Westinghouse

Type F-122 Oil Circuit-Breakers

600 Amperes, 4,160 Volts

INSTRUCTION BOOK

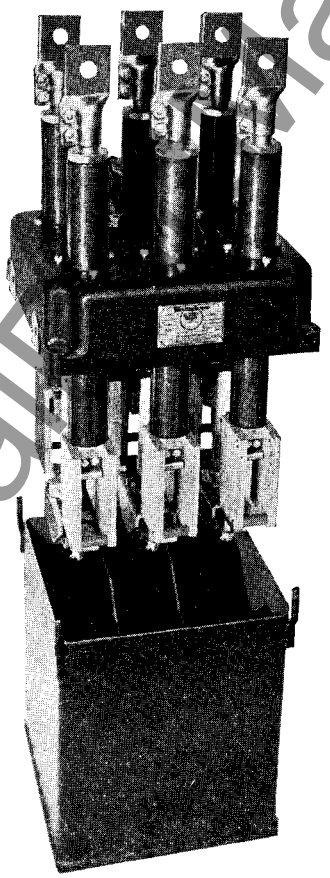

FIG. 1—TYPE F-122 OIL CIRCUIT-BREAKER UNIT, 600 AMPERES, 4160 VOLTS

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Type F-122 Oil Circuit-Breakers

600 Amperes, 4160 Volts
3-Pole

Manually or Electrically Operated

General Description

The type F-122 oil circuit-breaker is a low interrupting capacity breaker—embodying the desirable features of larger breakers, including internal mechanism, wound type micarta bushings, heavy butt type contacts, "De-ion" Interruptors, and silver-to-silver main contacts.

This breaker has a large factor of safety in interrupting capacity, being thoroughly tested in the testing laboratories at East Pittsburgh. The "De-ion" Interruptor assures speedy and positive operation with a minimum of disturbance.

The contacts are of large cross section, to withstand long service without renewal.

The breaker will give excellent service with a reasonable amount of care and the instructions which follow should be used as a guide in servicing this breaker.

Shipment

The breaker unit will be shipped separately, except when the mechanism is bolted directly to the breaker unit, boxed and fastened in the closed position. Operating mechanisms and details may be shipped in separate containers, all marked for easy identification.

Unpacking

Care should be used in unpacking the circuit-breakers and parts, so that small parts are not damaged. Extra precautions should be taken so that the bushings are not damaged.

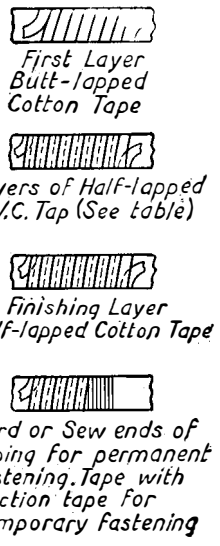
A careful inspection should be made, to insure that no parts were broken or damaged during shipment. In case of damage the proper claims should be made to the transportation company.

Installation

1. Attach the breaker to the supporting structure, first making sure that the structure is level.
2. Remove the tank and examine the inside for evidence of moisture and foreign matter. Flush with insulating oil.
3. Connect the breaker to the operating mechanism. Remove the wire or blocking which holds the breaker in the closed position, and allow the breaker to open slowly.
4. Examine the contacts and note that they are clean and in alignment. For adjustment see section covering adjustment.
5. Operate the circuit-breaker by hand several times, watching each pole and the operating mechanism to be sure all parts move smoothly and freely.
6. When the mechanism is remote mounted, adjust the connections between the breaker and operating mechanism so that full contact is obtained and the breaker rests on the bumpers when in the open position.
7. Install connections to the breaker studs.
8. Insulate the connections with varnished cambric and non-elastic webbing in accordance with Westinghouse Standards for the various operating potentials. See Fig. 2.
9. With the tank removed, fill with Wemco "C" oil to the line marked on the tank or as directed on the breaker name plate.
10. Bolt the tank in place, being sure that it is drawn up evenly all around.
11. Connect the breaker frame, through one of the mounting bolts, to ground. The National Electric Code requires grounding cable to have one-fifth of the main circuit capacity except that it must never be smaller than No. 8 and need not be larger than No. 0, B & S gauge.

Adjustments

Breaker Mechanisms—The toggle mechanism is designed for reversible operation, so that the direction of oper-



Service Volts	Layers of Varnished Cambric Tape
2500	
4000	5
4500	6
6600	7
7500	8

Wrap the conductor with butt-lapped layer of ".007 white cotton tape and cover with one coat of No. 9 insulating varnish (Westinghouse Catalog No. 311). Then wrap with half-lapped layers of ".010 varnished cambric tape (Westinghouse No. 1225 Tan Treated Cloth) applying as many layers as given in the above table. Apply a coat of No. 9 insulating varnish (Westinghouse No. 311) between layers. Tape over the cambric with one layer of ".007 cotton tape and wrap the ends with cord to keep them in place. Finish with two coats of M-1736 black insulating varnish (Westinghouse Catalog No. 414).

FIG. 2—INSTRUCTIONS FOR TAPING CONNECTIONS

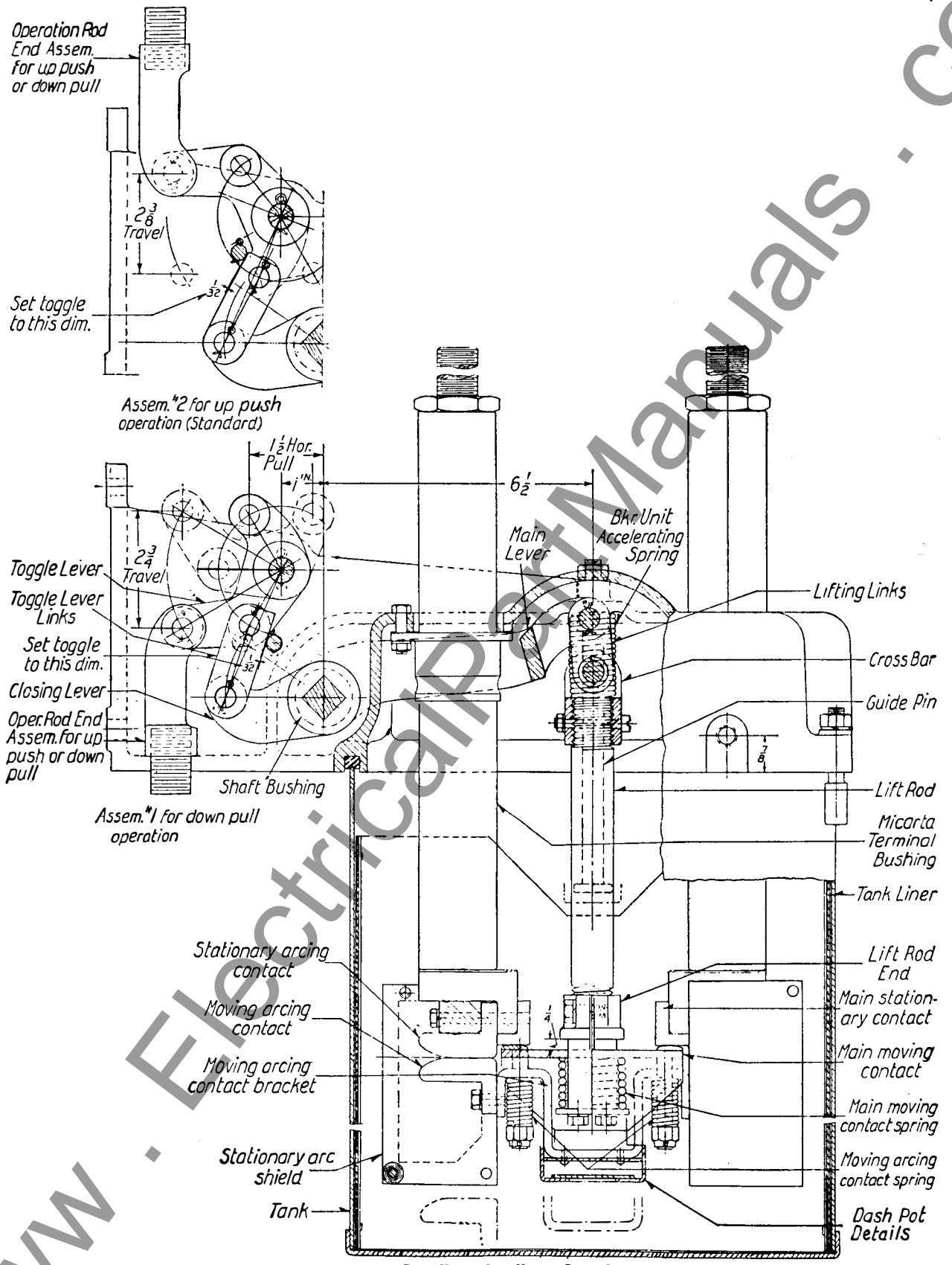


FIG. 3—BREAKER POLE UNIT—SIDE VIEW—CROSS SECTION

ation can be changed by a simple change in the position of the operating lever and connecting links. Both assemblies are shown in Figs. 3 and 9. To change from one direction of operation to the other the toggle lever and links are assembled as shown. The clearance between the operating links and the stop pin should be approximately $\frac{1}{32}$-inch in either case, when the contacts are in full contact.

