INSTRUCTION BOOK

Type FO-22-B

OIL CIRCUIT BREAKER

600 Amperes

7200 Volts

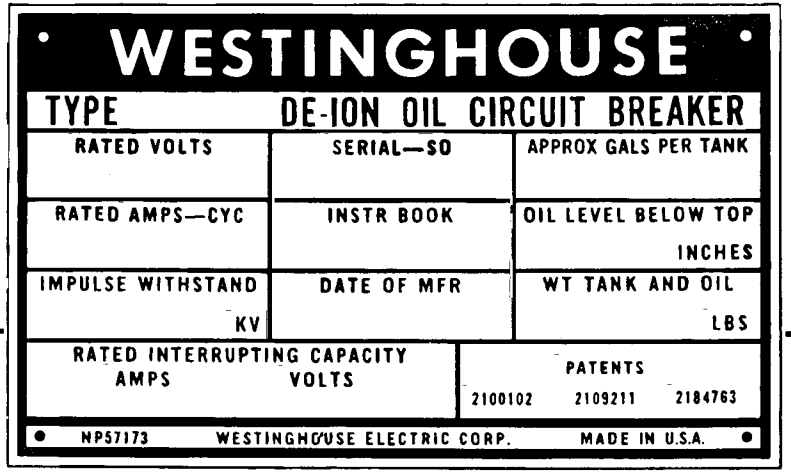
Westinghouse Electric Corporation

I.B. 33-720-1

SPECIAL INQUIRIES

When communicating with Westinghouse regarding the product covered by this Instruction Book, include all data contained on the nameplate attached to the equipment.* Also, to facilitate replies when particular information is desired, be sure to state fully and clearly the problem and attendant conditions.

Address all communications to the nearest Westinghouse representative as listed in the back of this book.



* For a permanent record, it is suggested that all nameplate data be duplicated and retained in a convenient location.

DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

Type FO-22-B

OIL CIRCUIT BREAKER

600 Amperes 7200 Volts

Manually or Electrically Operated
Automatic or Nonautomatic Trip

WESTINGHOUSE ELECTRIC CORPORATION
SWITCHGEAR DIVISION
EAST PITTSBURGH PLANT
SUPERSEDES I. B. 5766
EAST PITTSBURGH, PA.
NOVEMBER, 1953
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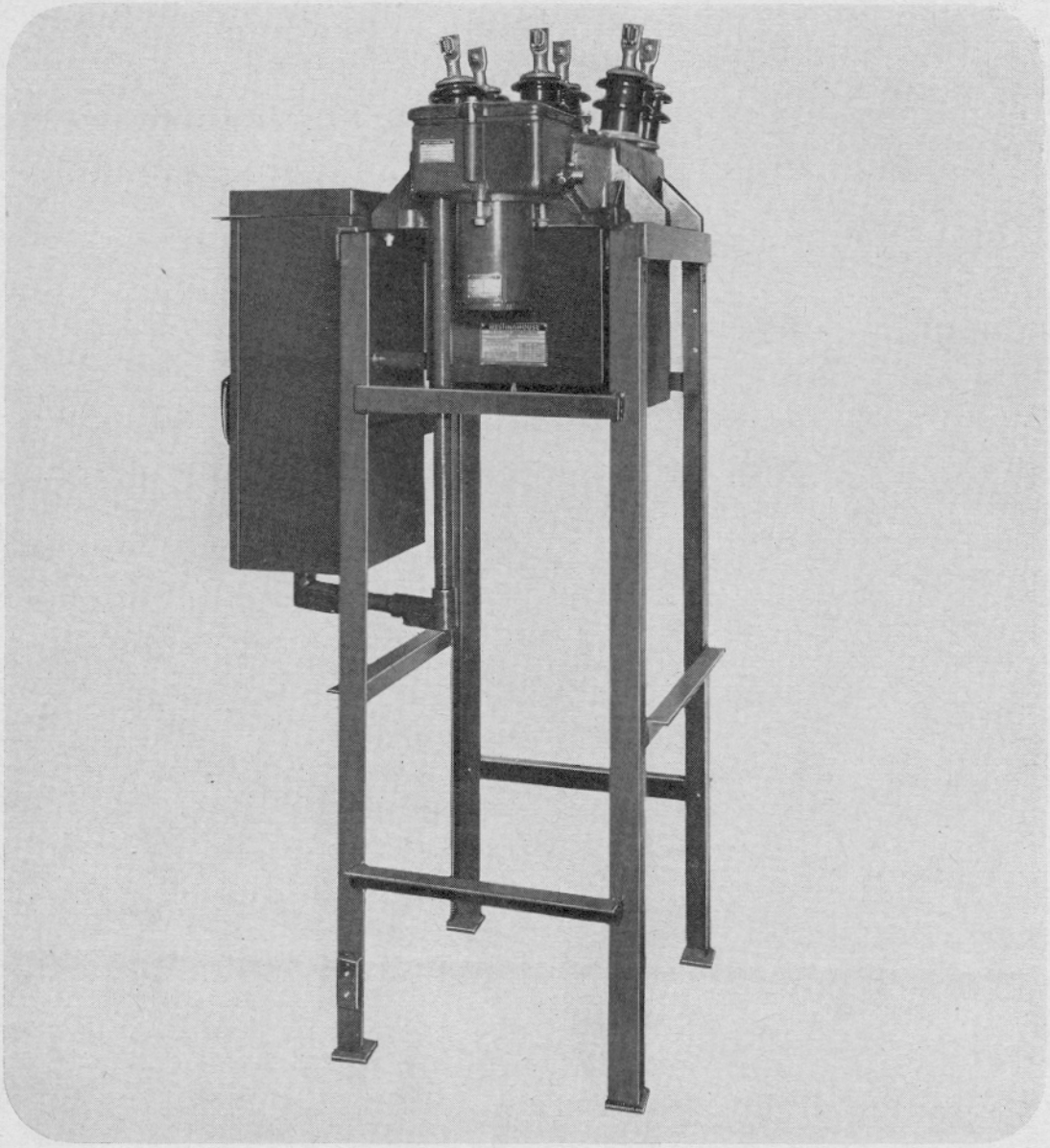

