a silver nickel alloy to insure good conductivity and with normal maintenance should give long and satisfactory operation.

F. REPLACEMENT OF STATIONARY ARCING CONTACT

Should replacement of a stationary arcing contact (Fig. 4, Item 2) be necessary, remove the arc chute and unscrew two hexagon bolts (Fig. 4, Item 3) which secure it to the top terminal (Fig. 4, Item 5). Arcing contact is now free for replacement.

G. REPLACEMENT OF STATIONARY TERTIARY CONTACT

Should replacement of a stationary tertiary contact (Fig. 4, Item 9) be necessary, merely bend down corners of locking strip (Item 40, front side of panel). Then, by using a wrench across the flats of the backing head of the contact tip, the stationary tertiary contact (Fig. 4, Item 9) can be screwed out from the top terminal (Fig. 4, Item 5).

H. SERIES TRIP ARMATURE AND SUCTION CUP ASSEMBLY

The inverse time series overcurrent trip consists of a trip armature and suction cup assembly. The suction cup assembly provides for adjustment for the inverse time delay and is of the oil film sucker type. Figure 6 shows the arrangement of the parts and Figure 9 gives the characteristic time delay curves.

Before the breaker leaves the factory the series trip device is adjusted for 100 percent load and 100 percent inverse time lag. At this setting the breaker will just trip at about 100

percent load if there is no oil in the cup. With oil (18-140-204) in the cup to the indicated level (groove side of cup), the breaker will follow approximately 100 percent load, 100 percent inverse time lag (I.T.L.) shown on Figure 9. The I.T.L. setting can be changed by loosening the thumb screw (Fig. 6, Item 12) and turning the cup (Item 8) to the desired I.T.L. value indicated by the pointer (Item 11) which lines up with percentage markings on the cup. The thumb screw then be tightened, clamping cup into this position.

To adjust the load setting, loosen knob (Item 1) and rotate lower cup housing (Item 7) until the desired setting, as shown on the calibration label (Item 15) up with the pointer (Item 6). Tighten knob to clamp cup housing into position (a serrated washer locks the housing into position).

Any value of the current 10 to 12 times normal causes practically instantaneous tripping.

The oil in the cups of the I.T.L. attachment should be renewed with clean dashpot oil (18-140-204) at least a year (Often if dusty conditions prevail). When changing dashpot oil, the cup and discs should be washed with alcohol. When replacing lower disc, (Item 10) make sure the vellumoid washer is in place. The proper function of this device depends on the sealing of the lapped surface of the discs (Item 9 and 10). Therefore, these parts must be kept free of lint, dust and other foreign particles.

Be sure to replace all parts to the original pole for they were factory calibrated. An interchange of parts from one pole to another will cause calibration errors.

When required, an instantaneous trip armature is available. This armature may be substituted for the standard inverse time armature (Fig. 6, Item 2). The instantaneous armature trips the breaker at its particular setting without any time delay.

When required, a definite time delay armature is available. This armature may be substituted for the standard inverse time armature (Fig. 6, Item 2). The definite time delay armature gives inverse tripping time up to and below 200 and 300% of normal operating current and a time delay above the 200 or 300% current value.

I. REPLACEMENT OF FLEXIBLE CONNECTOR

Should replacement of connector assembly (Fig. 4, Item 33) be necessary, bend down corner of locking strip (Item 40) so that hex. half head screw (Item 23) can be removed through hole in back of contact arm assembly (Item 37). Remove tertiary contact (Item 10) as per instructions for removal of movable tertiary contact, then pivoting arcing contact (Item 14) on pin (Item 15) so that screws (Item 24) are exposed for removal, remove screws and pull out connector assembly. Replacement is made in exact reverse sequence of removal.

J. CONTROL EQUIPMENT

The control equipment on the type G-50 electrically actuated breaker is selected to give the most satisfactory operation with the least amount of maintenance and is designed so that necessary servicing is accomplished with minimum interruption.

K. MANUAL OPERATING MECHANISM

The manual operating mechanism is factory adjusted and designed to require very little maintenance outside of periodic cleaning. Refer to Fig. 10 for its function.

Starting with the breaker in the open or tripped position see Fig. 10B, the operating handle is rotated counter-clockwise to re-latch the breaker. As the handle is rotated clockwise at the end of the handle shaft racks the gear sector (Item 9) upwards carrying with it the closing lever

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Item 11) which pivots on pin (Item 32). This brings the roller assembly (Item 13), mounted at the other end of the closing lever on pin (Item 14), forward so as to engage the operating latch assembly (Item 12). As the operating latch assembly drops behind the roller, it allows the trip latch (Item 18) to pivot clockwise on pin (Item 17) raising its back end and allowing trip finger (Item 27) to pivot on its bearing and pin (Item 26) and latch the trip latch. Thus the closing lever latches the operating latch, the trip finger latches the trip latch so the breaker is ready for closing.

In closing, the handle is turned clockwise causing the closing lever to rotate clockwise about its pin forcing the operating latch assembly to pivot about its floating center, which is now held fixed by the gooseneck of the trip latch. As operating latch pivots, pin (Item 4) tying the operating latch, the operating link (Item 3), and operating bracket (Item 6), together moves upward pushing the contact arm forward against the resistance of two springs (Item 30) and later against the resistance of the contact springs. As the closing lever (Item 11) reaches its extreme position, the closing latch (Item 15) snaps in position under the two rollers assembled on the outer ends of pin (Item 16). Pressure is maintained on the closing latch by spring (Item 19), latching the breaker in the closed position.

The tripping action is as follows: An impulse is given to the trip bar by one of the tripping devices -- series trip, manual trip, or any other. This impulse is transmitted to the trip finger (Item 27), which is fastened to the center section of the trip bar forcing the trip finger out from under the trip latch roller. The trip latch, having been released, is forced to pivot counter-clockwise about its pin by a component of the total spring force acting on the contact arm. The motion of the trip latch releases the floating center of the operating latch, allowing this latch to pivot about pin (Item 4) and roll off the closing latch and over, under the influence of the spring forces. The mechanism collapses back into the open position due to the spring-forces reacting on the contact arm. As the operating bracket (Item 6) pivots on its fixed center, a projection on it forces the closing latch down readying the breaker for relatching.

L. ELECTRICAL OPERATING MECHANISM

The operating mechanism of the electrically operated breaker is identical to that of the manually operated breaker, except that a D.C. solenoid is added. It can be operated from a battery or from any other D.C. supply. (See Fig. 8 for control scheme). The solenoid armature is hooked to the breaker mechanism through an insulating link (Fig. 2, Item 10). The armature is connected to the link by an eccentric pin (Fig. 2, Item 12) locked in place by a set screw (Item 11), which is set with red glyptol lacquer. The eccentric pin makes it possible to adjust the armature stroke slightly by loosening set screw (Item 11) and turning the eccentric pin which will raise or lower the armature. This changes the gap length at the end of the armature stroke. The mechanism is properly adjusted at the factory, but if field adjustment is found necessary be sure in locking the eccentric pin that the dog

point of the set screw engages one of the holes in the head of the pin. Also, be sure there is a slight air gap left at the end of the piston stroke. The air gap should be at a minimum without the piston striking bottom clamp.

Where D.C. current is not available, the breaker may be operated from an alternating current supply by adding a rectifier (Fig. 2, Item 17), an aging resistor (Item 19), and by substituting A.C. relays in place of D.C. relays. The rectifier is of the copper oxide type and has an aging characteristic which must be compensated for after it has been used for a short period. This can be done by moving the adjusting slide so as to cut out some ohmage from the aging resistor.

M. RELAYS

The relays consist of an X-control relay and a Y cutoff relay. The coils of the closing solenoid and the X-relay are designed for intermittent duty and must be de-energized as soon as the breaker is closed. This is done through the Y-cutoff relay which interrupts the X-relay circuit as soon as it gets energized and its normally closed contacts open up. Thus the solenoid coil becomes de-energized as soon as the X-relay contacts open up and remains de-energized even though the control switch may be held in the closed position. This prevents what is commonly called "pumping" of the breaker.

