Instruction Book

Type DB-50 "De-ion"

Air Circuit Breaker

1600 Ampere Frame Size

600 Volts A-C

250 Volts D-C

Interrupting Rating

50,000 Amperes

WESTINGHOUSE ELECTRIC CORPORATION

Switchgear Apparatus Departments, East Pittsburgh, Pa.

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Supersedes I. B. 35-230-C3

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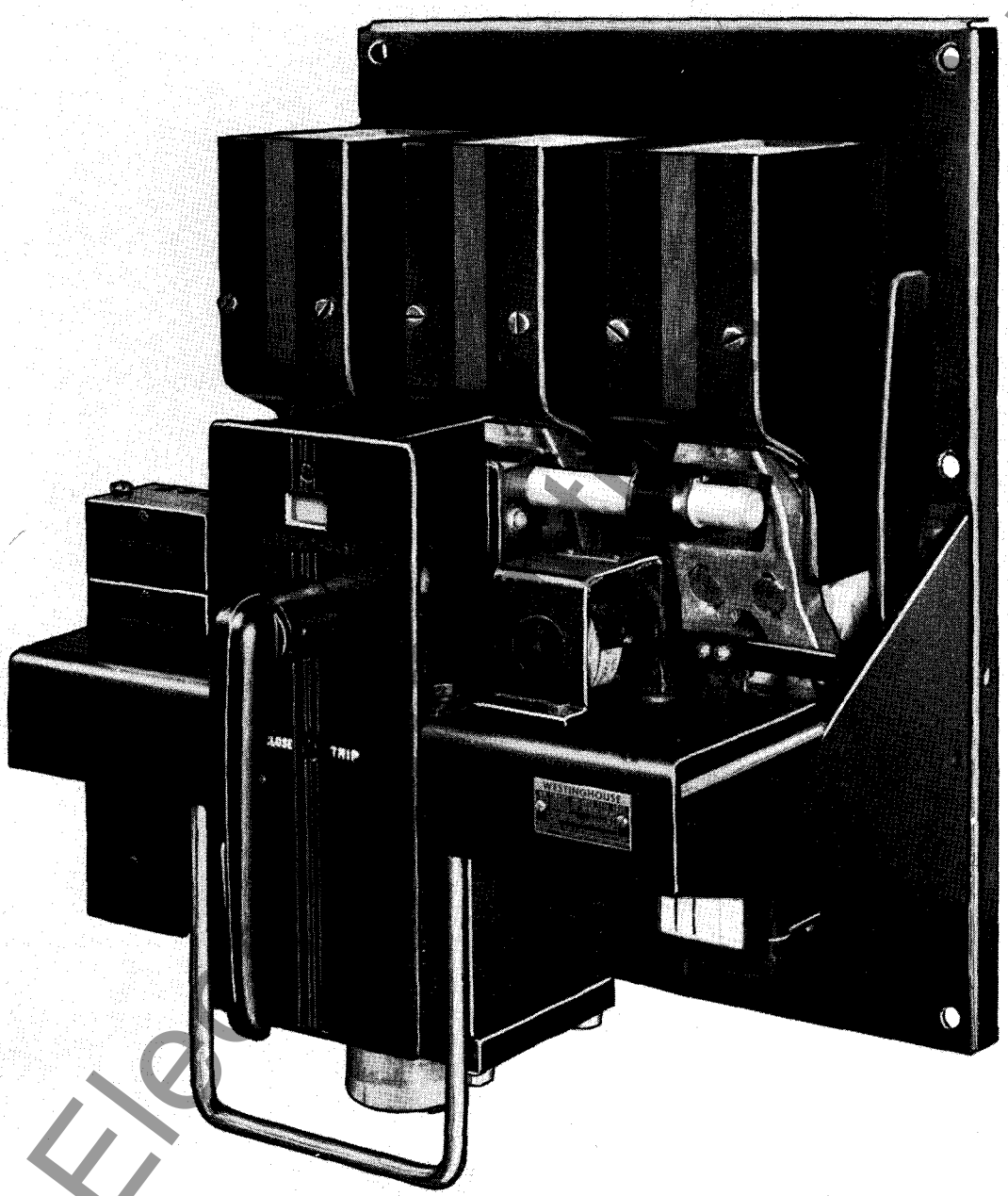

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WESTINGHOUSE

Type "DB" Air Circuit Breaker

Type "DB" air circuit breaker is designed to give continuous and reliable service as the protective link between the power source and associated productive equipment. This breaker is built to operate with a minimum of maintenance, while at the same time its simplified construction permits maximum accessibility for inspection and adjustment when required. The ease with which attachments may be added or removed is an outstanding feature of the "DB" design.

For the greatest measure of safety to operating personnel and also to minimize maintenance requirements, the breaker should be mounted in an enclosure suitable to local operating conditions. A selection of standard enclosures is available for various applications.

Important: To assure proper functioning, inspect each breaker at regular intervals in accordance with a systematic maintenance schedule. The frequency and character of the inspections will for the most part be determined by the severity of the duty performed. The minimum requirements, however, should consist of a light monthly inspection, with a thorough inspection semi-annually. Occasional checks on calibration as well as on coordination and freedom of all moving parts, must be included in the maintenance schedule. Consult Westinghouse engineering and service personnel for recommendations pertaining to special operating or maintenance conditions.

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PART I—RECEIVING, HANDLING, AND STORING

Type "DB-50" air circuit breakers, with all attachments mounted in place, are shipped in wooden crates.

Important: To avoid damage to the breakers, do not use hooks in handling.

Net weights of Type DB-50 are given in Table No. 1 below.

TABLE NO. 1 NET WEIGHTS

TYPE DB-50

	2-Pole	3-Pole
MANUAL	220 lbs.	280 lbs.
ELECTRIC	295 lbs.	355 lbs.

Immediately upon receipt, examine shipment for any loss or damage incurred during transit. If injury or rough handling is evident, file a damage claim at once with the transportation company and notify the nearest Westinghouse Sales Office.

When unpacking, be sure that no loose parts are missing or left in the packing material. Report all shortages at once. Blow out any dust or particles of packing material that may have accumulated on the circuit breaker parts.

INSPECTION

The "DB" breaker assembly consists of a coordinated group of sub-assemblies mounted on a steel supporting panel. The complete breaker assembly is to be mounted with the steel panel in a vertical position. All inspections for proper operation should, therefore, be made with the breaker in this position. Final inspection should preferably be made with the breaker in its permanent mounting.

Inspect the breaker as follows:

1. Raise and lower the trip bar by hand to make sure that it does not bind.

2. Rotate the manual operating handle slowly in a clockwise direction to move the contacts toward the closed position.

a. Observe whether all parts are in proper alignment and move freely.

b. Make certain that the studs have not been forced out of alignment.

c. Be sure that the contacts are clean and properly aligned. For a description of contact alignment, refer to "Contacts", Page 10.

3. If the contacts are in alignment and all parts move freely, continue the clockwise rotation until the breaker is latched.

4. Return the manual operating handle to the neutral position, then rotate counterclockwise to trip the breaker.

a. The toggle linkage should collapse and the moving contact assembly move freely to the full open position. This should be followed immediately by complete resetting of the links in the toggle mechanism as the handle is returned to the neutral position.

b. The links must always be free to move without friction or binding.

5. Check the attachments for operation in accordance with the appropriate instructions as given under "Maintenance", Part Three of this book.

NOTE: It is not advisable to lubricate any parts of the breaker. The lubrication supplied during factory assembly is sufficient for years of service. The lubricant is of a special form which is used sparingly. The addition of oil will only promote the accumulation of dust and dirt.

STORING

If circuit breakers are not to be installed in their permanent location at once, they should be carefully inspected for loose or damaged parts and then stored in a clean dry place in an upright position to avoid damage to the circuit breaker parts. A covering of paper will prevent dust from settling on the circuit breaker parts and is preferred to packing or other materials that are apt to absorb moisture.

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PART II—INSTALLATION

Type "DB-50" circuit breakers are furnished as complete unit assemblies and the installation consists of: (1) bolting them to the supporting framework or structure; (2) connecting the current-carrying cables or bus bars; and (3) completing any secondary control wiring that may be necessary.

CAUTION: During installation, the circuit breaker should be in the open position. Be sure to de-energize the load and control leads to be connected, and also the section of the switchboard where installation is being made.

Mounting dimensions and details of the front enclosure cutouts are shown in Fig. 1.

To prevent distortion of the breaker panel, the supporting structure should be checked for alignment.

CONNECTIONS

Typical circuit breaker wiring diagrams are shown in Fig. 2. The connecting cables or bus bars should have adequate current-carrying capacity, otherwise, heat will be conducted to the circuit breaker resulting in possible excessive temperature rise. Connecting cables or bus bars must be supported so that the circuit breaker studs will not be subjected to unnecessary stresses.

The circuit breaker studs and all connections should be clean, smooth, and free from burrs to assure full contact area. They should be firmly clamped or bolted in place to prevent excessive heating.

TABLE NO. 2 CLOSING SOLENOID CONTROL VOLTAGES AND CLOSING CURRENTS

NOMINAL VOLTAGE	MINIMUM VOLTAGE AT COIL TERMINALS		CURRENT IN AMPERES AT NORMAL VOLTAGE FOR DB-50 BREAKER		
	Close	Trip	Close S	Close H	Trip
24V.D-C	...	14	...	...	9.5
48V.D-C	...	28	...	...	4.9
125V.D-C	90	70	35	124	2.2
250V.D-C	180	140	18	62	1.1
115V.60Cy	...	95	...	...	3.4
230V.60Cy	190	190	35*	124*	1.7
460V.60Cy	380	380	18*	62*	.7

* Selenium Rectox is provided.

S = Standard-burden closing coil.

H = High-burden closing coil. MUST be specified for each DB-50 breaker having short time delay devices and for each A-C operated DB-50 breaker where closing power is taken from the line side of breaker and the regulation is questionable.

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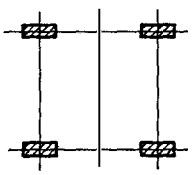
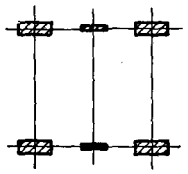
Approximate Only. Do Not Use for Construction Purposes.

THE FOLLOWING ATTACHMENTS CAN BE SUPPLIED WITHOUT INCREASING OVERALL DIMENSIONS:

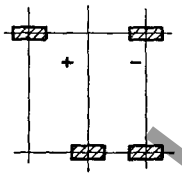
- Auxiliary Switches (12-Circuit Maximum)
- Shunt Trip
- Under voltage Trip (With or Without Time Delay)
- Alarm Switch
- Key Lock or Key Interlock
- Field Discharge Contact
- Electric Lockout
- Operation Counter



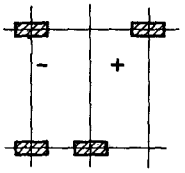
Current stud arrangement—2-pole breaker



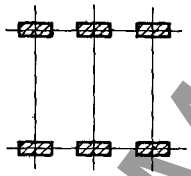
Current stud arrangement—2-pole breaker with field discharge contacts



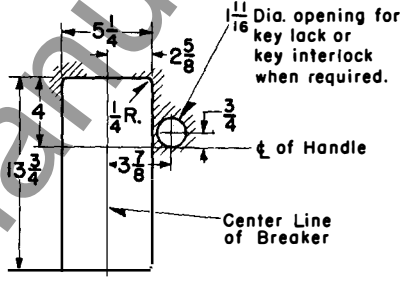
Current stud arrangement—2-pole breaker with reverse current attachment (Standard NEMA arrangement)



Current stud arrangement—2-pole breaker with reverse current attachment (Standard ABS-AIEE Marine arrangement)



