Westinghouse

Type F-10 Oil Circuit-Breaker

(Molded Base)

INSTRUCTION BOOK

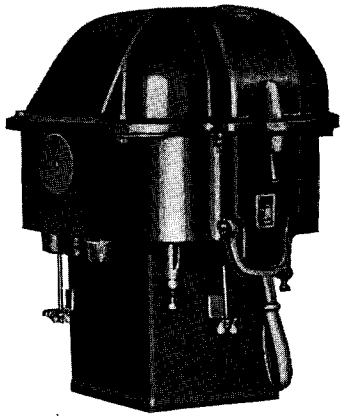


Fig. 1—Type F-10 Oil Circuit-Breaker Complete

Westinghouse Electric & Manufacturing Company

East Pittsburgh Works East Pittsburgh, Pa.

I. B. 5248-B

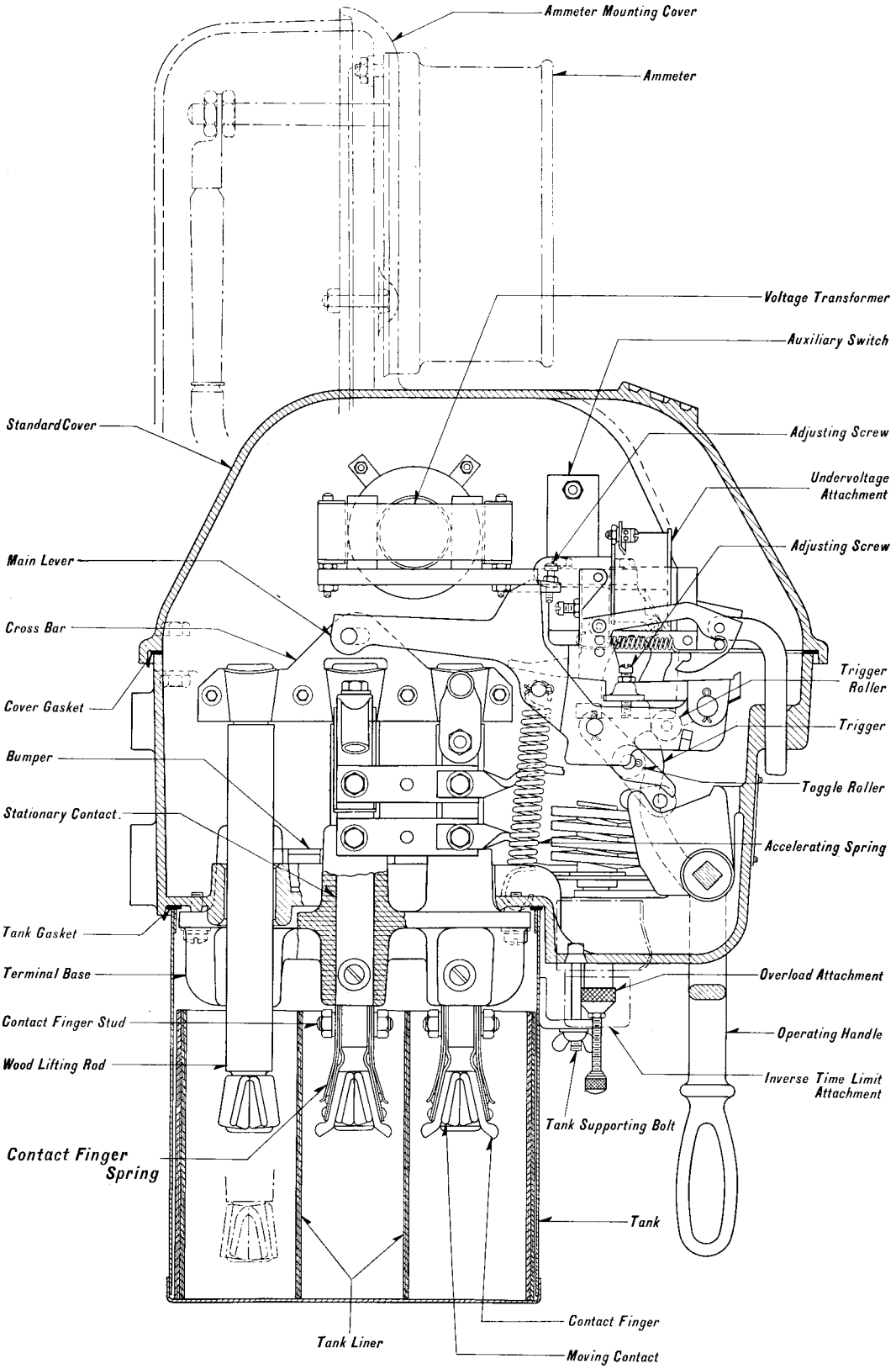


Fig. 2—Breaker Unit

Westinghouse

Type F-10 Oil Circuit-Breaker

(Molded Base)

APPLICATION

The type F-10 oil circuit-breaker is an enclosed, dust and drip proof breaker, designed primarily for industrial applications.

CONSTRUCTION

Breaker Unit—This breaker is illustrated in Figs. 1, 2 and 3. It's frame bolts to the wall or to the conduit box. This frame is provided with holes so that the leads can be taken out horizontally through a conduit or downward from each side of the breaker, or be taken from the rear of the breaker into the conduit box. The holes not being utilized are covered by covering washers which are interchangeable with the insulators used in the holes through which the leads are brought out.