N. AUXILIARY SWITCHES

The auxiliary switch for the type G-50 breaker is of the rotary type and of sturdy construction. It is link connected (Fig. 1, Item 22) to operate with the breaker contacts, and it follows their position. "A" switches are closed when breaker contacts are closed and "b" switches are closed when breaker contacts are open. Auxiliary switch contacts are factory set for "a" and "b" position and designed so as to require very little maintenance. A moulded bakelite cover can be easily removed for contact inspection. The "a" and "b" positions can be interchanged in the field if desired by reassembling the rotor element.

In addition to the "a" and "b" auxiliary switches, an "aa" auxiliary switch is furnished with each electrically operated breaker. This switch follows the operating mechanisms; switch is closed when mechanism is in the energized position and open when mechanism is in de-energized or open position. The function of this switch is to make the Y relay circuit just as the mechanism is about to close and thus initiate the de-energization of the X-relay and then of the closing coil at the proper time.

O. SHUNT TRIP ATTACHMENT

The shunt trip attachment (Fig. 1, Item 23) is used to trip breaker electrically from a remote point by closing its circuit either manually, through a control switch, or automatically through relay contacts. Since the shunt trip coil is designed for a momentary duty cycle, an "a" auxiliary switch is used to interrupt its circuit immediately after the breaker is tripped. Fig. 8 shows a control scheme for this shunt trip attachment.

6. Special Accessories

Special conditions of circuit breaker application require attachments of both standard and special types. These attachments are listed in the following pages and are optional, depending on customer's requirements.

A. UNDERVOLTAGE TRIP ATTACHMENT

The undervoltage trip attachment (Fig. 7) is a device which

trips the breaker when the applied voltage drops below a predetermined value. With an undervoltage attachment the breaker has a positive means of tripping in the event of operating voltage failure. The energy for tripping the breaker is supplied by a preloaded spring (Item 16) which receives a slight additional loading as the armature (Item 7) picks up. The device is connected across the line through a

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step down transformer (Item 2) and a rectifier (Item 3). In the de-energized position, switch (Item 6) is closed allowing full voltage to be applied to the coil (Item 5) as soon as the line is energized. This causes armature (Item 7) to pick up. As the armature picks up, the switch (Item 6) opens shunting voltage through resistor (Item 4) which reduces the voltage applied to the coil (Item 5). This device will pick up if line voltage is 80% of normal voltage or above and will drop out if line voltage drops below a predetermined value (between 30 to 60% of normal line voltage). As armature (Item 7) drops, pivoting on pin (Item 11), adjusting screw (Item 13) pushes up on trip pin (Item 15), which in turn pushes the trip bar of the breaker up tripping the breaker. If line voltage is below 80% of normal the armature will not pick up, and the breaker being in the trip free position, cannot be closed.

To adjust the drop out value of this device (between 30 to 60% of line voltage), increase or decrease the tension on spring (Item 16) through set screw (Item 17). Increase tension for a drop out at a lower percentage of line voltage and decrease tension for a drop out at higher percentage of line voltage. One has to keep in mind however, that any adjustment on the tension of the spring affects the pick up value of the device. This can be compensated for through adjusting the value of the resistor (Item 4) by moving its slide to increase or decrease the resistance as the case requires. Set screw (Item 8) controls the distance of the drop out and may also help in compensating for spring tension adjustment. Be sure lock-nuts (Item 9, 13 and 18) are securely tight after adjustment has been made.

Rectifier (Item 3) is subject to aging and may therefore, have more resistance after aging. To compensate for this, the transformer (Item 2) may have the secondary leads re-connected so that the red-yellow (red-yellow stays per-

manently connected) and the red leads are connected to undervoltage device.

B. BELL ALARM AND ELECTRICAL LOCKOUT SWITCH

The bell alarm and electrical lockout switch (See Fig. 1) is connected so that it closes a circuit to a bell (or other signalling device) upon automatic opening of the circuit breaker. It may also open the circuit controlling the closing solenoid on an automatic opening of the breaker so that closing circuit cannot be energized until this switch is closed.

The function of the device is as follows: When used for alarm duty the switch is wired normally open. Any automatic tripping of the breaker will close the switch by operating cam pushing down a follower which operates switch, closing the alarm circuit. When breaker is manually tripped, the tripping action forces the follower over so it does not operate the switch. When used for an electrical lockout, the switch is wired normally closed and any automatic tripping opens the circuit to the closing solenoid.

To shut off the alarm, or to reset the lockout, the reset button must be pushed in the same as if to trip the breaker manually. Thus the breaker is reset for the next closing operation.

C. DOOR INTERLOCK

When specified, a door interlock is available as protection against opening the enclosure door of an energized breaker. This device consists of an interlock latch attached to the trip bar of the breaker and a door interlock fastened to the inside of the enclosure door. As the breaker closes, the latch moves to engage the door interlock, thus automatically locking the door. When the breaker is opened, the latch of the door interlock automatically disengage, allowing the enclosure door to be opened.

7. Recommended Service Parts

Fig. No.	Item No.	Part	Drwg. No.	Quan. for 1 Brkr.	Quan. for 6 Brkr.	Quan. for 12 or more Brkr.
1	3	Arc Chute Assembly	18-339-877	1	2	4
1	7	Mounting Bolt Assembly	18-140-048	3	9	12
4	14	Arcing Contact (Movable)	18-242-025	3	9	12
4	2	Stationary Arcing Contact Assembly	18-242-029	1	2	4
4	10	Tertiary Contact Assem. Part 1 Movable	18-140-094	1	2	4
4	9	Tertiary Contact Assem. Part 2 Stationary	18-140-094	1	2	4
4	11	Main Contact Block	18-242-028	2	4	6
4	20	Guide Pin (For Arc. Contact)	18-140-058	2	4	6
4	12	Guide Pin (For Main Contact)	18-140-081	2	4	6
4	8	Connector Assembly	18-146-807	3	6	9
4	37	Contact Arm Assembly	18-439-703	—	1	2
10	5	Bumper Pad	18-140-303	6	12	18
6	14	Knob Assembly	18-140-528	—	1	2
4	16	Spring Shield	18-142-735	1	2	3
10	30	Extension Spring	18-140-145	—	1	2
10	19	Extension Spring	18-140-154	—	1	2
4	32	Spring Part 11	18-633-502	4	8	12
4	17	Spring Part 12	18-633-502	2	4	6
4	28	Spring Part 13	18-633-502	1	2	3
		Dash Pot Oil (Spec. 18-682-504)	18-140-204	1 pint	1 pint	2 pints
1	32	Contact Finger Assembly (Secondary)	18-214-486	—	—	1
1	27	Contact Finger Assembly Primary Disconnect 600 A. Pt. 1	18-337-177	—	—	*6 for rating below 600 A
1	26	Contact Finger Assembly Primary Disconnect 1200 A.	18-377-177	—	—	*6 for rating above 600 A
5	10	Trip Coil (When shunt trip is specified) Specify Control Voltage	18-341-280	1	1	1
		Closing Coil (When electrical closing is specified)	18-683-476	—	—	1

*For breakers rated 1600 A. it is recommended that both sizes of contact fingers (Primary disconnect) be carried as spare parts.

