

Westinghouse

Type FO-22-A Oil Circuit-Breakers

**400 and 600 Amperes, 7500 Volts
Manually or Electrically Operated—
Automatic or Non-Automatic Trip
INSTRUCTION BOOK**

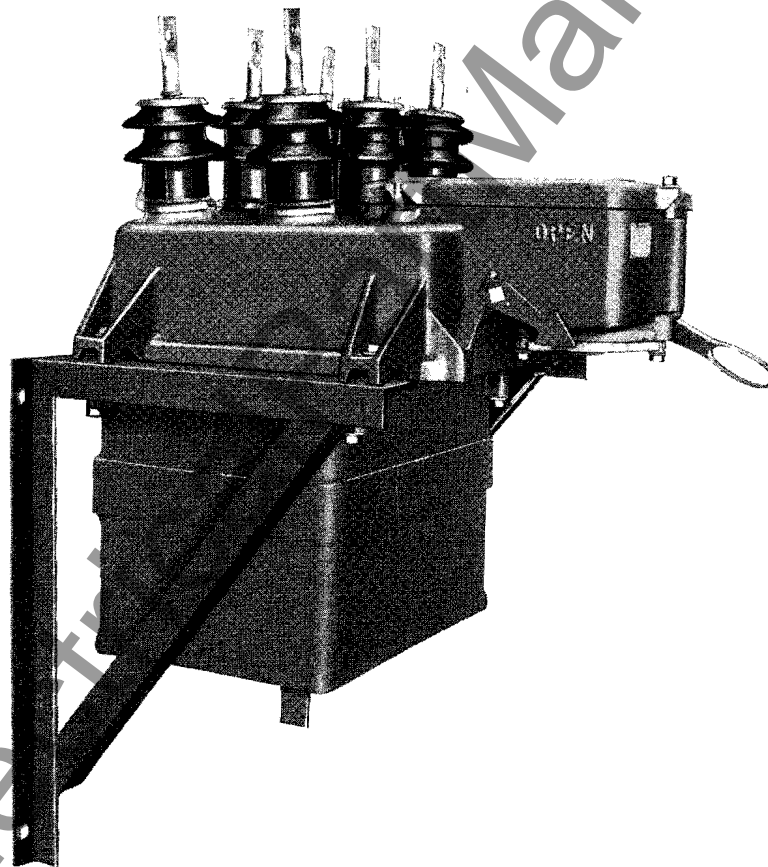


FIG. 1—TYPE FO-22-A OIL CIRCUIT-BREAKER
(WALL MOUNTING)

Westinghouse Electric & Manufacturing Company

East Pittsburgh Works

East Pittsburgh, Pa.

(Printed in U.S.A.) (11-36)

I. B. 5766
(Filing No. 33-000)

Westinghouse Type FO-22-A Oil Circuit-Breakers

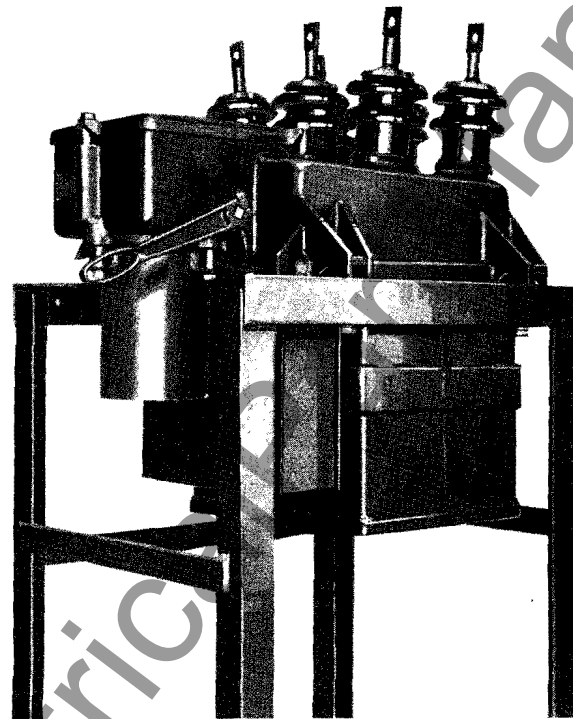


FIG. 2—TYPE FO-22-A OIL CIRCUIT-BREAKER COMPLETE (FRAME MOUNTED)

Westinghouse

Type FO-22-A Oil Circuit-Breakers

400 and 600 Amperes, 7500 Volts

Manually or Electrically Operated—Automatic or Non-Automatic Trip

General Description

The FO-22-A outdoor oil breakers are built in 400- and 600-ampere, 7500-volt, 2- and 3-pole single-throw sizes.

They can be either frame-, wall- or pole-mounted, manually or electrically operated. Automatic breakers can be equipped with either series or transformer trip coils.

They embody the desirable features of larger breakers, including internal mechanism, wound type condenser 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, having been 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 silver-to-silver contacts eliminate the formation of high resistance contact due to copper oxide.

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

Shipment

The breakers are shipped completely assembled with all attachments and auxiliaries mounted in place. Do not remove the crating until the breaker reaches its permanent location.

Installation

1. Remove the crating and frame skids.

2. Mount the breaker on its foundation. The four mounting bolts should be left loose, until the frame is leveled by inserting shims under the feet. The breaker must be perfectly level.

If the supporting frame for the breaker unit is to be fabricated in the field, the horizontal members supporting the breaker unit must be either 1½" pipe, or 2, 2½" or 3" angle, depending upon the span. The tank lifter is designed for

use with the above structural steel members only, and cannot be used with other sections.

A standard ½" washer (1⅜" O.D.) must be placed under the heads of the breaker unit mounting bolts. The washer prevents the breaker unit from slipping sideways on the horizontal supports by wedging in the supporting lug vee.

3. Remove the breaker cover and knock the blocking out of the mechanism. **Do not insert hands in breaker when removing this blocking as the mechanism may snap open.**

4. Remove the tank and examine the inside for evidence of moisture or foreign matter. Flush with benzine. Tanks should not be lowered in wet weather without provision for keeping moisture out of them. The internal parts of the breaker should also be protected.

5. Examine the contacts to see that they are clean and in alignment. For adjustment, see section covering adjustments.

6. Operate the breaker by hand several times, watching each pole and the operating mechanism to be sure that all parts move freely.

7. Install connections to the breaker studs. All contact surfaces should be cleaned and should be free of burrs. The terminal studs are not designed to carry

undue cable or bus bar loads. An excessive strain, which at first may have no apparent effect, will eventually loosen the porcelain weather casing and permit moisture to enter the breaker.

8. With the tank removed, fill with oil in accordance with name plate instructions. When bolting in place, be sure the tank is drawn up evenly and tightly all around.

9. Connect the breaker frame to ground through one of the mounting bolts. The National Electric Code requires grounding cable to have one-fifth 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.

10. Run the conduits to the breaker mechanism and transformer trip coil housing (when supplied). The breaker casting is tapped for 1¼-inch conduit and the transformer trip coil housing (when supplied) has a 1⅜-inch hole for 1-inch conduit. See the outlined drawing for conduit locations. Fig. 20.

11. Connect the control and transformer circuits to the proper points on the auxiliary switch, or to the proper coil leads—Due to space limitations terminal blocks are not supplied. When the breaker is located a considerable distance from the battery or power transformer,

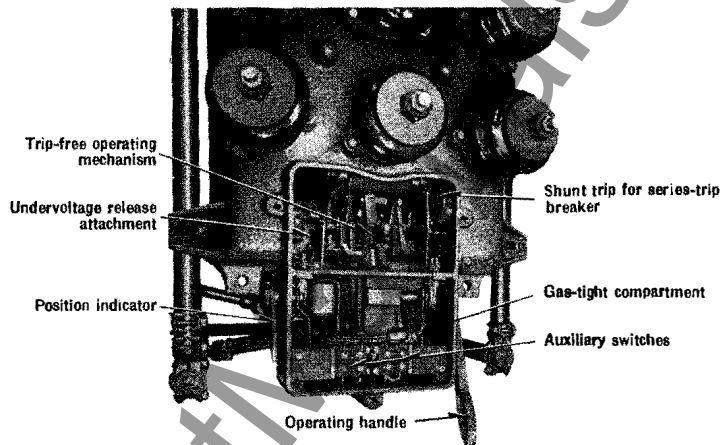


FIG. 3—TYPE FO-22-A OIL CIRCUIT-BREAKER, TOP VIEW SHOWING HOUSING WITH COVER REMOVED

Westinghouse Type FO-22-A Oil Circuit-Breakers

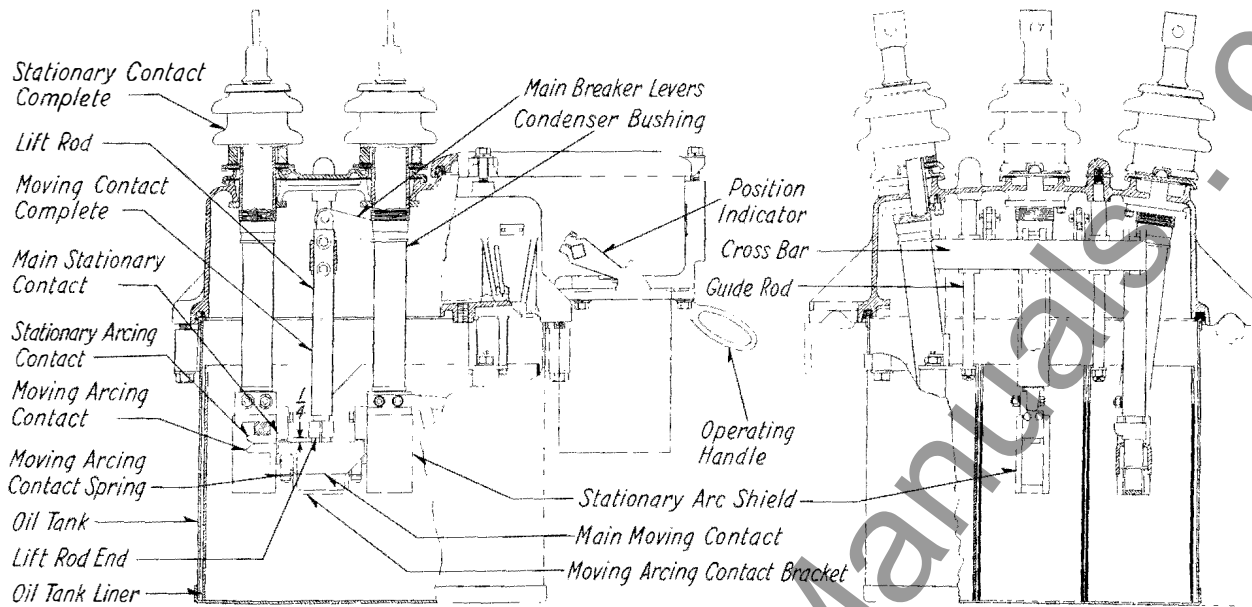


FIG. 4—BREAKER UNIT WITH SERIES TRIP COILS

allowance should be made for the voltage drop between the battery, or the transformer, and the terminals of the closing coil to secure proper operation at minimum control voltage. Always be sure the current transformer secondary connections are completed before impressing primary current on the breaker.