Frame Mounted Type FO-22-B Oil Circuit Breaker

FO-22-B outdoor oil breakers are built as a 600-ampere, 7200-volt, 3-phase single-throw assembly. 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.

INSTALLATION

RECEIVING

Type FO-22-B 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.

Important: Immediately upon receipt of a circuit breaker, an examination should be made for any damage sustained while in transit. If injury is evident, or indication of rough handling is visible, file a claim for damage with the carrier (transportation company), and promptly notify the nearest Westinghouse Sales Office.

Store the crated circuit breaker, previous to installation, in a clean dry location in an upright position. To protect the internal parts against moisture, make sure that tank is filled to proper level with insulating oil.

INSTALLATION PROCEDURE

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.

3. Remove the mechanism cover and remove the blocking from 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 new circuit breaker oil. Tank should not be lowered in wet weather without provision being made for keeping moisture out of it. Protect the internal parts also.

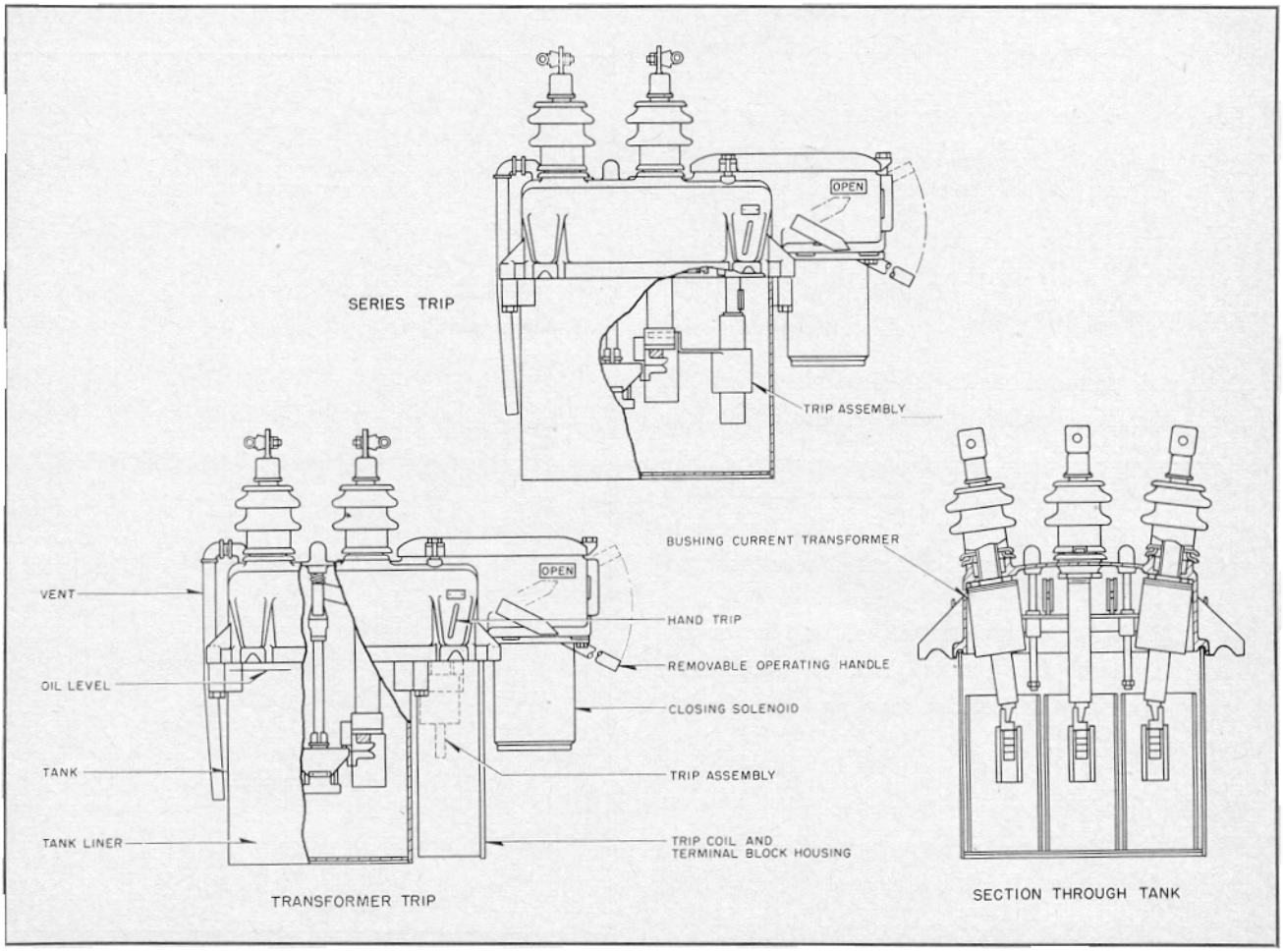

FIG. 1. General Assembly Views

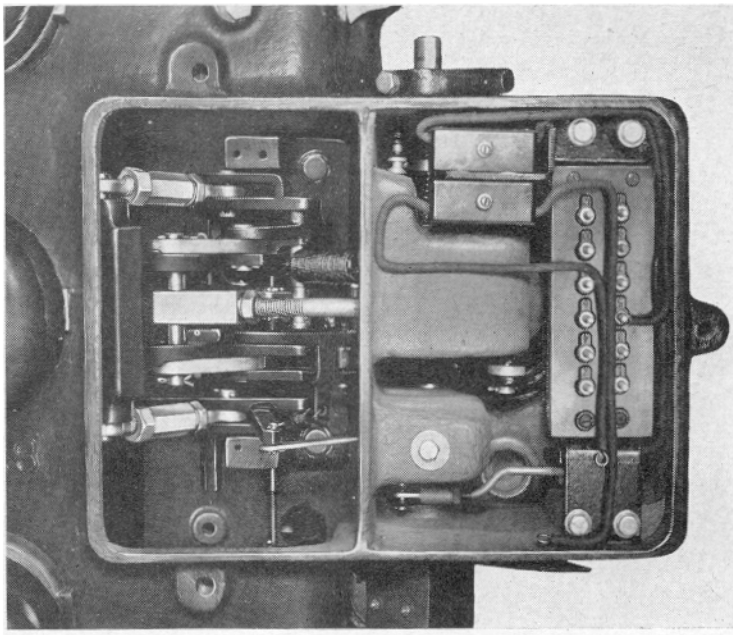

FIG. 2. Mechanism Assembly (Top View)

5. Examine the contacts to see that they are clean and in alignment. For adjustment, see section covering "Adjustments" beginning on page 5.