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- | | | |
|--|------------------------------|--|
| 1 Panel | 15 Pin Assembly | 26 Contact Fingers |
| 2 Arc Barrier | 16 Adjusting Screw | 27 Contact Fingers |
| 3 Arc Chute | 17 Operating Lever | 28 Pin |
| 4 Movable Contact Assembly | 18 Pin | 29 Dowel |
| 5 1/4 - 20 x 7/8" Long Fillister
Head Cap Screw | 19 Spring | 30 Main Contact and Overload Coil Assembly |
| 6 Arc Runner | 20 Handle | 31 Stationary Contact Assembly |
| 7 Mounting Bolt Assembly | 21 Manual Trip Assembly | 32 Secondary Contact Fingers |
| 8 Flexible Cable | 22 Auxiliary Switch Assembly | 33 Bolt Insert |
| 9 Eccentric Pin | 23 Shunt Trip Assembly | 34 1/4 - 20 x 2 1/2" Long. Fillister Hd. Machine Screw |
| 10 Tie Bar | 24 Bracket | 35 Lifting Bracket |
| 11 Position Indicator | 25 Interlock Trip Assembly | |
| 12 Bevel Gear | | |
| 13 Bearing Bracket | | |
| 14 Pinion | | |

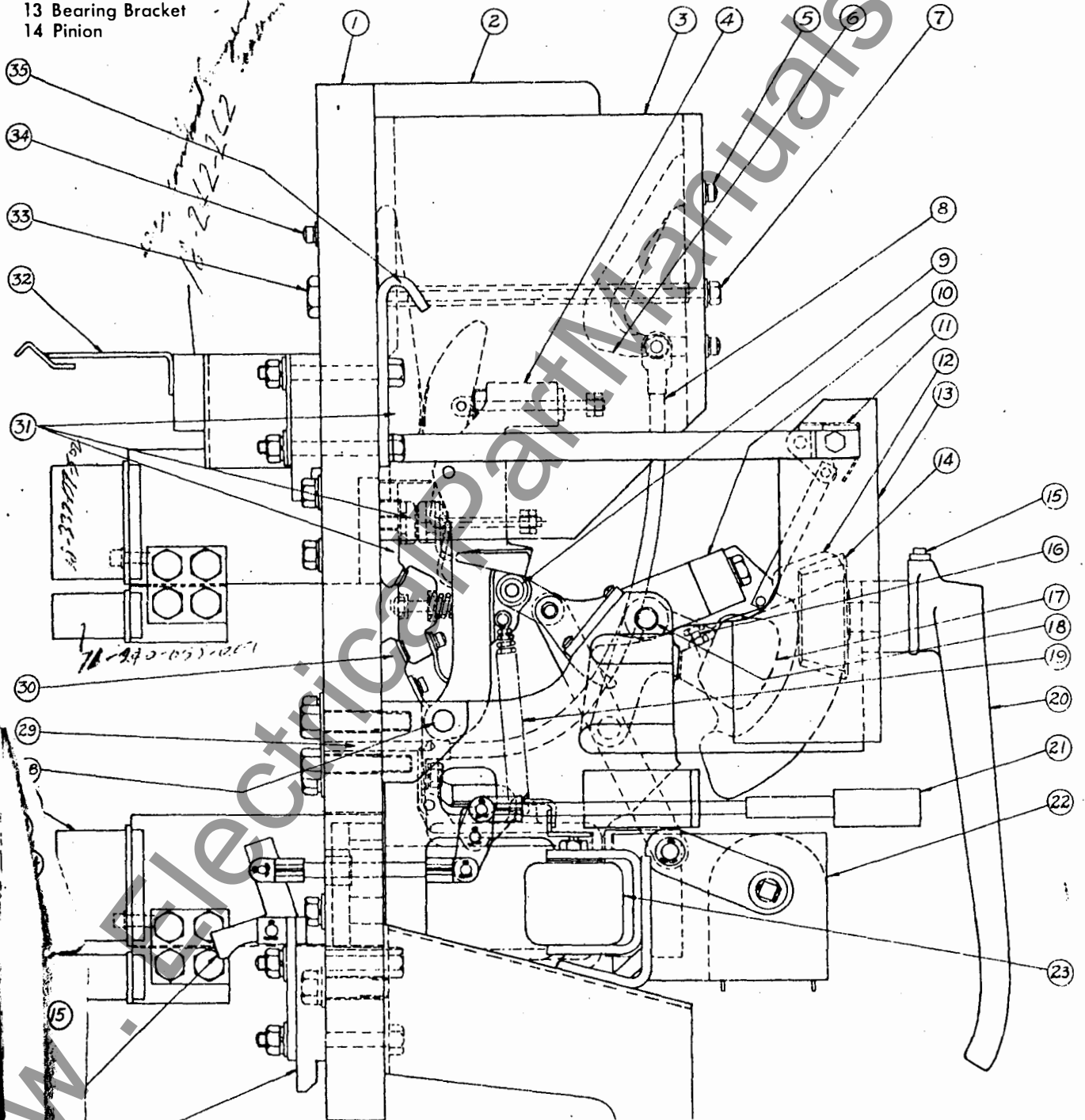


Fig. 1
Manually Operated
AIR CIRCUIT BREAKER

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- 1 "b-b" Stationary Contact
- 2 Indicator Bracket
- 3 Closing Lever
- 4 Auxiliary Equip. Mounting Plate
- 5 "b-b" Movable Contact
- 6 Set Screw
- 7 Pin
- 8 "a-a" Movable Contact
- 9 "a-a" Stationary Contact
- 10 Insulating Link

- 11 Set Screw
- 12 Eccentric Pin
- 13 Insulating Spacer
- 14 Solenoid
- 15 Insulating Spacer
- 16 Rectifier Connecting Bars
- 17 Rectifier for a-c Control Voltage
- 18 Secondary Contact Fingers
- 19 Rectifier Aging Resistor

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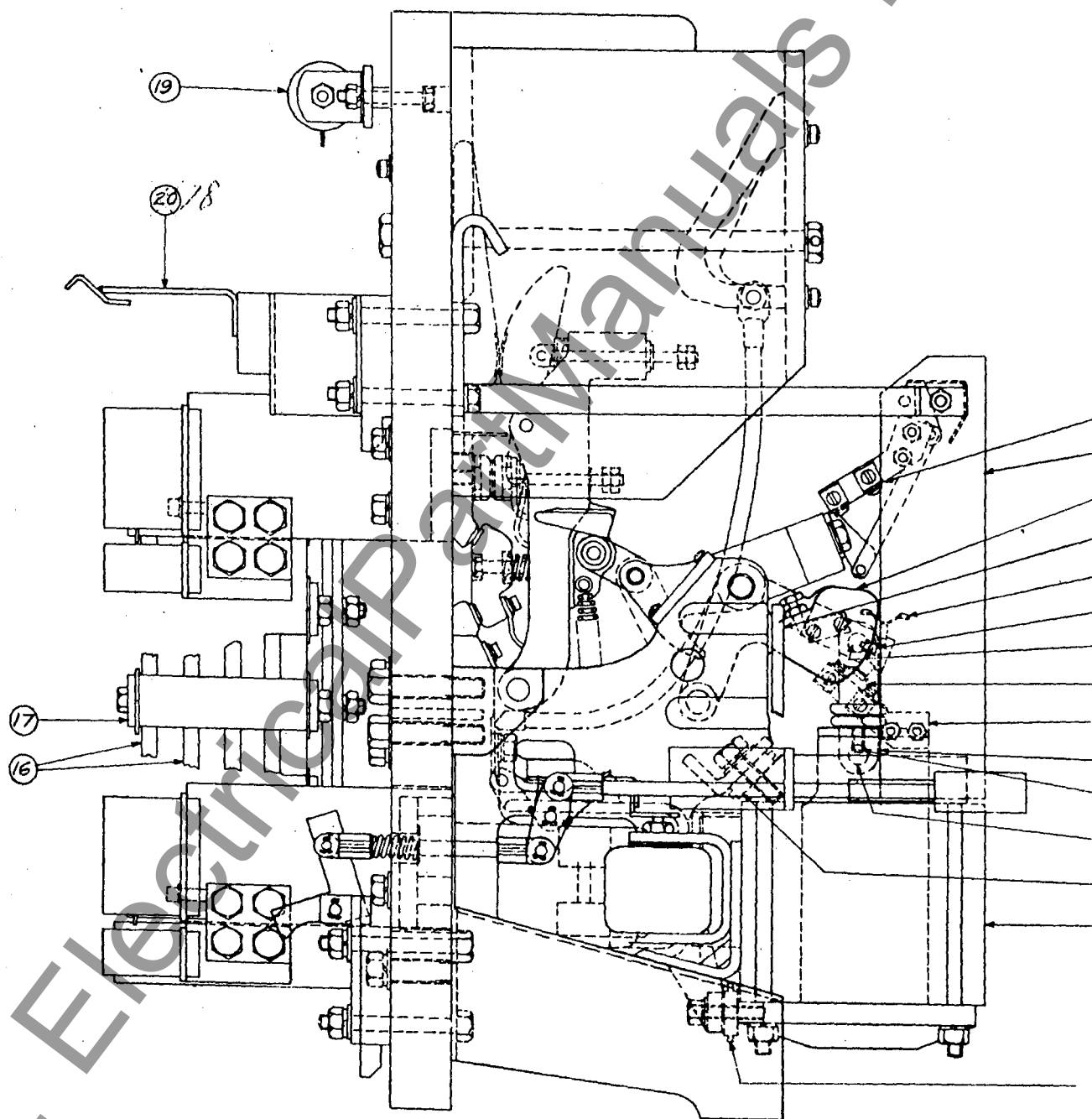