12. Check the operation of the breaker and attachments by operating it electrically, if for electrical operation.

Adjustments

Contacts—The contact arrangement is shown in Fig. 4. The main and arcing

contacts are both of the butt type, the $\frac{1}{4}$ -inch lead of the arcing contacts being maintained by the thickness of the copper on the arcing tips. The contact pressure on the main contacts is obtained by a compression spring. With the breaker closed the top of the main moving contact should be $\frac{1}{4}$ -inch below the shoulder on the lift rod end. If necessary to adjust, remove the moving arcing contact bracket with arcing contacts, loosen the lift rod end and screw the assembly up or down as necessary.

It is important that the $\frac{1}{4}$ -inch dimension be maintained as this determines the main contact pressure. A limited amount

of horizontal adjustment can be secured by loosening the stationary clamp nut and shifting the stationary contact in the top casting.

The main contacts make silver-to-silver contact and it is therefore unnecessary to use an abrasive to keep them clean. The oxide of silver does not increase the contact drop. In fitting new contacts it is unnecessary to secure perfect line contact. With the comparatively soft material (silver) good contact is secured after a few operations, as the silver flows slightly under pressure.

If the silver contact tips on the moving contacts are replaced, use solder of at

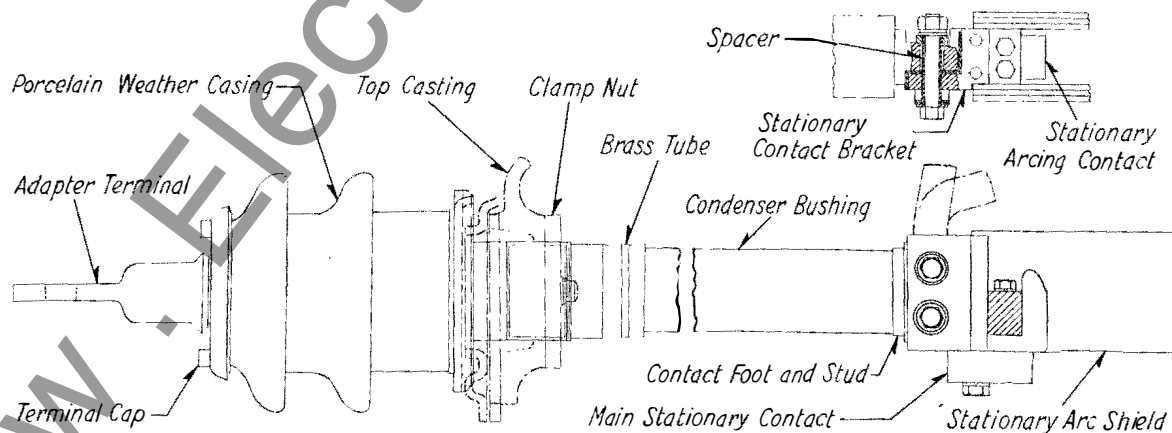


FIG. 5—STATIONARY CONTACT WITHOUT SERIES TRIP COIL

Westinghouse Type FO-22-A Oil Circuit-Breakers

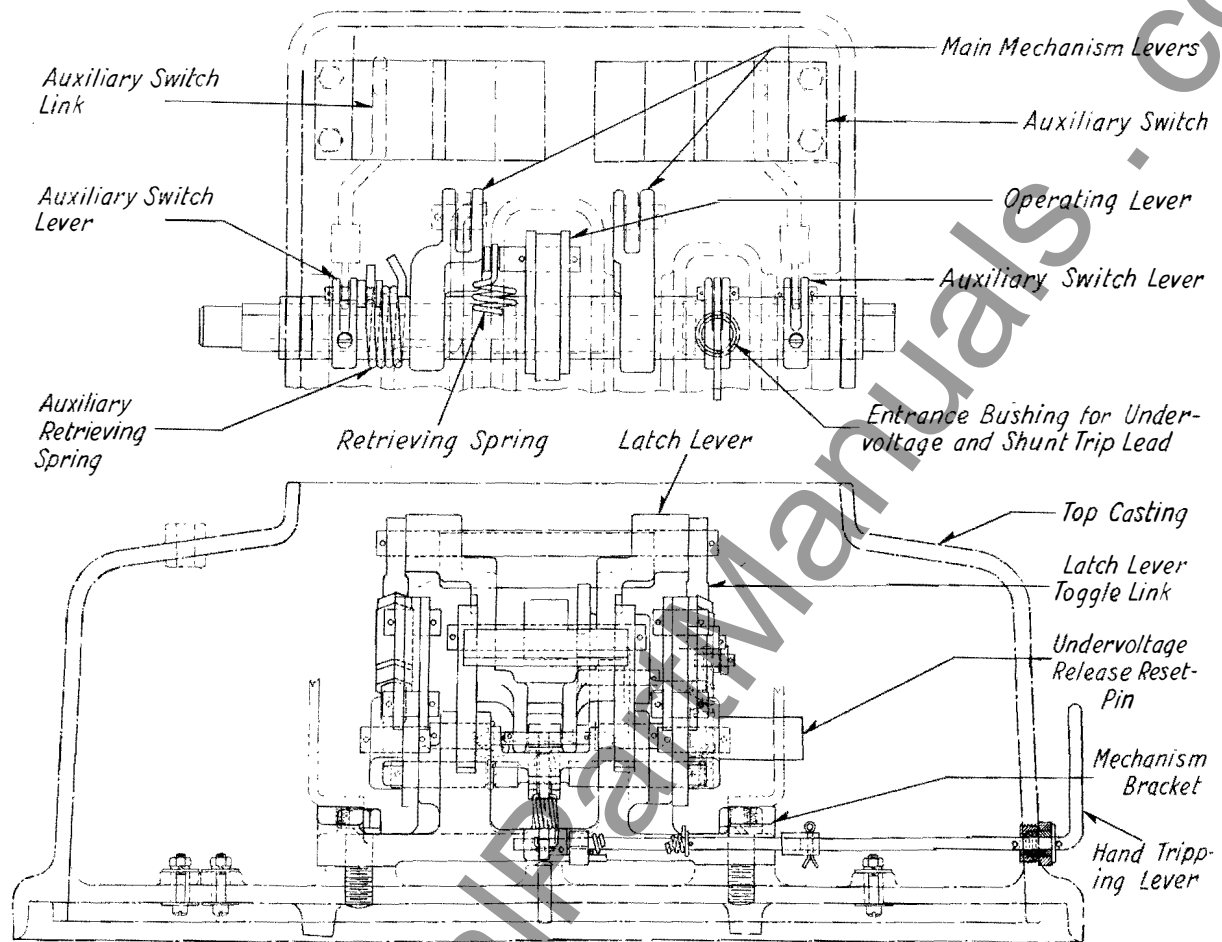


FIG. 6—MECHANISM OPERATING LEVERS (TOP AND REAR VIEWS)

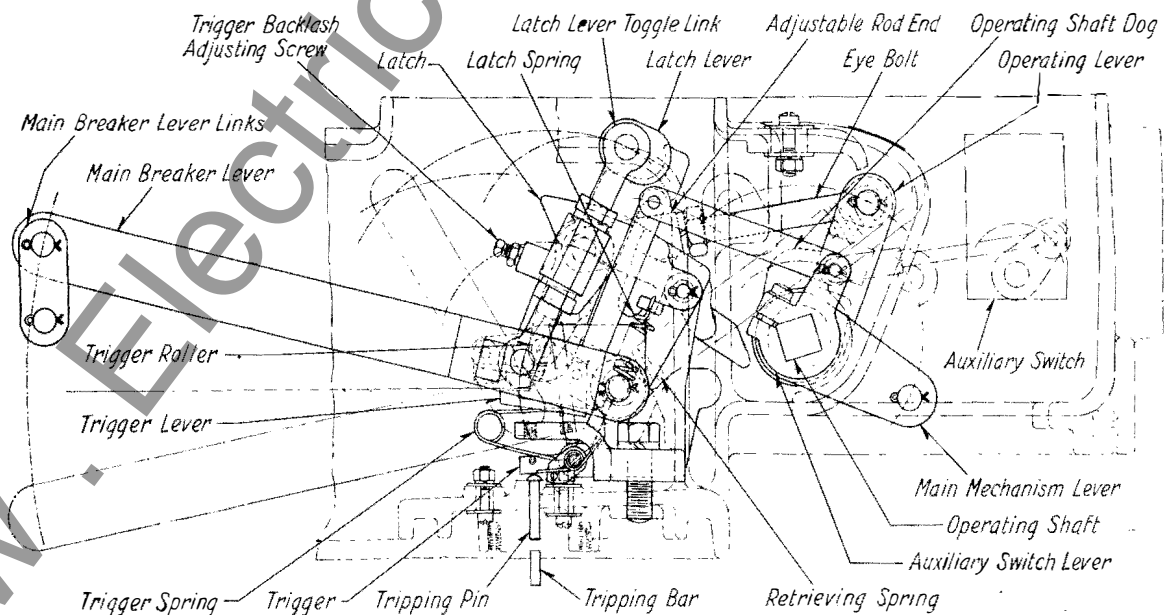


FIG. 7—MECHANISM OPERATING LEVERS (SIDE VIEW)

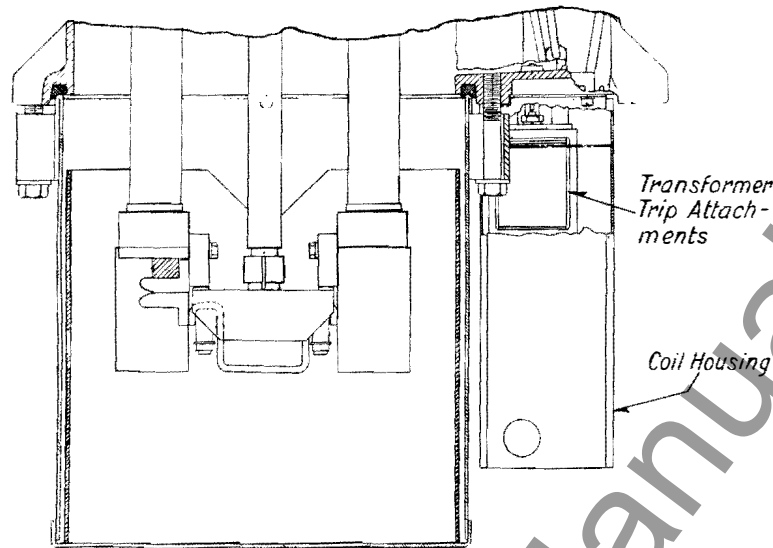


FIG. 8 BREAKER UNIT WITH TRANSFORMER TRIP COIL

least 300° C. melting point. Use only "pure silver," coin silver is unsatisfactory.