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

Caution: Always remove the hand closing lever after closing breaker. Do not trip breaker when lever is in place.

7. Install connections to the breaker studs. All contact surfaces should be cleaned and made free of burrs. The terminal studs are not designed to be subjected to undue strain due to cable or bus loads. Any excessive strain may loosen the porcelain weather casing and permit moisture to enter.

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. 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.

10. Run the conduits to the breaker mechanism and transformer trip coil housing (when supplied). See the outline drawings (Figs. 21 and 23) for conduit locations.

11. Connect the control and transformer circuits according to the diagram furnished. Control voltage marked on the name plate should be maintained at the coil with the coil energized.

Caution. 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 when operating electrically.

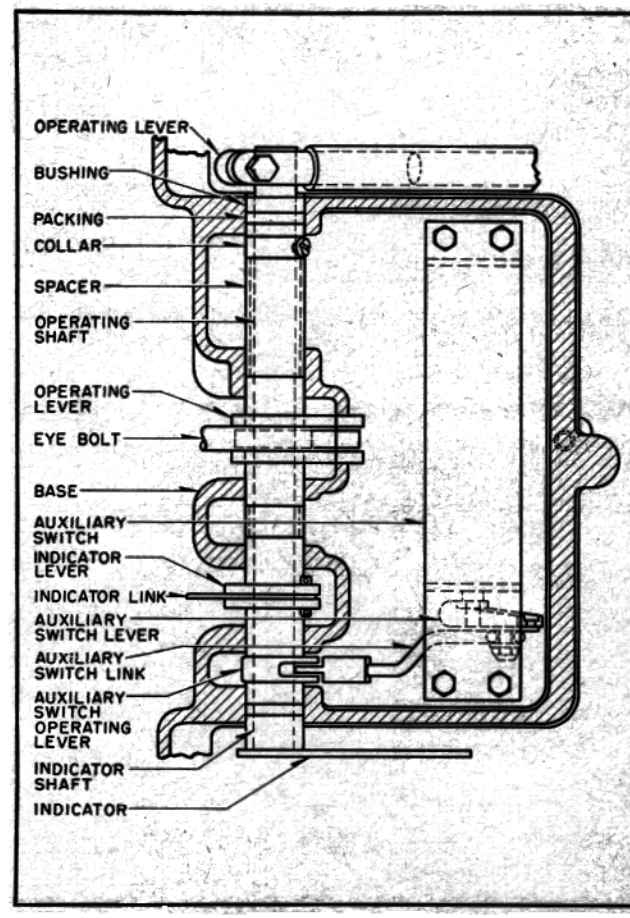

FIG. 3. Manually Operated Lever Assembly

ADJUSTMENT

CONTACTS

The contact arrangement is shown on Fig. 4. The main and arcing contacts are both of the butt type, the arcing contacts leading the main contacts by approximately 1/4 inch. The contact pressure on the main contacts is obtained by the compression spring. With the breaker closed the top of the main moving contact should be 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 turn the assembly up or down as necessary.

It is important that the 1/4-inch dimension be maintained as this determines the main contact pressure. A limited amount of horizontal adjustment can be secured, when replacing a terminal, by loosening the clamp nut and shifting it in the top casting.

The main contacts make a 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 not necessary to secure perfect line contact—good contact is obtained after a few operations, the silver flowing slightly under the pressure.