Fig. 2

Electrically Operated

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- | | |
|---------------------------------|----------------------------|
| 1 Barriers | 8 Auxiliary Switch |
| 2 Lifting Bracket | 9 Brace |
| 3 Window for Position Indicator | 10 Closing Handle |
| 4 Tie Bar | 11 Brace |
| 5 Rating Label | 12 Shunt Trip |
| 6 Auxiliary Switch Linkage | 13 Manual Trip Push Button |
| 7 Trip Bar Assembly | |

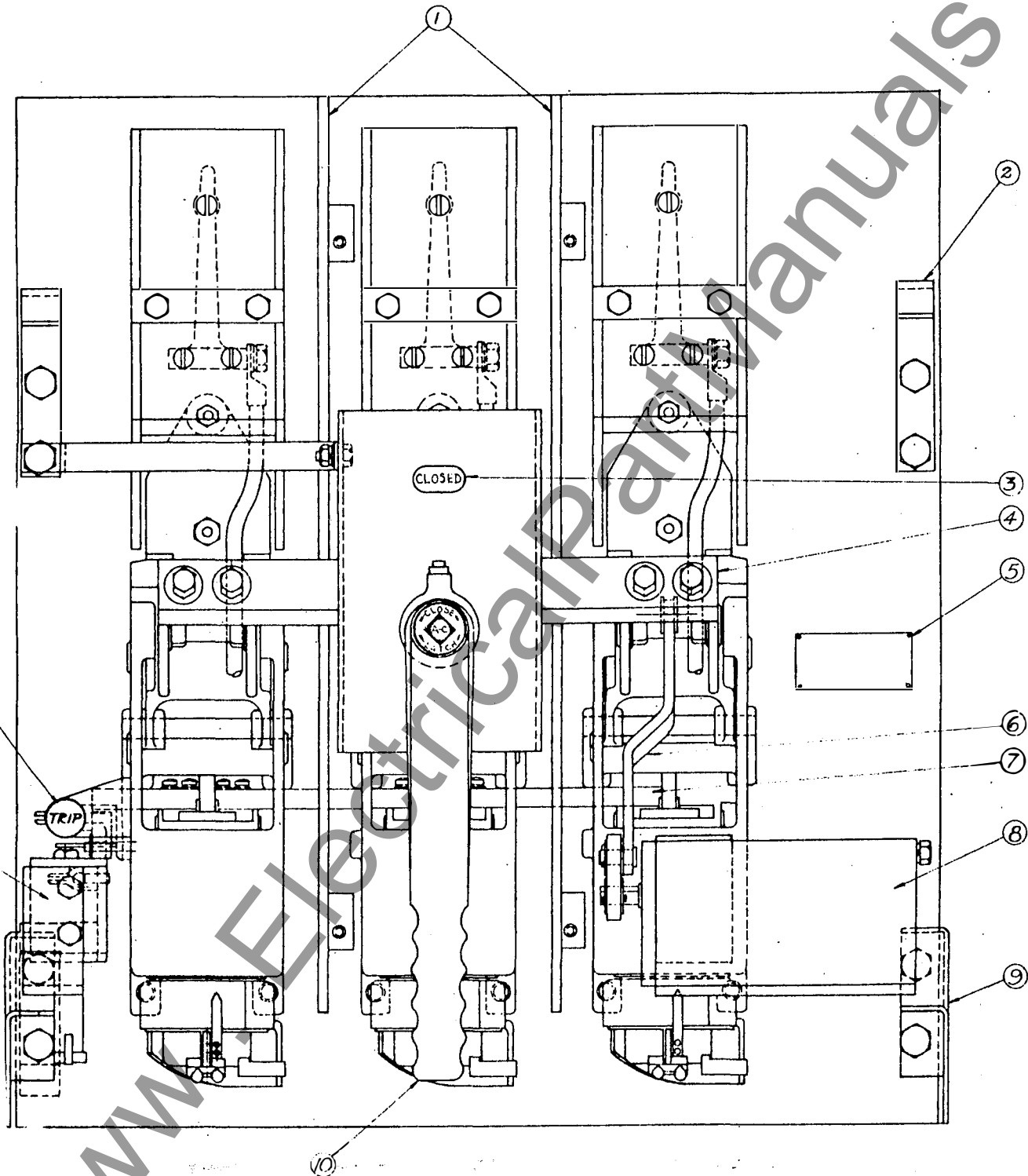


Fig. 3
Front View

17
16

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- Q0088-15
- 1 Panel
 - 2 Stationary Arcing Contact Assembly
 - 3 $\frac{1}{4}$ - 20 x 2 $\frac{1}{4}$ " Lg. Hex. Head Cap Screw
 - 4 No. 10 - 24 x 1" Long Fil. Head Machine Screw
 - 5 Upper Stationary Contact Assembly
 - 6 Arc Barrier
 - 7 Set Screw
 - 8 Connector Assembly
 - 9 Tertiary Contact
 - 10 Tertiary Contact
 - 11 Main Contact Block
 - 12 Guide Pin
 - 13 $\frac{1}{4}$ - 28 Hex. Elastic Stop Nut
 - 14 Movable Arcing Contact

- 15 Pin
- 16 Spring Shield
- 17 Spring
- 18 Shock Washer
- 19 $\frac{1}{4}$ - 20 Jam Nut
- 20 Guide Pin
- 21 Locking Strip
- 22 Pin
- 23 $\frac{3}{8}$ - 16 x $\frac{1}{2}$ " Long Hex. Half Head Cap Screw
- 24 $\frac{1}{4}$ - 20 x $\frac{5}{8}$ " Long Hex. Head Cap Screw
- 25 Square Lockwasher
- 26 Special Nut
- 27 Insulating Spacer
- 28 Spring
- 29 $\frac{1}{4}$ - 20 Jam Nut
- 30 Set Screw
- 31 Eccentric Pin
- 32 Spring
- 33 Flexible Connector Assembly
- 34 $\frac{1}{4}$ - 20 x $\frac{5}{8}$ " Long Hex. Soc. Head Cap Screw
- 35 Main Contact and Overload Coil Assembly
- 36 $\frac{1}{4}$ - 20 x $\frac{1}{2}$ " Long Hex. Head Cap Screw
- 37 Contact Arm Assembly
- 38 Set Screw
- 39 Pin
- 40 Locking Strip 18-150-214-001
- 41 Stationary Main Contacts