Bolted to the bottom of the frame is an insulating base of moulded material to which are bolted the stationary contact studs. These studs are of copper strap which carry at the bottom end the contact fingers. The contact fingers are arranged in pairs, one pair being used for 200 ampere breakers and below and two pairs for 300 amperes. The fingers exert heavy contact pressure on the moving contact, which is a copper punching. These contacts are of novel design so arranged that the arc incident to opening short circuits is drawn between the lower edge of the contact finger

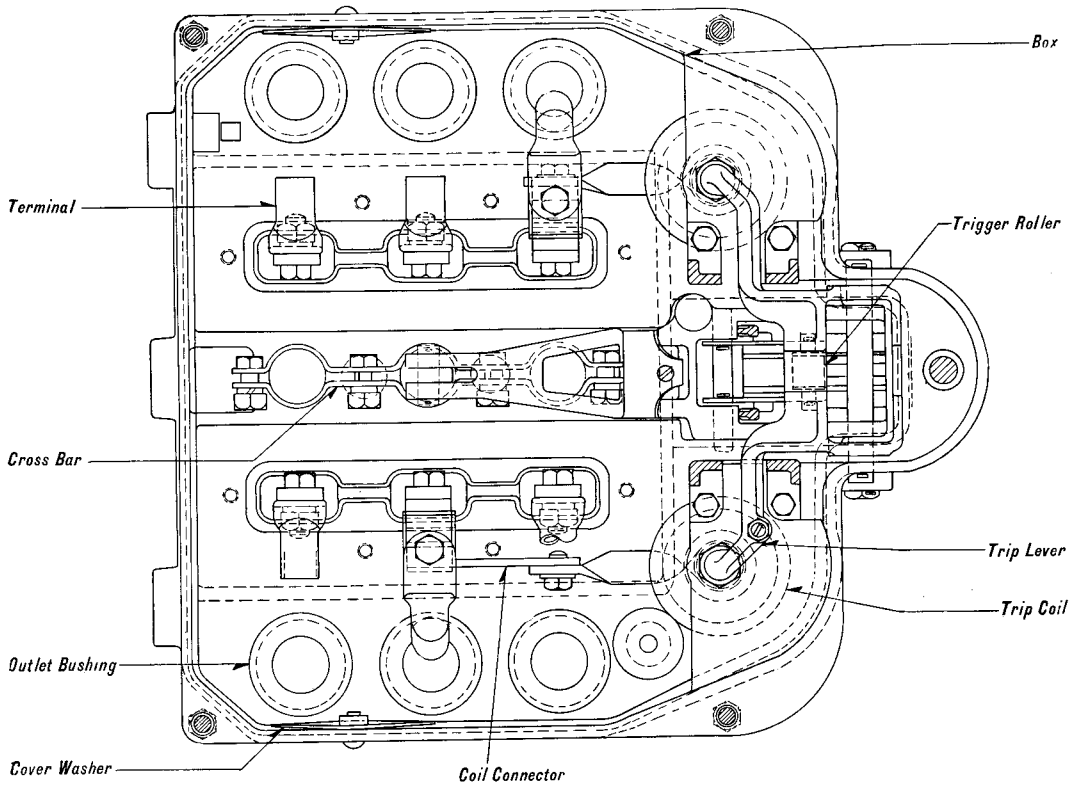


Fig. 3—Breaker Unit

and the upper edge of the moving contact, drawing the arc completely off of the main current carrying contact surface.

Mounted also on the frame are the fulcrums for the operating mechanism with the operating handle protruding from the lower front side. On the inside, a lug on the operating lever engages the center pin of the toggle, forcing the main lever up by the closing of the handle and raising the moving contact into engagement with the stationary fingers. When the handle is raised another lug strikes this center pin and breaking the toggle causes the breaker to open.

A second center pin is provided between the first pin and the main lever. This provides a second toggle joint which, when broken, will cause the breaker to open. This center pin is held just off center by a steel retaining piece that latches against a roller on the automatic trigger. When any of the automatic attachments engage this trigger to raise it, the retaining piece is released and the second center breaks, allowing the breaker to open. Raising the handle to the extreme position resets the retaining piece and closing is again possible.

Overload Attachment—The plain overload attachment is shown in Fig. 4, and the inverse-time-limit attachment in Fig. 5. Either attachment may be added to any non-automatic breaker to make it automatic on overload. When the current in the coil reaches a predetermined value the moving core of this device is lifted, striking a phosphor bronze pin and forcing it with the trigger upward to trip the breaker.

If the opening of the circuit-breaker is not desired unless the overload continues, an inverse-time-limit attachment shown in Fig. 5 is used. This attachment has an oil dashpot on the end. The calibration inscribed on the dashpot can be varied by screwing the pot into the cover. The time is varied by changing the number of holes in the bottom of the piston uncovered by the diaphragm. Instantaneous resetting 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. 6 shows approximate variations of the time with the variations of the overload, and the effect of changed temperatures on the standard dashpot oil, as supplied with the dashpot. The inverse time-limit attachment should not be used where temperature is below 15°C. unless special oil is provided for the dashpot.

The values given in Fig. 6 are approximate and will vary somewhat with changes in temperature and changes in viscosity of the oil. Where 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.