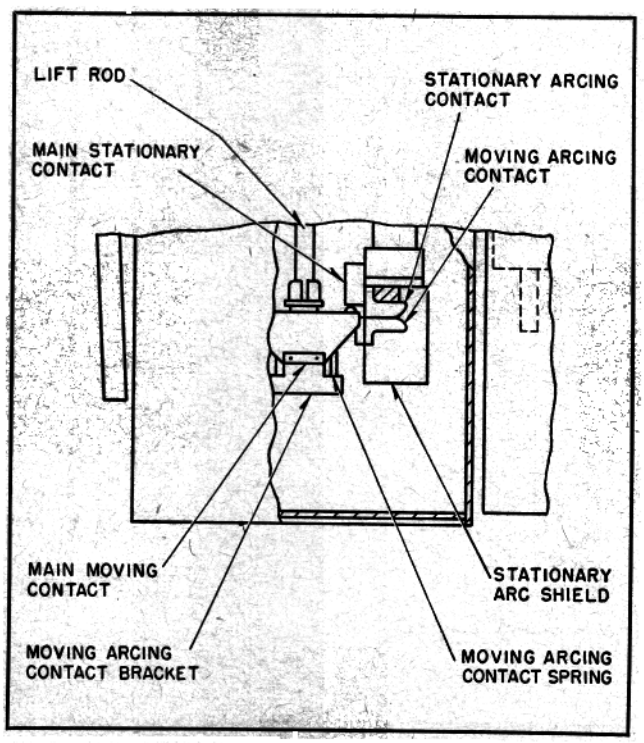

FIG. 4. Contact Arrangement

DE-ION* INTERRUPTERS

The De-ion Interrupters control the arc and quickly extinguish it by de-ionization. These devices need little attention other than an occasional inspection. They must be kept tight and properly aligned so that the moving contacts move freely. The fiber insulation should be inspected occasionally and assembly replaced if excessive deterioration is found.