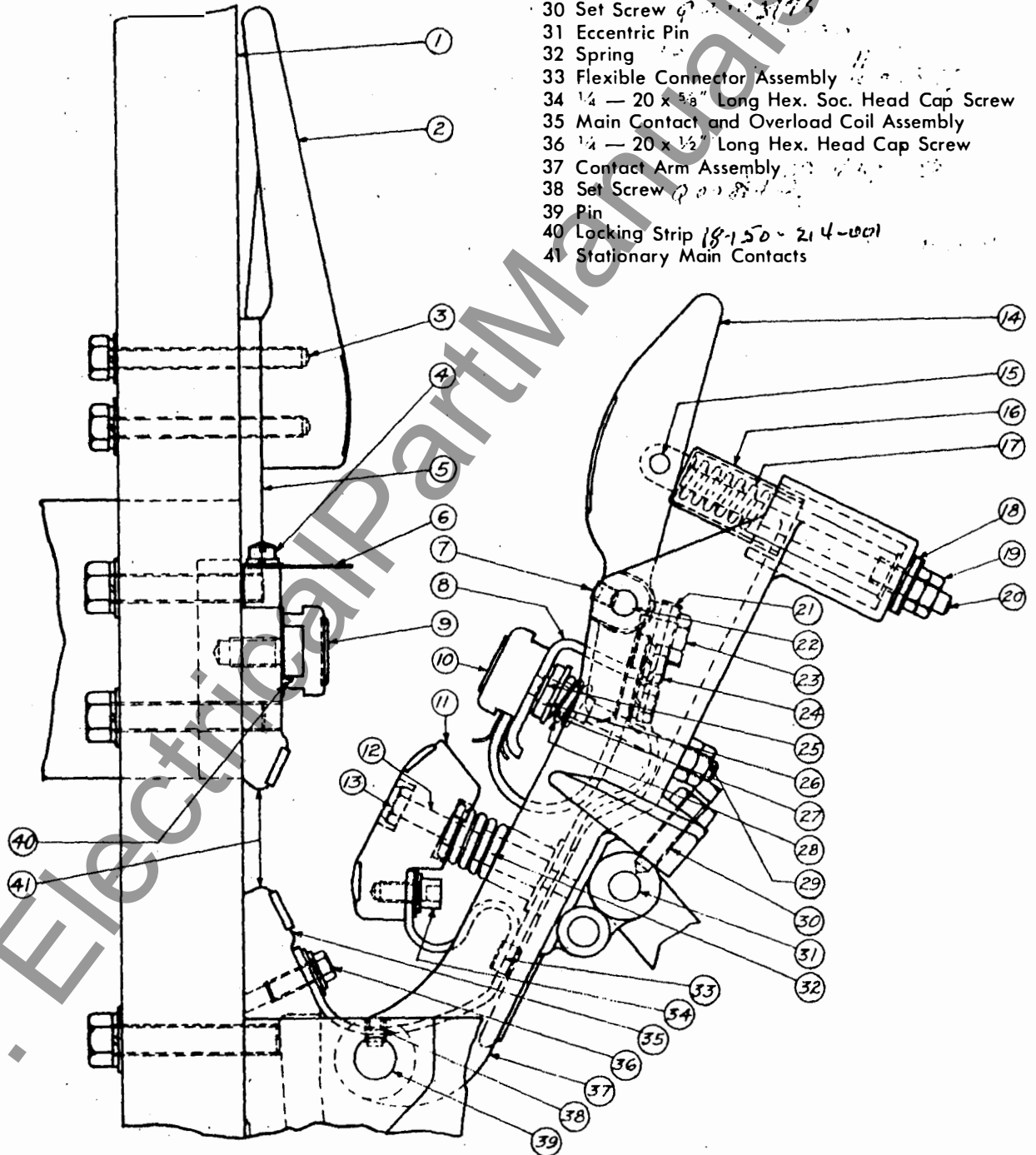


Fig. 4

Contact Assembly

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- | | |
|--|--|
| 1 Panel | 13 Set Screw |
| 2 Trip Finger | 14 Adjusting Nut |
| 3 Adjusting Screw | 15 Interlock Bracket <i>13-143-108-5-1</i> |
| <i>13-143-40-1-1</i> 4 Trip Bar Assembly | 16 Pin <i>13-143-108-5-1</i> |
| 5 Support Plate | 17 Interlock Lever <i>13-143-108-5-1</i> |
| <i>18-241-420-1-1</i> 6 Manual Trip Rod | 18 Pin <i>13-143-108-5-1</i> |
| <i>13-143-702-1-1</i> 7 Push Button | 19 Clevis (R. H. Thread) |
| <i>18-341-280</i> 8 Tripping Unit | 20 Spring <i>13-143-108-5-1</i> |
| <i>13-242-425-1-1</i> 9 Coil Yoke | 21 Interlock Trip Rod |
| 10 Coil | 22 Clevis (L. H. Thread) |
| 11 Mounting Bracket | 23 Cam |
| 12 Trip Armature | |

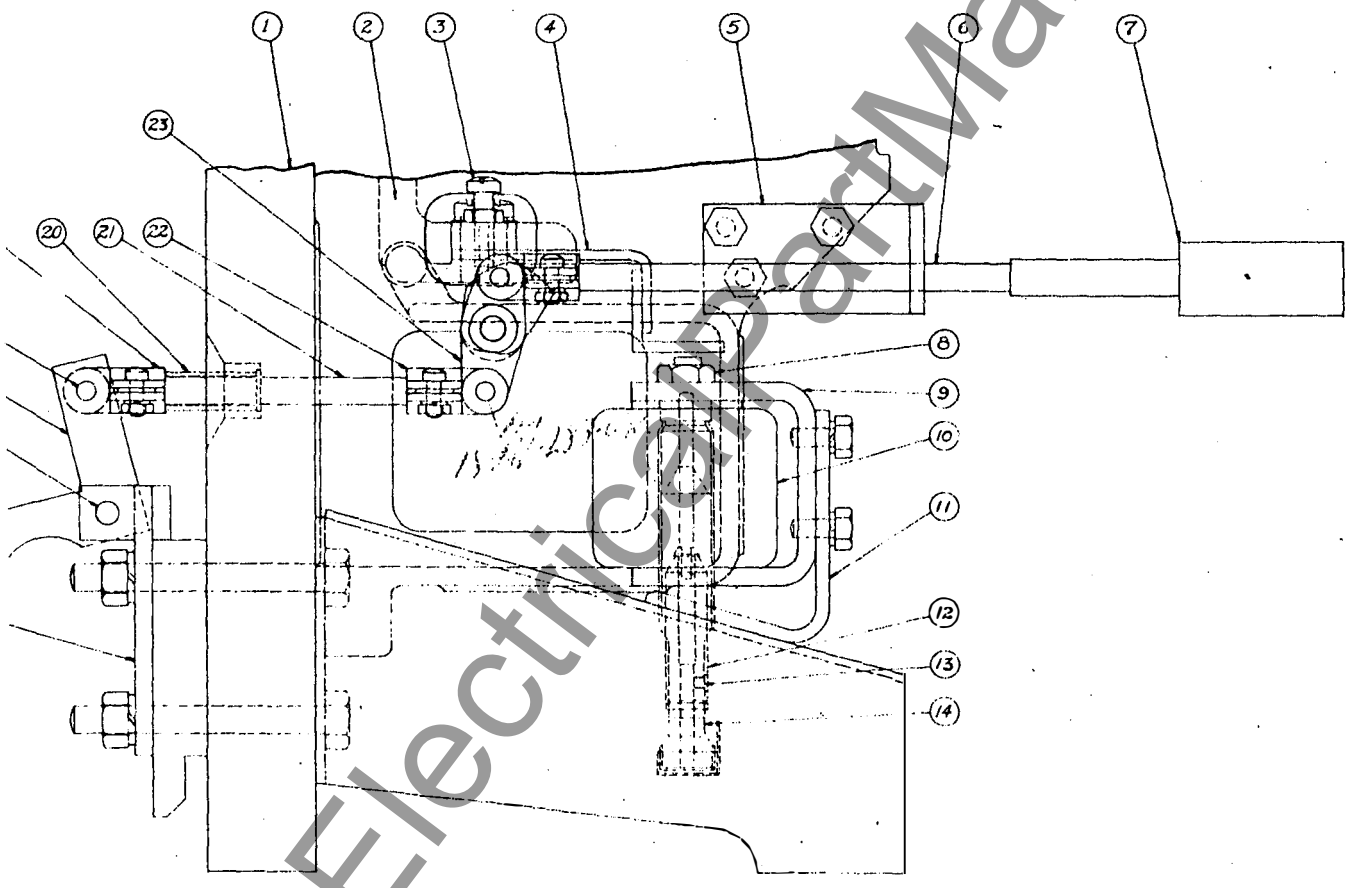


Fig. 5

Tripping Devices

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- | | |
|------------------------------|----------------------|
| 1 Stop | 9 Upper Disc |
| 2 Trip Armature Assembly | 10 Stationary Disc |
| 3 Bushing | 11 Indicator |
| 4 Upper Cup Housing | 12 Wing Nut |
| 5 Gasket | 13 Cup Holder |
| 6 Indicating Pointer | 14 Knob |
| 7 Lower Cup Housing Assembly | 15 Calibration Label |
| 8 Cup | |