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

Mechanical—Do not try to adjust the contacts by changing the toggle adjustment. Ref. Fig. 8. The toggle is set at the factory and should not be disturbed.

Two guide rods, Fig. 4, are used to align and guide the moving contacts for straight line motion. The cross bar must move freely on these rods. The lower end of the guide rods and part of the 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.

WARNING—Always remove the closing lever before tripping the breaker.

Mechanism—When the operating shaft is rotated to the closed position, by either the solenoid or the operating handle, the operating shaft dog engages with the operating lever, which is connected to the trip free mechanism by an eye-bolt and an adjustable rod end, and closes the breaker. The breaker is held in the closed position by the latch. The breaker is tripped manually by the hand tripping lever. When the breaker trips automatically the tripping bar strikes the tripping pin, which in turn strikes the trigger, the trigger is disengaged from the trigger lever bracket which drops and permits the latch lever to rotate upward and open the breaker. During the last part of the latch lever rotation, it strikes the latch and allows the trip free mechanism to retrieve.

The only adjustment possible on the mechanism is that for securing the proper setting of the trigger lever back-lash (distance between the trigger roller and trigger lever latching surface). The trigger lever back-lash should be approximately $\frac{1}{64}$ inch. This is secured by means of the trigger back-lash adjusting screw.

Care should be used to see that the operating lever does not strike the web of the top casting when in the closed position.

The auxiliary retrieving spring should be disengaged on manually operated breakers.

D-C. Operation

The solenoid bolts directly to the top casting and is connected to the mechanism through the main mechanism levers on the operating shaft. When installing the solenoid, it is necessary to remove the cast covers supplied with manually operated breakers. It is necessary only to observe that the clamp casting rests firmly on the brass tube and coil and that the clamp casting is placed against the proper grooves in the top casting. The solenoid must operate without friction and the solenoid plunger must strike the stationary core when the latch has $\frac{1}{8}$ -inch back-lash. This latch requirement is secured by lengthening or shortening the eye-bolt and adjustable rod end linkage connecting between the operating shaft and the mechanism.

Undervoltage Release Attachment

Refer to Fig. 10.

This attachment is mounted in the left side of the top casting (facing mechanism end) by means of the two mounting bolts indicated. Operation is secured by means of the operating pin included as part of the mechanism. Be sure that the set-up is rigid and agrees with the illustration.

Connect leads from the external circuit to the terminals on the undervoltage coil. The undervoltage coil should be connected directly across the line, but should be protected by fuses. No atten-

Westinghouse Type FO-22-A Oil Circuit-Breakers

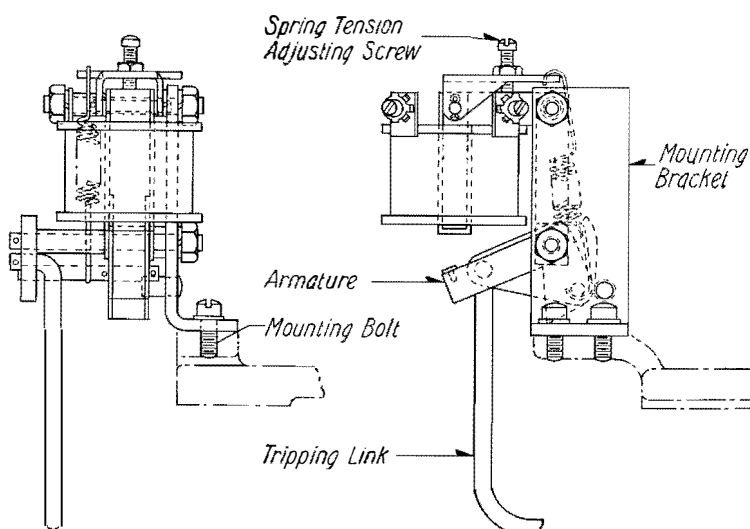


FIG. 11—SHUNT TRIP ATTACHMENT FOR SERIES TRIP BREAKERS

No attention need be paid to the correct connection as regards polarity. Check the control voltage on the name plate to make sure that it agrees with that on which the attachment is to be used.

The shunt trip circuit should be run through an auxiliary switch to break the tripping current when the breaker opens.

The shunt trip attachment for use with transformer trip or non-automatic

breakers is mounted on the transformer trip coil mounting plate in the coil housing, as shown in Figure 15.

Bushing Type Current Transformers

The breaker may be equipped with a maximum of 6 breaking type current transformers. The table below indicates the minimum primary tripping currents for the various attachments.

Transformer Trip Attachments

The mounting is illustrated in Figure 15. The attachments are calibrated at the factory and need only to be mounted, the calibration adjustments set at the proper value and the attachments given a preliminary trial.

Auxiliary Switches

The auxiliary switch is mounted in the top casting and connected to the switch lever on the operating shaft as indicated in Figures 6 and 12.

MINIMUM PRIMARY TRIPPING CURRENT OF FO-22-A OIL CIRCUIT BREAKERS WITH BUSHING TYPE, SINGLE RATIO, TRANSFORMERS

Transformer Rating in Amps. (5-Amp. Secondary)	Secondary Turns	Without Relays Inst. Trip and I. T. L. (5 Amps.)	With Circuit Closing Relay and Shunt Trip Coil *	With Circuit Opening Relay and Inst. Trip Attachment (4 Amps.)	With Circuit Closing Relay and Direct Trip Attachment (5 Amps.)	Primary Current for Full Scale Deflection on Secondary Ammeter †
50	7	...	40†	...	...	50
75	11	...	65†	...	...	75
100	17	...	80	...	...	100
125	19	...	100	...	...	125
150	26	150†	120	150†	...	150
200	37	200	160	200	...	200
250	48	250	200	240	...	250
300	58	300	240	275	300†	300
400	78	400	320	370	400†	400
500	98	500	400	450	500†	500
600	118	600	480	525	600†	600

† Two transformers in series.

* 4-ampere tap. Breaker will trip at 125% of these values on 5-ampere tap.

‡ Requires special calibration.

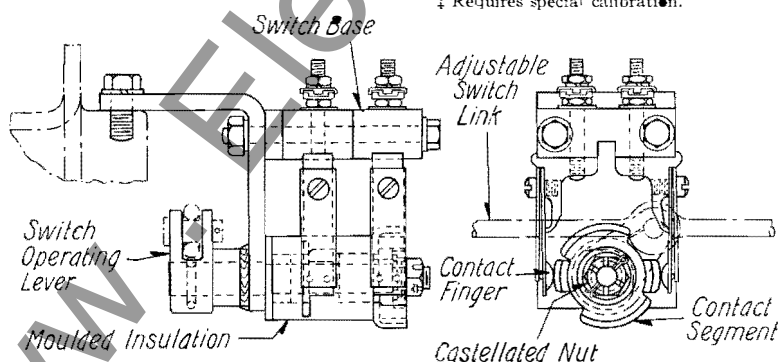
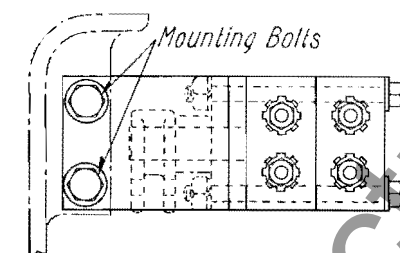


FIG. 12—AUXILIARY SWITCH

The contact segment can be varied in 15-degree steps by removing the castellated nut and shifting the segment one or more notches on the moulded insulation.

Operation Counter

The Operation counter is shown in Figure 16. It is only necessary to observe that the counter adds one unit for each operation of the breaker.

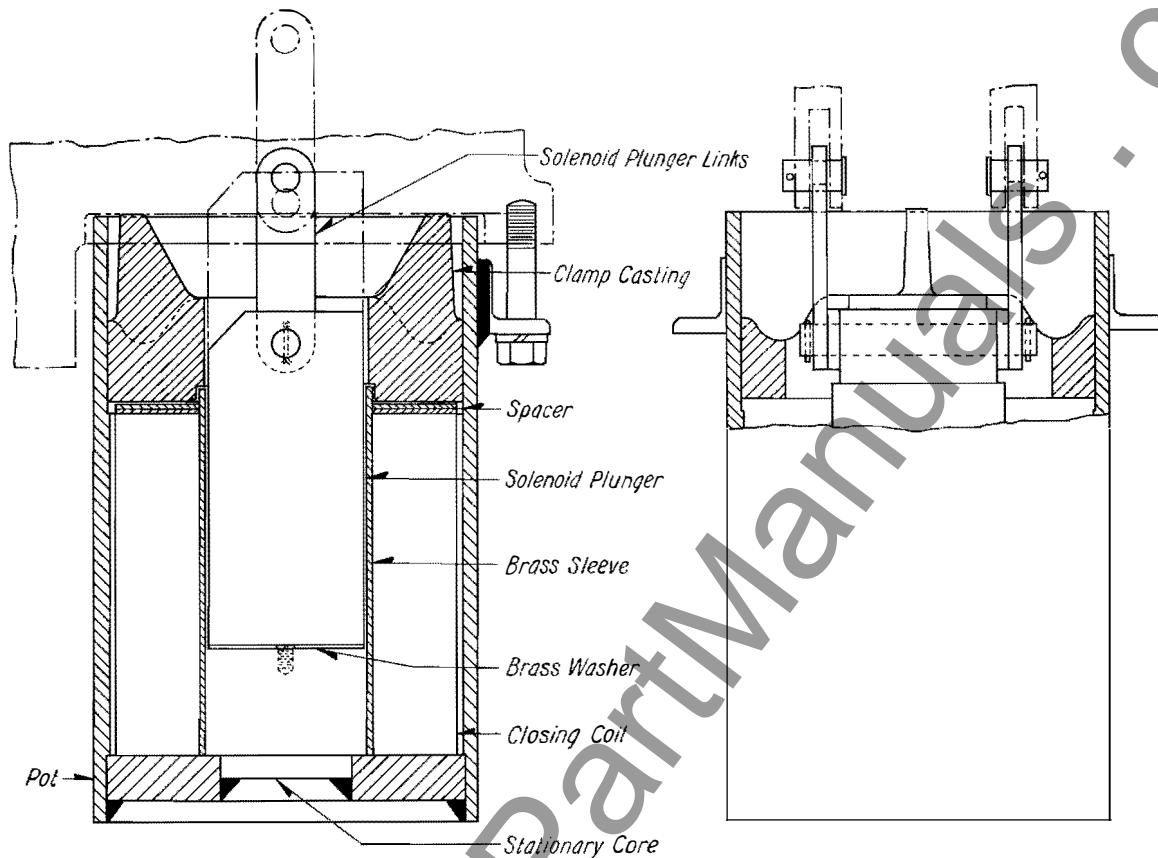


FIG. 9—SOLENOID OPERATING MECHANISM

tion need be paid to correct connection as regards polarity. The undervoltage coils should be connected to the line side of the breaker. Check the control voltage stamped on the name plate to make sure that it agrees with that on which the attachment is to be used.