Current stud arrangement—3-pole breaker



Cut-out in dead front door of cover

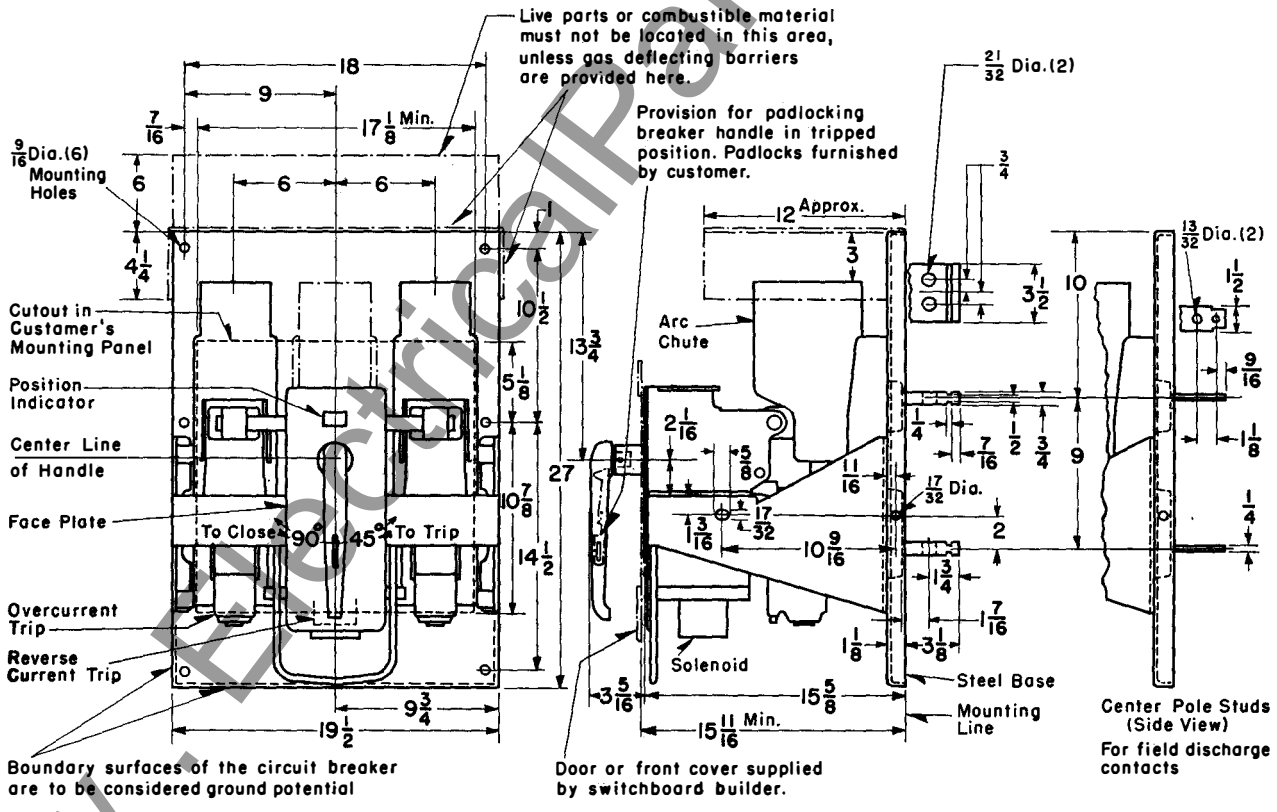


Fig. 1—DB-50 Outline Dimensions and Mounting

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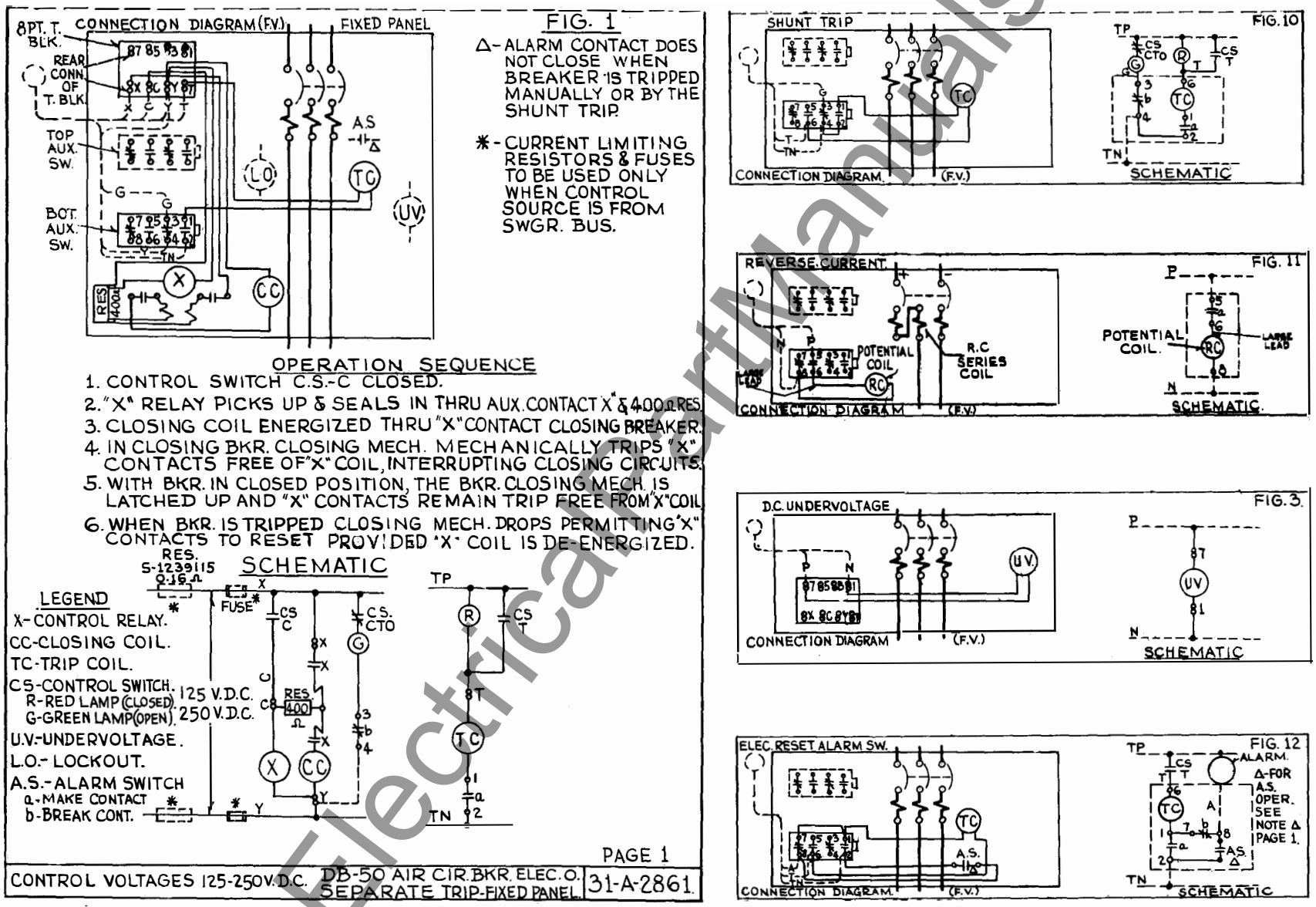

Fig. 2—Typical Wiring Diagrams—Type DB-50 Circuit Breaker

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PART III—MAINTENANCE

POLE UNIT

Each pole unit is mounted on a separate molded base through which the breaker studs pass. (See Fig. 3.) The molded bases are attached to the steel mounting panel and provide insulation for the breaker studs.

The upper stud and contact are attached to the molded base by two bolts. The moving contact is pivoted on the molded base and attached to the cross bar through insulating links. The series coil and lower stud are fastened to the molded base by four bolts.

CONTACTS. (See Fig. 3.) The DB-50 arcing contact should touch first on closing, open last on opening. Contact pressure on the mains is maintained by adjusting gap G to be .984-1.000 inch. This gap is adjusted by removing the cross bar and screwing the insulating link in or out on the stud. Be sure to tighten the lock nuts after each adjustment.

Do not over-adjust as this will cause the contact springs to compress to the solid position and thus increase the closing effort. Check for over-adjustment by prying the stationary arc tips open to at least 1/16-inch gap.

MAINTENANCE OF CONTACTS. Rough or high spots should be removed with a file or sandpaper. To replace the arcing contacts, open the breaker, remove the arc chutes and then the stationary arcing contacts. Close the breaker and remove the moving arcing contacts. The new contacts can then be added in the reverse order.

CAUTION: All power should be removed when changing, maintaining or adjusting contacts.

OPERATING MECHANISM

The operating mechanism (see Fig. 3) is non-adjustable and consists of a series of non-ferrous links designed to secure low closing and tripping forces. To check for friction, raise the trip bar and slowly rotate the manual operating handle in close and trip direction. The linkage should follow the handle without sticking.

A small quantity of lubricant is placed on the handle shaft, the roller lever roller, and the latch plate at the factory.

CLOSING SPRING MECHANISM

The closing spring mechanism is shown in Fig. 3A.

Rotating the closing handle clockwise raises the lift link and lower spring guide to compress the closing spring. Near the end of the closing stroke the top end of the lift link strikes the first toggle lever to start the breaker closing. As the breaker closes the push rod raises the toggle link and push link out of the toggle which permits the closing spring to complete the breaker closing.

Slow emergency operation to check the contact sequence can be obtained by exerting a slight closing pressure on the closing handle and simultaneously pushing forward on the breaker cross bar to start the breaker closing.

MAINTENANCE: Oil the pins and slides every 10,000 operations.

CLOSING SOLENOID

The closing solenoid (see Fig. 14) is non-adjustable. It is designed for intermittent duty only. Check for loose bolts.

To remove closing coil, trip breaker. Disconnect closing coil leads from control circuit wiring. Take off bolts (18), washers (19), relay release arm (17), bolts (10), washers (11) and plate (2). Drop closing coil (16) with brass tube (5).

In replacing closing coil be sure to replace brass tube (5) so that stationary core (4) and moving core (22) are aligned in the tube. Be careful not to disturb or bend plunger (23). Re-assemble closing coil and details in reverse order from removal.

If the circuit breaker is permanently mounted near the floor so that the closing coil cannot be dropped far enough for removal then follow these directions. Trip breaker and remove breaker manual operating handle and breaker face plate. Disconnect closing coil leads from control circuit wiring. Take off bolts (18), washers (19), relay release arm (17), bolts (10), washers (11) and plate (2). Drop closing coil (16) with brass tube (5) so that pin (6) is exposed. Push pin (6) to right into hole on right hand side of solenoid yoke (1) and allow moving core (22) to drop into brass tube (5). Pick up closing

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coil with brass tube and moving core and bring out through the U-shaped foot on breaker. Do not lose plunger (24) and plug (27) in moving core (22).

To replace closing coil be sure plunger (24) and plug (27) are in moving core (22) and reassemble closing coil and details in reverse order from removal. Take care to align stationary core (4) and moving core (22) in brass tube (5). Take care to align plunger (24) and plug (27) with plunger (23).

The minimum permissible control voltages at the terminal of the closing coil, and the closing currents at normal voltage are listed in Table No. 2 shown on Page 7.

OVERCURRENT TRIPPING DEVICE

The overcurrent trip is an air delayed device that can be supplied with various rating coils ranging from 100 to 1600 amperes. The con-