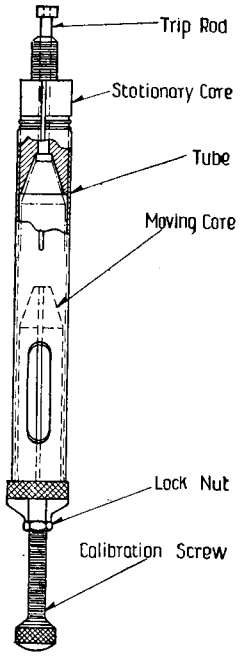


Fig. 4—Overload Attachment

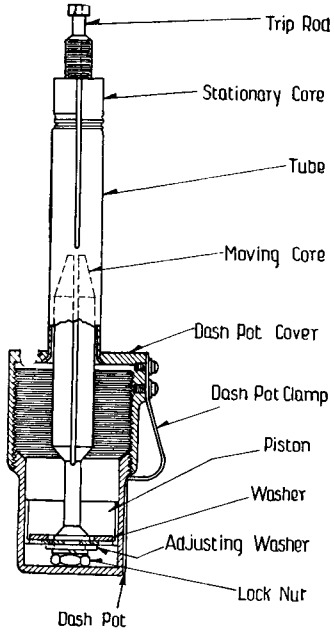


Fig. 5—Inverse-Time-Limit Attachment

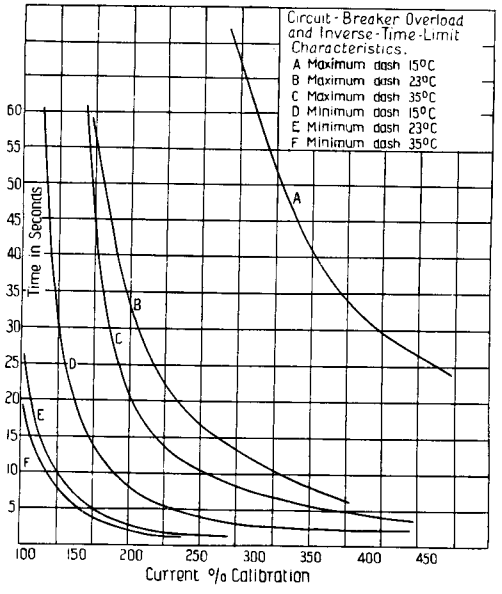


Fig. 6—Dashpot Curves

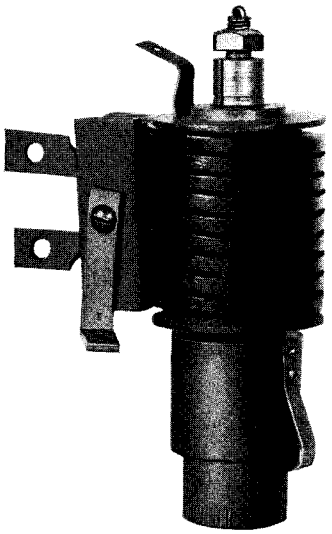


Fig. 7—Oil Well Coil and Dashpot

Undervoltage Release Attachment—The undervoltage release attachment (Fig. 13) may be used on any breaker to cause it to open the circuit when voltage falls to approximately 50 per cent of normal.

The undervoltage release device is supplied in two forms; one for hand retrieving, and one for automatic retrieving.

Auxiliary Switch—The auxiliary switch consists of a single pole, single-throw switch, making contact when the breaker closes. It may be mounted on the undervoltage release mechanism or may be supplied for mounting directly on the undervoltage brackets for mounting on the breaker.

Ammeter Mounting Cover—The standard cover can be replaced by a special cover adapted for mounting a Westinghouse type SY or SM ammeter.

TESTING

Before shipment the non-automatic breaker is thoroughly tested and all adjustments are made. It is also tested to make sure that all automatic auxiliaries function properly when attached. When ordered with attachments, breaker is tested complete before shipment.

SHIPPING

The non-automatic breaker is boxed complete and shipped ready to put in service, upon the addition of the necessary oil. When an automatic breaker is required the tripping attachments are assembled and tested in the breaker. This method of boxing enables immediate shipment to be made. Each box

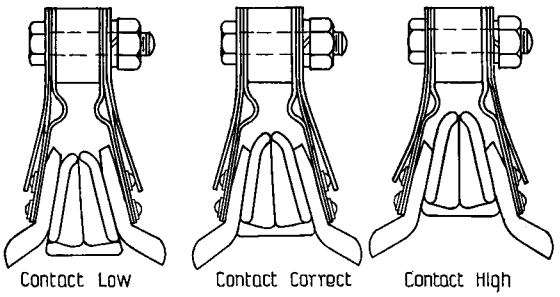


Fig. 8—Contacts

is clearly labeled with the name and style number of its contents.

UNPACKING

Care should be taken in unpacking to see that no damage is done to the delicate parts. Clean all parts of the apparatus free from excelsior, dirt, etc. Examine the mechanical parts for breakage, distortion or anything else that might cause improper operation. Examine the tank for signs of mechanical injury. Be sure that there is no foreign matter in the tank that might float in the oil or dissolve in it. Check to see that all packing blocks are removed from the mechanism. The auxiliaries should be cleaned very carefully as any dirt in the dash pot, or in the cores of the tripping devices may make them inoperative.

INSTALLING AND WIRING

Breaker Unit—Remove the cover from the breaker and bolt the breaker to the wall or to the conduit box. The breaker should be as level as possible as determined by lying a level over the top of the box. Operate the breaker by hand a few times to see that it works all right. Trip by hand and by raising the trigger by hand.

Observe the contacts to see that they are properly adjusted and not bent or distorted in anyway which would prevent the moving contact properly engaging the stationary fingers or making good contact at the full closed position. A contact at the closed position may be tested by "feeling" with a piece of thin paper or feeler gauge. Just before putting the breaker in service, clean the contacts free from all dirt and clean off the oxide with emery cloth or a very fine file.

As shipped the breaker has the insulators in the holes for downward leads.

When it is desirable to bring the leads to the breaker in a conduit, the conduit box (Fig. 9)

is used. The leads for the breaker terminals are then taken back through the holes in the rear of the breaker and from there into the conduit. Holes are provided for 2½" conduit so that either incoming or out-going leads may be taken up, down or side-ways from the breaker. If it is desirable the leads may be brought out through the side of the breaker through a 2½ in. conduit. The bushings in the bottom should be removed and the holes covered with washers.