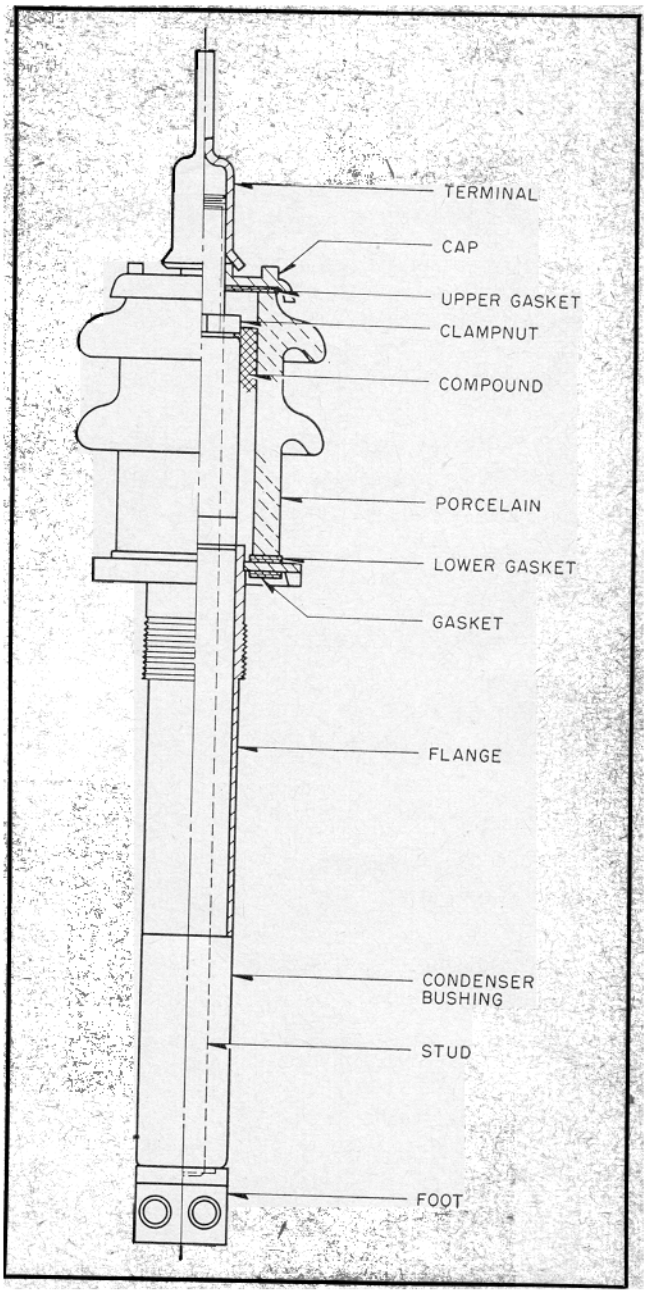

FIG. 5. Condenser Bushing

*Registered trade-mark