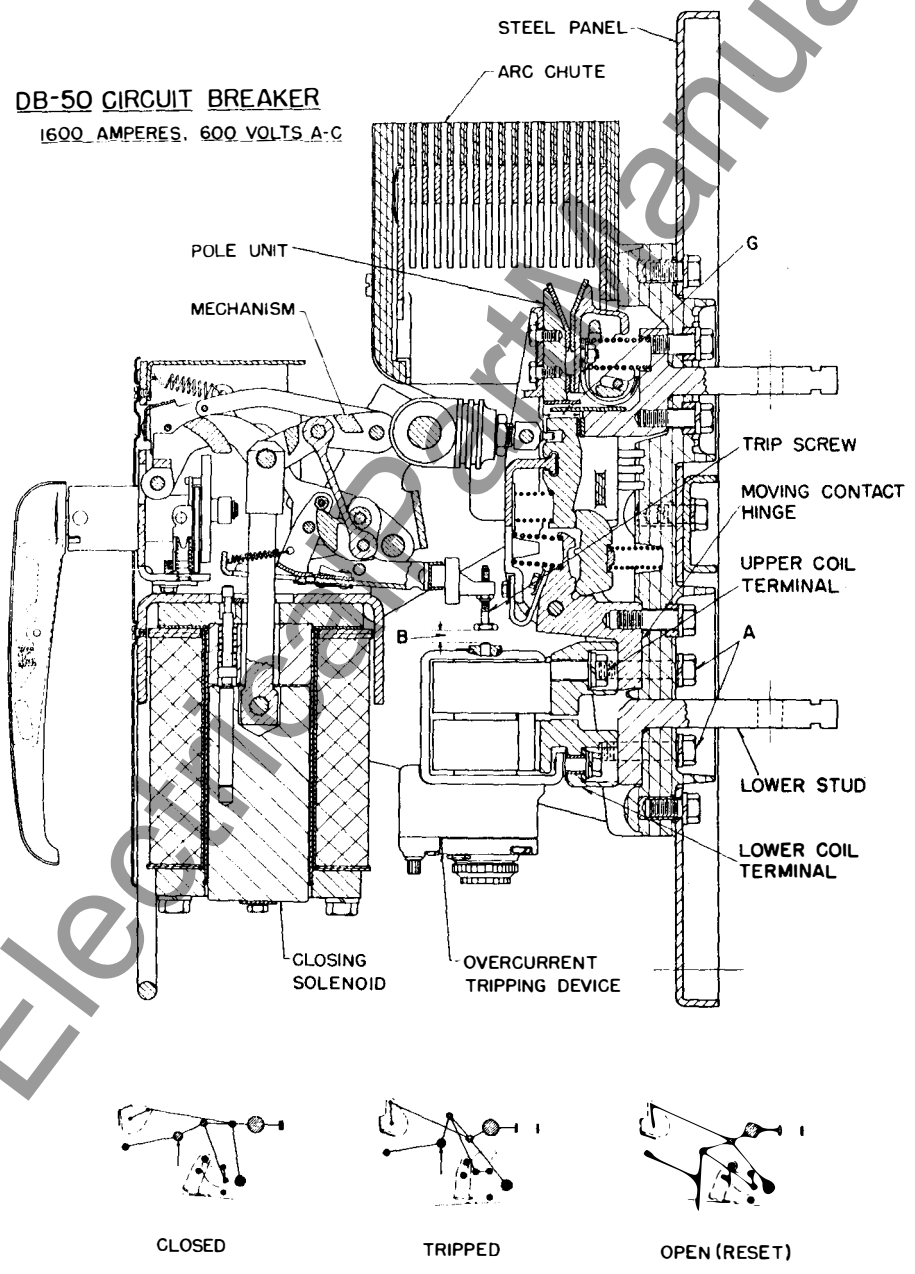

Fig. 3—Cross-Sectional View of Type DB-50 Circuit Breaker

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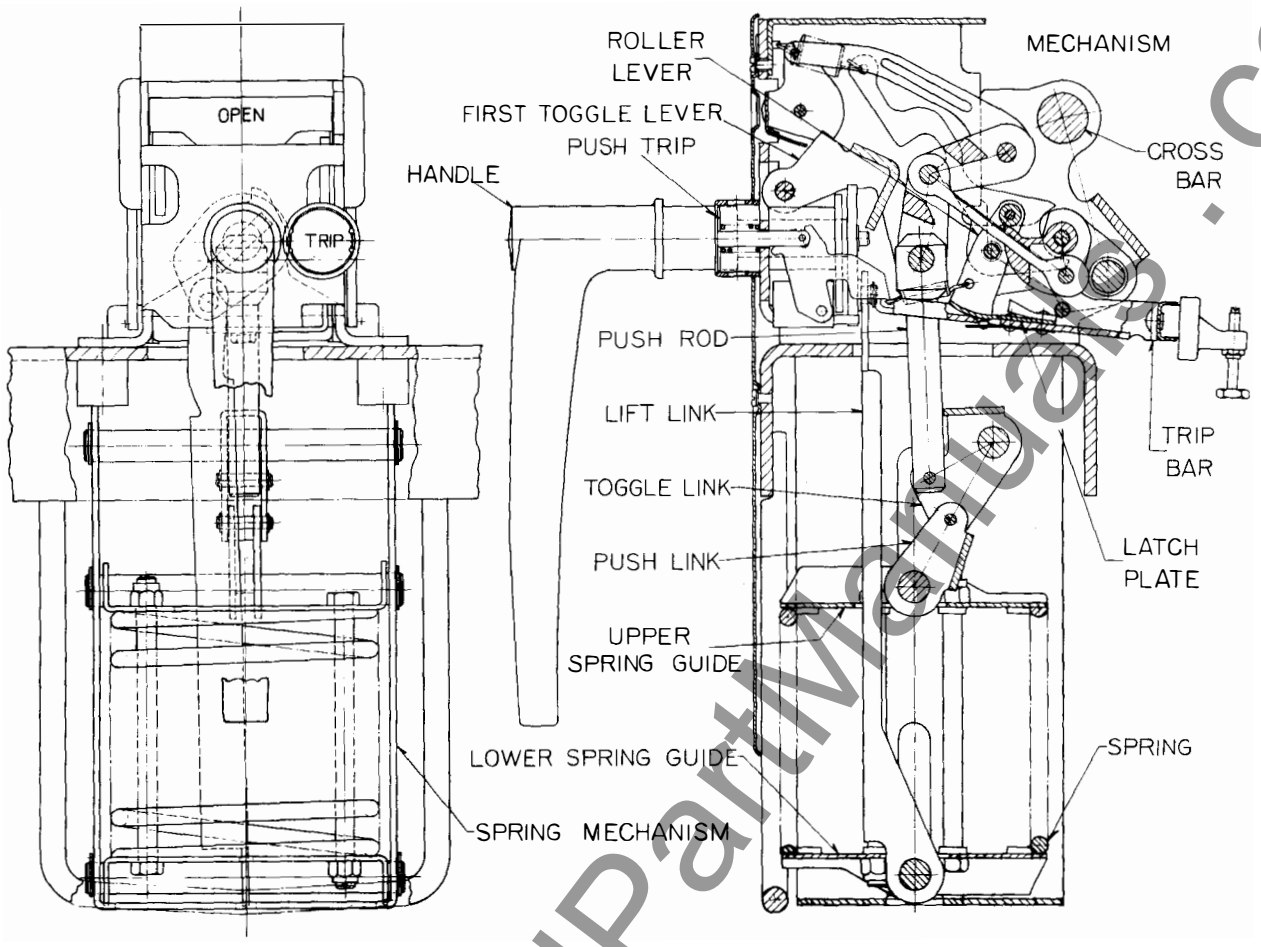

Fig. 3A—Type DB-50 Spring Closing Mechanism

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struction, except for the coils, is similar for all ratings.

The overcurrent tripping device can easily be removed from the breaker and replaced with another unit of different rating or of the same rating without affecting the calibrations.

Installation and Removal

Before installing the overcurrent tripping device to the circuit breaker, determine the maximum travel of the trip plunger as shown at A Fig. 6. Trip units shipped separately are labeled with this travel. To measure the travel first remove the scale plate by pushing down and in at the bottom of the plate. Then, while releasing the instantaneous or short delay valve by raising their armature, push the moving core assembly to its maximum upward position. This can be done by prying upward with a screw driver inserted under the long delay pick-up lever. In this position, measure the maximum travel of the trip plunger above the top bearing nut as shown at A Fig. 6. Replace the scale plate and unit is then ready for assembly to circuit breaker.

To install the overcurrent trip to the circuit breaker it is merely necessary to insert the device into the pole unit so that the upper coil terminal makes contact with the lower part of the moving contact hinge and the lower coil terminal contacts the lower breaker stud as shown in Fig. 3. The unit is then bolted in this position by means of four hexagon head, steel bolts 2-1/2 inches long shown at A, Fig. 3. Use only one lock washer under the head of each of the bolts. Care should be taken to make sure that bolts longer than specified above are not used, because the ends of the bolts may bottom in coil terminal thereby causing a loose connection.

Finally, the trip screw mounted on the trip finger above the unit must be adjusted for proper tripping. While doing this, be sure that the breaker is disconnected from the circuit. Then, adjust special spacing tool S#1649025 to the exact dimension A, Fig. 6, as measured previously. Set this spacing tool with correct dimension on the top bearing nut of the overcurrent trip directly under the trip screw. Then with the breaker closed and by means of special wrench S#1649026, turn the trip screw very carefully and slowly in the clockwise direction until the breaker just trips. From that point, continue turning the trip screw another one-half turn. This half turn will provide 1/64 inch of overtravel which insures positive tripping of the circuit breaker. This adjustment can most easily be made by holding the spacing tool in place with the left hand and turning the trip screw by means of special wrench with the right hand. These tools should be inserted from the bottom and care taken to avoid jamming these in the mechanism or contacts when the breaker opens.

This adjustment duplicates the one made at the factory for calibration of the timing points

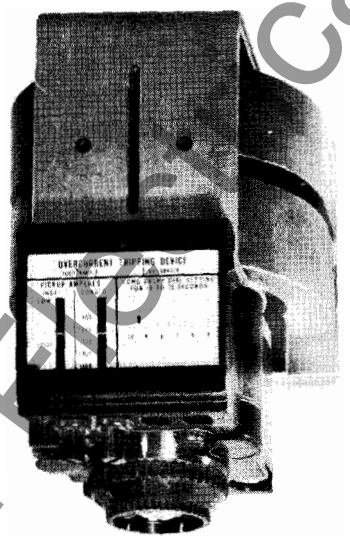

Fig. 4—Series Overcurrent Tripping Device with Long Time and Instantaneous Element

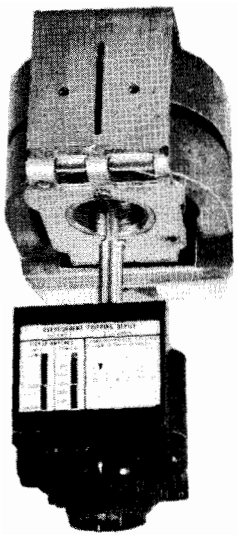

Fig. 5—Series Overcurrent Tripping Device Showing the Assembly of Calibration Case to Magnetic Circuit.

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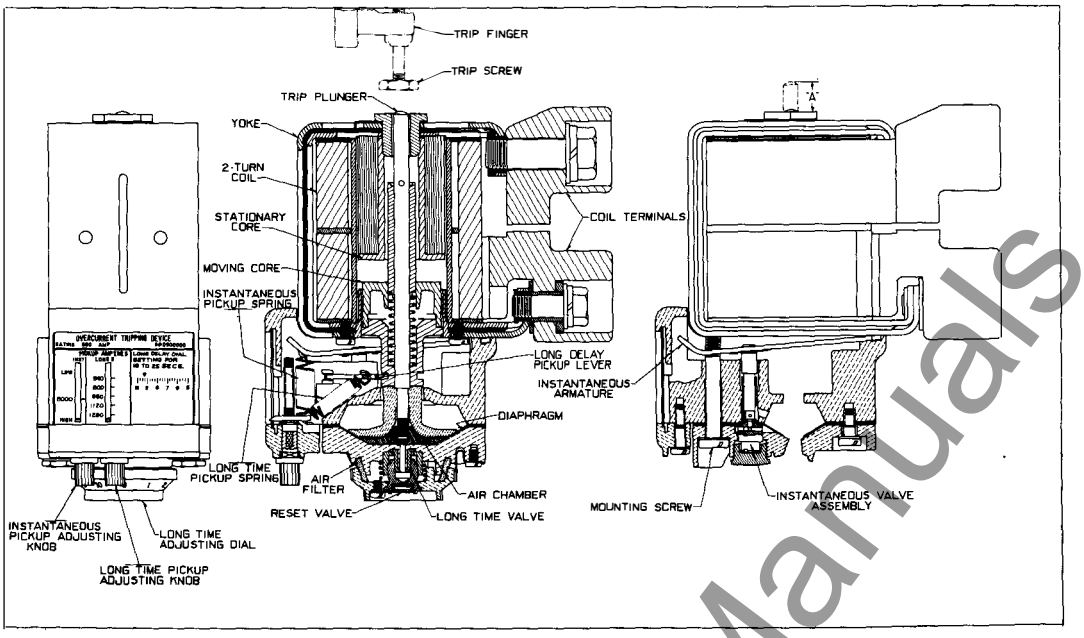

Fig. 6—Cross-Sectional View of Series Overcurrent Tripping Device with Long Delay and Instantaneous Elements

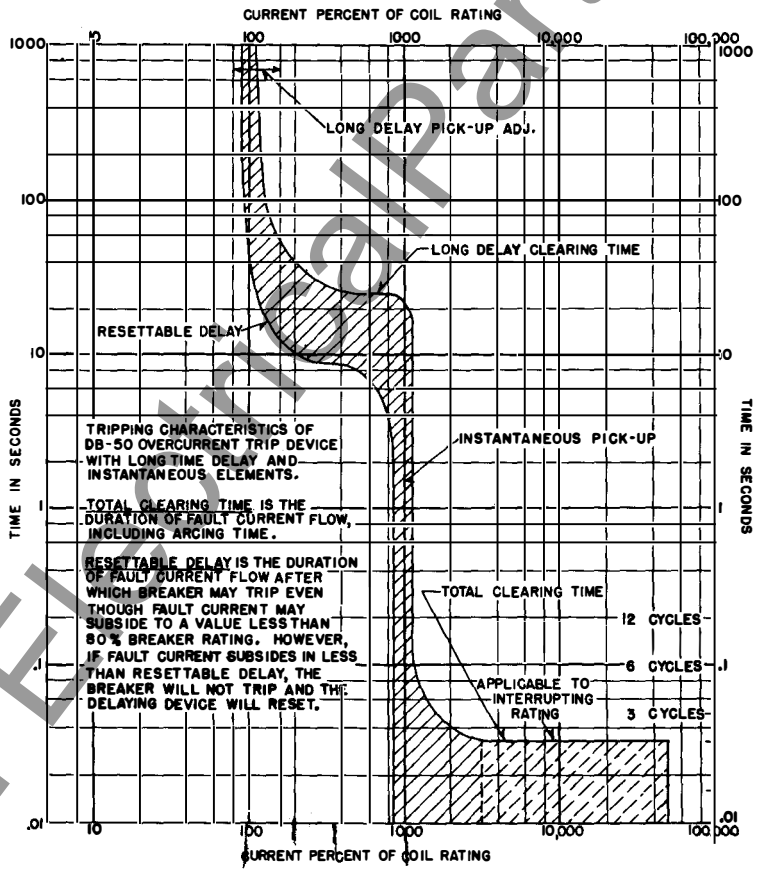

Fig. 7—Tripping Characteristics of Standard Series Overcurrent Tripping Device with Long Delay and Instantaneous Elements

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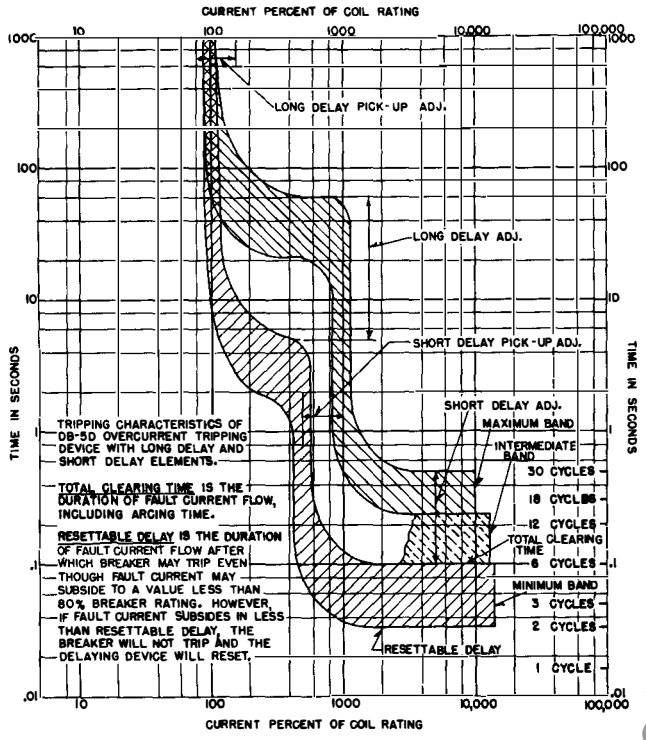

Fig. 8—Tripping Characteristics of Selective Series Overcurrent Tripping Device with Long Delay and Short Delay Elements

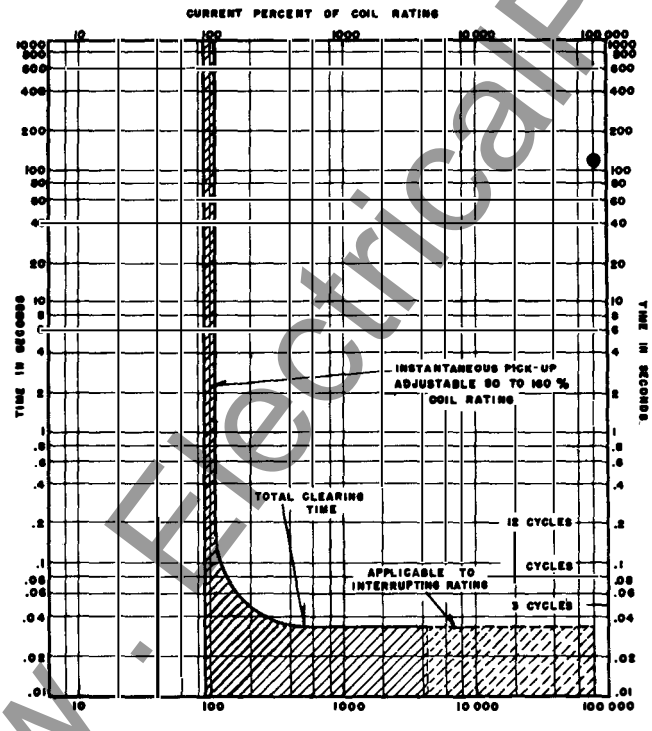

Fig. 9—Tripping Characteristics of Special Series Overcurrent Tripping Device with Instantaneous Element Only

on the unit. Since the trip plunger travel to trip the breaker is a direct function of the tripping time, it is important that this adjustment be made with care and precaution.