Care should be taken that terminal straps are not bent too near to grounded parts, when making connections.

The breaker should be connected in accordance with the diagram for the complete installation, if covered by a complete diagram, or according to the diagram in this book. The leads should be carefully soldered into the terminal lug. **The wires used to make connections should have an area of not less than that given in the National Electric Code in tables on allowable carrying capacity of wires and cables.** The insulation on the leads should extend through the porcelain into the breaker box. Be sure to ground the breaker frame as a safety measure.

Overload Device—The plain overload attachment shown in Fig. 4 and the inverse-time-limit attachment in Fig. 5 are mounted in the same way. Remove the coil from the core and insert it in position in the box, passing the core through it and the holes in the box. Put on the one nut required to hold it in place as shown in Fig. 2.

When putting on these attachments it is necessary to get the overload coils connected in series with two legs of the line. To do this remove the jumper from the right front stud and the left middle stud and use these as jumpers from the left middle stud to the left trip coil as illustrated in Figs. 11 and 12. The right coil connects to the right front stud without any jumper.

These overload devices are calibrated from 100% to 180% of the normal rating. The calibration may be adjusted within this range by changing the air gap between the cores. This is done in the case of the plain overload by the adjusting screw and in the case of the inverse-time limit by regulating the dashpot. The lock nut on the overload should be drawn up tight after changing the calibration.

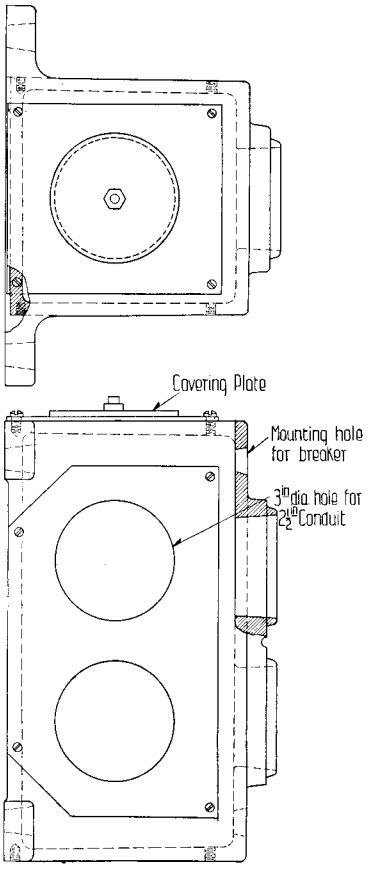


Fig. 9—Conduit Box

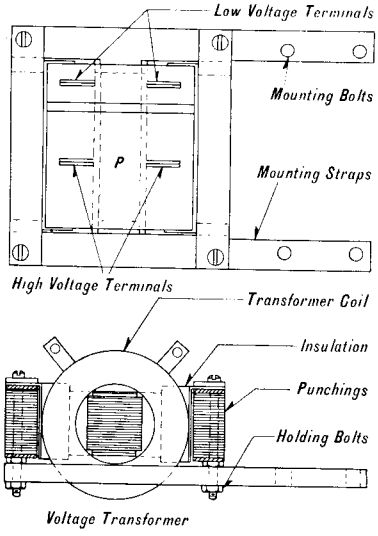
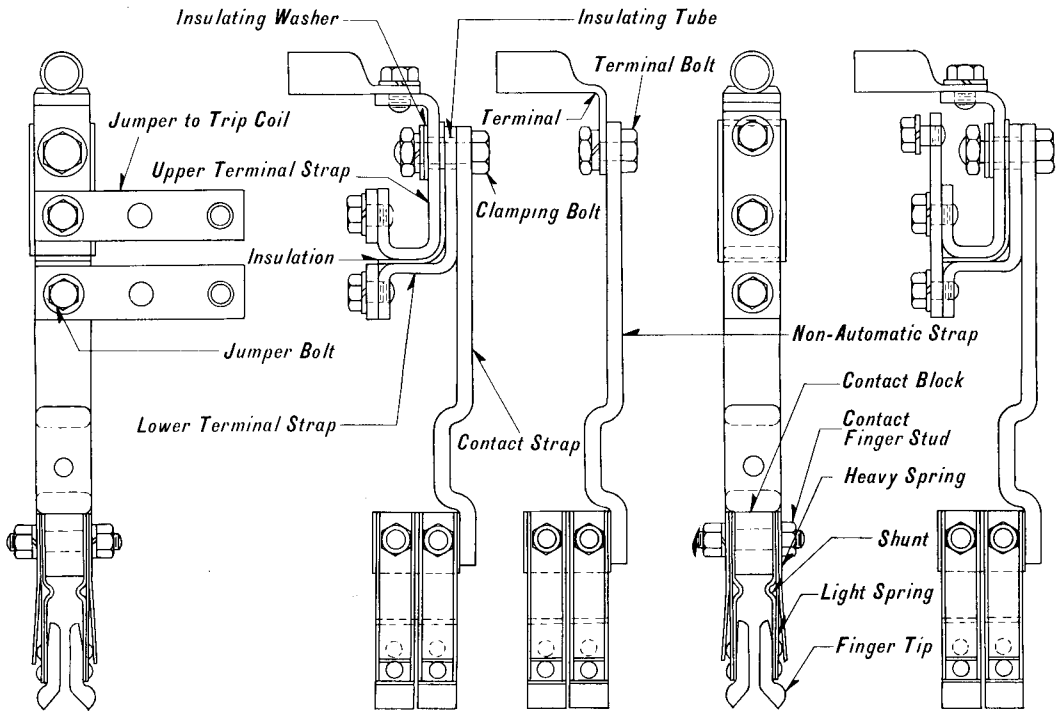
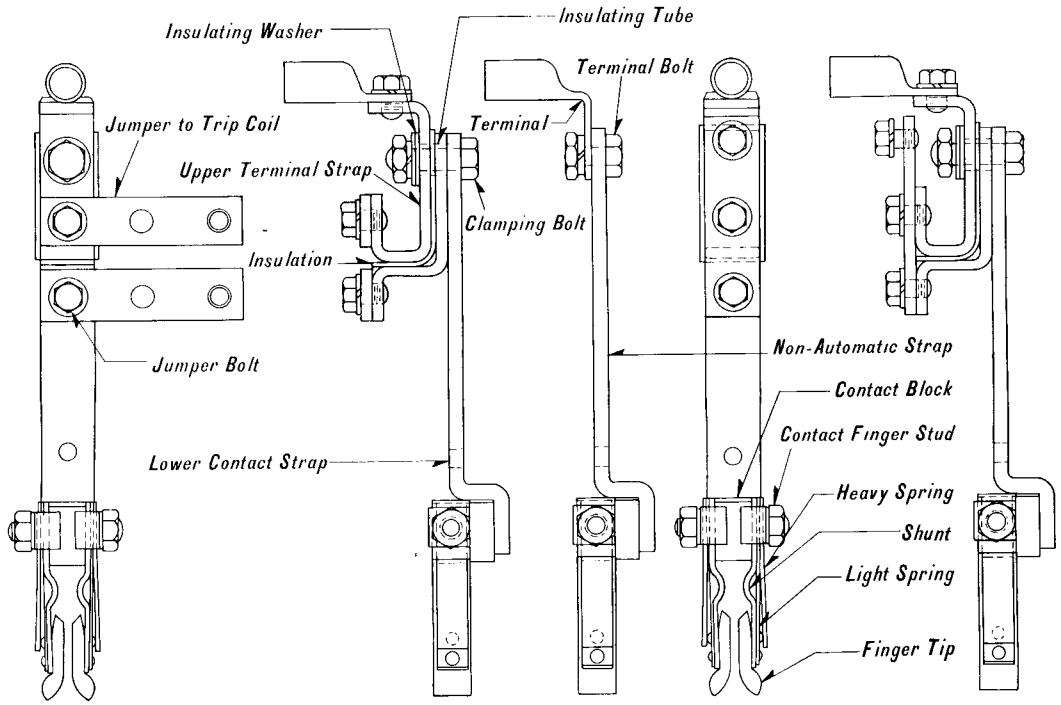