Two guide rods, Figs. 3 and 4, are used to align the moving contacts and guide the contacts for straight line motion. The cross bar must move up and down freely on these rods. The lower end of the guide rods and the lower surface of the moving cross bar cooperate to form hydraulic bumpers. No adjustment is necessary, other than to be sure the moving contacts open to the full position. **Do not operate the breaker excessively without oil.**

Contacts—The contact arrangement is shown in Fig. 3. The main and arcing contacts are both of the butt type, the ¼-inch lead of the arcing contacts being maintained by the thickness of copper on the arcing tips while the contact pressure on the main contacts is obtained by a compression spring. With the breaker closed the main contact should be ¼-inch below the shoulder on the lift rod end. If necessary to adjust, the moving arcing contacts are removed, the lift rod end loosened and the contact assembly screwed up or down as necessary.

It is important that the ¼-inch dimension is maintained as this determines the contact pressure on the main contacts.

The main contacts make silver-to-silver contact and it is unnecessary to use an abrasive to keep them clean. The oxide of silver does not increase the contact drop, consequently the temperature of the contacts will not progressively increase as is the case with plain copper contacts carrying large currents. In fitting new contacts it is unnecessary that perfect line contact be obtained. With the comparatively soft material (silver) good contact is obtained after a few operations, as the silver flows slightly under pressure.

If the silver contacts on the moving contacts are replaced, use solder of at least 300°C. melting point. **Use only "pure silver", coin silver is unsatisfactory.**

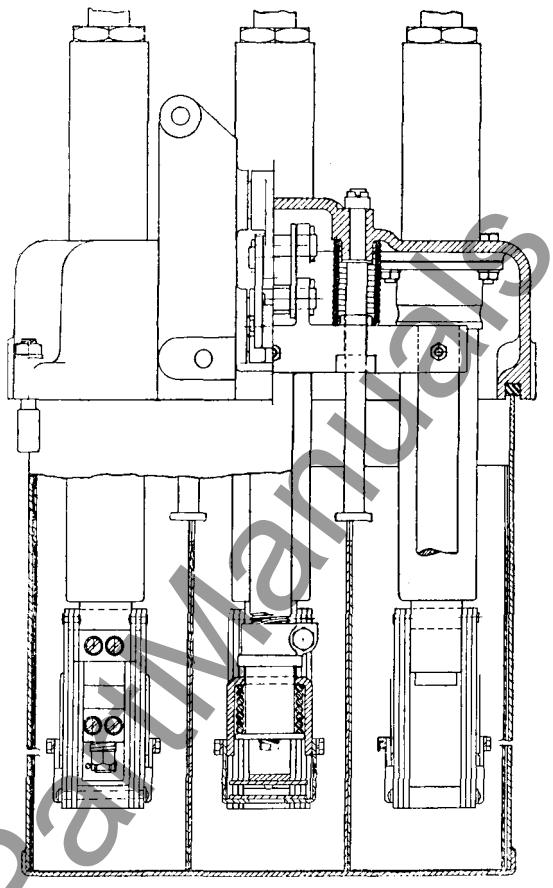


FIG. 4—THREE-POLE BREAKER UNIT—FRONT VIEW

"De-ion" Interruptors—The "De-ion" Interruptors control the arc and quickly extinguish it by de-ionization. These devices need little attention other than an occasional inspection. They must be kept securely tightened and properly aligned so that the moving contacts move freely and do not rub causing excessive friction. The fibre insulation is affected very little by the arc action but should be inspected occasionally and replaced if excessive deterioration is found.

Terminal Bushings—The surface of the bushing insulation should be smooth and well varnished. If the varnished surface is damaged it should be smoothed off with fine sandpaper and re-varnished with three coats of good quality, clear, air-drying spar varnish. Each coat should be allowed to dry for 24 hours

Operation

Points to be observed in operation—

1. Before making any adjustment to an oil circuit-breaker, make sure that all lines leading to it are electrically dead.
2. Be sure the breaker frame is grounded.
3. Do not operate the breaker excessively by the electrical operating mechanism when the oil tank is removed.
4. Examine all contacts frequently, especially after severe short-circuits. See that contacts are aligned properly. Replace those badly burned.
5. After making adjustments, operate the breaker carefully by hand to make sure that it operates smoothly and correctly.
6. Inspect the oil regularly and after severe short-circuits. If it shows

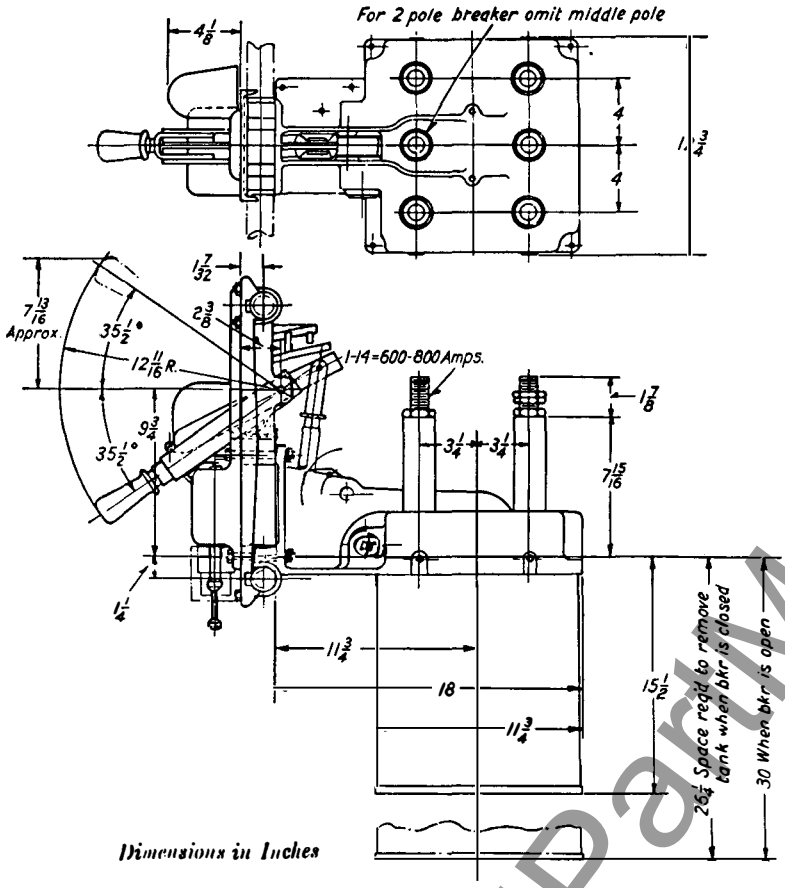


FIG. 5—OUTLINE DRAWING FOR TYPE F-122 BREAKER WITH COMMON PIPE MOUNTING FOR UNIT AND COVERPLATE

signs of moisture, carbonization or dirt, filter and retest it before replacing it in service. See that the oil level in the tanks is maintained at the proper height.

7. Remove all oil and thoroughly clean the tanks, tank liners, lift rods, terminal bushings, etc., at least once a year.
8. Thoroughly inspect all bolts and nuts—and tighten if necessary. Inspect all pins, links and bearings especially for excessive wear. Check all cotter pins. Do not use thin lock washers on moving contact parts.
9. Arrange for regular inspection to see that the apparatus is in adjustment, the oil is of good quality and that the complete breaker functions as required. Regular inspection periods pay dividends.

Insulating Oil

Dielectric tests of the oil should be made every three months, to show if it is reasonably good for circuit-breaker work. Samples should not be taken until the oil has remained undisturbed for at least four hours. In testing for indication of water, take the sample from the bottom of the tank. If for indication of carbon, and after a heavy short-circuit, take the sample from the surface of the oil.

Care of Circuit-Breaker Oil—The care of the insulating oil in circuit-breakers is of the utmost importance in their successful operation. Contamination by dirt, moisture, metallic particles, lint, etc., all reduce the dielectric strength, upon which the operation and current interrupting ability largely depend. Consequently, the most careful attention should be given to keeping the oil clean, not only in filling the tanks originally but in later maintenance or other work on the breakers which might involve opening the tanks.

Only the highest grade, such as Wemco "C" or other approved oil should be used in the breakers. The oil should be new or at least thoroughly reconditioned by means of a filter press or centrifuge. In any case, before using, it should be given a dielectric test which should show a minimum of 22,000 volts (preferably 25,000 to 30,000) measured between 1-inch diameter discs spaced .1 inch apart.