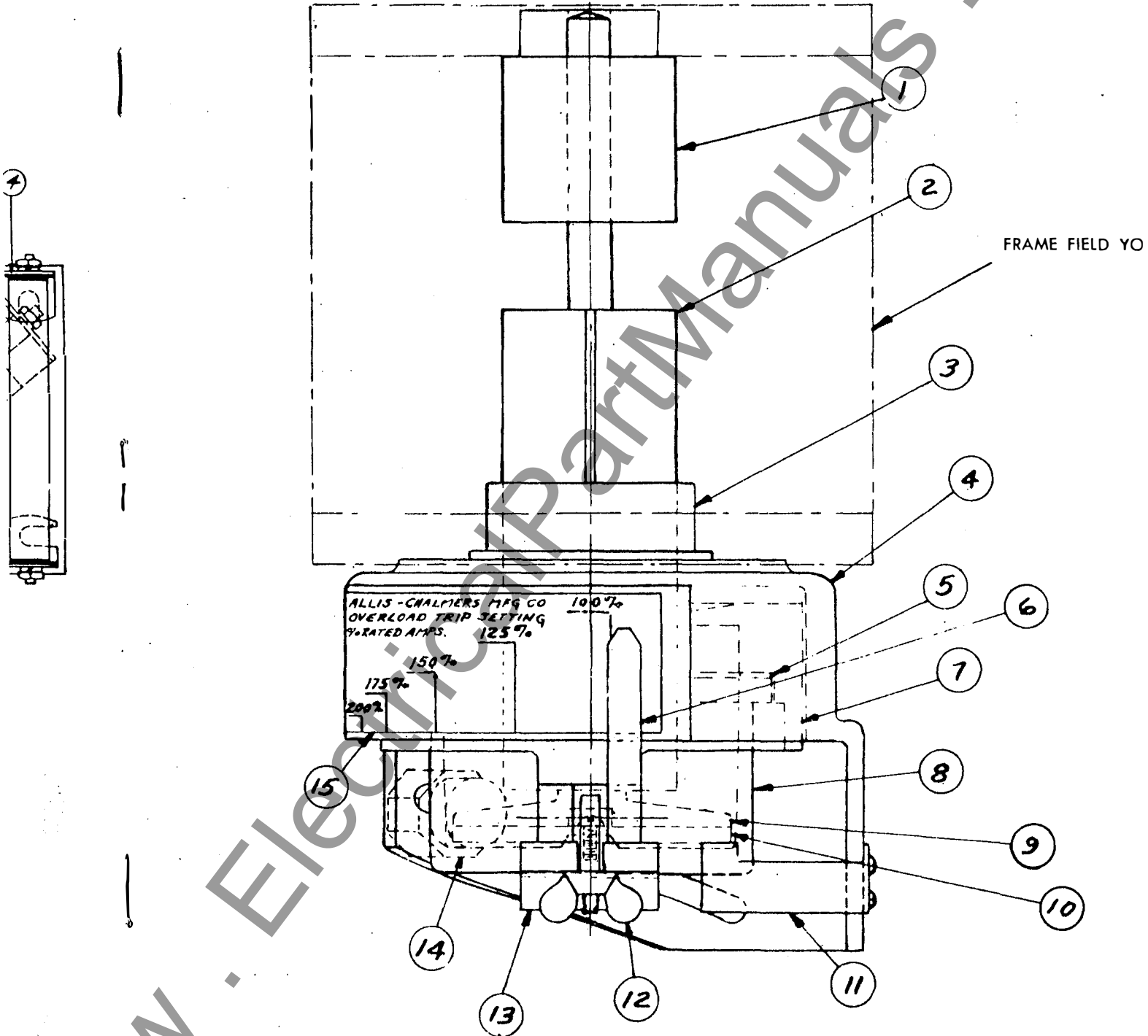


Fig. 6

Trip Armature and Suction Cup Assembly

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- | | |
|-------------------|--------------------|
| 1 Mounting Plate | 11 Pin |
| 2 Transformer | 12 Screw Mounting |
| 3 Rectifier | 13 Lock Nut |
| 4 Resistor | 14 Adjusting Screw |
| 5 Coil | 15 Trip Pin |
| 6 Switch | 16 Spring |
| 7 Armature | 17 Adjusting Screw |
| 8 Adjusting Screw | 18 Lock Nut |
| 9 Lock Nut | 19 Core Assembly |
| 10 Bracket | |