Do not run the coil circuit through an auxiliary switch as this will result in "pumping."

Make sure that the retrieving spring retrieves the armature to within $\frac{1}{8}$ inch of the stationary core with the breaker in the open position. The low voltage coil is not a pickup coil and consequently is not capable of picking up the low voltage release armature when the distance exceeds this amount. If normal voltage is applied after this dimension is exceeded, the coil will burn out.

If noise develops, the faces of the armature and stationary core should be examined to see that a good clean seat is obtained when they are together. If necessary to clean these faces, be sure to leave them bearing over their entire area.

The attachment should be inspected

periodically to make sure that all parts are rigidly assembled and functioning properly.

Shunt Trip Attachment

The shunt trip attachment for use with series trip breakers is mounted in the

right side of the top casting (facing mechanism end) by the two mounting bolts indicated. Refer to Figure 11.

Be sure that the set-up is rigid and agrees with the illustration.

Connect lead from the external circuit to the terminals on the shunt trip coil.

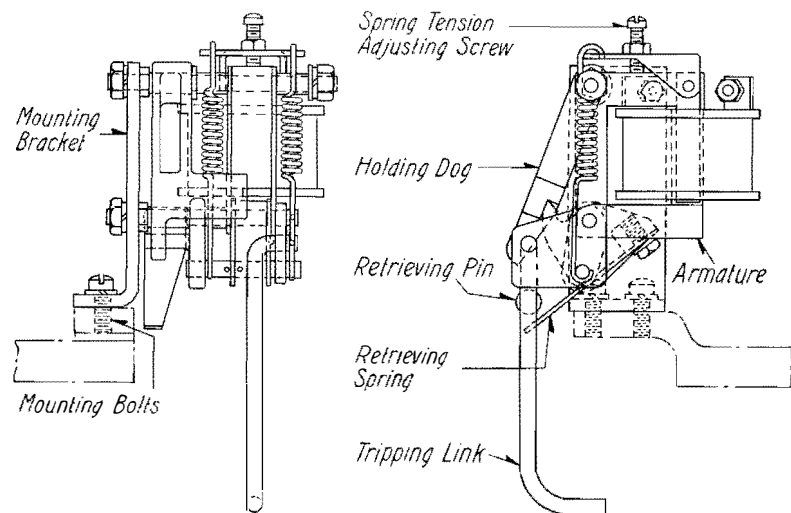


FIG. 10—UNDervOLTAGE RELEASE ATTACHMENT

Westinghouse Type FO-22-A Oil Circuit-Breakers

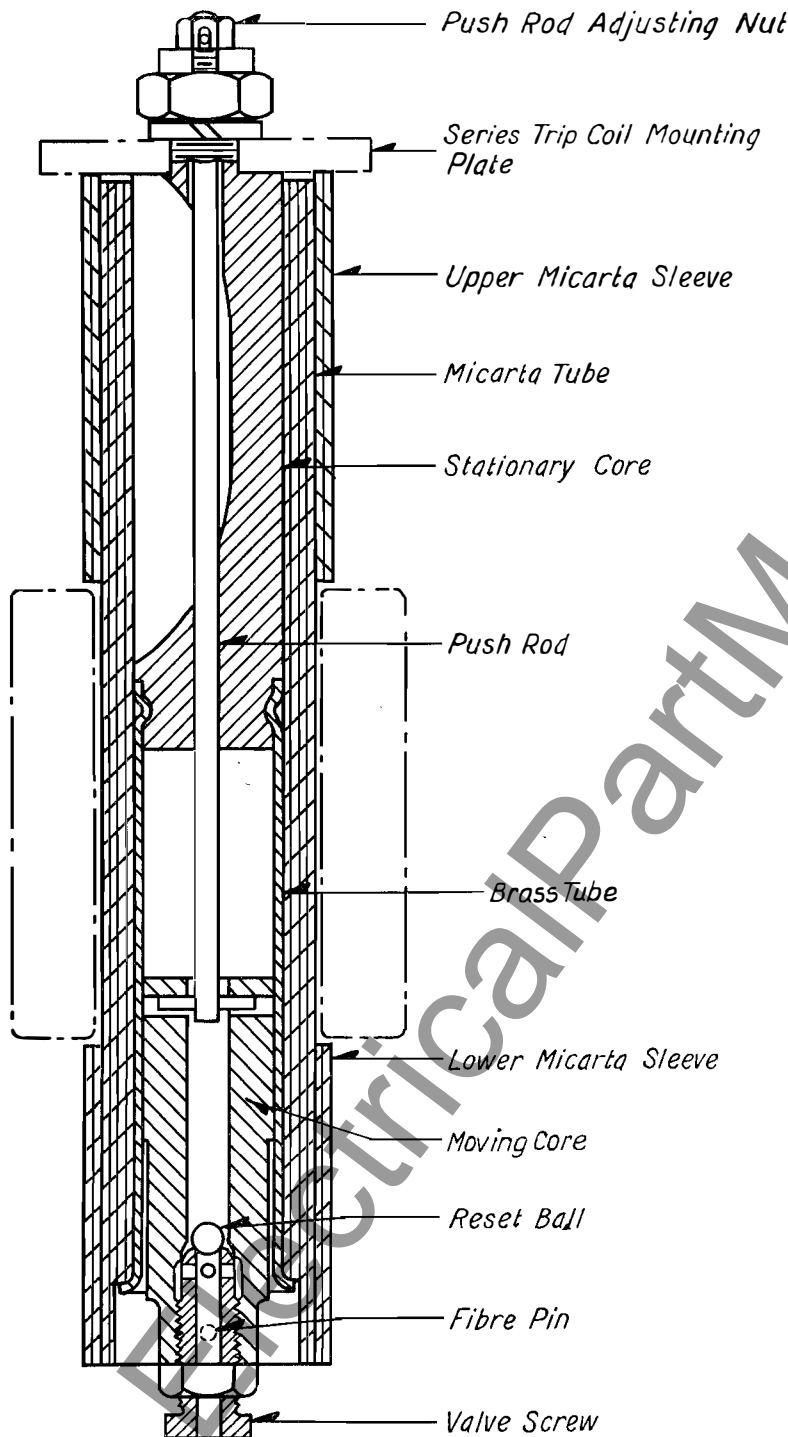


FIG. 13—SERIES TRIP ATTACHMENT

Series Trip Attachment

The series trip attachment mounts on the series trip coil mounting plate and is connected to the series trip mechanism as indicated in Figures 13 and 14.

The oil entrapped between the moving and stationary cores retards the upward motion of the moving core by a varying amount, depending upon the setting of the valve screw. The valve screw is not calibrated and the correct setting must be determined by test. The reset ball is for the purpose of allowing the moving core to reset with reasonable speed. During the downward motion of the moving core, the reset ball is forced from its seat and allows the oil to flow rapidly into the chamber between the moving and stationary cores.

The push rod adjusting nut is used to adjust the distance between the moving and stationary cores so that the various coils will pick up and trip the breaker at the same time. It is sometimes necessary to file the tops of the push rod so that the breaker trips during the last $\frac{1}{16}$ inch of the moving core travel, as the greatest power is developed when the moving and stationary cores are close together. When the coils are mounted at the factory, this adjustment is properly made and should not be disturbed.

The series coils should be set to trip at the desired current by removing the calibration rod cap, loosening the calibration rod clamp and screwing the calibration rod up or down until the proper marking is flush with the top of the calibration rod clamp. Be sure to tighten the clamp after adjustment. If a setting in between the actual markings is required, the actual markings can be interpolated with reasonable accuracy.