Before filling, the tanks should be thoroughly cleaned and flushed out with insulating oil. The same treatment should be given the inside of the top of the breaker and the operating linkage and contact system. In doing this, rags which will leave lint should not be used as this absorbs and holds moisture.

The same care should be used during inspection or maintenance work on the breaker, which should preferably be done only under favorable weather conditions. If the oil is to be reconditioned following operation of the breaker under short-circuit, the tank, and entire inside of the breaker should be cleaned before the oil is returned to the tank. If the work merely involves lowering or removal of the tank, care should be taken to keep the tank covered until it is replaced so that dirt, dust metallic particles, etc., cannot fall into the oil.

The above precautions may appear academic to those familiar with the maintenance and operation of oil circuit-breakers, but a little more than ordinary care in oil handling will be well repaid in reliable and dependable operation for which the breaker is designed and built.

For instructions as to the care and testing of insulating oil, see Instruction Book 44-820-1.

Mounting of Switchboard Breaker (on Panel or on Panel Bracket)

Before mounting the coverplate and the breaker to the panel, first assemble the signal switch and bell alarm, if they are ordered, to the coverplate as shown on Fig. 6. Then place the 5-ampere tripping coils from the overload attachment, if supplied, in the coil box of the coverplate, and mount the coverplate

and the breaker to the panel. The breaker should be mounted as nearly level as possible. The nipple supplied with the breaker units should be screwed into the rod end of the rear of the operating handle and the mechanical set-up will be complete. By adjusting the amount by which the nipple is screwed into the rod end, it is possible to vary the contacts in the breaker. This adjustment should be made in such a way that full contact is obtained in the breaker when the handle is latched closed. In adjusting the breaker special care should be taken to see that the toggle lever is $\frac{1}{32}$ of an inch, or less, from the stop pin in the closed position. See Fig. 3 and instructions under "Adjustments." If this adjustment is not correct, the latch load on the coverplate will be excessive and the tripping attachments may not function properly. With this adjustment correct, the signal switch should make good contact in both the open and closed positions of the breaker. It should be observed that proper contact in the breaker is necessary in order to get proper contact on the signal switch.

When the adjustment of the breaker and signal switch is correct and operating properly, then the tripping cores can be put in place, and the nuts put on which hold them. If an under-voltage release is supplied, it may now be mounted on the coverplate and the leads thrust through the clearance between the coverplate and the panel, and then drawn back through the holes drilled in the panel for the leads.

For mounting other auxiliaries on the switchboard mounting breaker, see description under the heading of "Mounting of the Auxiliaries". (See page 8).

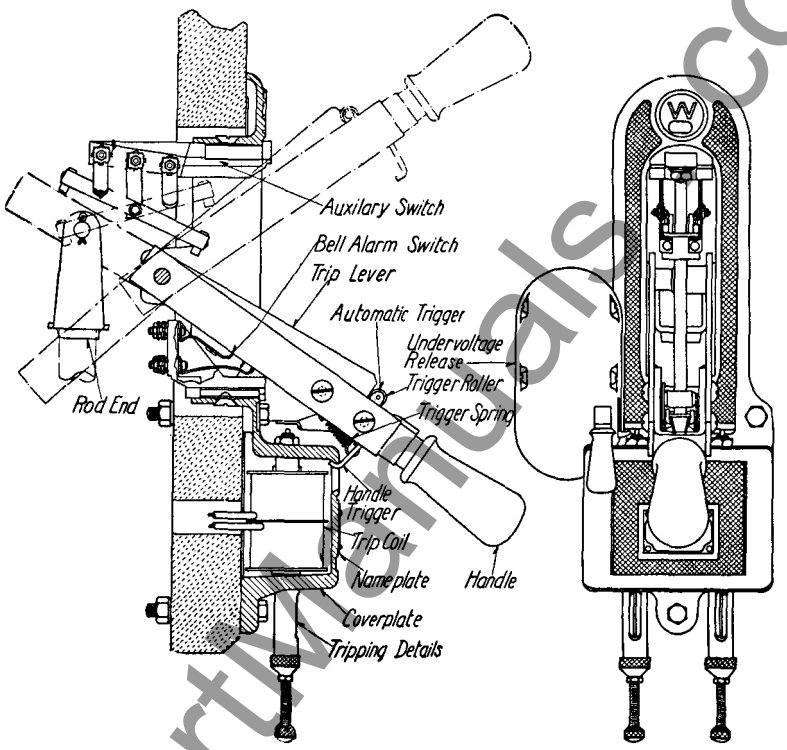


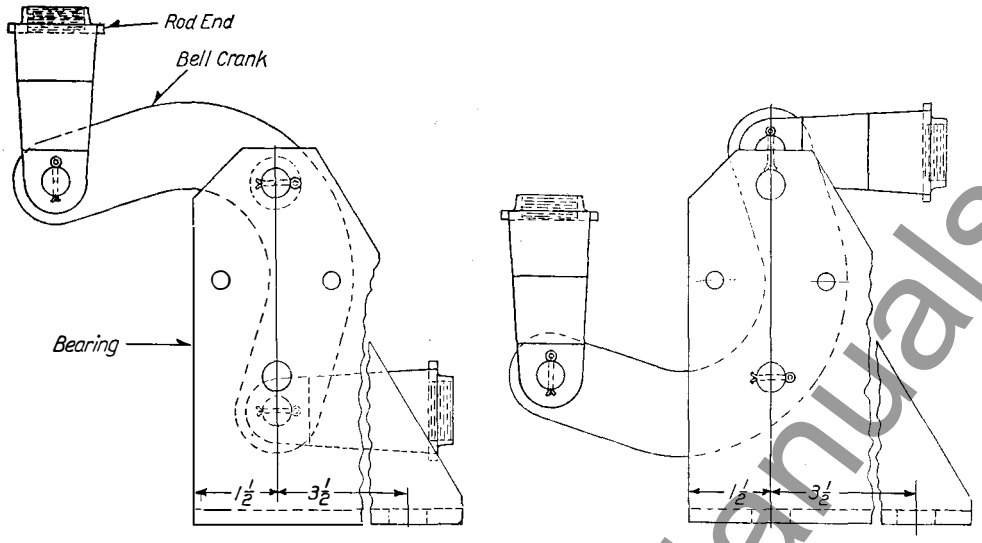
FIG. 6—SINGLE HANDLE 2-COIL COVERPLATE

Mounting of Remote Control Breaker

The remote control breaker unit should be mounted in place upon the wall or pipe as nearly level as possible, and the operating rod end reversed so that the offset will be as shown in Figs. 3 and 9. The auxiliary switch and bell alarm contacts, if supplied, should be mounted in the coverplate before the coverplate is mounted on the panel or panel bracket. The two extra bolts supplied with the two-coil coverplate should be discarded. The coverplate can then be mounted as shown in Fig. 8, with the coils in place in the coil box. The tripping cores can then be put in place on the coverplate and tightened. Here again, if an under-voltage release is used, it may be placed on the coverplate after it is assembled to the panel by pushing the leads through the clearance between the coverplate and the panel, and pulling them through the drilled holes in the panel. All connections should be made after the mechanical assembly is complete. The coverplate and breaker units should then be connected together with operating rods through the bell cranks as shown in Fig. 8.

The connecting pipes are ¾-inch x strong pipe, and should be cut 4 inches shorter than the distance between fulcrums of the levers to be connected. These pipes should be threaded 2¾ inches on each end with ¾-inch straight pipe thread. A ¾-inch pipe lock nut should be put at one end or the other of each pipe, with the exception of the breaker unit end. A pipe nut should never be used on the breaker unit end. The length of the pipe should be adjusted so that the travel of each crank lever is approximately equal on each side of the horizontal or vertical center line. The last length should be adjusted so that with the handle in the latched position, the contacts in the breaker are making full contact, as previously described. With proper adjustment on the breaker contacts, it will be observed that proper contact is secured on the signal switch if one is used. The bell cranks as supplied are for mounting above the floor. If it is desired to mount the bell cranks below the floor, it is necessary to reverse them. To reverse the bell cranks, remove the fulcrum pin and replace it in the lower hole. To reverse the accelerating device it is necessary to remove the fulcrum pin and to replace it in the upper hole. It is also necessary to change the accelerating spring on the accelerating device. See Fig. 7.