To remove an overcurrent tripping device from the breaker, remove the four bolts A Figure 3 which hold the tripping device to the breaker base. Before removing the last bolt, hold the tripping device to prevent it from falling.

Construction

The overcurrent tripping device is air delayed with all of its elements completely adjustable. A typical unit is shown ready for mounting on a circuit breaker pole unit in Figure 4.

The tripping device consists of two main subassemblies namely:

1. The magnetic frame and coil assembly as shown in Figure 5A.

2. The delay elements assembly as shown in Figure 5B. The two assemblies are held together by means of the two white mounting screws as seen from the bottom of the calibration case.

As seen from the sectional view Figure 6, the magnet frame and coil assembly consists of a yoke, a coil, a stationary and moving core together with their necessary insulation.

The delay elements assembly as seen from the same figure contains an air chamber, a diaphragm, and trip plunger as well as all the armatures, springs, and valves to produce the adjustable long delay, short delay and instantaneous characteristics of the circuit breaker tripping curve.

Time-Current Classification

The overcurrent tripping devices can be supplied with any combination of the three tripping elements, namely, long delay, short delay, and instantaneous elements. The most popular combinations are listed below:

1—DUAL OVERCURRENT SERIES TRIPPING DEVICE

This unit has an adjustable long delay and an adjustable instantaneous element, the characteristic curve of which is shown in Figure 7.

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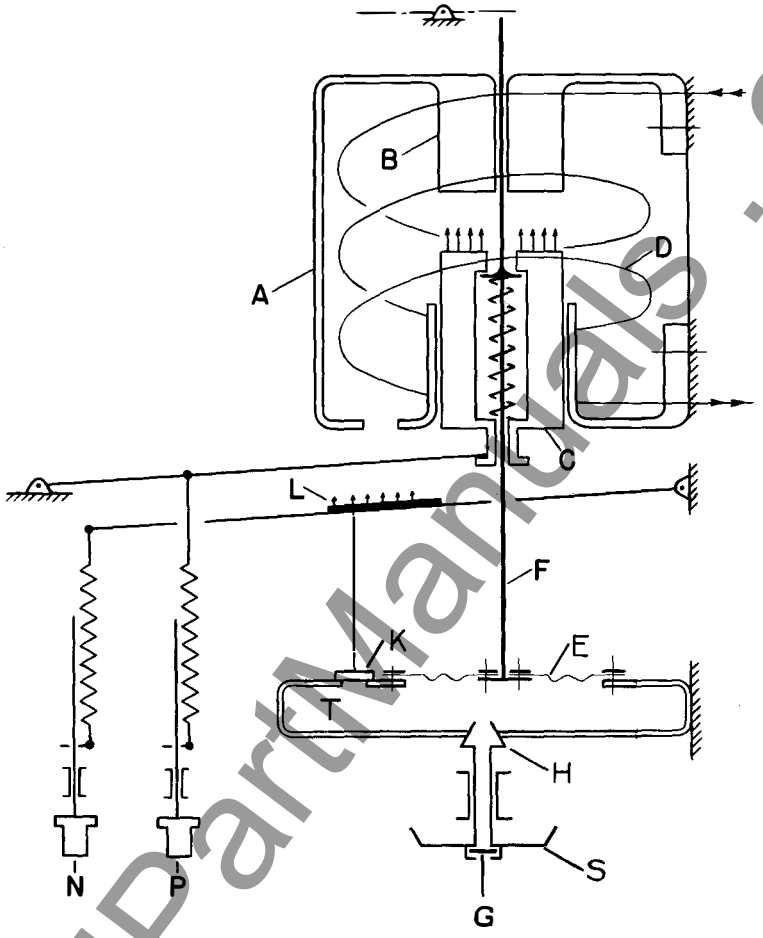

Fig. 10—Schematic Diagram of Standard Overcurrent Tripping Device with Adjustable Long Delay and Adjustable Instantaneous Element

The calibration for the various elements are:

(a) Long delay pick-up
Adjustable with calibrated marks at 80-100-120-140 and 160 percent of coil rating.

(b) Long delay
Adjustable with one calibrated mark at 25 seconds (limits 19-25 seconds).

(c) Instantaneous pick-up
Adjustable with one calibrated mark at 1000 percent of coil rating.

2—DUAL SELECTIVE OVERCURRENT SERIES TRIPPING DEVICE FOR GROUP OR TIE BREAKERS

A selective device is equipped with an adjustable long delay and an adjustable short delay element. These two elements combine to give a typical selective curve as shown in Figure 8. This unit can be made selective with a standard device or another selective device of the same or of a different rating.

The calibration for the various elements are:

(a) Long delay pick-up
Adjustable with calibrated marks at 80-100-120-140 and 160 percent of coil rating.

(b) Long Delay
The long delay is available with any one of the delay ranges listed below:

Delay Range	Description
60	Adjustable with one calibrated mark at 60 seconds and another at 30 seconds or less.
50	Adjustable with one calibrated mark at 5 seconds and another at 25 seconds or less.
40	Adjustable with one calibrated mark at 40 seconds and another at 20 seconds or less.
30	Adjustable with one calibrated mark at 30 seconds and another at 15 seconds or less.
20	Adjustable with one calibrated mark at 20 and another at 10 seconds or less.
10	Adjustable with one calibrated mark at 10 seconds and another at 5 seconds or less.

(c) Short delay pick-up
Adjustable with calibrated marks at 500-750 and 1000 percent of coil rating.

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(d) Short delay
Adjustable with calibrated marks at 6-15 and 30 cycles.

3—DUAL SELECTIVE OVERCURRENT SERIES TRIPPING DEVICE FOR LOAD BREAKERS

This device is equipped with an adjustable long delay and an adjustable instantaneous element. The calibration for the various elements are:

(a) Long delay pick-up
Adjustable with calibrated marks at 80-100-120-140 and 160 percent of coil rating.

(b) Long Delay
The long delay is available with any one of the delay ranges listed below:

Delay Range	Description
30	Adjustable with one calibrated mark at 30 seconds and another at 15 seconds or less.
20	Adjustable with one calibrated mark at 20 seconds and another at 10 seconds or less.
10	Adjustable with one calibrated mark at 10 seconds and another at 5 seconds or less.

(c) Instantaneous pick-up
Adjustable with calibrated marks at 500-1000 and 1500 percent of coil rating.

4—SPECIAL INSTANTANEOUS TRIP ONLY

This device is equipped with an adjustable instantaneous element only. A typical time-current characteristic for such a device is shown in Figure 9.

This device is available with either of the two calibrations listed below:

(a) Instantaneous pick-up
Adjustable with calibrated marks at 80-100-120-140 and 160 percent of coil rating.

(b) Instantaneous pick-up
Adjustable with calibrated marks at 500-1000 and 1500 percent of coil rating.

Operation

1—DUAL OVERCURRENT SERIES TRIPPING DEVICE AND DUAL SELECTIVE OVERCURRENT SERIES TRIPPING DEVICE FOR LOAD BREAKERS

An overload or short circuit current through the series coil D, Figure 10, will cause the moving core C to be attracted and move toward the stationary core B. At low currents, the moving core C will carry the tripping stem F along with it, immediately closing reset valve G after which motion is retarded by the diaphragm E. The rate of travel of the diaphragm is determined by the rate at which air is permitted to enter chamber T by the various valves H and K. At higher currents when the attraction between the moving core C and the stationary core B is greater than the load on the spring inside the moving core, the moving core will compress the spring and travel independently of the tripping stem F. This spring insures a constant force pattern acting on the diaphragm E.

Valve H is the long delay valve and it is permanently open to a calibrated setting. This setting which controls the tripping time can be changed by means of dial S, Figure 10. The magnitude of current at which the long delay will begin to operate is determined by the long delay pick-up adjusting knob P Figure 10. The magnitude of current at which the instantaneous trip will operate is determined by the instantaneous pick-up adjusting knob N Figure 10.

2—DUAL SELECTIVE OVERCURRENT SERIES TRIPPING DEVICE FOR GROUP OR TIE BREAKERS.

The operation of this selective device is the same as the dual overcurrent series tripping device except that in this case, the instantaneous valve K, Figure 10 is replaced with a short delay valve J, Figure 11 which controls the size of orifice and consequently the tripping time in the short circuit region. This orifice is adjustable by means of knob R.

3—SPECIAL INSTANTANEOUS TRIP ONLY DEVICE

The special instantaneous trip only device, in principle, is the simplest of the four. As seen from Figure 12, the adjustable instantaneous trip is merely a modification of the adjustable long delay pickup of the dual overcurrent series tripping device.

Time-Current Characteristics

The time current curve of this air delayed device has an inverse time characteristic up to approximately 500 per cent of coil rating in the long delay range as shown in Figure 7. Within this range, the moving core and tripping stem move as a unit, that is, the magnetic pull has not increased sufficiently to overcome the loaded spring inside the moving core. Above

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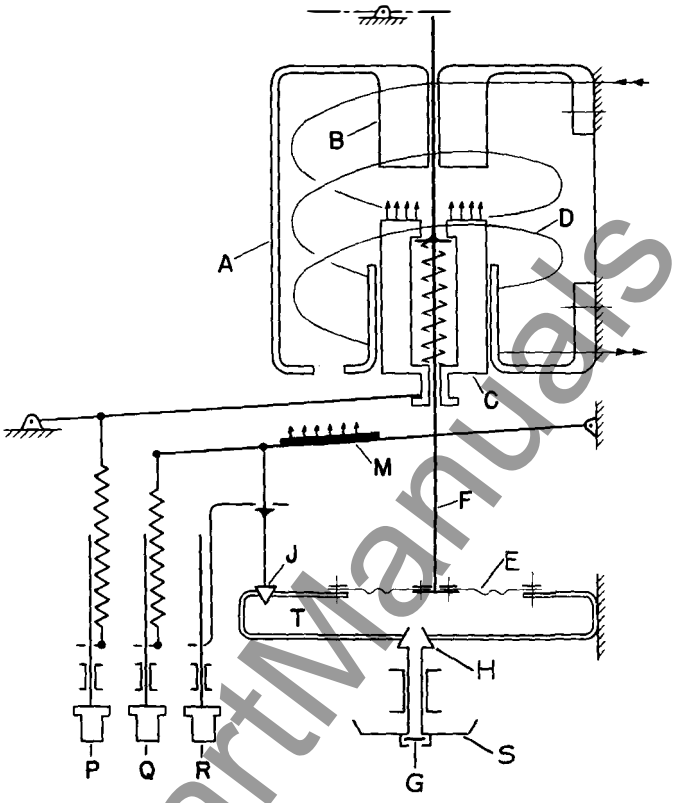

Fig. 11—Schematic Diagram of Selective Series Overcurrent Tripping Device with Adjustable Long Delay and Short Delay Elements

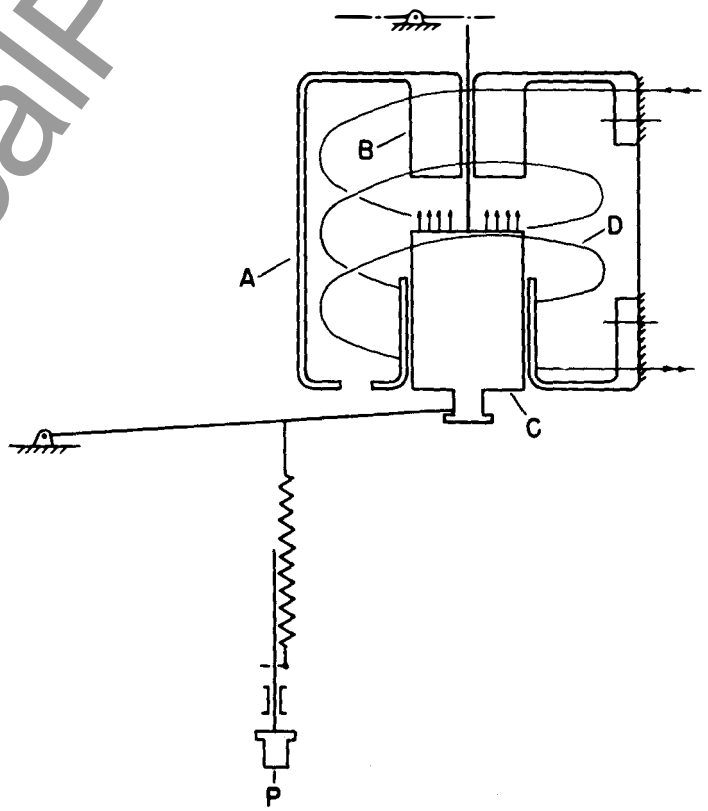

Fig. 12—Schematic Diagram of Special Series Overcurrent Tripping Device with Instantaneous Element Only.