Fig. 10—Transformer for 2200 Volts



Automatic with jumper in place for coil | **Non-Automatic** | **Automatic connected for Non-Automatic Operation**

Fig. 11—300 Ampere Studs



Automatic with jumper in place for coil | **Non-Automatic** | **Automatic connected for Non-Automatic Operation**

Fig. 12—200 Ampere Studs

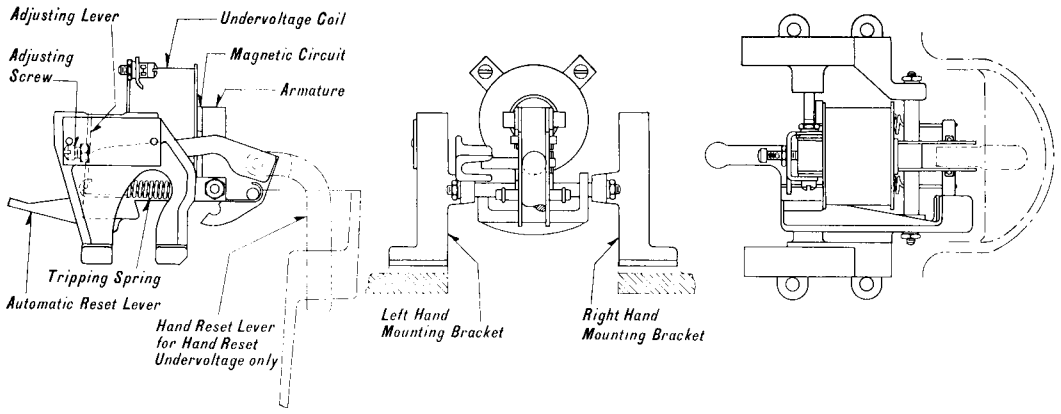


Fig. 13—Undervoltage Release Attachment

Undervoltage Release and Electric Lockout Attachment—The undervoltage release mechanism bolts to pads on the breaker frame as shown in Figs. 2 and 13. It should be operated by hand after mounting to see that the moving parts are free and properly functioning.

The hand retrieve undervoltage must be connected to the load side of the breaker so that when the breaker trips due to failure of voltage. The restoring of the voltage will not burn it up due to open magnetic circuit, as shown in Fig. 17. The hand retrieve undervoltage may be connected to the line side of the breaker only when an auxiliary switch is used to de-energize the coil with the breaker open, as shown in Fig. 18.

After the breaker has been closed, the hand reset lever of the undervoltage must be released rapidly in order to be free to drop out with a hammer blow in case of voltage failure.

The automatic retrieve undervoltage release mechanism is mounted on the breaker as shown in Fig. 2. It should be noted that with the breaker in full open position, the undervoltage core is drawn up within $\frac{1}{32}$ in. of its closed position. If it is not, adjust the air gap so that it will be drawn up to this position. This is accomplished by turning adjusting screw shown in Fig. 2. If this is not done there is danger of the undervoltage coil burning out.

This automatic retrieve undervoltage must be connected to the line side of the breaker so that it will be energized before closing the breaker. As shown in Fig. 20, the automatic resetting of the core precludes the possibility of a burn out.