Any length of pipe exceeding 12 feet should have an intermediate support. The operating rods should all be in tension except the one next to the breaker, and in applications where this vertical rod is long enough, to cause buckling under



BELL CRANK SHOWING ASSEMBLIES FOR ABOVE AND BELOW FLOOR MOUNTING

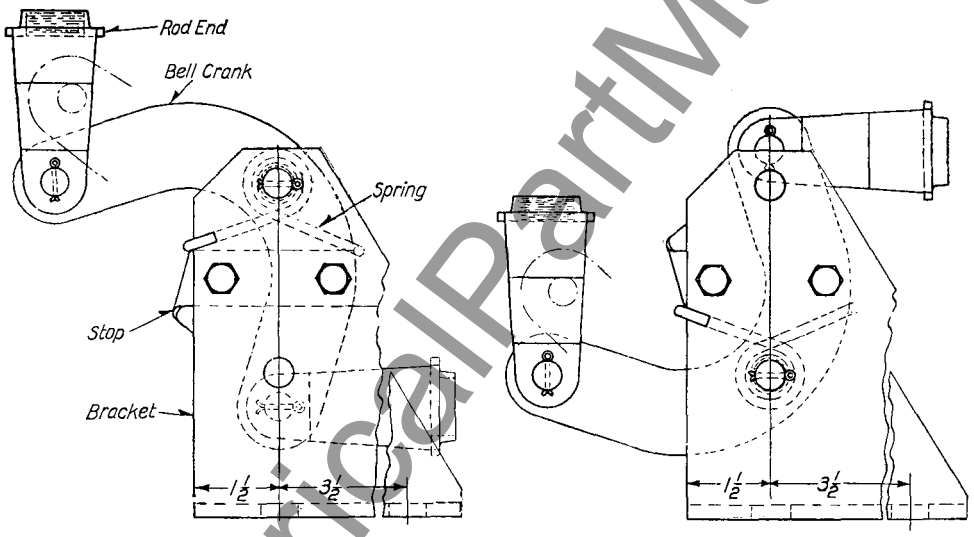


FIG. 7—ACCELERATING DEVICE SHOWING ASSEMBLY FOR ABOVE AND BELOW FLOOR MOUNTING

strain of closing the breaker, it will be necessary to reverse the accelerating device and also to reverse the toggle in the breaker so that this rod will be in tension instead of compression. To reverse the toggle in the breaker the toggle lever should be reversed and the toggle links connected to the hole in the other end of the toggle lever. The contact pressure should always be checked after making this change, as it may be necessary to re-adjust the contacts. This will cause the toggle to close the breaker with a downward motion of the operating rod. See Figs. 3 and 9.

Mounting of the Auxiliaries

Electric Lock-out Device—The electric lock-out device mounts on the side of the breaker unit and is attached to the breaker frame as shown in Fig. 18. It is necessary to replace the standard pin in the breaker operating lever by the special large headed pin supplied with the device. It should be observed that the armature moves freely, and that with the armature closed, the large headed pin has clearance to pass; while wit hthe coil de-energized, and the armature open, the lug is under the pin and successfully prevents the breaker from closing.

Mechanical Interlock—When two single-handle coverplates, or the two handles of a double-handle coverplate, are to be interlocked so that only one can be closed at a time, the mechanical interlock is used. See Fig. 19. In order to mount this attachment, it is necessary to remove the fulcrum pin from the coverplate handle, and take off the spacing washer for the handles on the side next to the coverplate with which it is to be interlocked. Then the mounting brackets of the interlock may be placed on the

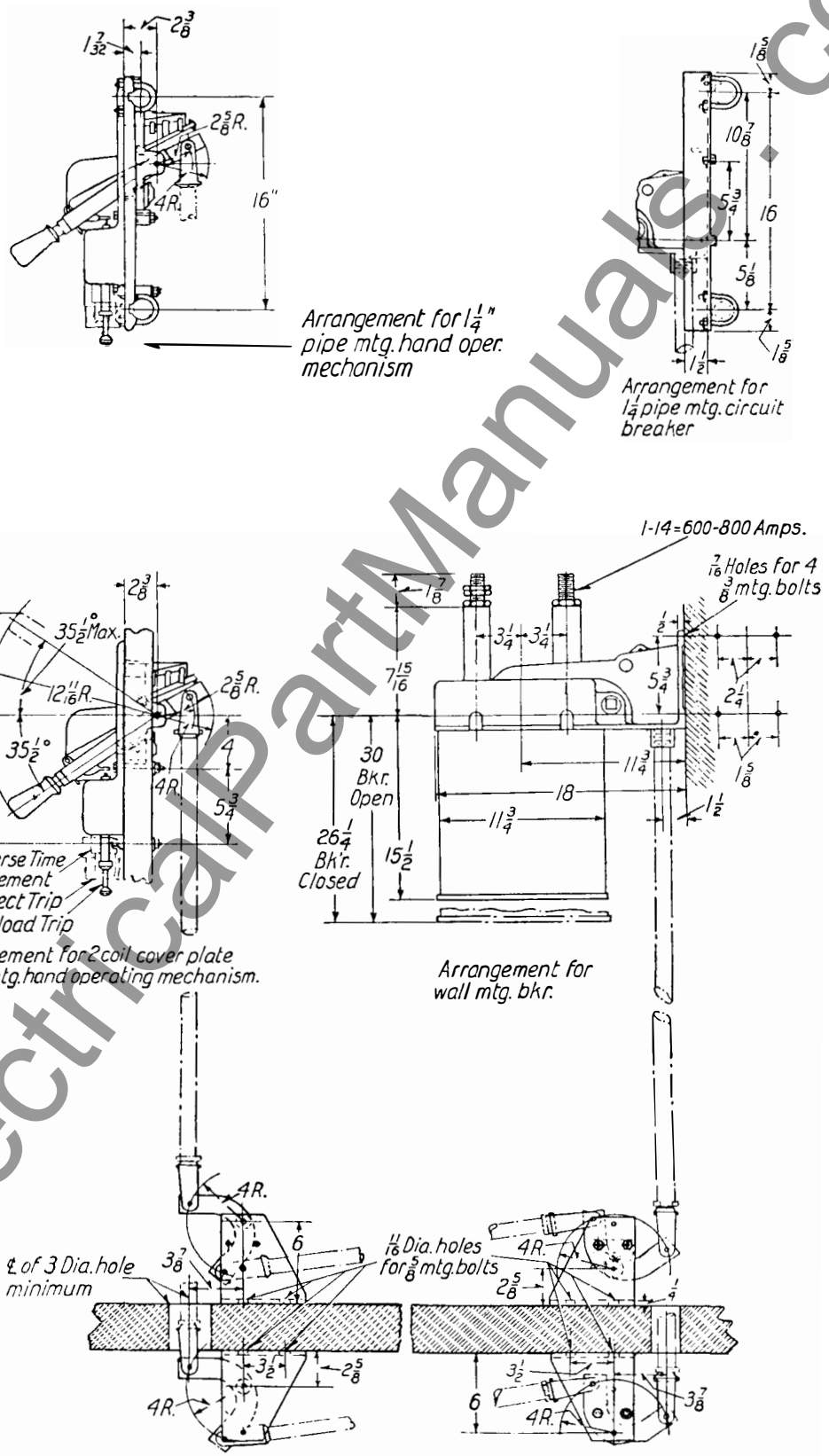


FIG. 8—REMOTE CONTROL MOUNTING DETAILS

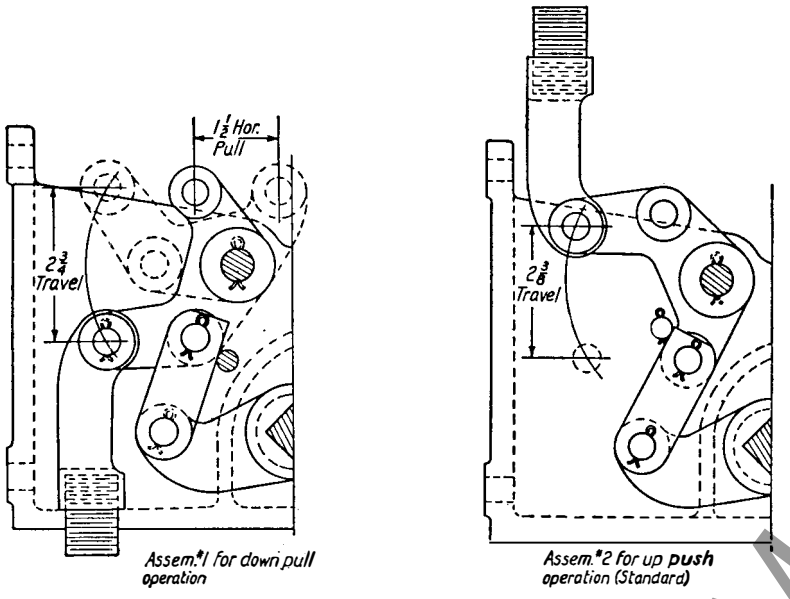


FIG. 9—TOGGLE ASSEMBLIES

coverplate as shown in the picture, and all screws tightened. It will be found that to put the brackets on first and to insert the interlock bar in place after the brackets are lined up will make the assembly easy. It should be observed that the interlock bar moves freely and is returned to the neutral position by the spring when the handle releases it.