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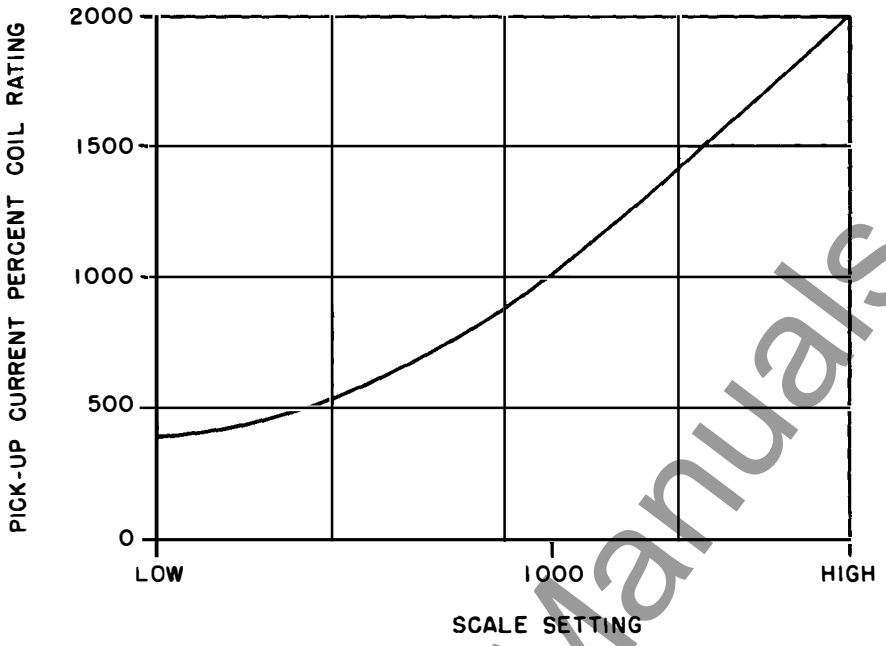

Fig. 13—Instantaneous Pick-up Percent of Coil Rating vs Coil Settings Obtained by Means of Standard Instantaneous Adjusting Knob

500 per cent, the tripping time is essentially constant with increase in current. Within this region, the magnetic force is sufficient to overcome the spring inside the moving core at the outset, thereby subjecting the diaphragm to the constant force pattern of the spring. The tripping time will remain constant until interrupted by the instantaneous or short delay pick-up wherever they occur. For the same reason, the tripping time in the short delay region remains constant with increasing current for a given setting of the short delay.

Adjustment of Calibration Settings

CAUTION: As a safety measure, the breaker should be disconnected from the circuit before making any adjustment.

1—LONG DELAY PICK-UP

The long delay pick-up can be adjusted by means of P, Figure 10, also shown in Figure 6. The unit has been calibrated and the calibration plate marked at five settings, namely 80, 100, 120, 140 and 160 per cent of the coil rating. Settings slightly below 80 per cent and above 160 per cent as well as intermediate settings although not calibrated can be obtained by means of the adjusting knob. The pick-up was placed on the 100 per cent setting before shipment. A different setting can be obtained by turning the adjusting knob with the help of a small screw driver inserted in the slots for that purpose.

2—LONG-DELAY CALIBRATION

The long delay can be adjusted by means of the long time adjusting dial S Figure 10, also shown in Figure 6. The dial adjustment is limited to slightly less than one turn. One point has been calibrated at the factory and it is indicated by a white mark on the outer edge of dial. When this white mark coincides with the white indicator on the front lower case the tripping time will be between 19 and 25 seconds for currents above 500 per cent of the coil rating as shown in Figs. 7 and 8.

3—INSTANTANEOUS PICK-UP

The instantaneous pick-up can be adjusted by means of knob N, Figure 10 also shown in Figure 6. The instantaneous pick-up has been calibrated and the calibration plate marked at 10 times the coil rating at the factory. The extremities of this scale are marked "High" and "Low". Various pick-up settings below and above 10 times coil rating can be obtained by raising or lowering the indicator by means of the adjusting knob. The adjusting knob can be turned by hand or more easily turned with a small screwdriver inserted in the slots provided for that purpose. Figure 14 shows the approximate pick-up currents that can be expected for various scale settings below and above the calibrated setting.

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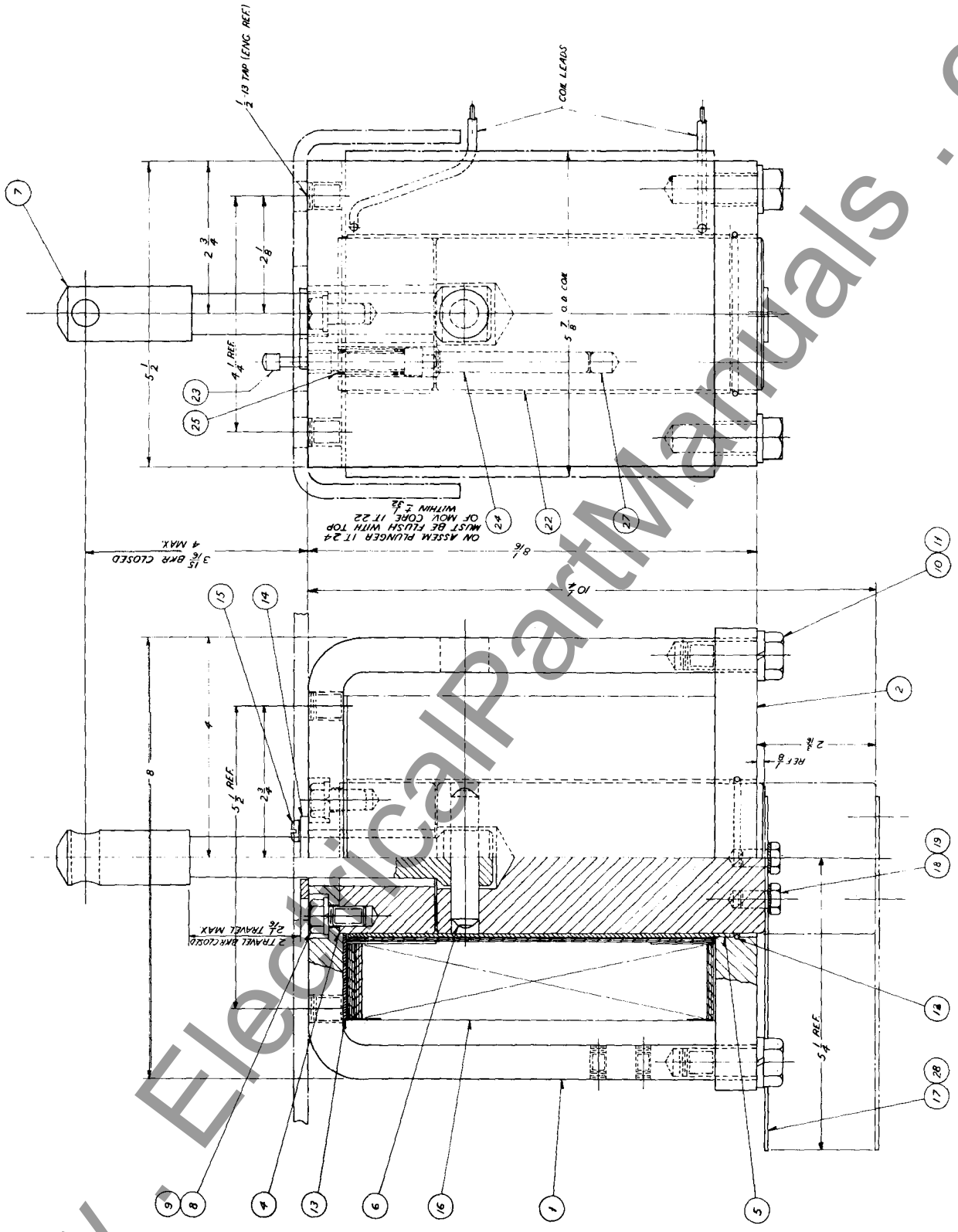

Fig. 14—Closing Solenoid—Construction Details

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4—SHORT DELAY PICK-UP

The short delay pick-up can be adjusted by means of knob Q, Fig. 11. It is adjustable over a range of from five hundred to one thousand percent of coil rating with three calibrated marks at 500-750 and 1000 percent. The adjusting knob Q, Fig. 11, can be easily turned to these or any intermediate settings by hand or by means of a small screw driver inserted in the slot provided for that purpose.

5—SHORT DELAY CALIBRATION

The short delay can be adjusted by means of knob R, Fig. 11. The range of adjustment is from 6 to 30 cycles with specific calibration marks at 6, 15 and 30 cycles. Knob R can be turned by hand or more easily with a small screw driver inserted in the slot provided for that purpose.

6—SPECIAL INSTANTANEOUS ONLY PICK-UP

The special instantaneous pick-up can be adjusted by means of knob P, Fig. 12. The range of adjustment on one unit is from 80 to 160 percent of coil rating with specific calibration marks at 80-100-120-140 and 160 percent. Another unit is supplied with a range of adjustment from 500 to 1500 percent of coil rating with specific calibration marks at 500-1000 and 1500 percent. Settings slightly above and below this range as well as intermediate settings can be obtained by turning the adjusting knob P by hand, or with the help of a small screw driver inserted in the slot on the bottom of the knob. Other similar instantaneous only tripping ranges can be supplied on request.

MAINTENANCE

If for any reason, the instantaneous or short delay valves have to be removed or replaced, this can be done without removing the unit from the breaker. First remove the molded cap on the bottom of the instantaneous valve. The 9/16-inch open end wrench supplied for adjusting trip screw will fit this cap which is shown clearly in Figure 6. Note that the instantaneous valve is on the left side of the unit and the short delay valve is on the right side. Both these valves are rarely used together. When a valve is omitted or rendered inoperative, it is replaced with a plug which closes the valve opening.

To remove a valve first remove valve cap shown in Figure 6, then use a screwdriver to turn the whole valve assembly counterclockwise 180 degrees at which point the valve can be removed. It can be replaced with a completely new assembly.

To replace the valve be sure that the small projection on the side of the valve enters the keyway in the lower case body. It should then be pushed up to the gasket surface and turned clockwise 180 degrees. The molded cap with a new coat of some commercial sealing compound on its threads should then be inserted to hold and seal the valve in place. The sealing compound should preferably be one that will remain plastic indefinitely, facilitating its future removal. Be sure not to fasten the molded cap too tightly as it may damage the diaphragm against which it seals.

CONTROL RELAY

The control relay (see Fig. 15) mounts directly under the auxiliary switch. It is a single-coil, mechanically-tripped device with the coil suitable for continuous energization. The operation sequence is outlined in Fig. 2, Page 9. The contacts should normally last the life of the breaker, but are replaceable if found necessary.

The trip pin (see Fig. 15) is made to release the relay contacts when the release lever is approximately 1/16-inch from its stop surface on the relay mold, with the breaker closed.

The relay trip rod (3 and 9) should be adjusted for correct operation of the relay and the relay release arm (6) as follows:

Disconnect the closing coil leads from the control circuit wiring.

Hold guide (2) with wrench and loosen lock nut (4). Move bolt (9) up or down so that when the relay operating coil is energized, the relay will trip when the shoulder on guide (2) is within 1/32-inch of striking mounting bracket (1). Also when the shoulder on the guide is against the mounting bracket de-energizing and then energizing the relay operating coil should not cause the relay contacts to move toward the closed position. Be sure to really tighten locknut (4) to guide (2) to maintain this adjustment.

Energize relay operating coil. Slowly close the breaker manually. Move nut (3) up or down so that when relay release arm (6) strikes nut

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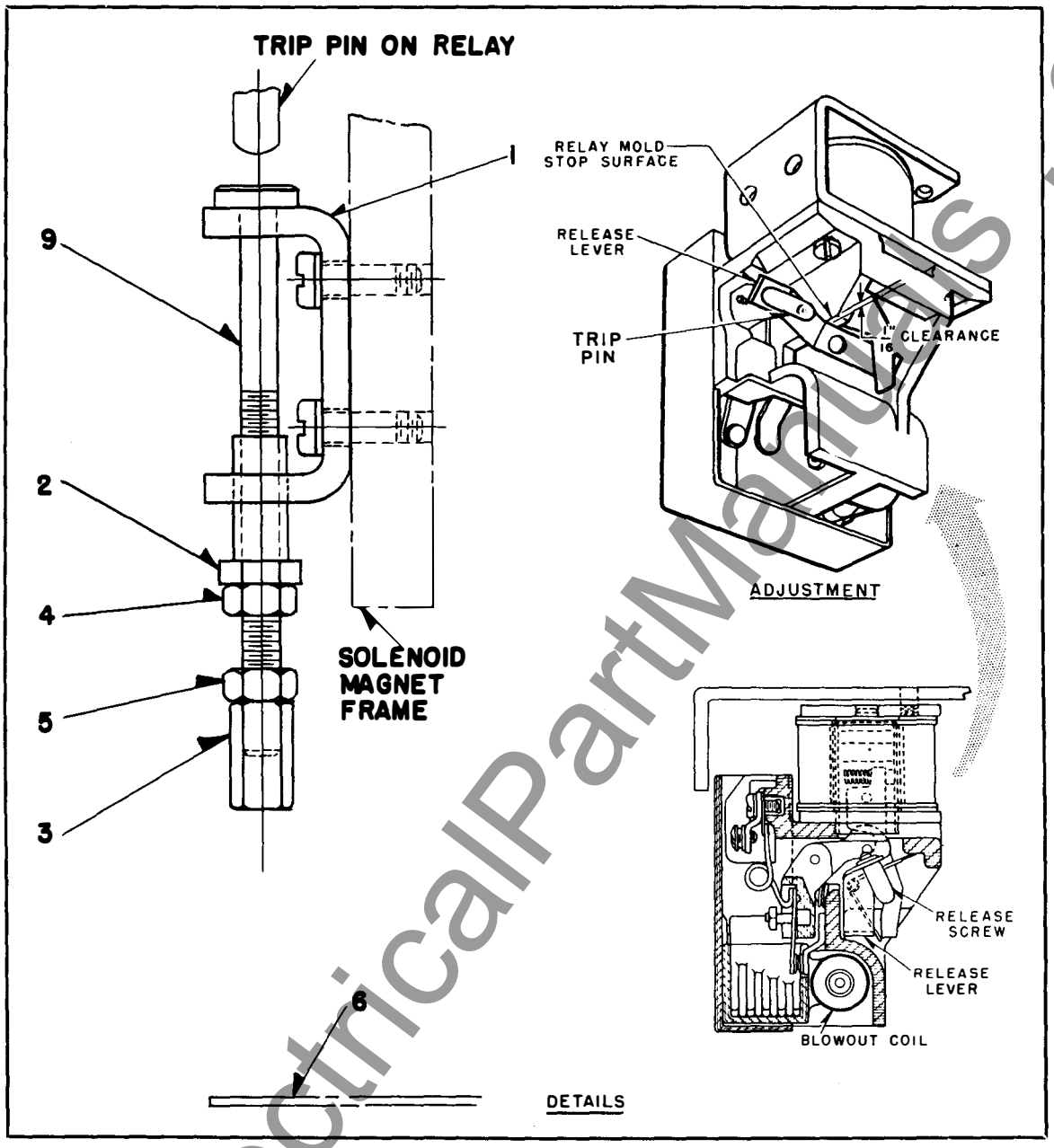

Fig. 15—Control Relay—Adjustment and Construction Details

(3), the relay contacts will open just before the breaker latches. This position can be best determined by watching the pawl in the breaker operating mechanism. The relay contacts should open when the pin has 1/32-inch to travel upward to allow the pawl to snap in place. When the breaker is latched, de-energizing and then energizing the relay operating coil should not cause the relay contacts to move toward the closed position. Trip breaker. Tighten locknut (5) to nut (3) to maintain this adjustment.