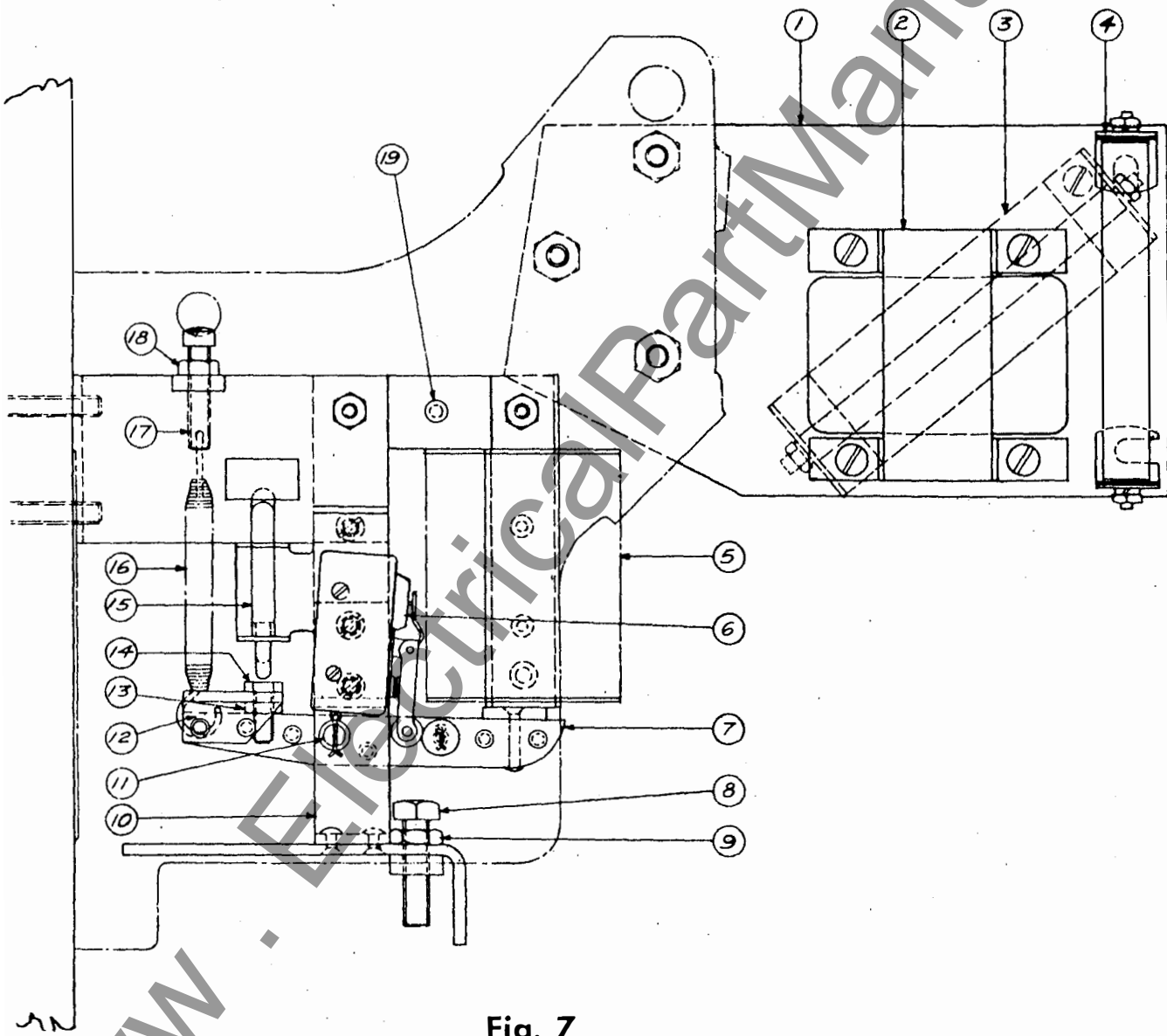


Fig. 7

Undervoltage Attachment

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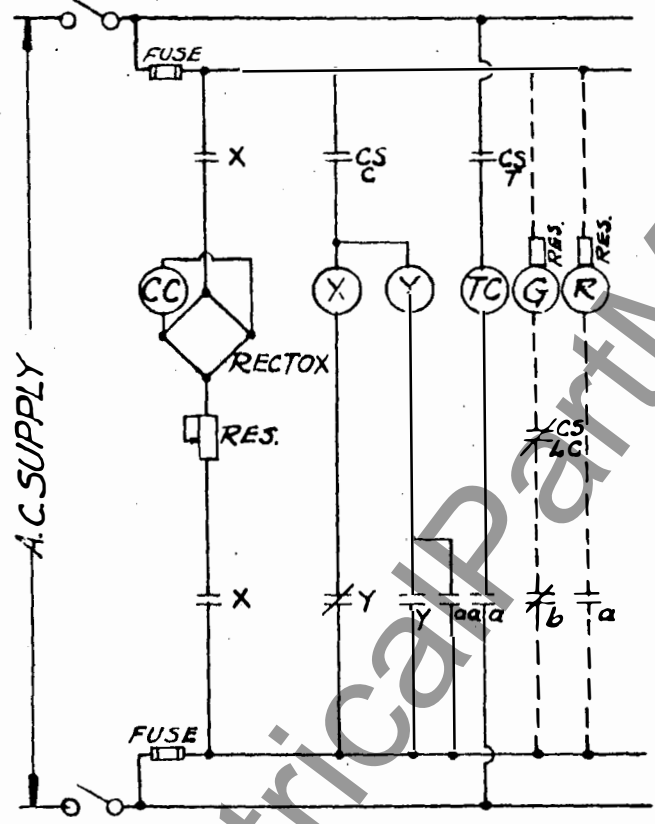
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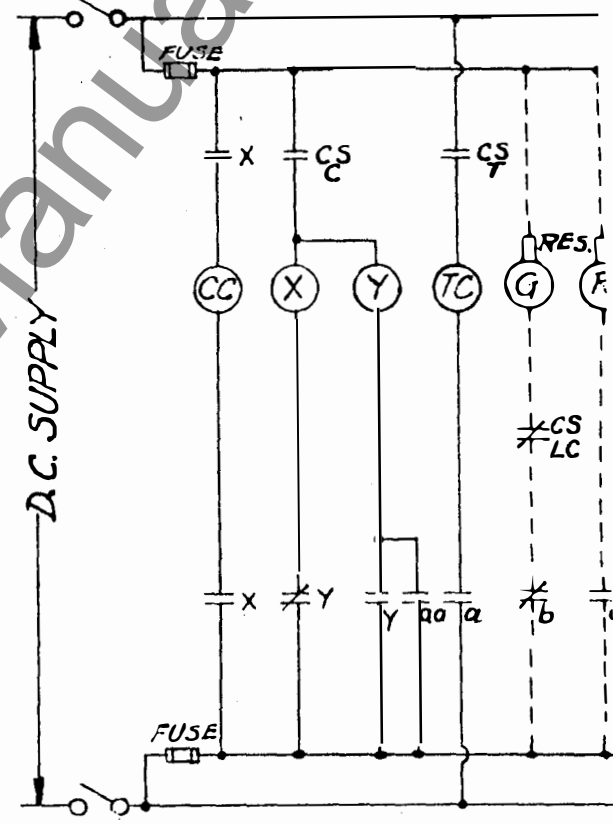
CYCLES

Symbols

CC	Closing Coil	R	Red Indicating Lamp
TC	Trip Coil	G	Green Indicating Lamp
XY	Control Relays	CSC	Control Switch Close
a	Auxiliary Switch	CST	Control Switch Trip
aa	Auxiliary Cut-off Switch	CSLC	Control Switch Lamp Cut-out
b	Auxiliary Switch		