The movement of one handle to the closed position should move the interlock bar over the other handle so that it locks on the straight part of the bar and not the beveled part. Adjustment is provided so that the length may be altered when assembling. When this interlock is used in addition to a lock-out device on one of the handles, a hole in the mounting bracket of the electric lock-out device takes the interlock bar and one of the interlock mounting brackets should be omitted. If for any reason the interlock bar does not move freely, it will be necessary to properly line up the holes in which it is supported. This can be done by loosening the coverplate mounting bolt and moving the coverplate bodily to alignment. In very extreme cases it may be found necessary to file the top lug of the mounting bracket to line up.

Mechanical Sequence Interlock—The mechanical sequence interlock can be mounted on a double-handle coverplate only. The brackets for the sequence interlock are held in place by a special pin which replaces the fulcrum pin of the handles, omit spacing washers for handle on one side of each handle only. The adjusting screws at top and bottom should be adjusted so that there will be no binding between the cam-shaped slot and the interlock pins on the coverplate lever. The interlock pins replace the standard pins for the rod ends. See Figs. 20 to 25.

Undervoltage Release Attachment—The hand retrieved undervoltage release attachment mounts on the left hand mounting bolt of the coverplates. It is necessary to remove this bolt and to put it in from the rear of the panel, screwing it into the undervoltage cover. Tightening the two undervoltage release mounting bolts clamps the undervoltage release tightly in the proper position. After it is completely mounted, operate it a few times by hand to see that the movement is free and that it operates properly. See Fig. 12.

The automatic retrieve undervoltage release mounts on the right hand side of the coverplate in a similar manner. It is necessary to bolt a reset pin to the trip lever of the coverplate to operate this device. See Fig. 13.

Other Tripping Devices—The **overload trip,** the **shunt trip,** and the **overload trip with dashpot,** mount on the coverplate by passing the core up through from the bottom into position in the coverplate and then securing it there by means of one nut. The tripping cores with the dashpot below, should not be mounted on the coverplate until the mechanical installation is complete. This is necessary in order that all the bolt heads will be easily accessible.

Signal Switch and Bell Alarm—As indicated above, it is necessary to mount the signal switch and bell alarm in position on the coverplate as shown in Figs. 6 and 11, before the coverplate is put on the panel, otherwise it would be very difficult to tighten the screw which clamps it in position. This attachment is mounted in the coverplate by a flat-head machine screw.

Connections

After the breaker has been assembled, with its operating handle and auxiliaries as described above, the electrical connections should be made in accordance with the diagram furnished for the complete installation, if covered by a complete diagram, or in accordance with the diagram furnished in this instruction book. In case copper strap connections are to be used, they should be carefully grained before putting on and the contact nuts should be drawn down so as to bear evenly over their entire area. The lower contact nut should not touch the upper clamping nut of the bushing. The connection should have an area of not less than that given by the National Electric Code tables on allowable carrying capacity of wires and cables. After fastening in the main leads, the terminals should be insulated wth tape or insulating tube. See Fig. 2 for taping instructions. Good engineering practice demands that all terminals on circuit-breakers be insulated.

Maintenance of Accessories

Coverplate and Handle—The mechanical parts of the coverplate and handle should be kept in good condition in order