This undervoltage release may also be used as a lockout device by connecting across the auxiliary switch as shown in Fig. 19.

When undervoltage name plate is marked 25 and 60 cycles, undervoltage is set to operate on 60 cycle when shipped from factory. If operation on 25 cycles is desired, turn adjusting screw, Fig. 13, until armature will drop out at 50% normal voltage on 25 cycles.

When the automatic reset undervoltage release is used as an electrical lock-out device, the circuit marked "a" in Fig. 19 goes to circuit closing contacts on controller, circuit closing push button, etc. It is impossible to close breaker until this circuit is closed, thus energizing the U. V. coil. After breaker is once closed, the auxiliary switch completes the holding circuit.

The voltages on which the undervoltage coil may be applied are marked on the coil nameplate. This information should be checked to be sure that the voltage of the circuit appears on the name plate. Up to 550 volts the undervoltage coils are to be connected direct to the circuit. For 2200 volt service a self-contained transformer (Fig. 10) (2200-110) is used with the 110-volt undervoltage release. This transformer is good on both 25 and 60 cycles. Between 550 and 2500 volts an external voltage transformer should be used.

Coils, marked for two voltages at different frequencies, are adjusted at the factory for tripping at approximately 50% of normal voltage at 60 cycles and will trip at approximately 65% of normal voltage at 25 cycles. By turning the adjusting screw and decreasing tension on the spring shown in Fig. 13, the adjustment for 50% normal voltage tripping on 25 cycles may be secured.

Auxiliary Switch—The auxiliary switch used with the undervoltage release is shown in Fig. 14 and mounted in the position as shown in Fig. 2. When the undervoltage release is not used the auxiliary switch is supplied with one of the undervoltage brackets for mounting as shown in Fig. 15.

Ammeter Mounting Cover—The ammeter mounting cover, which replaces the standard cover, is adapted for mounting a self-contained type SY ammeter up to 75 amperes and type SM ammeter for higher capacities up to and including 200 amperes. For 300 ampere service use 5 ampere type SY ammeter with current transformer. The ammeter connects in series with the rear left stud of the breaker.

Breaker Tank—After thoroughly cleaning the tank it should be filled with clean dry oil and should then be put in place and drawn firmly up against the breaker frame.

MAINTENANCE

After long severe service the fingers or moving contact may become burned sufficiently to cause arcing on the main contacts. These fingers should then be renewed before the main current carrying contacts are badly damaged to cause heating of the breaker.

Oil Maintenance—It is vital for the successful operation of oil breakers not to use oil which has not been especially treated for the purpose. Only oil that carries the recommendation of the breaker manufacturer should be used. Wemco C oil is recommended.

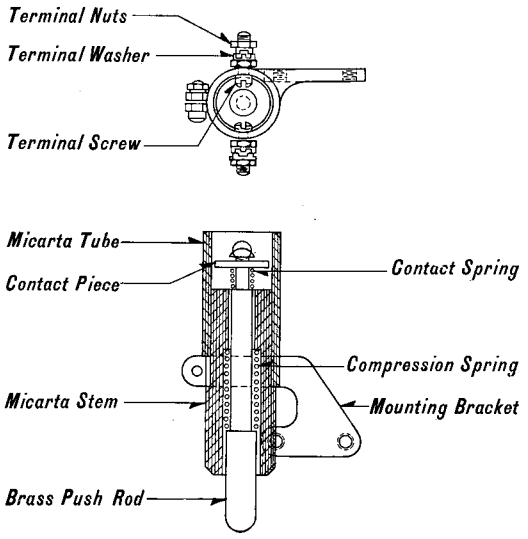


Fig. 14—Auxiliary Switch

Maintenance of Oil Level—Great care should be exercised to see that the oil level is kept at the proper height as indicated on the oil name plate. Considerable oil may be lost due to evaporation in normal service, interrupting heavy short circuits, or possible leakage from the breaker tank in case of defect or injury. Improper oil level may result in hazardous operation from flash over of switches or failure to properly open heavy short-circuits.

CARE OF INSULATING OIL

Deterioration in Use—All insulating oils are subject to carbonization. This carbonization forms a deposit on the bottom of the tank or any part of the mechanism located in the oil. The contacts and the interior of the tank should be cleaned at intervals, depending upon the service. The carbonization reduces the dielectric strength of the oil. It is necessary, therefore, that the tank be emptied and refilled with new oil from time to time. Deteriorated insulating oil can be filtered and dried by the use of Westinghouse Oil Drying and Purifying Outfits.

Storage—All Westinghouse insulating oil for oil circuit-breaker use is kept either in soldered tin cans or steel drums provided with steel bungs which are sealed before shipment, or in tank cars made exclusively for that purpose. All oil in steel drums, which have been stored exposed to weather, and all oil shipped in tank cars should be tested before using by taking a sample from each container. Drums stored out of doors should always be laid on their side with bungs turned down, never turned up on end; and when storing

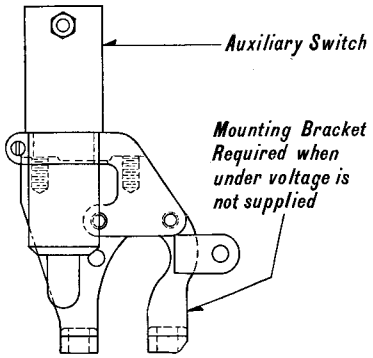


Fig. 15—Brackets

drums out of doors, protection against direct precipitation should be provided.