Westinghouse Type FO-22-A Oil Circuit-Breakers

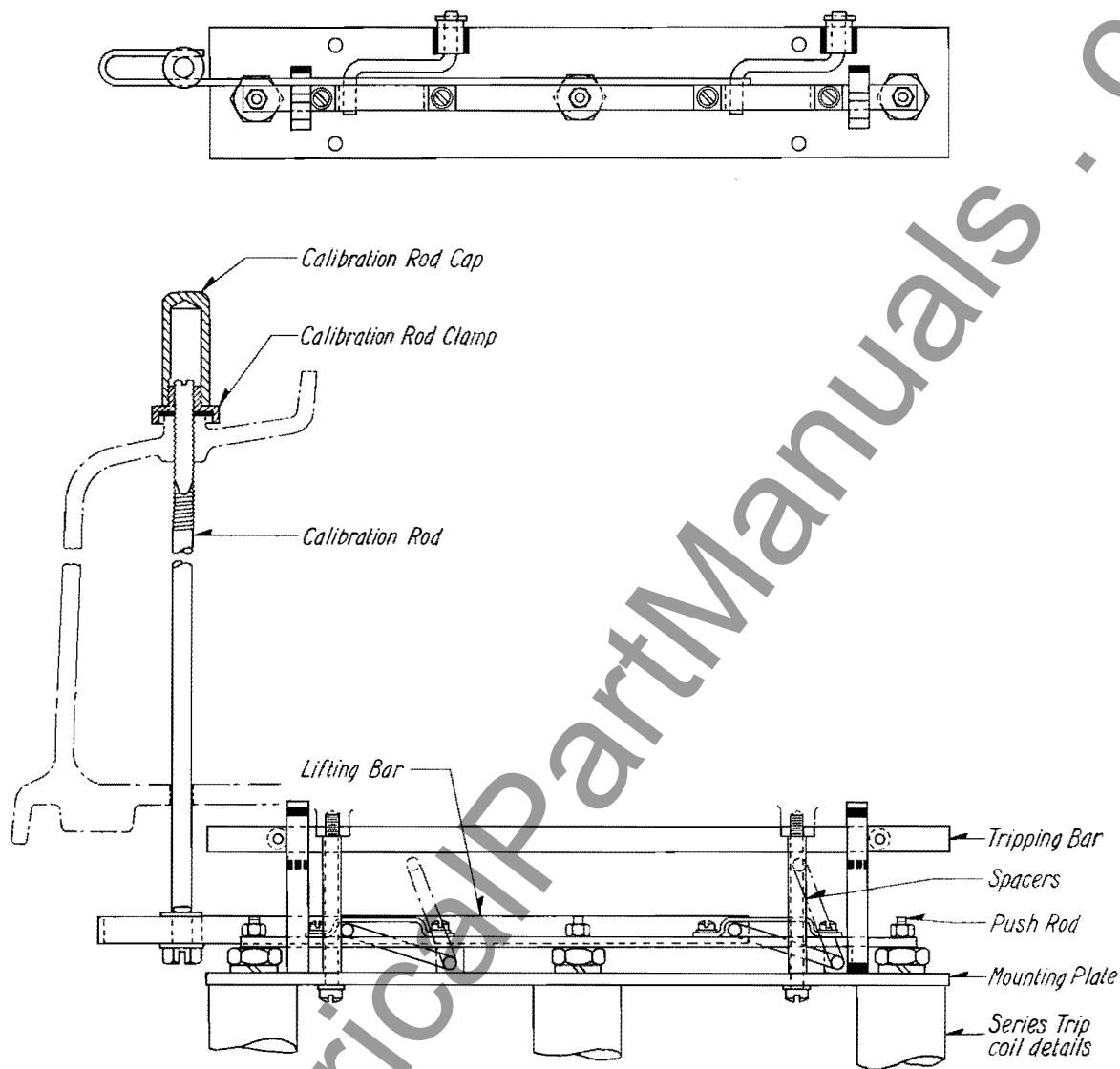


FIG. 14—SERIES TRIP ATTACHMENT AND MOUNTING PLATE

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 Insulating 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., reduces 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 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

Westinghouse Type FO-22-A Oil Circuit-Breakers

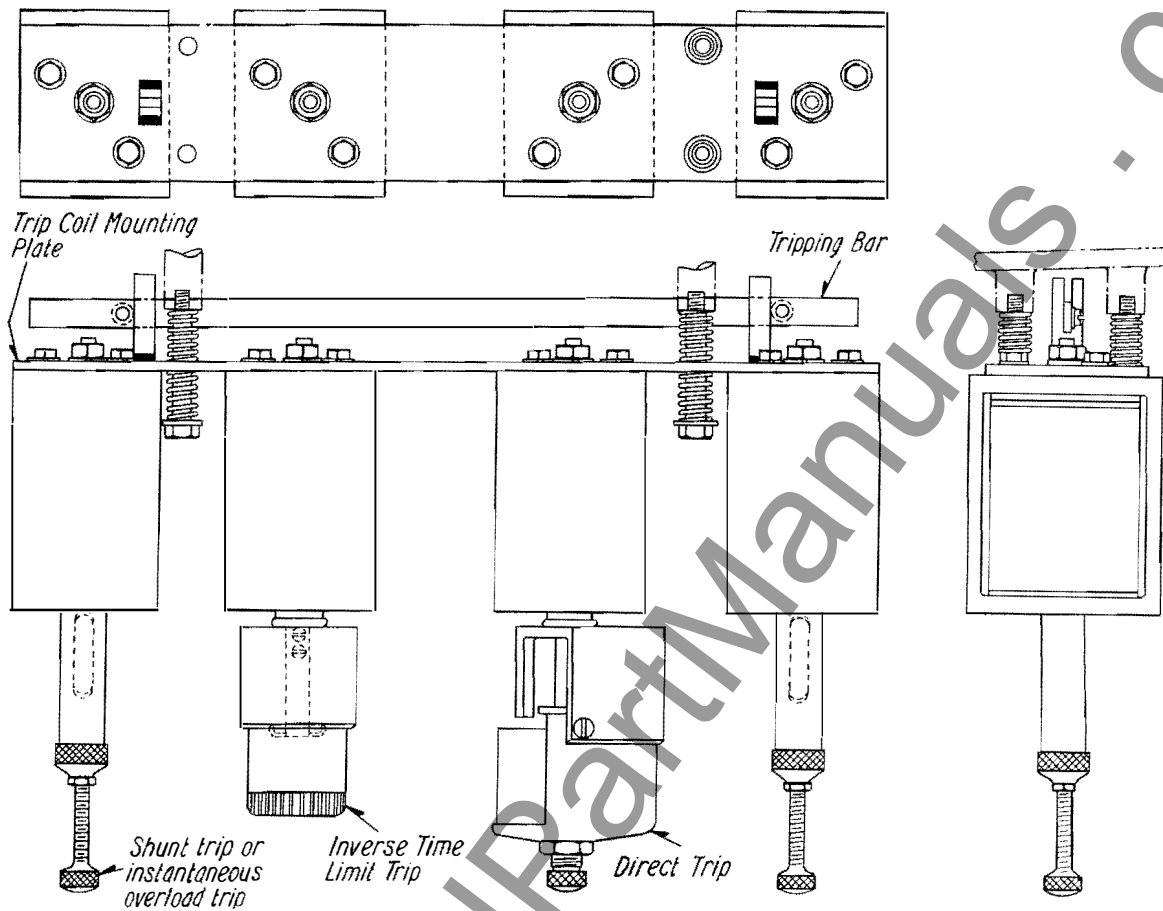


FIG. 15—TRANSFORMER TRIP ATTACHMENTS AND MOUNTING PLATE

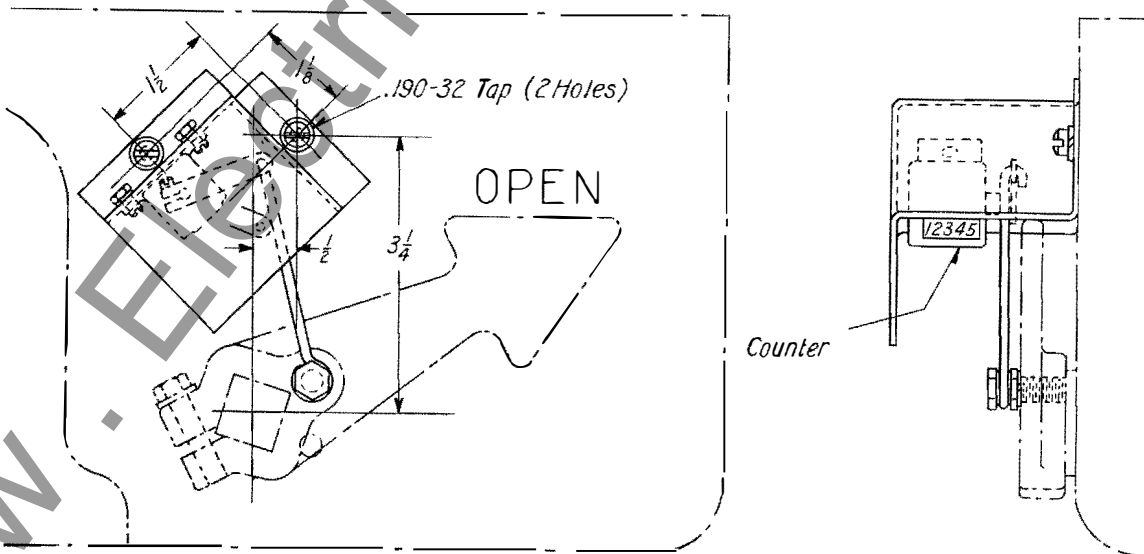


FIG. 16—OPERATING COUNTER AND LINKAGE

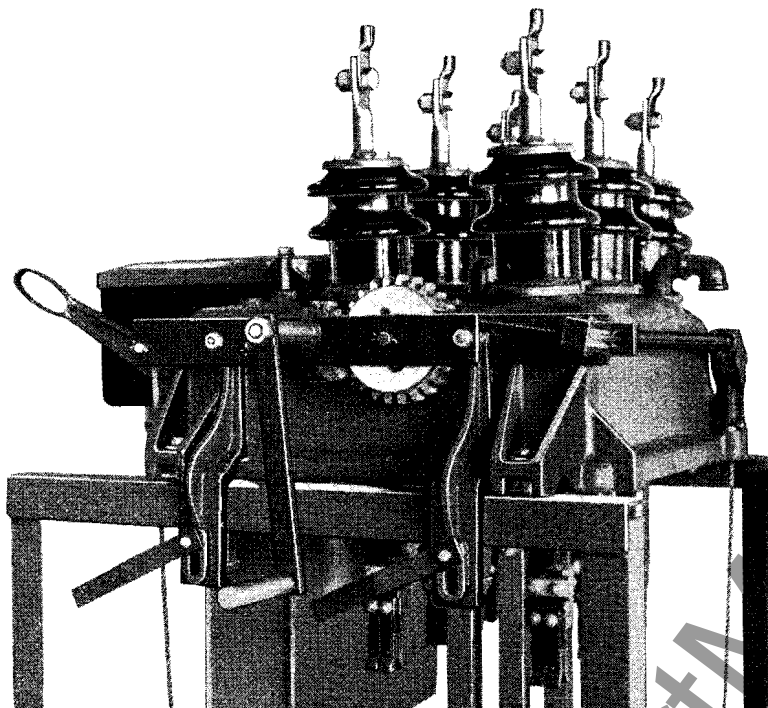


FIG. 17—TANK LIFTER IN POSITION FOR USE ON RIGHT HAND SIDE OF BREAKER

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 5336.

Tank Lifter

Refer to Figs. 17, 18 and 19.

The tank lifter can be mounted on either the right or left hand side of the breaker, and can be used with either the small or the large tank.

As received, the lifter will be assembled for use on the left hand side of the breaker, and with the cable arranged for use with the large tank.

The lifter is mounted on the supporting frame-work as indicated in Figure 17. The two mounting brackets are to be located between the top casting mounting lugs, and the swivel bracket is to be extended behind the breaker unit to the

opposite tank lug, into which the swivel bracket fits. It is necessary to remove the two tank bolts before using the lifter, as the lifting lugs fit into the tank lugs in place of the mounting bolts. The remaining two tank bolts can then be removed or replaced, depending upon whether the tank is being raised or lowered. The centerline of the lifting lug must be parallel to the tank side, as indicated in Fig. 18.