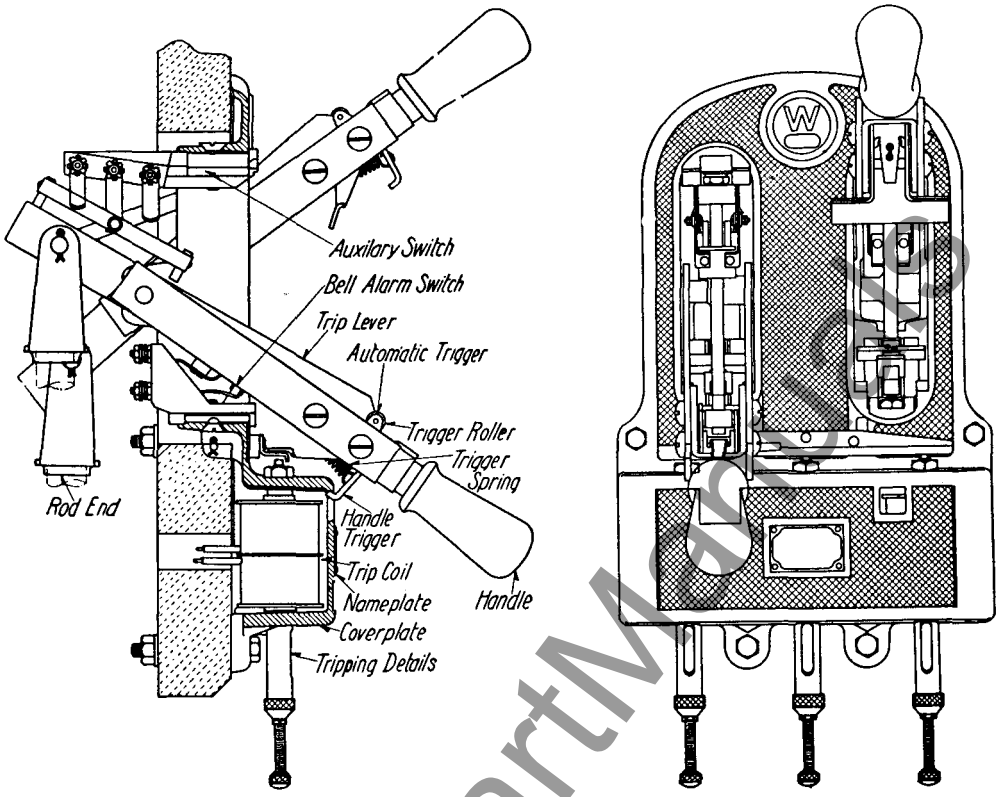


FIG. 10—DOUBLE HANDLE, 3-COIL COVERPLATE

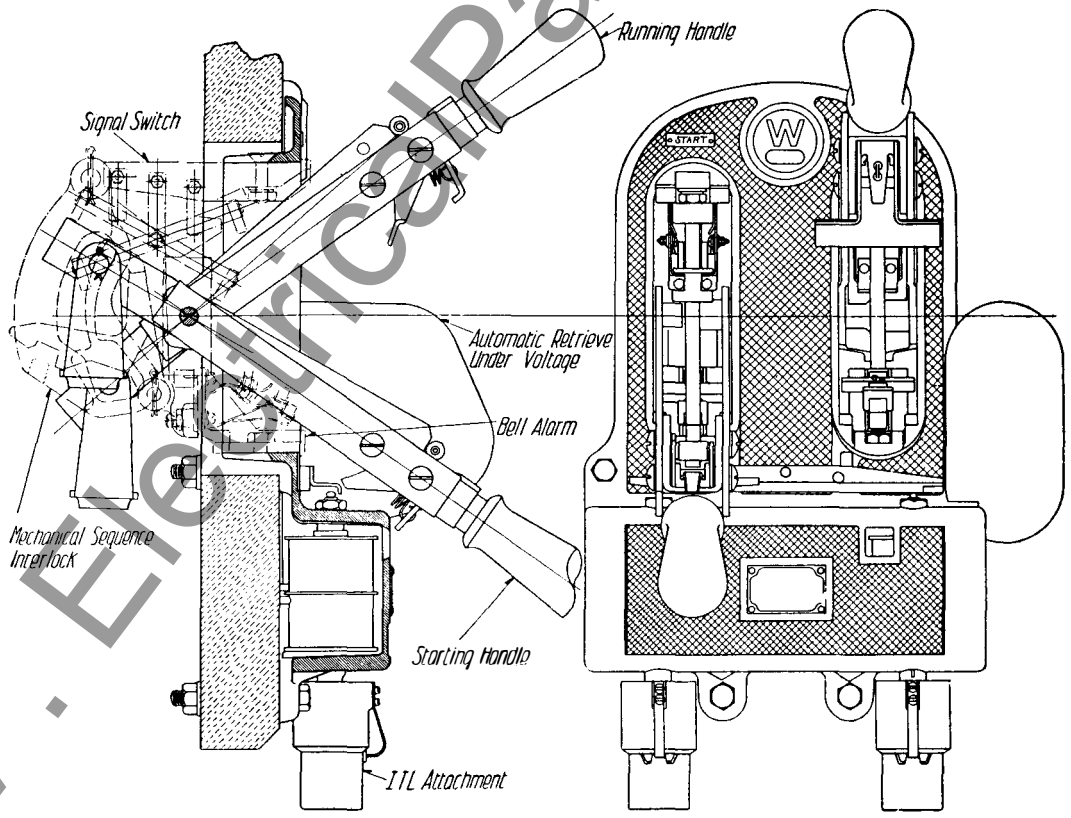


FIG. 11—DOUBLE HANDLE, 2-COIL COVERPLATE FOR MOTOR-STARTING EQUIPMENT

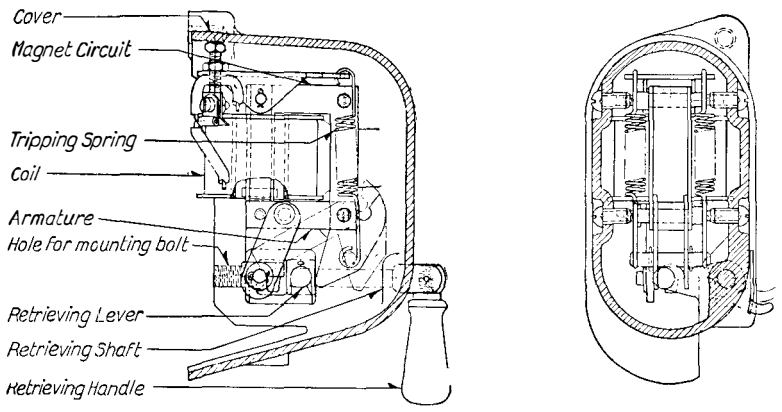


FIG. 12—HAND RETRIEVE UNDERVOLTAGE RELEASE

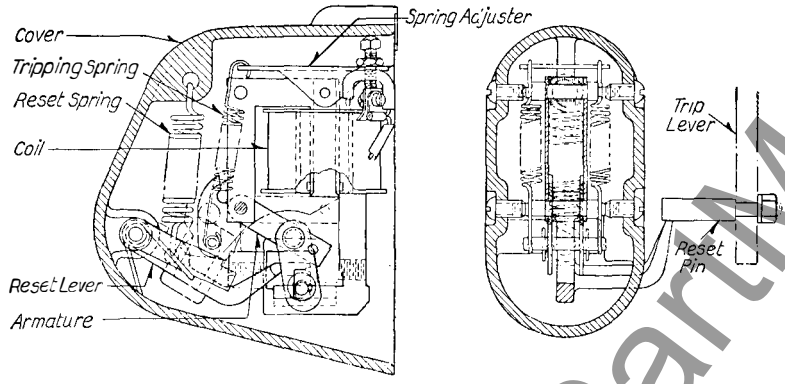


FIG. 13—AUTOMATIC RETRIEVE UNDERVOLTAGE RELEASE

that the tripping functions will be properly performed. A little oil on the bearings at intervals will keep the parts in good operating condition.

Other Devices—Though there is nothing about the construction of the other auxiliaries and tripping devices which would require the attention of the operator periodically, yet it is recommended that the tripping devices be given a casual inspection to see that cotter pins have not become lost and that screws and bolts are tight. Moving parts should be operated by hand to see that they are free on their bearings and do not bind.

Description and Adjustments of Auxiliaries

Coverplate—The coverplate contains the operating handle with space for overload coil, auxiliary switch, bell alarm, undervoltage and other auxiliaries. The operating handle is in two parts. The trip lever is attached to the breaker unit through a rod at the rear of the panel and engages the trigger in the handle lever on the front of the panel. The handle trigger holds the handle lever down after the circuit-breaker has been closed by pushing the handle. The auxiliaries will operate to disengage the trigger from the trip lever. Raising the handle disengages the handle trigger and permits the breaker unit to open.

The coverplate is made in three arrangements, the two-coil single-handle coverplate is used on non-automatic or automatic single-throw breakers unless special requirements demand the three-coil single-handle coverplate.

The double-handle coverplate is used with all automatic and non-automatic motor starting combination of breakers.

A special assembly of this double-handle coverplate can be used with motor starting combinations. It is provided with a pin to operate the automatic retrieve undervoltage release and latches are removed from starting side so that it is impossible to leave the motor running on starting voltage.

Undervoltage Release—The hand retrieve undervoltage release must be connected so as to leave the coil de-energized when the circuit-breaker is open. This may be done by energizing from the load side of breaker or wiring through the signal switch. Upon the reduction of the voltage across the coil to approximately 50 per cent of the normal voltage, the armature will be

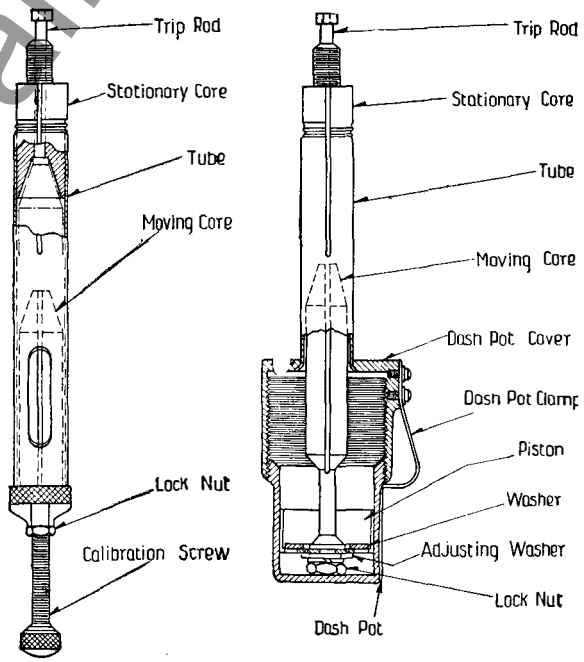


FIG. 14—OVERLOAD RELEASE CORES

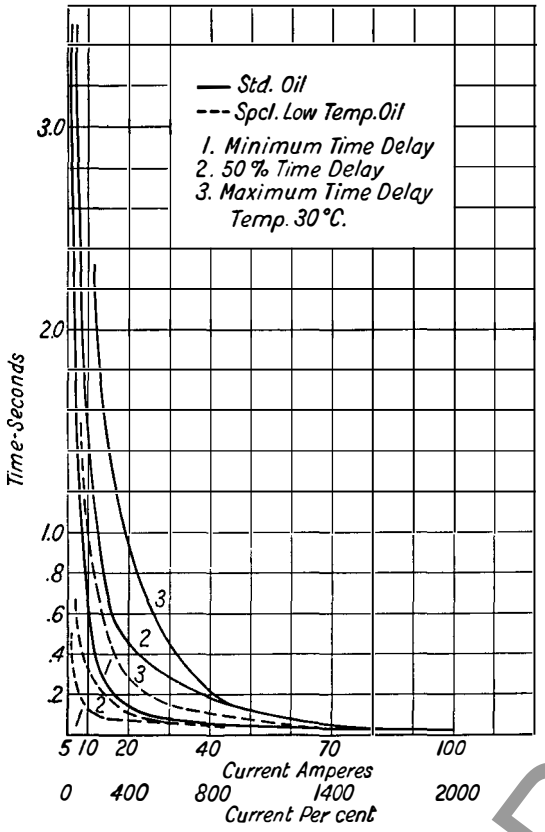


FIG. 15—CALIBRATION CURVE

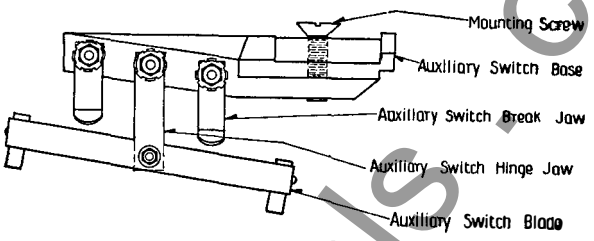


FIG. 16—AUXILIARY SWITCH

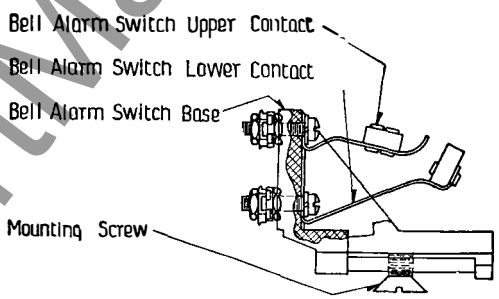


FIG. 17—BELL ALARM SWITCH

drawn downward by the tripping springs. The armature will strike the tripping arm which will raise the trigger on the coverplate and allow the circuit-breaker to open. The armature is not reset by the circuit-breaker in opening and must be reset by rotating the retrieving handle to the left before the coil is re-energized. The coil will burn out if the current is flowing in the coil when the armature is not in the retrieved position. The retrieving handle must be released quickly to secure positive tripping action, in case the undervoltage coil is not energized.

If noise develops, the face of the armature and magnetic circuit should be inspected to see that a good clean seat is obtained when they are together. If necessary to clean this seat be careful to leave it bearing over its entire area. The coils are marked with their style number, the style number of the series resistor and the voltages and frequencies on which they may be used. Reference to these should be made in all correspondence regarding the device. The device is made for use with or without resistor, depending upon whether it is desired to trip the breaker by short-circuiting the undervoltage coil. When this is done it is necessary to have a resistor in the circuit in order that a short-circuit on the control wiring will not be obtained.

A screw adjustment is provided for the opening springs by which it is possible to alter the drop-out point over a considerable range.

The automatic retrieve undervoltage mounts on the right-hand side of the coverplate. Its operation is identical with that of the hand retrieve device except that an additional reset lever and spring are provided which will retrieve the armature to the closed gap position when the breaker opens. When the breaker closes, a pin on the coverplate trip lever engages this lever and holds it back so that the armature is free to trip the breaker. This undervoltage release should be energized from the line side of the breaker.