a-c Control



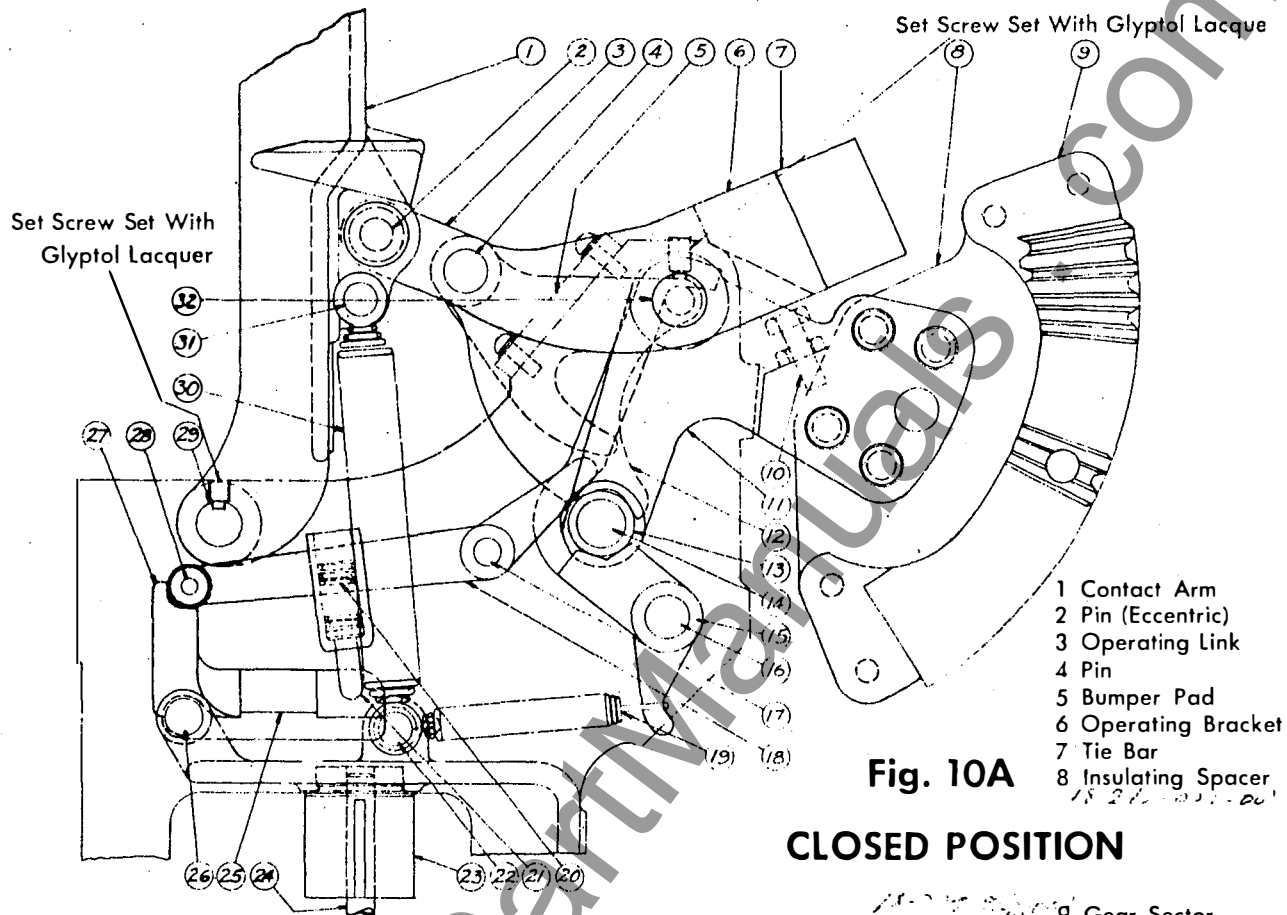
d-c Control

Fig. 8

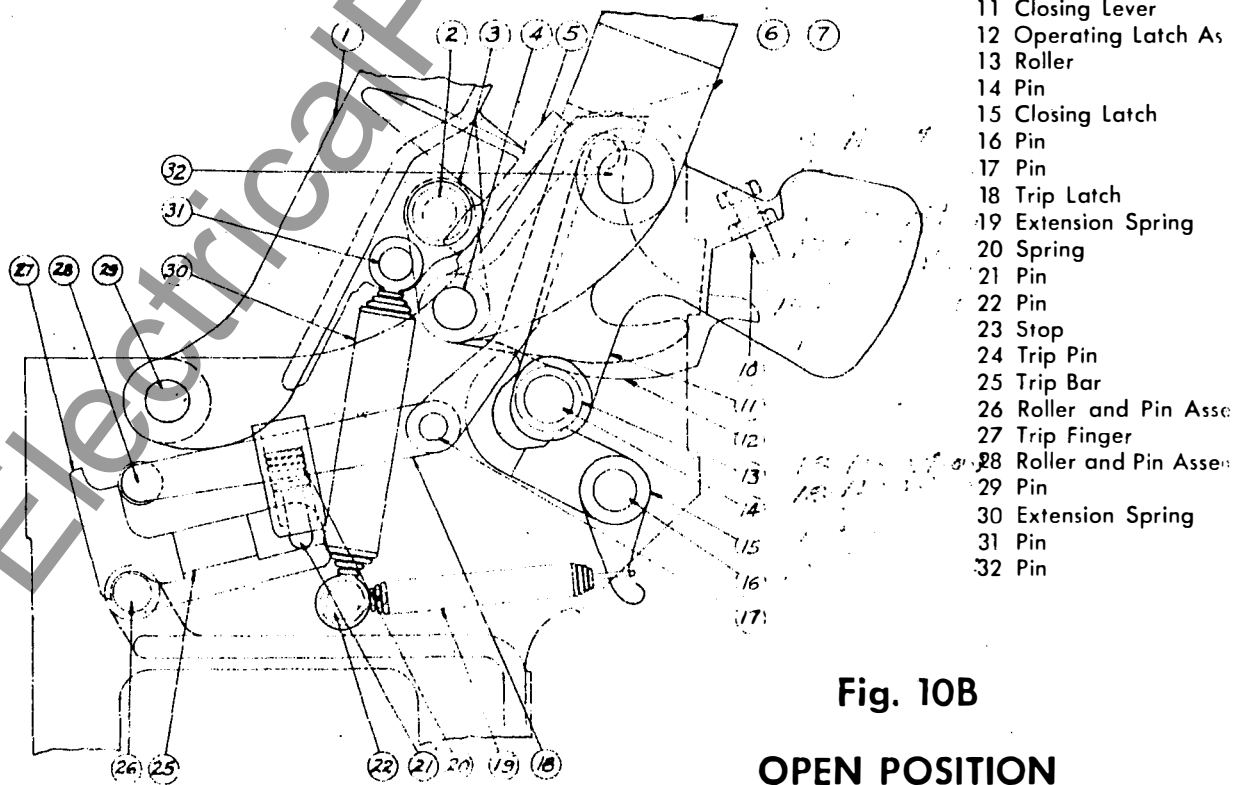
Control Schemes

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- 1 Contact Arm
- 2 Pin (Eccentric)
- 3 Operating Link
- 4 Pin
- 5 Bumper Pad
- 6 Operating Bracket
- 7 Tie Bar
- 8 Insulating Spacer



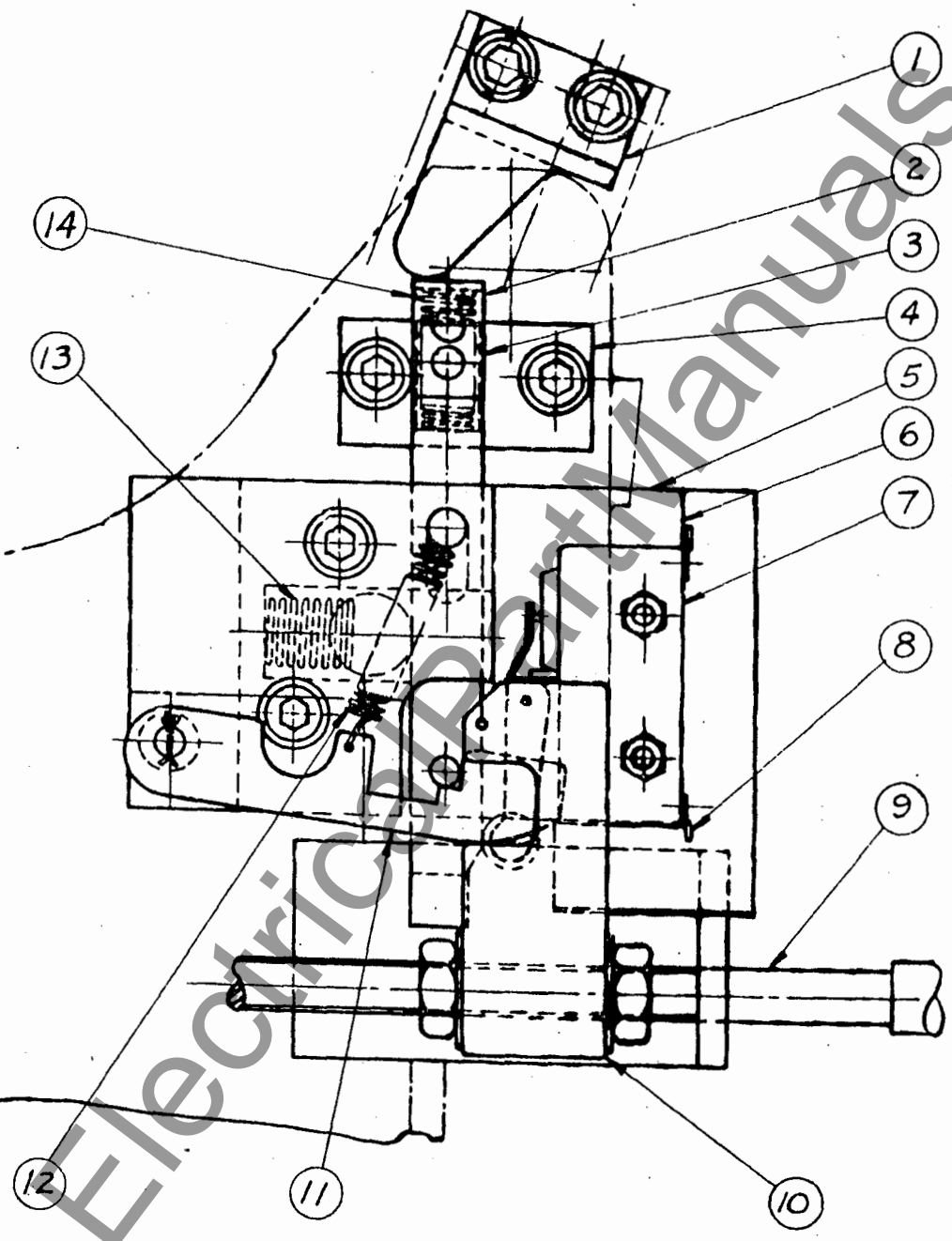
- 9 Gear Sector
- 10 Adjusting Screw
- 11 Closing Lever
- 12 Operating Latch As
- 13 Roller
- 14 Pin
- 15 Closing Latch
- 16 Pin
- 17 Pin
- 18 Trip Latch
- 19 Extension Spring
- 20 Spring
- 21 Pin
- 22 Pin
- 23 Stop
- 24 Trip Pin
- 25 Trip Bar
- 26 Roller and Pin Asse
- 27 Trip Finger
- 28 Roller and Pin Asse
- 29 Pin
- 30 Extension Spring
- 31 Pin
- 32 Pin

Fig. 10

Manual Operating Mechanism

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Set Screw
Glyptol



Fig. 11

Bell Alarm and Electrical Lockout

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