Handling—Extreme precautions are required to insure that all containers and any apparatus therein are absolutely dry when oil is transferred to them from a drum, soldered tin or tank car. A drum of cold oil when taken into a warm room will sweat and the resulting moisture on its outer surface may mix with the oil in drawing it from the drum. The container should always be allowed to stand long enough to reach room temperature before breaking the seal. Tank cars should never be emptied during wet weather. Any vessels used in transferring oil should be absolutely dry and frec from any foreign matter, especially metallic or carbonization particles.

Filtering—Although the drums are thoroughly washed and dried at the Refinery before filling, a certain amount of scale is generally loosened inside the container. This must be removed by passing the oil through two layers of ordinary finely woven cotton cambric, which has been thoroughly washed to remove the sizing and then dried. The cloth may be stretched across a funnel of large size. The oil will pass through the cloth more rapidly if slightly warm. If the funnel does not discharge directly into the tank of the circuit-breaker, the oil should not be returned to an empty drum unless it is known to be thoroughly clean and dry. The thoroughness of filtering should be determined by a dielectric test.

Detection of Moisture—It is impossible to over-emphasize the effect of relative small amounts of moisture in oil in circuit-breakers and the serious effect which such moisture may have on breaker operation from break-down on voltage surges or on interrupting short circuits. The amount of moisture which will seriously lower the insulating value of oil is of the order of 1—part in 20,000. This is too small to be detected by settling out or by the well-known hot metal test. It can only be done by a dielectric test. The Westinghouse Electric& Manufacturing Company manufactures a special device for this purpose and furnishes instructions for its use.

Removal of Moisture—Moisture may be entirely removed by passing the oil through a Westinghouse Oil Drying and Purifying Outfit, or a Sharples Transformer Oil Purifier and Dehydrator. When this outfit is not available the oil may be dried in a fairly satisfactorily, although slow and inconvenient manner, by passing it through a bag of clean dry lime and filtering it afterwards to remove particles of suspended matter. It is not advisable to use various other methods, such as passing hot dry air through the oil on account of the difficulty of entirely removing all moisture from the air, or heating the oil for a considerable length of time on account of the liability of injuring the oil during the heat treatment.

For further information on care of oil, refer to I.B. # 5336.

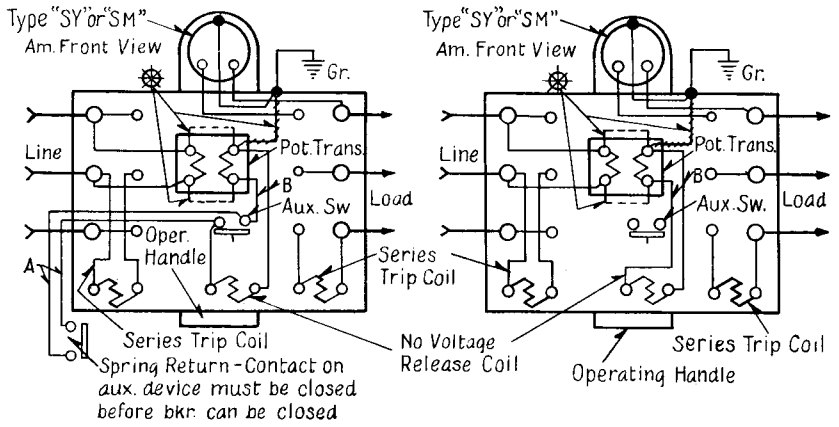


Fig. 16—Diagram of Connections Showing Ammeter (Otherwise same as Fig. 17 to 21)

RENEWAL PARTS

When ordering renewal parts give the name of the part as shown in the illustrations in this book or refer to Renewal Part Catalogue No. 6197-1 and give the amperes, volts and style number of the breaker unit as given on the nameplate of the breaker.

Refer to the back of this publication for nearest District Office from which to order renewal parts.

Recommended Stock of Renewal Parts

The following is a list of the renewal parts and the minimum quantities of each that should be carried in stock. These are the parts most subject to wear in ordinary operation and damage or breakage due to possible abnormal conditions. The maintenance of such stock will minimize service interruptions due to breakdowns.

NO. OF POLES		TWO POLE								THREE POLE								FOUR POLE							
RATING OF BREAKER COMPLETE STYLE NUMBER		200 Ampere Style No. 437890				300 Ampere Style No. 437891				200 Ampere Style No. 437892				300 Ampere Style No. 437893				200 Ampere Style No. 437894				300 Ampere Style No. 437895			
		Recommended for Stock				Recommended for Stock				Recommended for Stock				Recommended for Stock				Recommended for Stock				Recommended for Stock			
Name of Part	Style No.	No. Per Bkr.	2 Bkrs	5 Bkrs	15 Bkrs	No. Per Bkr.	2 Bkrs	5 Bkrs	15 Bkrs	No. Per Bkr.	2 Bkrs	5 Bkrs	15 Bkrs	No. Per Bkr.	2 Bkrs	5 Bkrs	15 Bkrs	No. Per Bkr	2 Bkrs	5 Bkrs	15 Bkrs	No. Per Bkr.	2 Bkrs	5 Bkrs	15 Bkrs
Breakers in use up to and including—																									
Circuit Breaker Complete	.....	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
Bumper	215109	2	2	4	6	2	2	4	6	2	2	4	6	2	2	4	6	2	2	4	6	2	2	4	6
Wood Lifting Rod	535517	2	1	2	4	2	1	2	4	3	1	3	6	3	1	3	6	..	..	..	..	..	..	..	..
Wood Lifting Rod	535518	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2	4	8	4	2	4	8
Moving Contact	300751	4	2	4	8	4	2	4	8	6	3	6	12	6	3	6	12	8	4	8	16	8	4	8	16
Molded Material Base	535515	2	0	1	2	2	0	1	2	2	0	1	2	2	0	1	2	..	..	..	..	.	..	..	..
Molded Material Base	535516	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	0	1	2	2	0	1	2
Outlet Bushing	304147	4	0	0	1	4	0	0	1	6	0	1	1	6	0	1	1	8	0	1	2	8	0	1	2
Contact Finger	300727	8	8	16	32	16	16	32	64	12	12	24	48	24	24	48	96	16	16	32	64	32	32	64	128
Contact Finger Spring	300726	8	4	8	16	16	8	16	32	12	6	12	24	24	12	24	48	16	8	16	32	32	16	32	64
Tank	477036	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	..	..	..	..	..	..	..	..
Tank	477037	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	0	0	1	1	0	0	1
Tank Liner	477038	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	..	..	..	..	..	..	..	..
Tank Liner	477039	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	0	1	1	1	0	1	1
Trigger	535519	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1
Accelerating Spring	535520	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1