Reconnect closing coil leads to the control circuit wiring.Check electric closing of breaker.

SHUNT TRIP ATTACHMENT

The shunt trip mounts on top of the platform immediately to the right of the operating mechanism.

(See Fig. 16 on following Page.)

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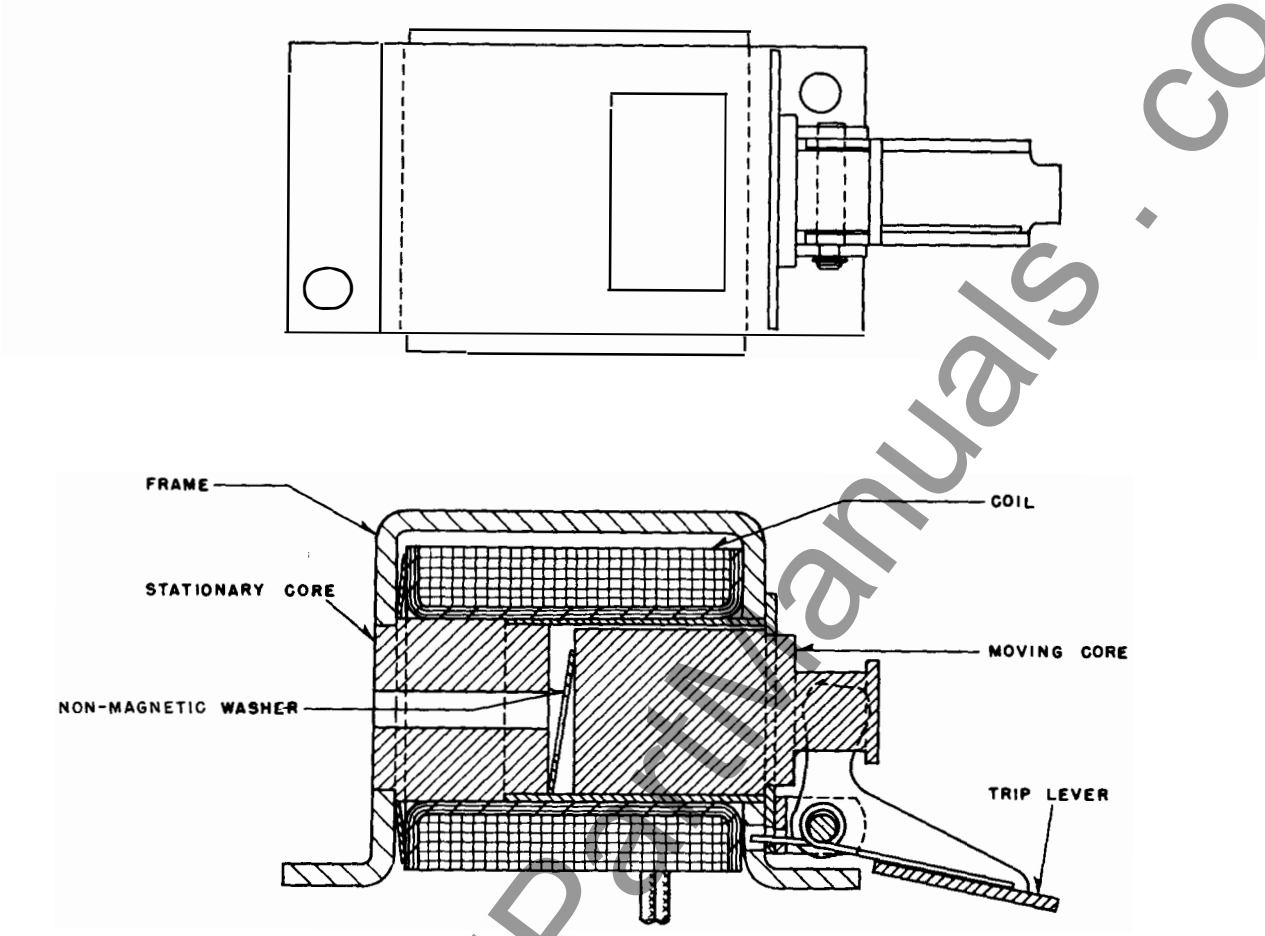

Fig. 16—Shunt Trip Attachment—Construction Details

It is non-adjustable and is intended for intermittent duty only. The shunt trip circuit must always be opened by an auxiliary switch contact. Tripping currents are tabulated in Table No. 2, Page 7.

Inspection

With the breaker in the open position, manually push the moving core against the stationary core and rotate the breaker handle to the closed position. The breaker should be trip free.

The trip lever of the shunt trip should have from 1/32 to 1/8-inch clearance to the trip bar.

Maintenance

Check for loose bolts and faulty coil.

UNDERVOLTAGE TRIP ATTACHMENT

The undervoltage trip mounts on top of the platform, to the right of the shunt trip. (See Fig. 17.) Its function is to trip the breaker when the voltage falls to between 30 to 60 per cent of normal.

The moving core is normally held magnetically against the stationary core to hold the rod and consequently the reset lever in the reset position. When the coil voltage is reduced sufficiently, the reset lever spring overcomes the magnetic attraction of the cores and rotates reset lever clockwise. As reset lever rotates, pin pushes against the latch to release it from its latch plate. When the latch releases, the trip spring rotates the trip lever counterclockwise to trip the breaker. The linkage is reset by the cross bar as the breaker opens.

Always connect the coil to the line side of the breaker unless the attachment is equipped with a time delay device. In this case, the time delay will delay the tripping of the breaker long enough to permit energization of the undervoltage coil from the load side. Do not use an auxiliary switch contact in the undervoltage circuit.

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UNDERVOLTAGE TIME DELAY ATTACHMENT

The undervoltage air dashpot time delay attachment mounts on the front of the undervoltage trip, replacing moving core cover. (See Fig. 17. The needle valve screw in the top regulates the opening through which the air is forced and hence the time delay. (See Fig. 18.) The attachment does not have a quick reset feature and therefore approximately one minute should be allowed between operations to permit complete resetting.

Inspection

Hold the trip bar down and close the breaker manually. Release the trip bar slowly, allowing the undervoltage trip spring to raise the trip bar and trip the breaker.

Maintenance

Check for loose bolts and faulty coils.

REVERSE CURRENT TRIP ATTACHMENT

This attachment mounts directly on the center molded pole unit base, in the space ordinarily occupied by the overcurrent attachment. (See Fig. 19.) It is used to trip the breaker when the direction of current flow in that pole is reversed. When the series coil current is flowing in the forward direction, armature movement is prevented by a stop. When the series coil current is reversed, the armature rotates in the opposite direction to trip the breaker. Calibration adjustment covers 5 and 25 per cent reverse current, based on normal current rating.

After tripping the reverse current armature is reset by opening the potential coil circuit. For this purpose an "a" contact of the breaker auxiliary switch should be connected in series with the potential coil.

Inspection

Close the breaker manually, and push backward on the spring stud located on the bottom of the armature, to trip the breaker. The armature should move without friction, and should have approximately 1/32-inch overtravel after tripping.

Final inspection should be made electrically, after the circuit connections are complete as shown in Fig. 2 Page 9.

Maintenance

Remove all power from the breaker and repeat the mechanical inspection given above. Check for loose bolts and open circuit in potential coil.

FIELD DISCHARGE SWITCH

The field discharge switch is ordinarily used with a two-pole breaker, and mounts on an insulating panel in place of the center pole.(See Fig. 20.) The switch is designed to close approximately simultaneously with the opening of the breaker contacts. An arc chute is always supplied to interrupt motor starting secondary currents.

Inspection

Remove the arc chute, close the breaker manually and check for freedom of motion. The contact gap should be approximately 1/16-inch when the arcing contacts on the circuit breaker touch on a closing operation. The gap is adjusted by loosening the locking nut and turning the operating rod in or out. Always leave a slight gap at the stop surface.

Maintenance

Remove power from the breaker, clean the contacts if necessary, check the contact gap and adjust if necessary. Check for loose bolts.

AUXILIARY SWITCH

The auxiliary switch mounts on top of the platform to the left of the operating mechanism. (See Fig. 21.) The contacts will carry 15 amperes continuously or 250 amperes for 3 seconds.

TABLE NO. 3 INTERRUPTING CAPACITY

VOLTS	INTERRUPTING CAPACITY IN AMPERES	
	NON-INDUCTIVE CIRCUIT	INDUCTIVE CIRCUIT
125 V. D-C	11	6.25
250 V. D-C	2	1.75
115 V. A-C	75	15
450 V. A-C	25	5

The switch is a shaft-operated, 4-pole, rotary type having two "a" contacts (closed when the breaker is closed) and two "b" contacts (closed when the breaker is open). The rotor operates

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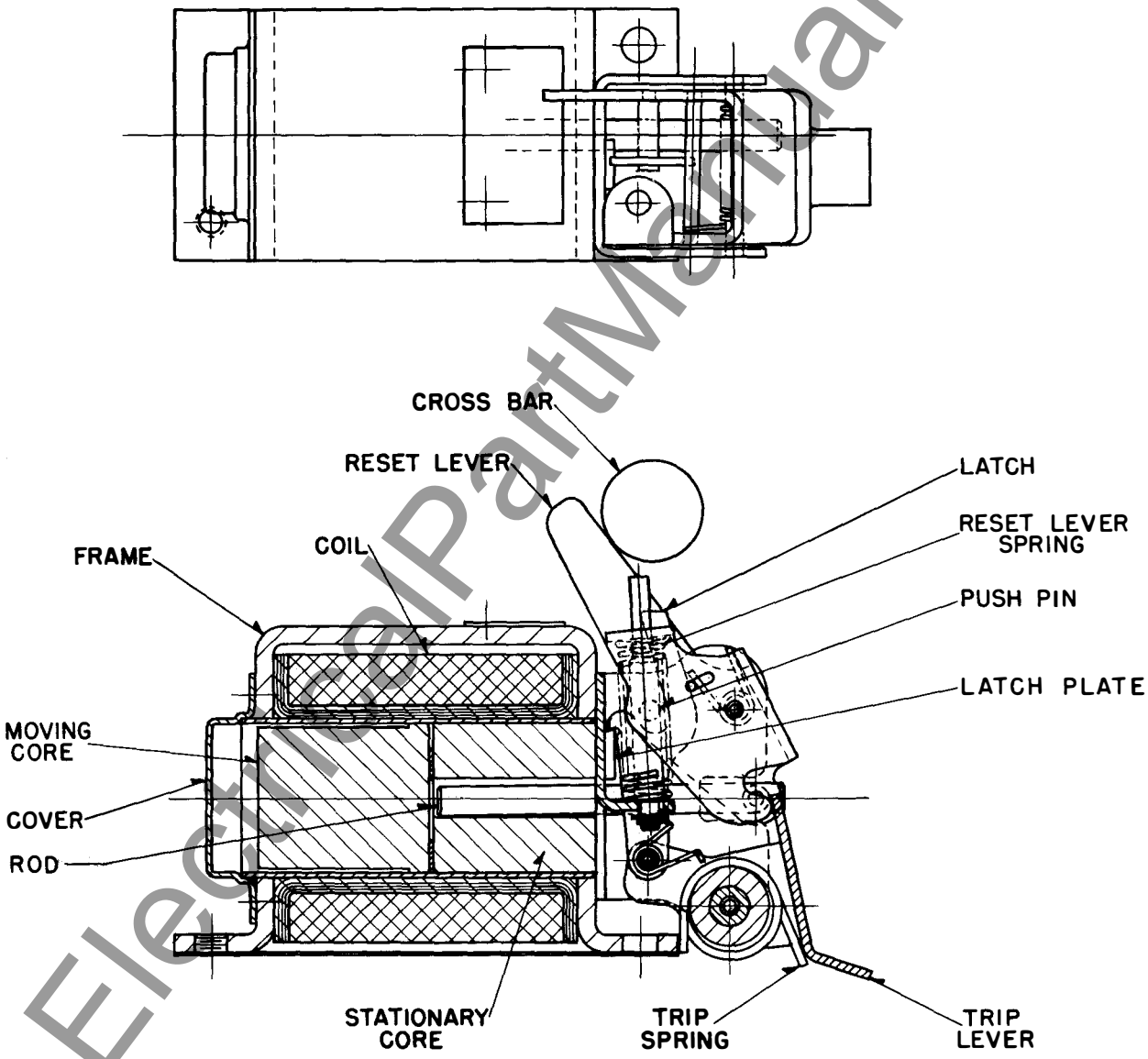