The tank lifter can be shifted sideways on the supporting framework to eliminate any minor interferences that may exist.

If the tank lifter is to be mounted on the right hand side of the breaker, as shown in Fig. 17, remove the mounting bracket bolts and rotate the mounting brackets 180 degrees. The cable position should be as indicated in the following: (See Fig. 19).

1. Lifter on left hand side—Large tank—Cable run at "a", over pulley 1 and down to tank.
2. Lifter on left hand side—Small tank—Cable run at "c" around pulley 2 and down to tank.
3. Lifter on right hand side—Large tank—Cable run under pulley 2 to "b", over pulley 1 and down to tank.

4. Lifter on the right hand side—Small tank—Cable run at "d" around pulley 2 and down to tank.

The operating handle should always rotate in a clockwise direction, when raising the tank, in order that the dog may function properly.

The swivel bracket can be adjusted to the proper length by screwing it in or out on the pipe threads.

All bearing surfaces, gearing and cable should be kept well oiled.

Maintenance

The following points should be observed in maintenance.

1. Before making any adjustments, make sure that all lines are electrically dead.
2. Be sure the breaker frame is grounded.
3. Do not operate the breaker excessively with the operating mechanism when the tank is removed.
4. Examine all contacts frequently, especially after short-circuit. See that the contacts are properly aligned.
5. After making any adjustments, operate the apparatus carefully by hand to make sure that it operates smoothly and correctly.
6. Inspect the oil after severe faults. If it shows signs of moisture, carbonization or dirt, filter and retest it.
7. Remove all oil and thoroughly clean the tanks, tank liners, lift rods, terminal bushings, etc. at least once a year.
8. Occasionally inspect all spring cotters and bolt nuts.
9. Any pitting of the contacts should be smoothed, or, if badly burned, the contacts should be replaced.
10. Keep the bearing surfaces of the mechanism and breaker adequately oiled.

Westinghouse Type FO-22-A Oil Circuit-Breakers

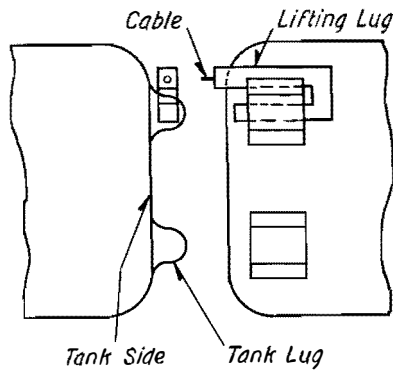
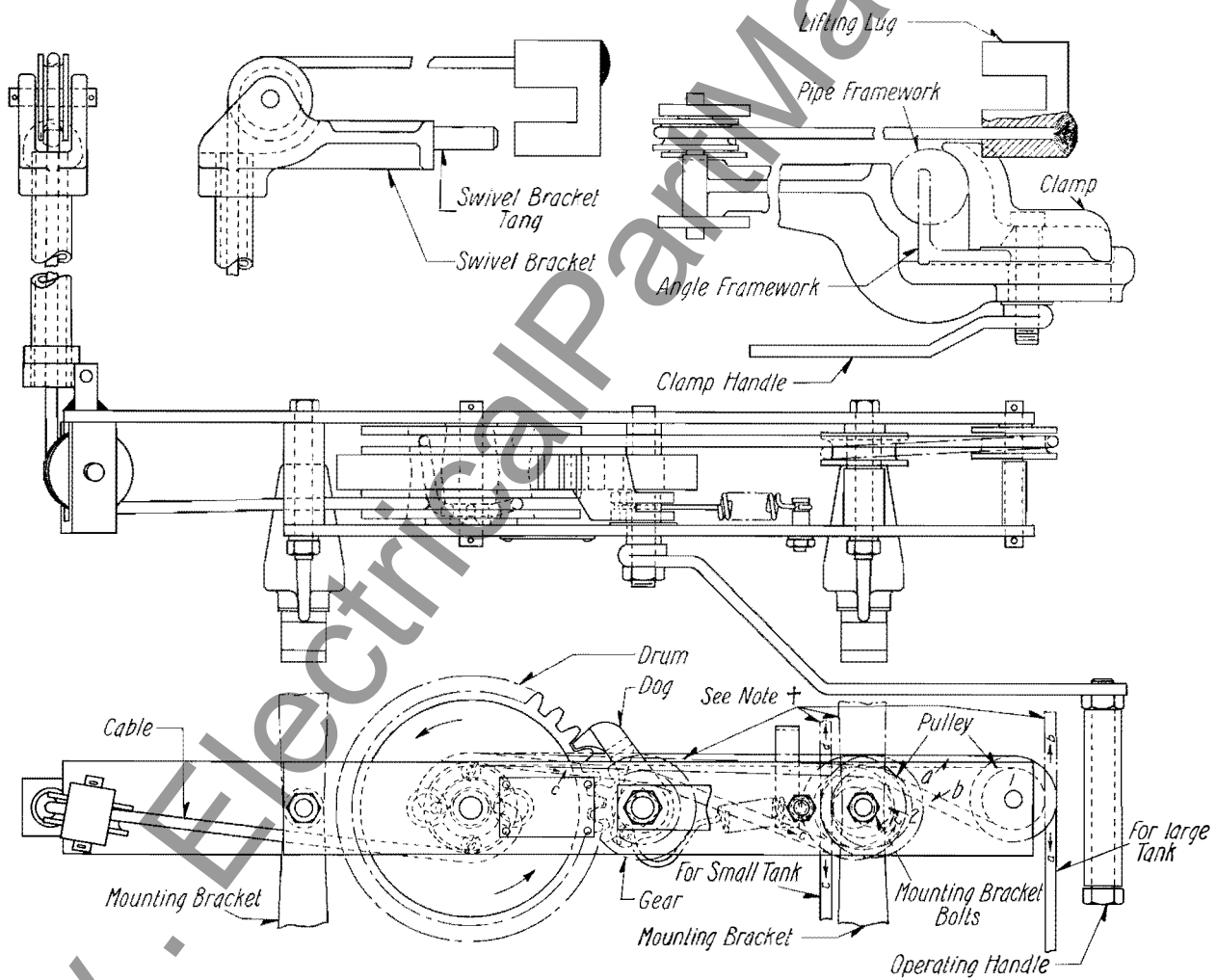


FIG. 18.—METHOD OF ENGAGING TANK AND LIFTING LUGS



† Cable and brackets to be as shown in dot and dash lines when tank lifter is used on opposite side of breaker.

FIG. 19.—TANK LIFTER ASSEMBLY

Westinghouse Type FO-22-A Oil Circuit-Breakers

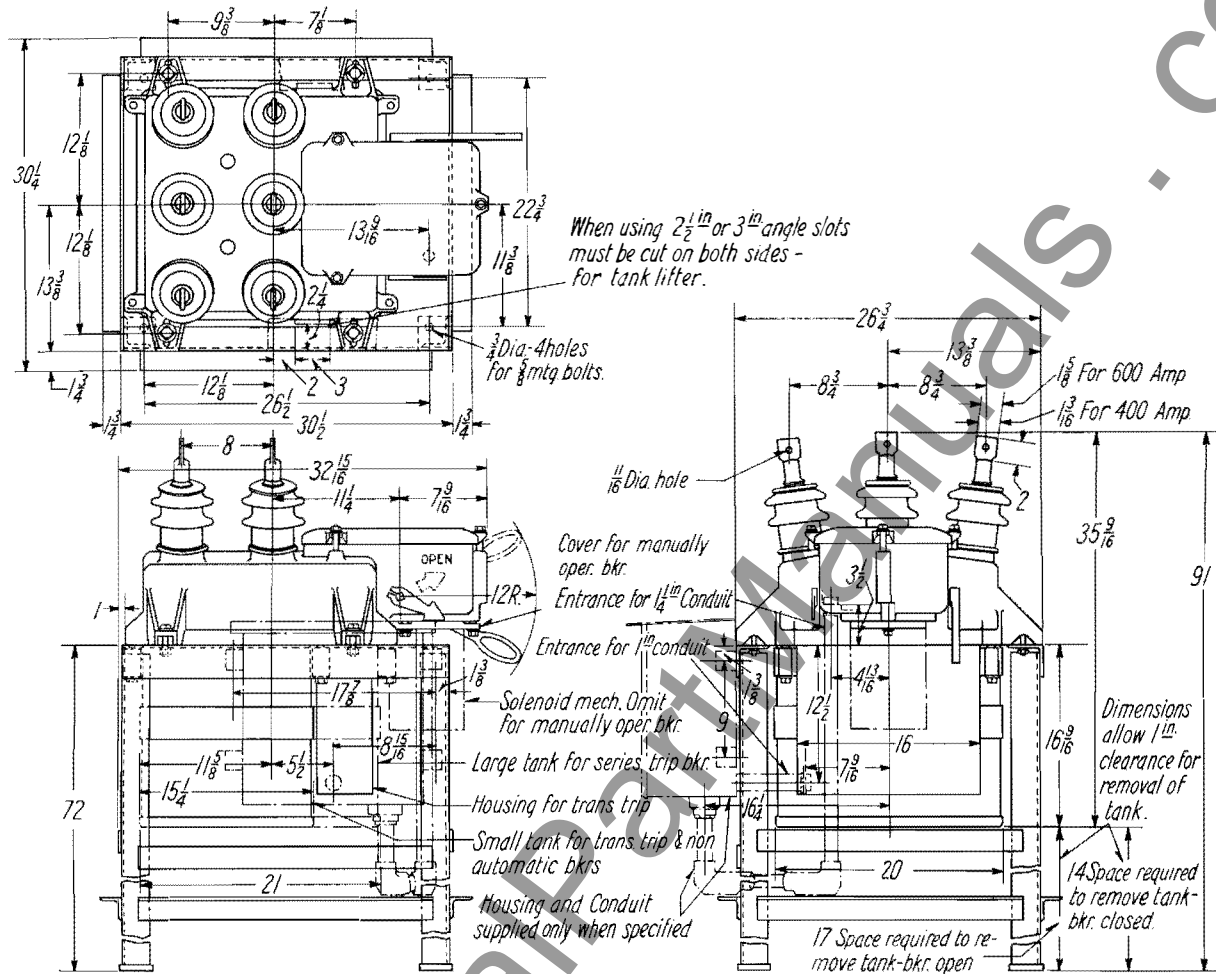


FIG. 20--TYPE FO-22-A OIL CIRCUIT-BREAKER
OUTLINE DRAWING—DIMENSIONS IN INCHES

RENEWAL PARTS DATA
Recommended Stock of Renewal Parts for
TYPE FO-22-A OIL CIRCUIT BREAKER
Outdoor Service

Manually or Electrically Operated—Automatic or Non-Automatic Trip
400—600 Amperes; 7500 Volts; 2- or 3-Pole; Single Throw

FOR ILLUSTRATION OF PARTS SEE FIGURES 4, 5, 6, 7, ETC.