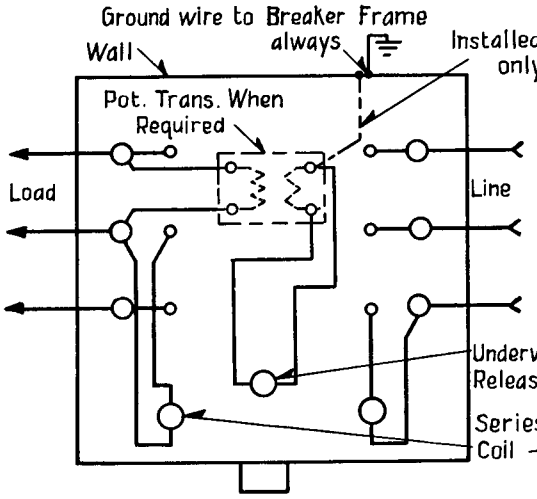


Fig. 17—Diagram of Connections for Hand Retrieve Undervoltage

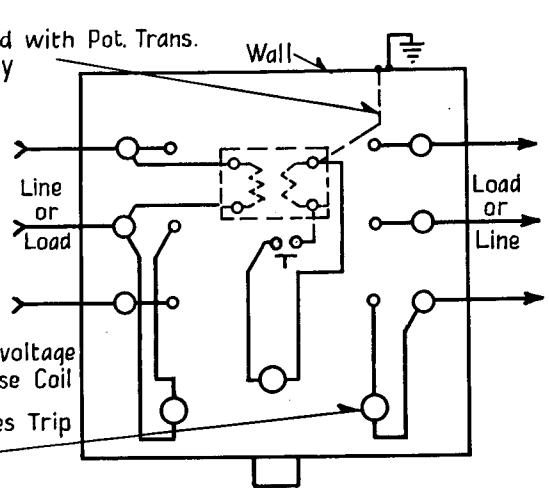


Fig. 18—Diagram of Connections for Hand Retrieve Undervoltage with Auxiliary Switch

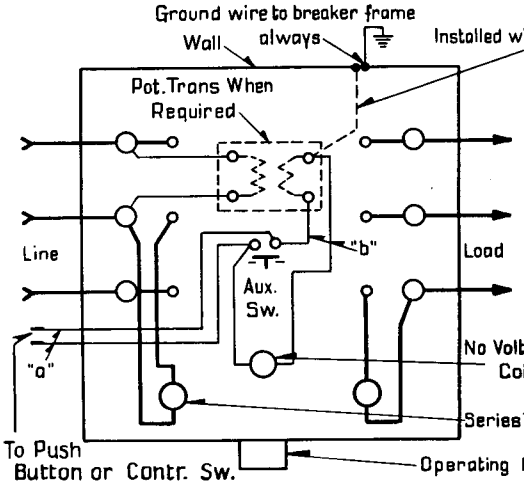


Fig. 19—Diagram of Connections for Electrical Lockout

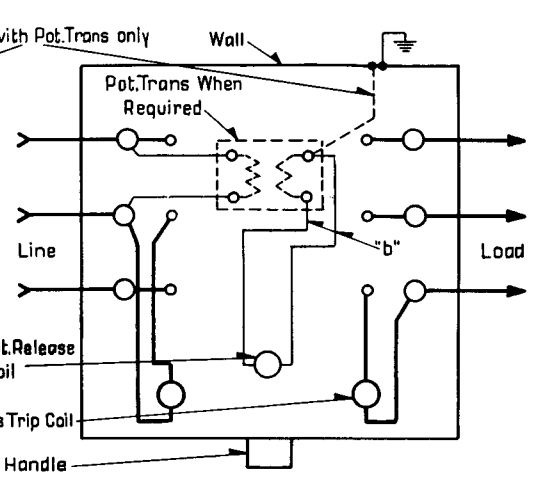


Fig. 20—Diagram of Connections for Automatic Retrieve Undervoltage

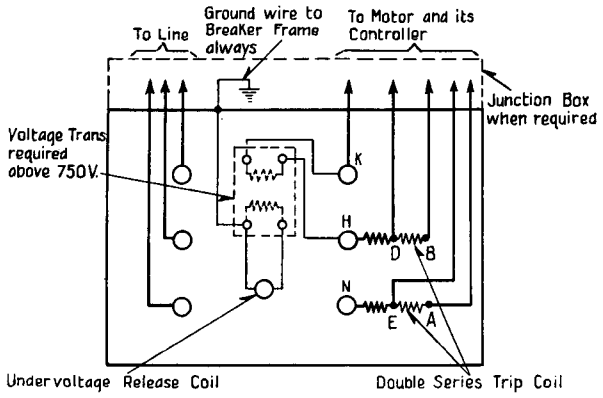


Fig. 21—Diagram of Connections for Oil Well Breaker