See Fig. 27 for connections when a rectox is supplied.

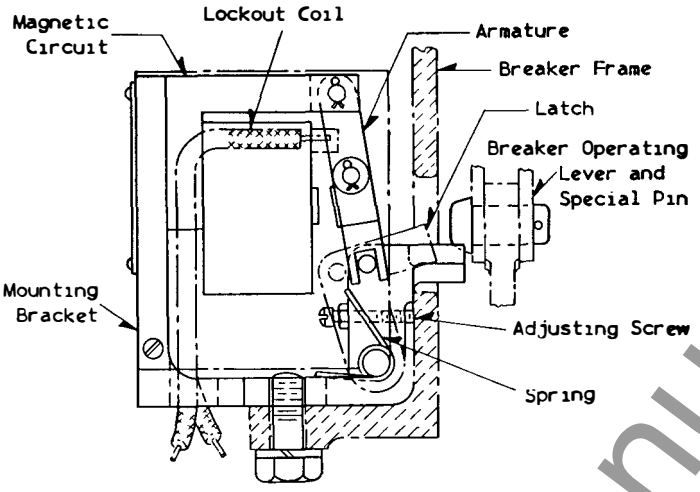


FIG. 18—ELECTRICAL LOCKOUT DEVICE (MOUNTS ON BREAKER FRAME)

Overload Release (Fig. 14)—The overload release consists of the parts shown in the picture. The moving core is magnetically drawn against the trip rod which is pushed up against the trigger. The calibration is varied by changing the air gap between the moving and stationary cores, by raising and lowering the calibration screw. The lock nuts must be drawn tight after changing calibration. The calibration setting is indicated by figures on the tube opposite the line on the moving core and corresponds to amperes in the secondary of the current transformer.

If the opening of the circuit-breaker is not desired unless the overload continues, an oil dashpot is attached to the end of the moving core. The calibration is then inscribed on the dashpot and is varied by screwing the pot into the cover. The time is varied by changing the number of the holes in the bottom of the piston uncovered by the diaphragm. Instantaneous tripping is possible because the check valve action of the washer at the time of tripping varies inversely with the amount of overload and directly with the variation in the viscosity of the oil. Fig. 15 shows approximate variations of the time with the variations of the overload and the effect of changed temperature on the standard dashpot oil as supplied with the dashpot.

The values given in Fig. 15 are approximate and will vary somewhat with changes in temperature, and changes in viscosity of the oil. Where a definite time delay is required the delay should be obtained by the use of suitable relays. The oil in the dashpots should be renewed periodically to obtain the best service.

Fill with oil to ¾-inch above the inside bottom surface of the pot, with the plunger removed.

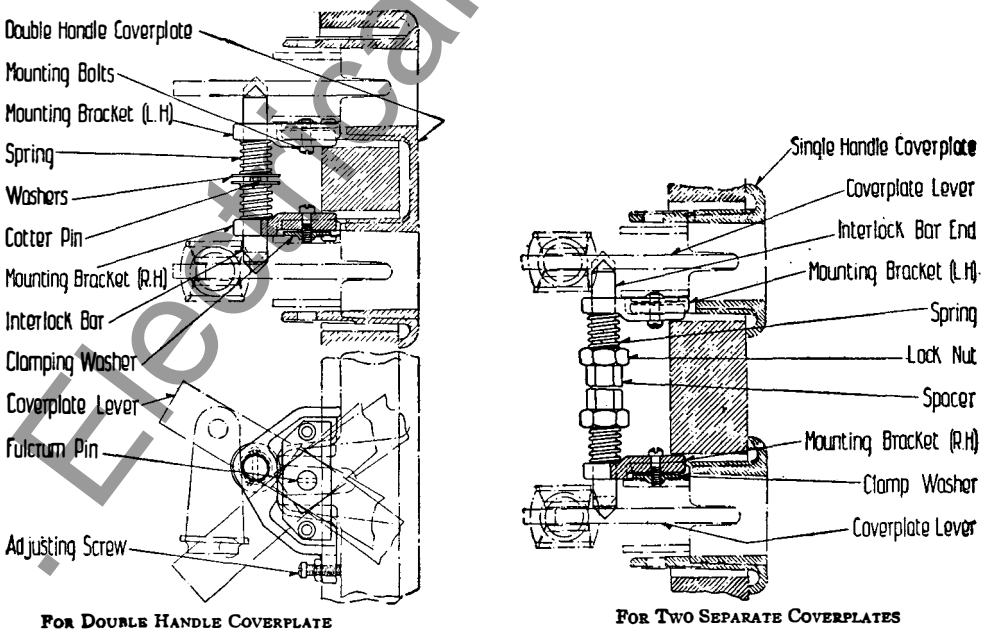


FIG. 19—MECHANICAL INTERLOCK

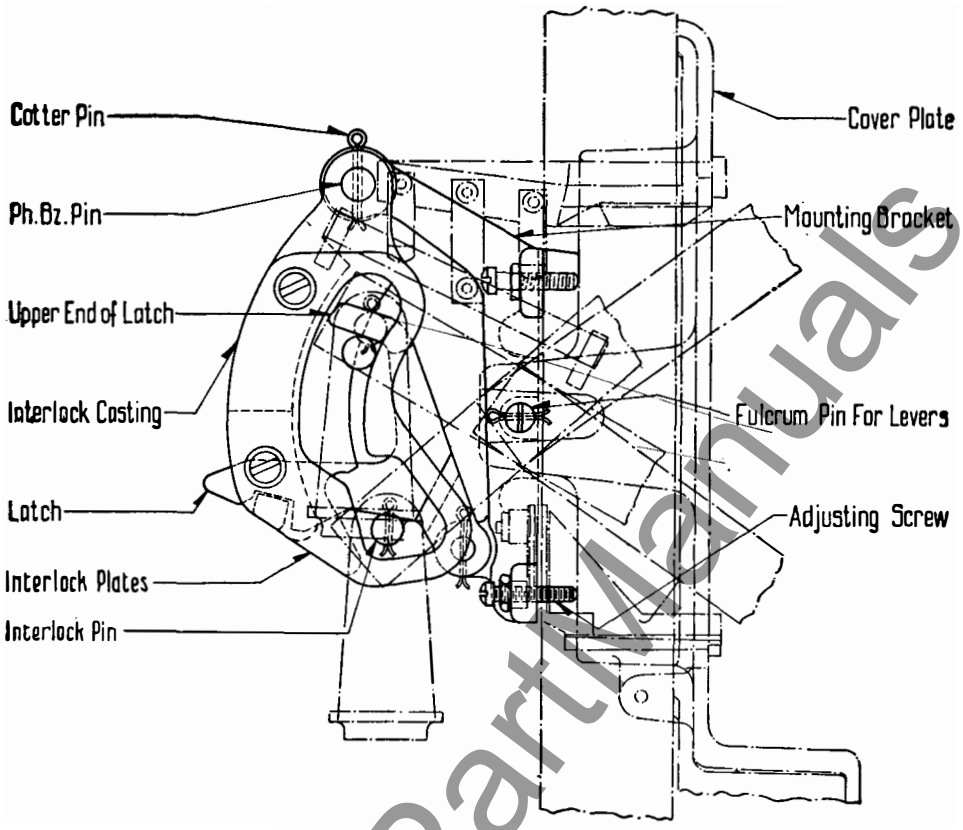


FIG. 20—MECHANICAL SEQUENCE INTERLOCK

Auxiliary Switch (Fig. 16)—The auxiliary switch is operated by the trip lever striking the fibre block in between the blades. The switch should be examined occasionally to be sure that the blades are making firm contact in the jaws, that the connections are tight and that the nuts are drawn tight on the clip washers at the hinge jaw.

Bell Alarm Switch (Fig. 17)—The bell alarm switch makes contact only when the handle is drawn down with the circuit-breaker open, as would be the case if tripped by any attachment. The upper block is depressed by the handle side bars and the lower block by the tripping lever. It should be examined occasionally to make sure that the contacts and all connections are secure.

Panel Bracket—The panel bracket is an iron casting with U-bolts to mount it to pipe structure and provided with holes so that the coverplate and breaker, or the coverplate alone, may be mounted on this bracket. It is especially adaptable to mounting the breaker on pipe structures where no panel is required, or where it is desirable to mount the breaker separately from the panel.

Pipe Bracket—The pipe mounting bracket for the breaker consists of pieces of angle iron provided with standard pipe fittings and holes so that the breaker unit is bolted to the angle iron and the angle iron is held to the pipe.

Pipe Structure—The pipe structure as supplied is a simple arrangement made of 1¼-inch pipe and standard switchboard clamps, arranged to support the breaker by means of a panel bracket. It should be assembled with 12 inches of vertical pipe protruding above the horizontal pipe. This projection is for mounting transformers. When transformers are not used this pipe may be cut off.