The following is a list of the Renewal Parts and the quantities of each that we recommend should be stocked by the user of this apparatus to minimize interrupted operation caused by breakdowns. The parts recommended are those most subject to wear in normal operation or those subject to damage or breakage due to possible abnormal conditions. This list of Renewal Parts is given only as a guide. When continuous operation is a primary consideration, additional insurance against shut-downs is desirable. Under such conditions more renewal parts should be carried, the amount depending upon the severity of the service and the time required to secure replacement.

For Breakers in use up to and including.....	2-POLE			3-POLE			Style No. of Part
	No. Per Breaker	1	5	No. Per Breaker	1	5	
Name of Part	No. Per Breaker	Recommended for Stock		No. Per Breaker	Recommended for Stock		
Breaker Complete.....	1	0	0	1	0	0	
Breaker Unit Complete.....	1	0	0	1	0	0	
Moving Contact Complete.....	2	0	0	3	0	0	
Lift Rod.....	2	0	1	3	0	1	949 462
Main Moving Contact.....	2	0	2	3	0	3	998 182
*Main Moving Contact Spring.....	2	0	1	3	0	1	944 187
Moving Arcing Contact Bracket.....	2	0	0	3	0	0	944 349
Moving Arcing Contact.....	4	4	8	6	6	12	947 450
Moving Arcing Contact Spring.....	4	2	4	6	4	6	969 731
Stationary Contact Complete.....	4	0	0	6	0	0	
Condenser Bushing—400 Amperes.....	4	0	2	6	0	2	716 174
Condenser Bushing—600 Amperes.....	4	0	2	6	0	2	949 478
Main Stationary Contact.....	4	2	4	6	2	6	1 017 077
Stationary Arcing Contact.....	4	4	8	6	6	12	947 450
Stationary Arc Shield.....	4	0	2	6	0	2	947 454
*Oil Tank Complete.....	1	0	0	1	0	0	712 239
Oil Tank.....	1	0	0	1	0	0	759 376
Tank Liner.....	3	0	1	3	0	1	687 130
Breaker Operating Mechanism.....	1	0	0	1	0	0	
Operating Lever.....	1	0	0	1	0	0	685 788
Auxiliary Retrieving Spring.....	1	0	1	1	0	1	949 464
Retrieving Spring.....	1	0	1	1	0	1	685 799
Main Lever—Right Hand.....	1	0	0	1	0	0	1 017 079
Main Lever—Left Hand.....	1	0	0	1	0	0	1 017 080
Trigger Lever.....	1	0	0	1	0	0	998 104
Trigger.....	1	0	0	1	0	0	685 795
Trigger Spring.....	1	0	1	1	0	1	685 797
Trigger Roller.....	1	0	0	1	0	0	570 112
Latch Lever.....	1	0	0	1	0	0	998 128
Latch.....	1	0	0	1	0	0	1 017 078
Latch Spring.....	1	0	1	1	0	1	685 798
Operating Shaft Dog.....	1	0	0	1	0	0	685 789
* Closing Coil.....	1	0	0	1	0	0	†
* Trip Coil.....	1	0	1	1	0	1	†
* Overload Trip Coil.....	1	0	1	1	0	1	†
* Direct Trip Coil.....	1	0	1	1	0	1	†
* Undervoltage Release Coil.....	1	0	1	1	0	1	†

* Not listed on illustration.

† When ordering, specify identification number stamped on part.

Parts indented are included in the part under which they are indented.

ORDERING INSTRUCTIONS

When ordering Renewal Parts, always specify the name of the part wanted as shown on the illustrations in this Instruction Book, giving Shop Order Number, and the type of Oil Circuit Breaker, as shown on the nameplate. For example:

One Moving or Stationary Contact Complete, 600 Amperes, for Type FO-22-A Oil Circuit-Breaker, S.O. 33-F-737, shown in Instruction Book 5766, Fig. 4.

To avoid delays and misunderstandings, note carefully the following points:

1. Send all correspondence and orders to the nearest Sales Office of the Company.
2. State whether shipment is to be made by freight, express or parcel post. In the absence of instructions, goods will be shipped at our discretion. Parcel post shipments will be insured only on request. All shipments are at purchaser's risk.
3. Small orders should be combined so as to amount to a value of at least \$1.00 net. Where the total of the sale is less than this, the material will be invoiced at \$1.00.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Business Addresses PARENT COMPANY Headquarters, East Pittsburgh, Pa.

- *AKRON, OHIO, 106 South Main St.
- *ALBANY, N. Y., 360 Broadway
- *ALEXANDRIA, VA., 121 Frazier Ave.
- *ALLEN TOWN, PA., 522 Maple St.
- *APPLETON, WISC., #1 Bellaire Court
- †APPLETON, WISC., 1029 So. Outagamie St.
- *ATLANTA, GA., 426 Marietta St., N. W.
- *ATTICA, N. Y.
- *BAKERSFIELD, CALIF., 2224 San Emedio St.
- *BALTIMORE, MD., 118 E. Lombard St.
- †BALTIMORE, MD., 501 East Preston Road
- *BALTIMORE, MD., 40 S. Calvert St.
- *BEAUMONT, TEXAS, 2293 Broadway Ave.
- ①*BINGHAMTON, N. Y., Suite 704, Marine Midland Bldg., 86 Court St.
- *BIRMINGHAM, ALA., 2030 Second Ave.
- *BLUEFIELD, W. VA., 208 Bluefield Avenue
- *BOISE, IDAHO, P. O. Box 1597
- *BOSTON, MASS., 10 High St.
- †BOSTON, MASS., 12 Farnsworth St.
- *BRIDGEPORT, CONN., Bruce Ave. & Seymour St.
- *BUFFALO, N. Y., 814 Ellicott Square
- †BUFFALO, N. Y., 1132 Seneca St.
- *BURLINGTON, IOWA, 1708 River St.
- *BURLINGTON, VER., 208 Park Ave.
- *BUTTE, MONTANA, 129 West Park Street
- *CANTON, OHIO, Market & Tuscarawas Sts.
- *CHARLOTTE, N. C., 210 East Sixth St.
- ①*CHARLESTON, W. VA., P. O. Box 865
- *CHATTANOOGA, TENN., 536 Market St.
- *CHICAGO, ILL., 20 N. Wacker Drive
- ①*CHICAGO, ILL., 2211 W. Pershing Road
- *CHICOPEE FALLS, MASSACHUSETTS
- *CINCINNATI, OHIO, 207 West Third St.
- *CLEVELAND, OHIO, 1216 West Fifty-Eighth St.
- *COLUMBIA, S. C., 912 Lady St.
- *COLUMBUS, OHIO, Gay & Third Sts.
- *DALLAS, TEXAS, 209 Browder St.
- *DALLAS, TEXAS, 1712 Carter St.
- *DAYTON, OHIO, 206 E. Second St.
- *DAYTON, OHIO, 30 North Main St.
- *DENVER, COLORADO, 900 Fifteenth St.
- *DENVER, COLORADO, 1700 Sixteenth St.
- *DENVER, COLORADO, 2644 Walnut St.
- *DERRY, PA.
- *DES MOINES, IOWA, 523 Sixth Ave.
- *DETROIT, MICH., 5757 Trumbull Ave.
- *DULUTH, MINN., 10 East Superior St.
- *EASTPORT, ME., P. O. Box 764
- *EL PASO, TEXAS, 303 N. Oregon St.
- *EL PASO, TEXAS, 450 Canal St.
- *EL PASO, TEX., 7/8 Zork Hdw. Co., 309 N. El Paso St.
- *EMERYVILLE, CALIF., 5815 Peladeau St.
- *EMERYVILLE, CALIF., 1466 Powell St.
- *EMERYVILLE, CALIF., 6161 Green St.
- *ERIE, PA., 1003 State St.
- *EVANSVILLE, IND., 201 N. W. First St.
- *FAIRMONT, W. VA., 602 Cleveland Ave.
- *FARGO, N. D., 319—12 Ave. N.
- *FORT WAYNE, IND., 1010 Packard Ave.
- *FORT WORTH, TEXAS, 501 Jones St.
- *GARY, IND., 701 Washington St.
- *GRAND RAPIDS, MICH., 507 Monroe Ave., N. W.
- *GREENVILLE, S. C., West Earle St.
- *HAMMOND, IND., 235 167th St.
- *HARTFORD, CONN., Main & Pearl Sts.
- *HOMERWOOD WORKS, Pittsburgh, Pa., 543 N. Lang Ave.
- *HONOLULU, T. H., Hawaiian Elec. Co. Aigt
- *HOUSTON, TEXAS, 1314 Texas Ave.
- *HOUSTON, TEXAS, 2313 Commerce Ave.
- *HOUSTON, TEXAS, 2315 Commerce Ave.
- *HUNTINGTON, W. VA., 209 Ninth St.
- *INDIANAPOLIS, IND., 539 Madison Ave.
- *INDIANAPOLIS, IND., 551 West Merrill St.
- *ISHPEMING, MICH., 433 High St.
- *JACKSON, MICH., 212 West Michigan Ave.
- *JOHNSTOWN, PA., 47 Messenger St.
- *KANSAS CITY, MO., 2124 Wyandotte St.
- *KNOXVILLE, TENN., Gay & Clinch St.
- ①*KLIMA, OHIO
- *LITTLE ROCK, ARK., 1115 West 24th St.
- *LITTLE ROCK, ARK., 7/8 Fones Bros. Hdw. Co., 2nd & Rock Sts.
- *LOS ANGELES, CALIF., 420 So. San Pedro St.
- *LOUISVILLE, KY., 322 West Broadway
- *MADISON, WISC., 508 Edgewood Ave.
- *MANSFIELD, OHIO, 200 East Fifth St.
- *MARSHALL, TEXAS, 202 W. Merritt St.
- *MEMPHIS, TENN., 130 Madison Ave.
- *MIAMI, FLA., 1036 N. Miami Ave.
- *MILWAUKEE, WISC., 546 North Broadway
- *MILWAUKEE, WISC., 1669 N. Water St.
- *MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
- ①*MONROE, LA., 1301 N. Fourth St.
- *NASHVILLE, TENN., 219 N. Second Ave.
- *NEWARK, N. J., 1180 Raymond Blvd.
- †NEWARK, N. J., Haynes Ave. & Lincoln Highway
- *NEWARK, N. J., Plane & Orange St.
- *NEW HAVEN, CONN., 42 Church St.
- *NEW ORLEANS, LA., 333 St. Charles St.
- *NEW ORLEANS, LA., 527 Poydras St.
- *NEW YORK, N. Y., 150 Broadway
- *NEW YORK, N. Y., 460 West Thirty-Fourth St.
- *NIAGARA FALLS, N. Y., 205 Falls St.
- *NORFOLK, VA., 254 Tazewell St.
- *OKLAHOMA CITY, OKLA., 10 E. California St.
- *OKLAHOMA CITY, OKLA., Third & Alie Sts.
- *OMAHA, NEB., 409 South Seventeenth St.
- *OMAHA, NEB., 117 N. 13th St.
- *PEORIA, ILL., 104 E. State St.
- *PHILADELPHIA, PA., 3001 Walnut St.
- *PHOENIX, ARIZONA, 11 West Jefferson St.
- ①*PITTSBURGH, KANSAS, P. O. Box 15
- *PITTSBURGH, PA., Nuttall Works, 200 Mc Candles Ave.
- *PITTSBURGH, PA., 435 Seventh Ave.
- *PITTSBURGH, PA., 543 N. Lang Ave.
- *PITTSBURGH, PA., 3000 Liberty Ave.
- *PORTLAND, MAINE, 27 Deerfield Road
- *PORTLAND, OREGON, 309 S. W. Sixth Ave.
- †PORTLAND, OREGON, 2138 N. Interstate Ave.
- *PORTLAND, OREGON, 720 N. Thompson St.
- *PROVIDENCE, R. I., 16 Elbow St.
- *RALEIGH, N. C., 803 North Person St.
- *RALEIGH, N. C., 322 S. Harrington St.
- *READING, PA., 619 Spruce St.
- *RICHMOND, VA., Fifth & Byrd
- ①*ROANOKE, VA., 726 First St., S. E.
- *ROCHESTER, N. Y., 410 Atlantic Ave.
- *ROCKFORD, ILL., 130 South Second St.
- ①*SACRAMENTO, CALIF., 20th and "R" Sts.
- *SALT LAKE CITY, UTAH, 10 West First South St.
- *SALT LAKE CITY, UTAH, 346 A Pierpont Ave.
- *SALT LAKE CITY, UTAH, 235 W. S. Temple
- *SAN ANTONIO, TEXAS, 212 East Houston St.
- *SAN FRANCISCO, CALIF., 1 Montgomery St.
- *SEATTLE, WASH., 603 Stewart St.
- †SEATTLE, WASH., 3451 East Marginal Way
- *SHARON, PA., 469 Sharpville Ave.
- *SIOUX CITY, IOWA, 2311 George St.
- *SOUTH BEND, IND., 216 East Wayne St.
- *SOUTH BEND, IND., 107 E. Jefferson St.
- *SOUTH PHILA. WKS., Essington, Pa.
- *SOUTH PHILA. WKS., P. O. Box 7348, Philadelphia, Pa.
- *SPOKANE, WASH., So. 158 Monroe St.
- *SPRINGFIELD, ILL., 130 So. Sixth St.
- *SPRINGFIELD, MASS., 395 Liberty St.
- *SPRINGFIELD, MASS., 653 Page Boulevard
- *ST. LOUIS, MO., 411 North Seventh St.
- †ST. LOUIS, MO., 717 South Twelfth St.
- *ST. LOUIS, MO., 3850 Bingham Ave.
- *SYRACUSE, N. Y., 420 N. Geddes St.
- *TACOMA, WASH., 1023 "A" St.
- *TAMPA, FLA., 417 Ellamae Ave.
- *TOLEDO, OHIO, 245 Summit St.
- *TULSA, OKLA., 303 East Brady St.
- *UTICA, N. Y., 113 N. Genesee St.
- *WASHINGTON, D. C., 1434 New York Ave., N. W.
- *WATERLOO, IOWA, 328 Jefferson St.
- *WICHITA, KAN., 233 South St. Francis Ave.
- *WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
- *WORCESTER, MASS., 32 Southbridge St.
- *YORK, PA., 143 So. George St.
- *YOUNGSTOWN, OHIO, 25 E. Boardman St.