Fig. 17—Undervoltage Trip Attachment—Construction Details

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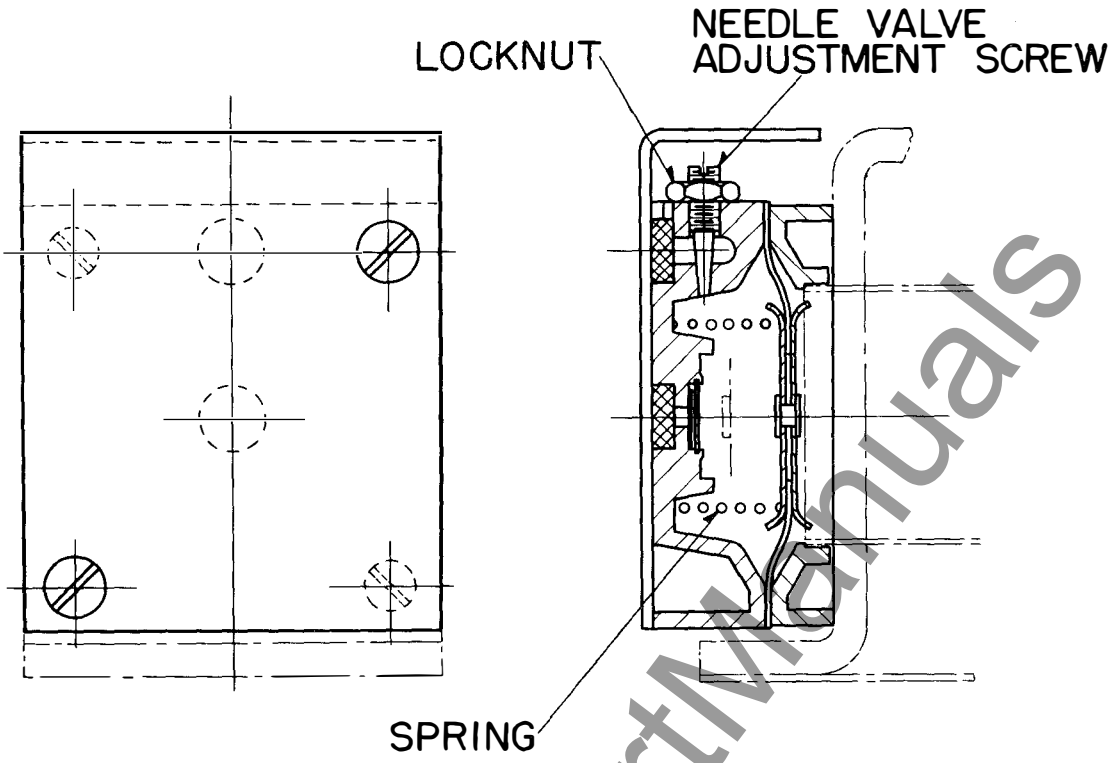

Fig. 18—Undervoltage Time Delay Attachment—Construction Details

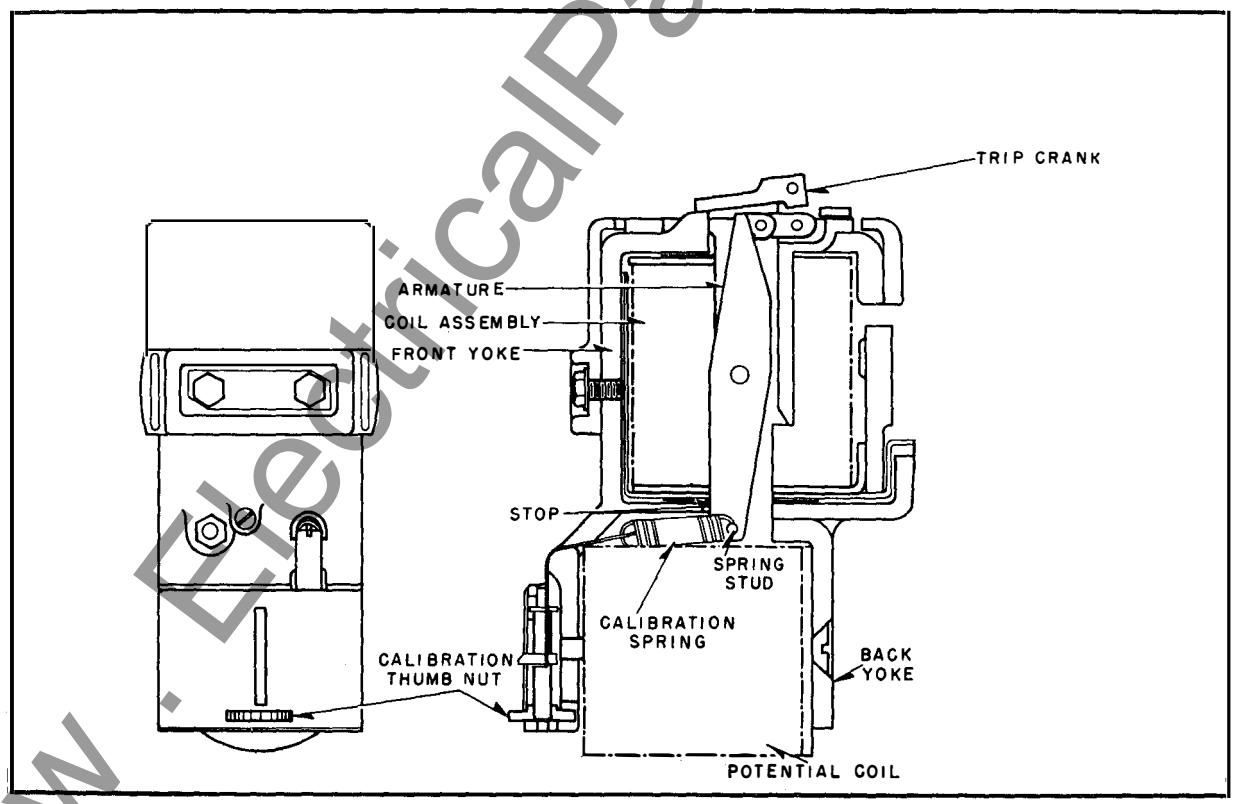

Fig. 19—Reverse Current Trip Attachment—Construction Details

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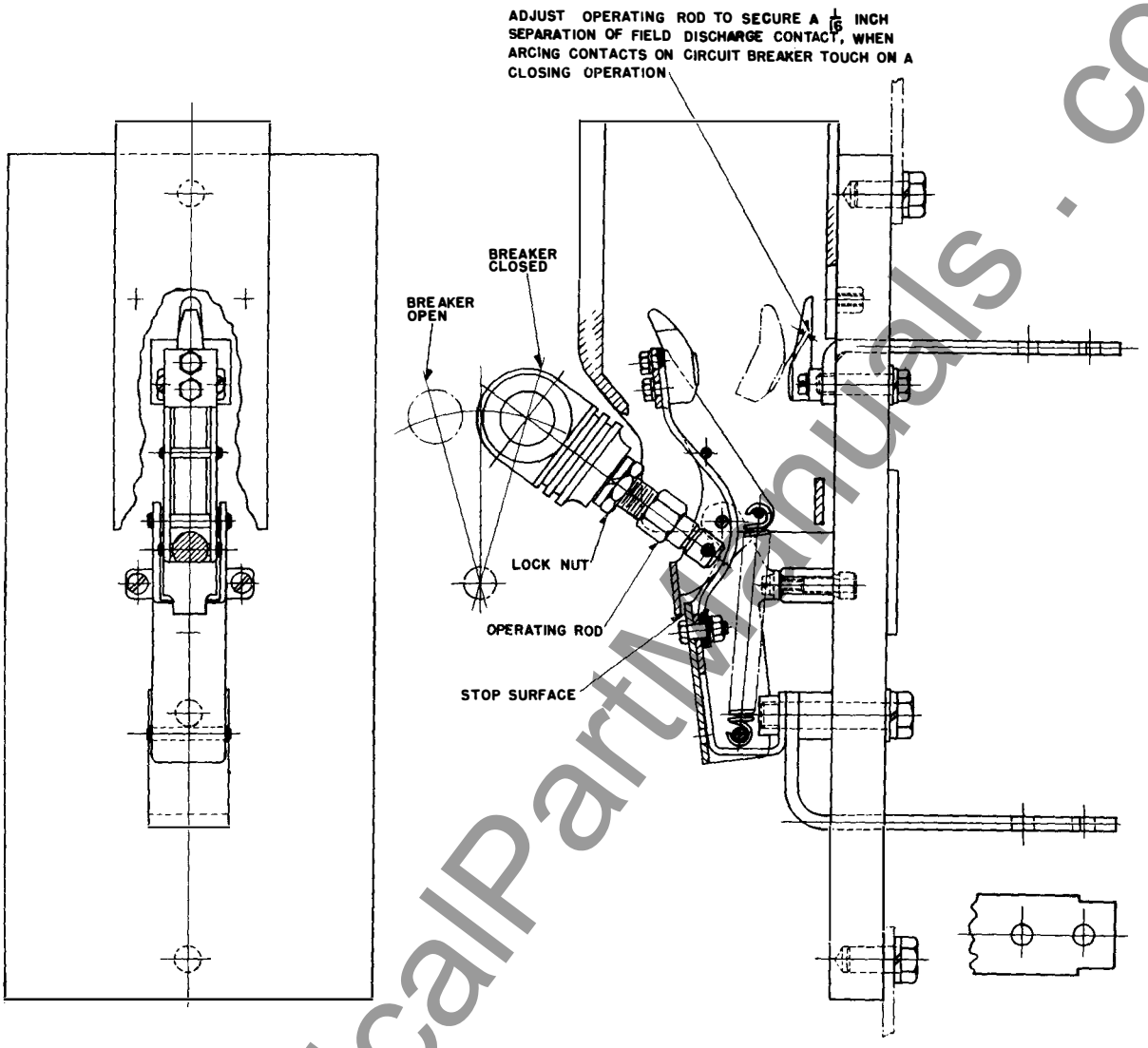

Fig. 20—Field Discharge Switch—Construction Details

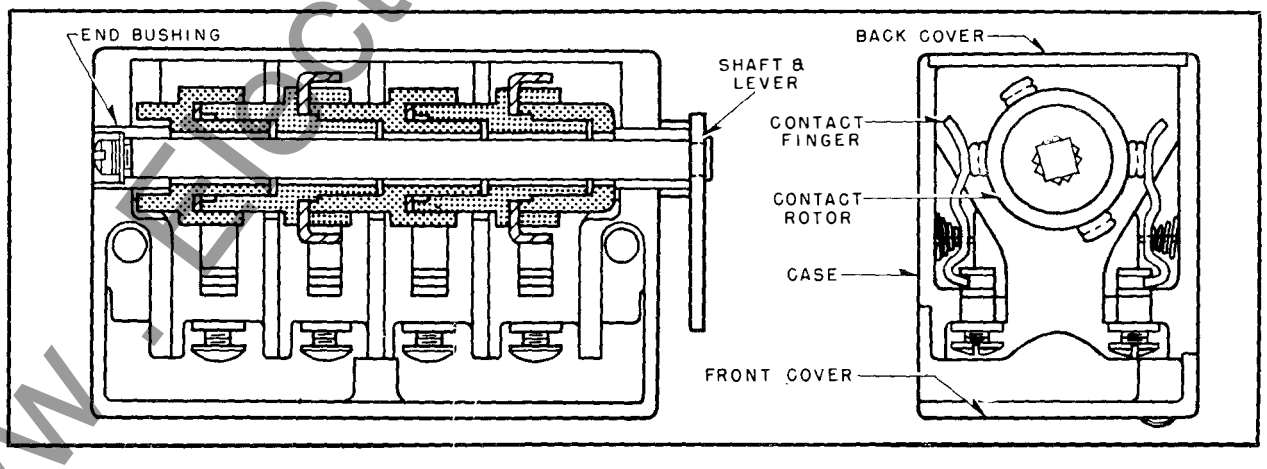

Fig. 21—Auxiliary Switch—Construction Details

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through a 90-degree angle and is non-adjustable however, the contacts may be changed from "a" to "b" or vice versa. To change, remove the switch from the platform, remove the back cover, shaft and end bushing. Remove the rotor and change the contacts as desired. Be sure to replace the shaft in the original position relative to one of the unchanged contacts.

Inspection

Remove front cover and make sure contacts are touching well before the end of travel.

Maintenance

Check for loose bolts. Replace contacts if necessary.

ALARM SWITCH ATTACHMENT

The alarm switch mounts above the shunt trip attachment (see Fig. 22) and will energize the alarm circuit on all opening operations excepting those initiated through the breaker handle or shunt trip. The alarm switch may be reset manually by rotating the breaker handle to the tripped position, or electrically by energizing the shunt trip coil (when electrical resetting has been provided). Manually or electrically closing breaker also resets alarm switch.

Inspection

Close the breaker manually and trip by rotating the breaker handle to be sure the alarm contacts do not "make". Repeat the above procedure except trip by raising the trip bar; note the alarm contacts do make contact.

Maintenance

Clean the alarm contacts when necessary. Check for loose bolts.

ELECTRIC LOCKOUT ATTACHMENT

The electric lockout mounts on the top of the platform immediately to the left of the operating mechanism and behind the auxiliary switches. (See Fig. 23). Its function is to hold the breaker open (trip free) until the lockout coil is energized. The lockout coil can be de-energized after closure of the breaker, if desired.

Inspection

Rotate the breaker handle to the closed position. The lockout should prevent closure of the breaker by holding the trip bar in the trip free position. Holding the lockout armature in the closed position should permit closure of the breaker. Releasing the armature after closure should not trip the breaker.

Maintenance

The device is non-adjustable. Check for open-circuited coil and for loose bolts.

KEY LOCK ATTACHMENT

The key lock mounts on the right side of the operating mechanism frame. (See Fig. 24.) The key can be removed in the open or closed position of the breaker.

Inspection

Rotate breaker handle to tripped position and turn key in the locked position. The key is then removable and the breaker handle is locked in the tripped position. Replace key, apply force in the counter-clock-wise direction to breaker handle and rotate key to the unlocked position to free breaker handle. Key should be removed in this position.

Maintenance

The device is non-adjustable. Check for loose bolts only.

KEY INTERLOCK ATTACHMENT

The key interlock mounts on the right side of the operating mechanism frame. (See Fig. 24.) When the key interlock attachment is furnished, the key lock attachment cannot be supplied. In the key interlock attachment the key cannot be removed unless the breaker is locked in the open position.

Inspection

Rotate the breaker handle to the tripped position and turn key to the locked position. The key is then removable and the breaker handle is locked in the tripped position. Replace the key, apply force in the counter-clockwise direction to the breaker handle and rotate the key to the unlocked position to free the breaker handle.