Panel Frame Mounting Bracket—This bracket is designed for mounting the breaker 4½ inches back of the panel on a pipe structure, with the coverplate mounted on the front of the panel.

Mechanical Sequence Interlock (Fig. 20)—The sequence interlock provides first that both handles cannot be closed at the same time; second, the running handle cannot be closed until the starting handle has been completely opened; third, if the running handle is not thrown in within a very limited period of time after the starting handle is opened, it will be impossible to close the running side without first throwing in the starting side again.

With both sides of the circuit-breaker in the open position, the following operation should take place in putting the motor on the line with full voltage across the terminals. First, the starting handle is closed applying reduced voltage across the terminals on the motor. The upward motion of the starting handle at the upper end of its travel touches the upper projection of the unlocked lever and releases the interlocking casting. The interlocking casting then rotates on its axis to such a position that when the starting side of the circuit-breaker is open, the starting handle will then strike

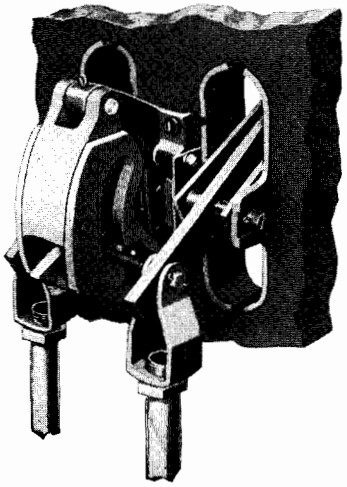


FIG. 21—VIEW OF STARTING SIDE WITH BOTH HANDLES OPEN

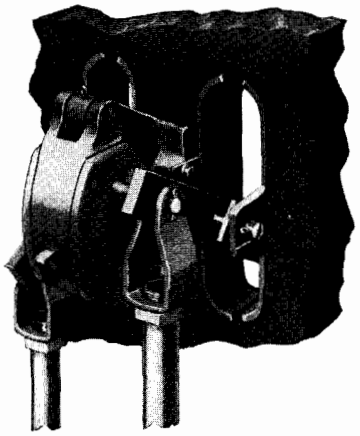


FIG. 22—VIEW OF STARTING SIDE WITH STARTING SIDE CLOSED

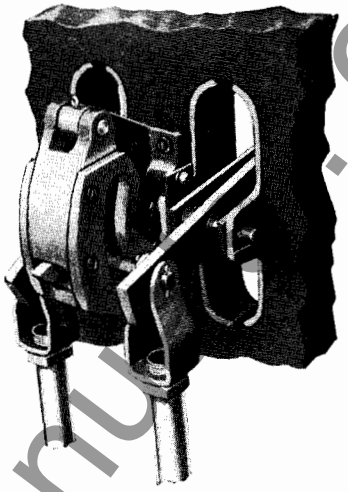


FIG. 23—VIEW OF STARTING SIDE JUST AS STARTING HANDLE IS REACHING ITS OPEN POSITION

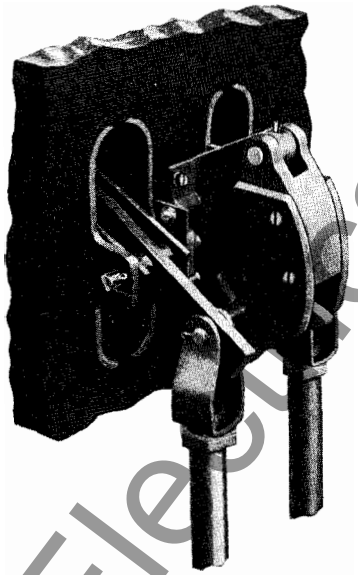


FIG. 24—VIEW OF RUNNING SIDE WITH BOTH HANDLES OPEN

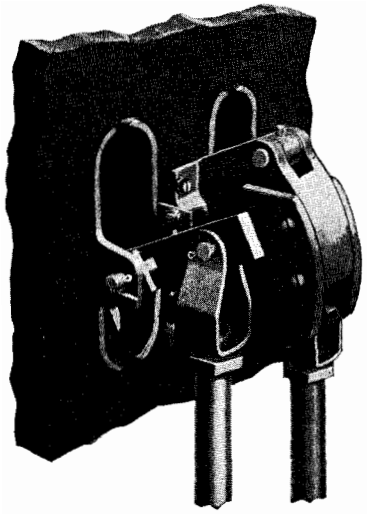


FIG. 25—VIEW OF RUNNING SIDE WITH RUNNING SIDE CLOSED

the unlocking surface of the interlocking casting and withdraw it from in front of the running handle pin and allowing the running handle pin to raise, as would occur if the running side of the circuit-breaker had started to close. Thus it is easy to see that it is impossible to close the running side of the circuit-breaker until the starting side has been fully closed and has reached its full open position. At the opening of the circuit-breaker the interlock castings return to their original positions. The operation of the device can readily be seen by reference to the illustrations. Figs. 21 to 25.

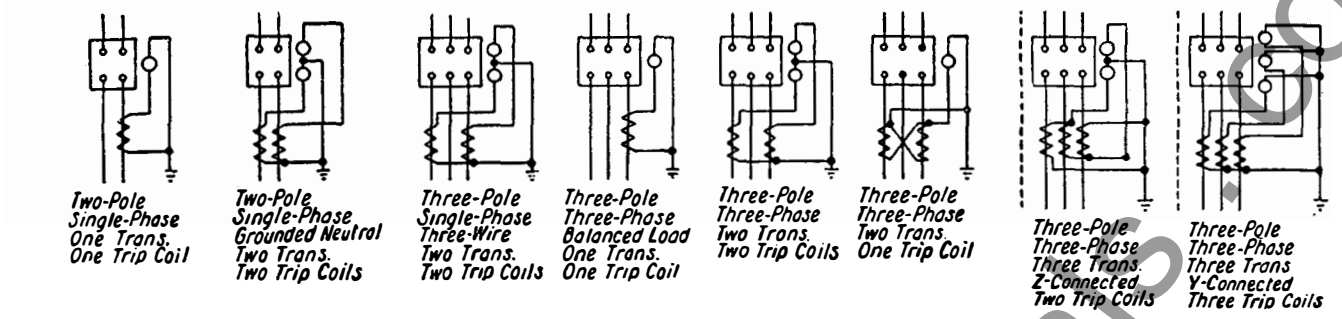


FIG. 26-A—TYPICAL TRANSFORMER TRIP COIL CONNECTIONS

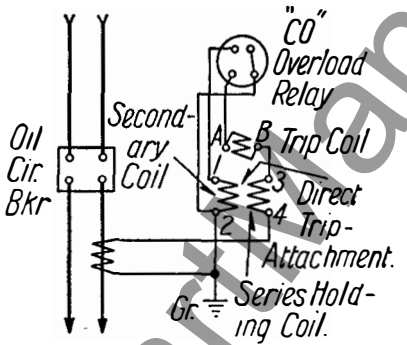


FIG. 26-B—SCHEMATIC DIAGRAM OF CONNECTIONS FOR DIRECT TRIP ATTACHMENT

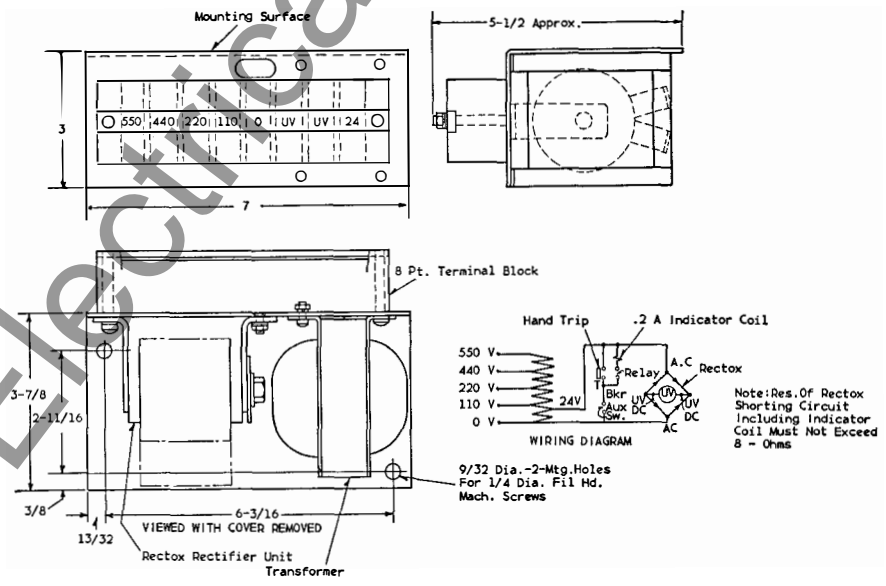


FIG. 27—DRILLING PLAN AND OUTLINE FOR RECTOX AND RESISTOR

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