*Sales Office †Service Office xWorks #Warehouse *First Class Mail Only \$Merchandising Only zHeadquarters.

WESTINGHOUSE ELECTRIC SUPPLY COMPANY AND AGENT JOBBERS

Fully equipped sales offices and warehouses are maintained at all locations

- ABILENE, KAN., Union Electric Co.
- AKRON, OHIO, The Mook Electric Sup. Co.
- ALBANY, N. Y., 360 Broadway
- ALLEN TOWN, PA., 522 Maple St.
- ATLANTA, GA., 96 Poplar St., N. W.
- AUGUSTA, MAINE, 90 Water St.
- BALTIMORE, MD., 40 South Calvert St.
- BANGOR, MAINE, 175 Broad St.
- BINGHAMTON, N. Y., 48 Wall St.
- BIRMINGHAM, ALA., Moore-Handley Hdw. Co.
- BLUEFIELD, W. VA., Superior-Stetling Co.
- BOSTON, MASS., 76 Pearl St.
- BUFFALO, N. Y., McCarthy Bros. & Ford
- BURLINGTON, VT., 208 Flynn Ave.
- BUTTE, MONTANA, 50 East Broadway
- CANTON, OHIO, The Mook Electric Sup. Co.
- CHARLOTTE, N. C., 210 East Sixth St.
- CHATTANOOGA, TENN., Mills & Lupton Sup. Co.
- CHICAGO, ILL., 113 North May St.
- CHICAGO, ILL., Hyland Electrical Sup. Co.
- CINCINNATI, OHIO, The Johnson Electric Sup. Co.
- CLEVELAND, OHIO, 3950 Prospect Ave.
- COLUMBIA, S. C., 912 Lady St.
- COLUMBUS, OHIO, The Hughes Peters Elec. Corp.
- COLUMBUS, OHIO, Pixley Electric Sup. Co.
- DALLAS, TEXAS, 409 Browder St.
- DENVER, COL., The Mine & Smelter Sup. Co.
- DES MOINES, IOWA, 218 Second St.
- DETROIT, MICH., 547 Harper Ave.
- DULUTH, MINN., 308 W. Michigan St.
- EL PASO, TEX., Zork Hardware Co.
- ERIE, PA., Star Electrical Co.
- EVANSVILLE, IND., 201-203 N. W. First St.
- FLINT, MICH., 1314 N. Saginaw St.
- FORT WORTH, TEXAS, 501 Jones St.
- GRAND RAPIDS, MICH., 507 Monroe Ave., N. W.
- GREENVILLE, S. C., 200 River St.
- HOUSTON, TEXAS, 1903 Ruiz St.
- HUNTINGTON, W. VA., Banks-Miller Sup. Co.
- INDIANAPOLIS, IND., 539 Madison Ave.
- JACKSONVILLE, FLA., 37 South Hogan St.
- KANSAS CITY, MO., Columbian Electrical Co.
- LOS ANGELES, CALIF., 905 East Second St.
- LOUISVILLE, KY., Tafel Electric Co.
- MADISON, WISC., 1022 E. Washington Ave.
- MIAMI, FLA., 1036 North Miami Ave.
- MEMPHIS, TENN., 366 Madison Ave.
- MILWAUKEE, WISC., 546 N. Broadway
- MINNEAPOLIS, MINN., 215 South Fourth St.
- MONROE, LA., Monroe Hardware Co.
- NASHVILLE, TENN., Tafel Electric Co.
- NEWARK, N. J., 157 Mulberry St.
- NEW HAVEN, CONN., 240 Cedar St.
- NEW ORLEANS, LA., Electrical Sup. Co.
- NEW YORK, N. Y., 150 Varick St.
- NEW YORK, N. Y., Times Appliance Co., Inc.
- NORFOLK, VA., 254 Tazewell St.
- OAKLAND, CALIF., Tenth & Alice Sts.
- OKLAHOMA CITY, OKLA., 10 E. California St.
- OMAHA, NEB., 117 North Thirteenth St.
- PEORIA, ILL., 104 East State St.
- PHILADELPHIA, PA., 1101 Race St.
- PHOENIX, ARIZONA, 315 West Jackson St.
- PITTSBURGH, PA., Iron City Electric Co.
- PORTLAND, OREGON, 134 N. W. Eighth Ave.
- PROVIDENCE, R. I., 66 Ship St.
- RALEIGH, N. C., 322 S. Harrington St.
- READING, PA., 619 Spruce St.
- RICHMOND, VA., 301 South Fifth St.
- ①ROANOKE, VA., 726 First St., S. E.
- *ROCHESTER, N. Y., 240 St. Paul St.
- ST. LOUIS, MO., 320 S. Broadway
- ST. PAUL, MINN., 145 East Fifth St.
- ①SACRAMENTO, CALIF., 20th and "R" Sts.
- SALT LAKE CITY, UTAH, 235 West South Temple St.
- SAN ANTONIO, TEXAS, 1201 E. Houston St.
- SAN DIEGO, CALIF., The Electric Supplies Dist. Co.
- SAN FRANCISCO, CALIF., 260 Fifth St.
- SCRANTON, PA., Penna. Elect'l Engineering Co.
- SEATTLE, WASH., 558 First Ave., South
- SIOUX CITY, IOWA, 1005 Dace St.
- SPOKANE, WASH., 152 So. Monroe St.
- SPRINGFIELD, MASS., 46 Hampden St.
- SYRACUSE, N. Y., 961 W. Genesee St.
- TAMPA, FLA., 417 Ellamae St.
- TOLEDO, OHIO, 812 Lafayette St.
- TRENTON, N. J., 245 N. Broad St.
- TULSA, OKLA., 303 East Brady St.
- UTICA, N. Y., 113 N. Genesee St.
- WASHINGTON, D. C., 1216 "K" St., N. W.
- WATERLOO, IOWA, 328 Jefferson St.
- WICHITA, KANSAS, 400 S. Emporia Ave.
- WILMINGTON, DEL., 216 E. Second St.
- WORCESTER, MASS., 24 Southbridge St.
- YORK, PA., 143 S. George St.
- YOUNGSTOWN, OHIO, Mook Elec. Sup. Co.

①Changed or added since previous issue.