Maintenance

The device is non-adjustable. Check for loose screws and nuts only.

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RECTIFIER UNIT FOR A-C UNDERVOLTAGE AND A-C ELECTRIC LOCKOUT ATTACHMENTS

When an a-c undervoltage attachment or an a-c electric lockout attachment or both is required, a RECTOX unit is mounted underneath the breaker platform under the undervoltage device as shown in Fig. 25. An autotransformer is provided in the unit so that the common voltages for 60 cycles and 25 cycles can be connected to the appropriate terminal on the unit. The attachment leads are soldered to the rectifier in the unit to insure against possible open circuits.

Inspection

There are no moving parts. Make certain a-c incoming leads are connected to proper terminals.

Maintenance

Check for loose connections.

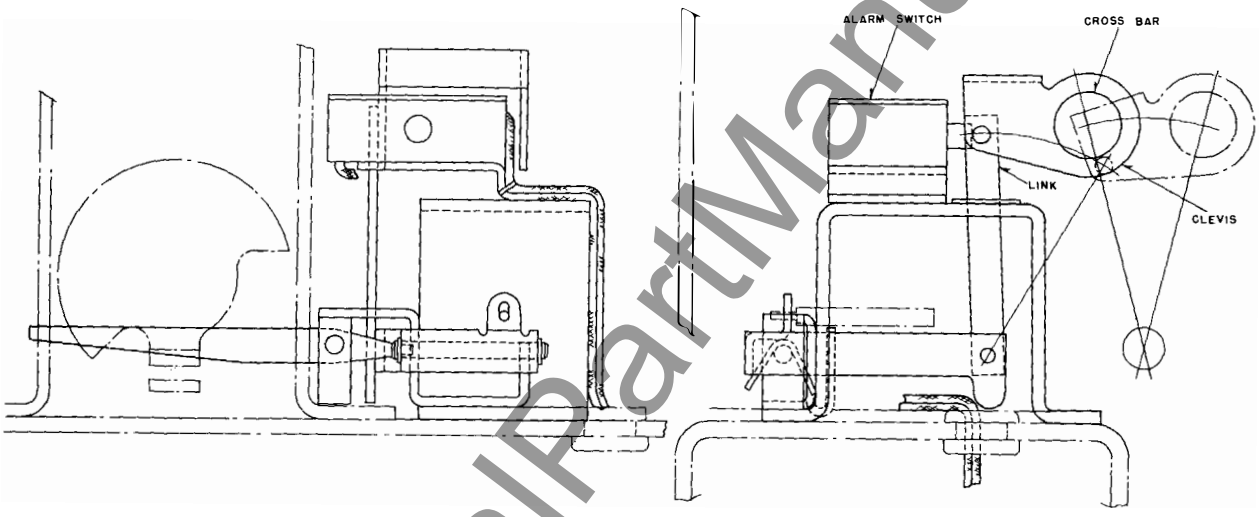

Fig. 22—Alarm Switch Attachment—Construction Details

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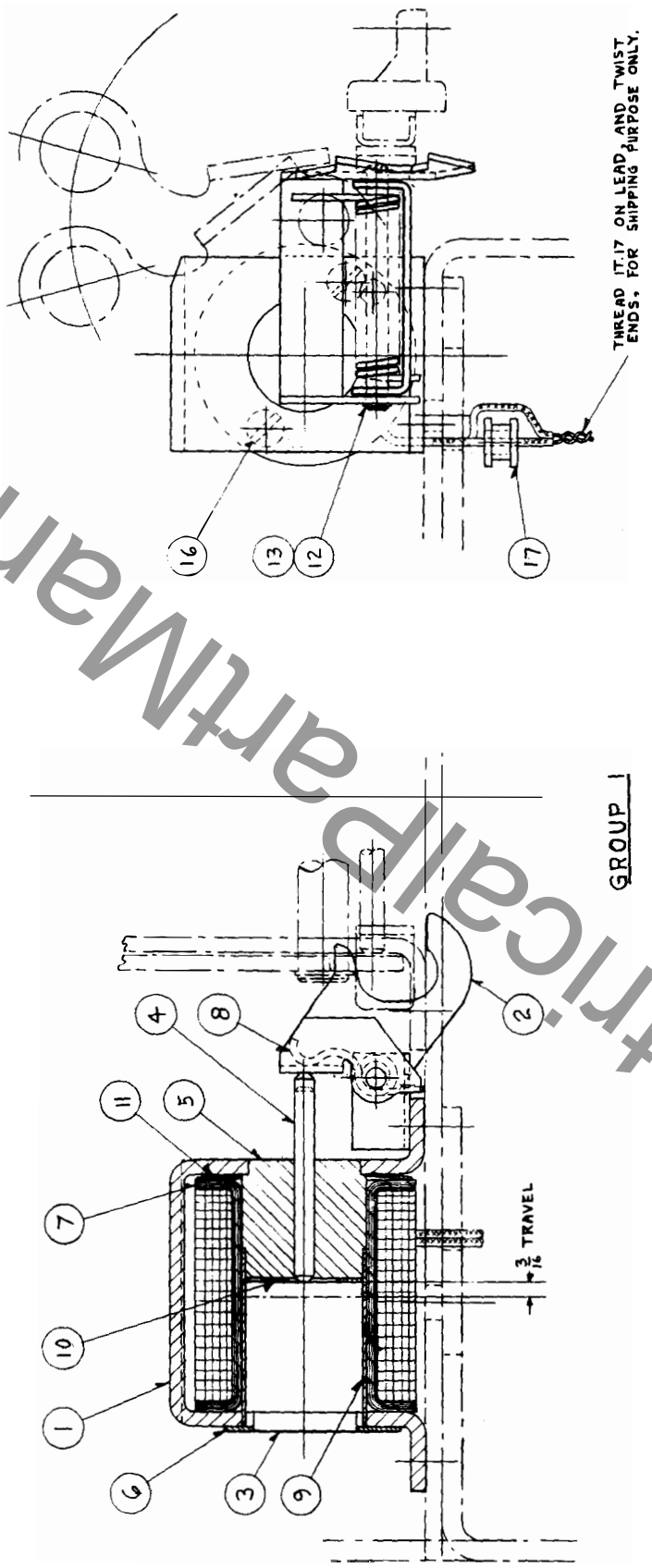

Fig. 23—Electric Lockout Attachment—Construction Details

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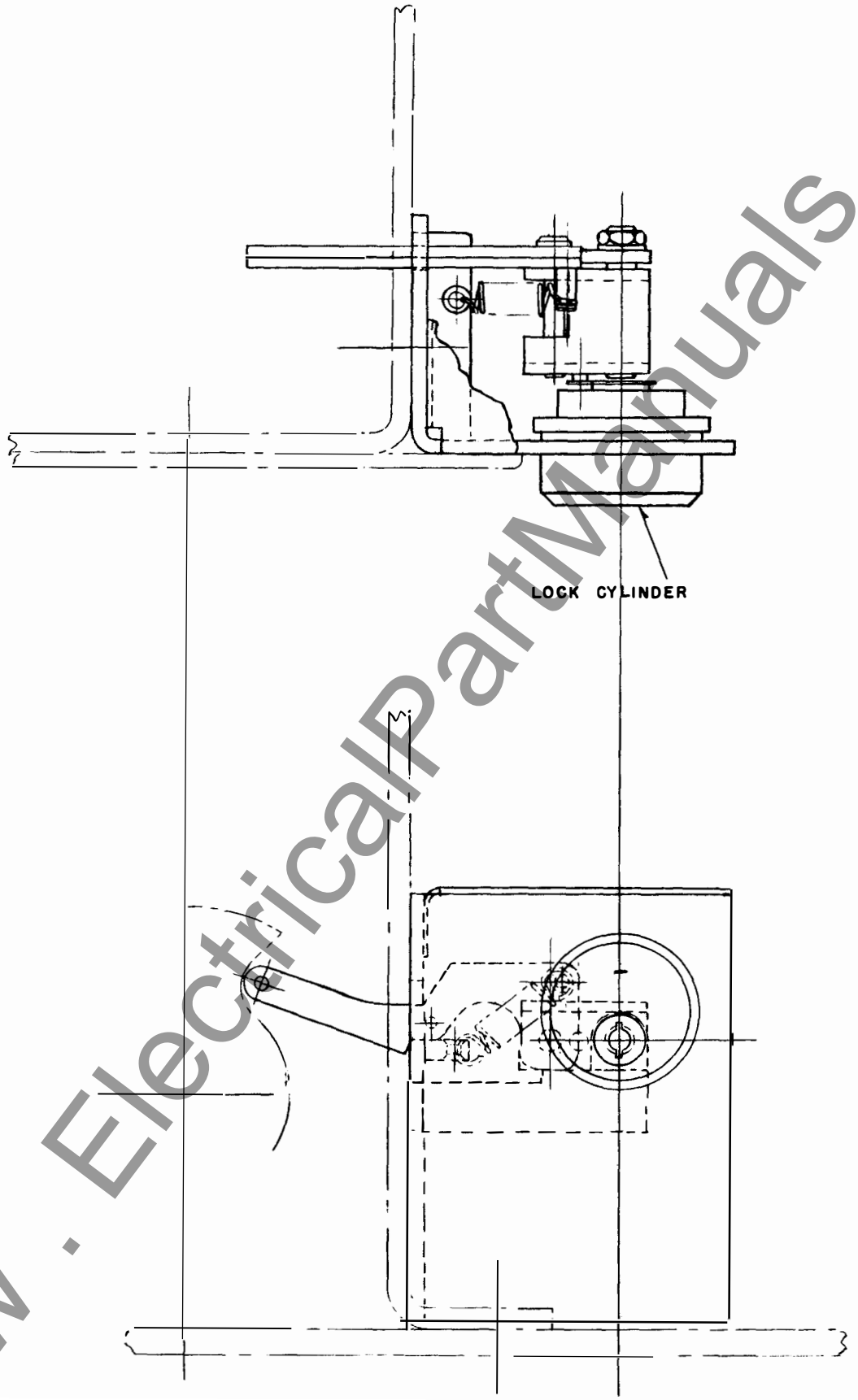

Fig. 24—Key Lock or Key Interlock Attachment—Construction Details

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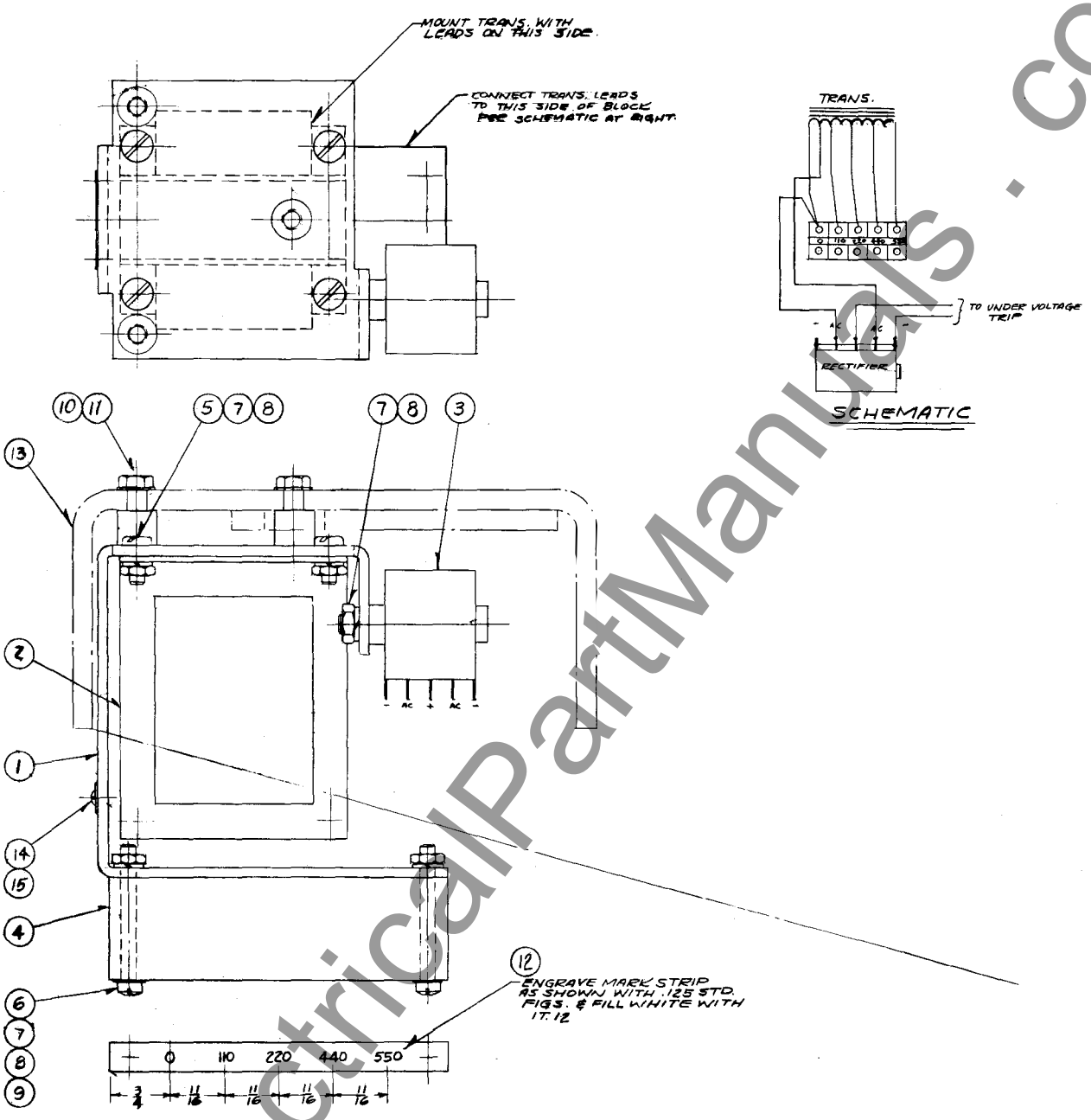

Fig. 25 Rectifier Unit for A-c Undervoltage and A-c Electric Lockout Attachments

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