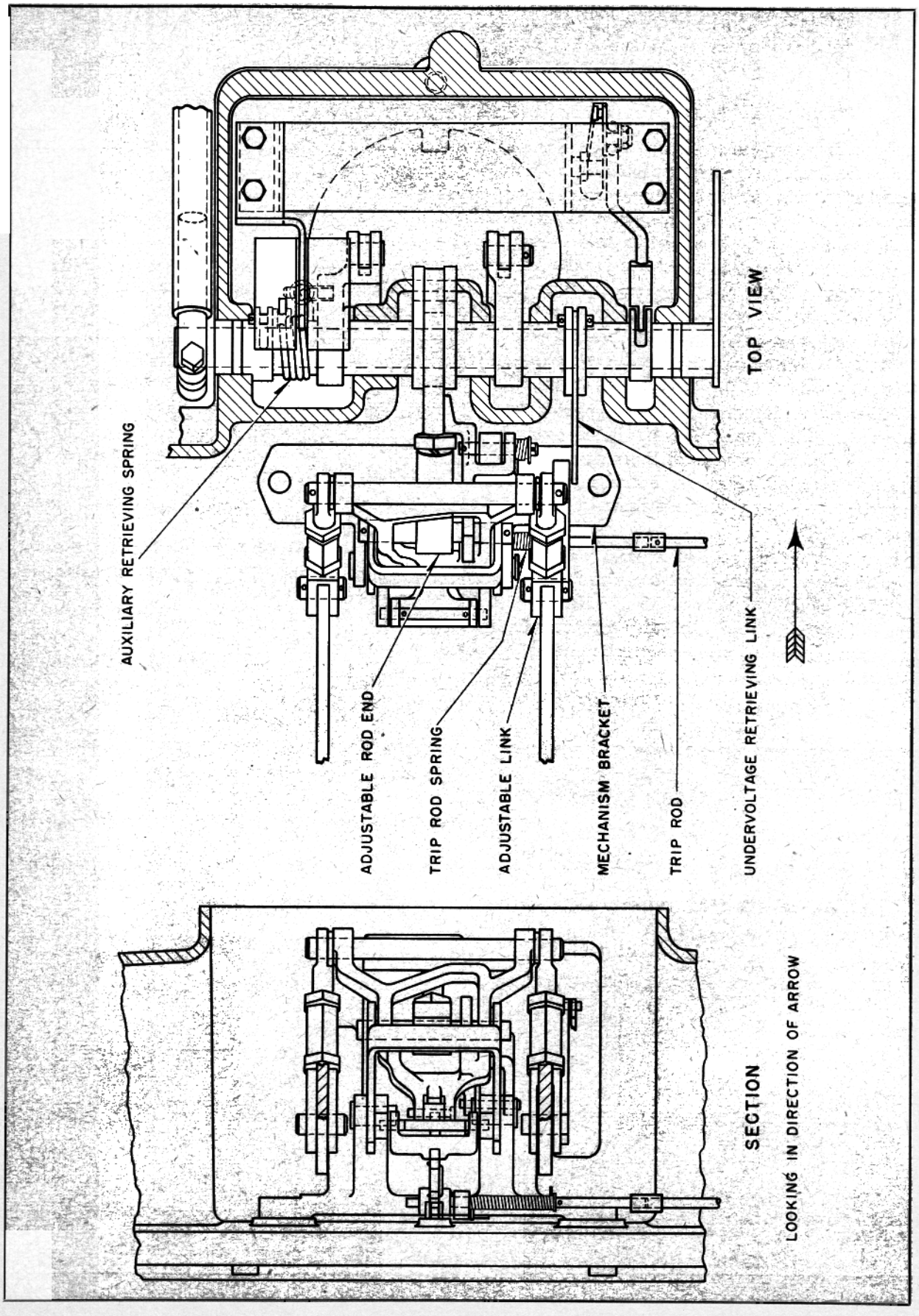

FIG. 6. Operating Mechanism (Top and End Views)

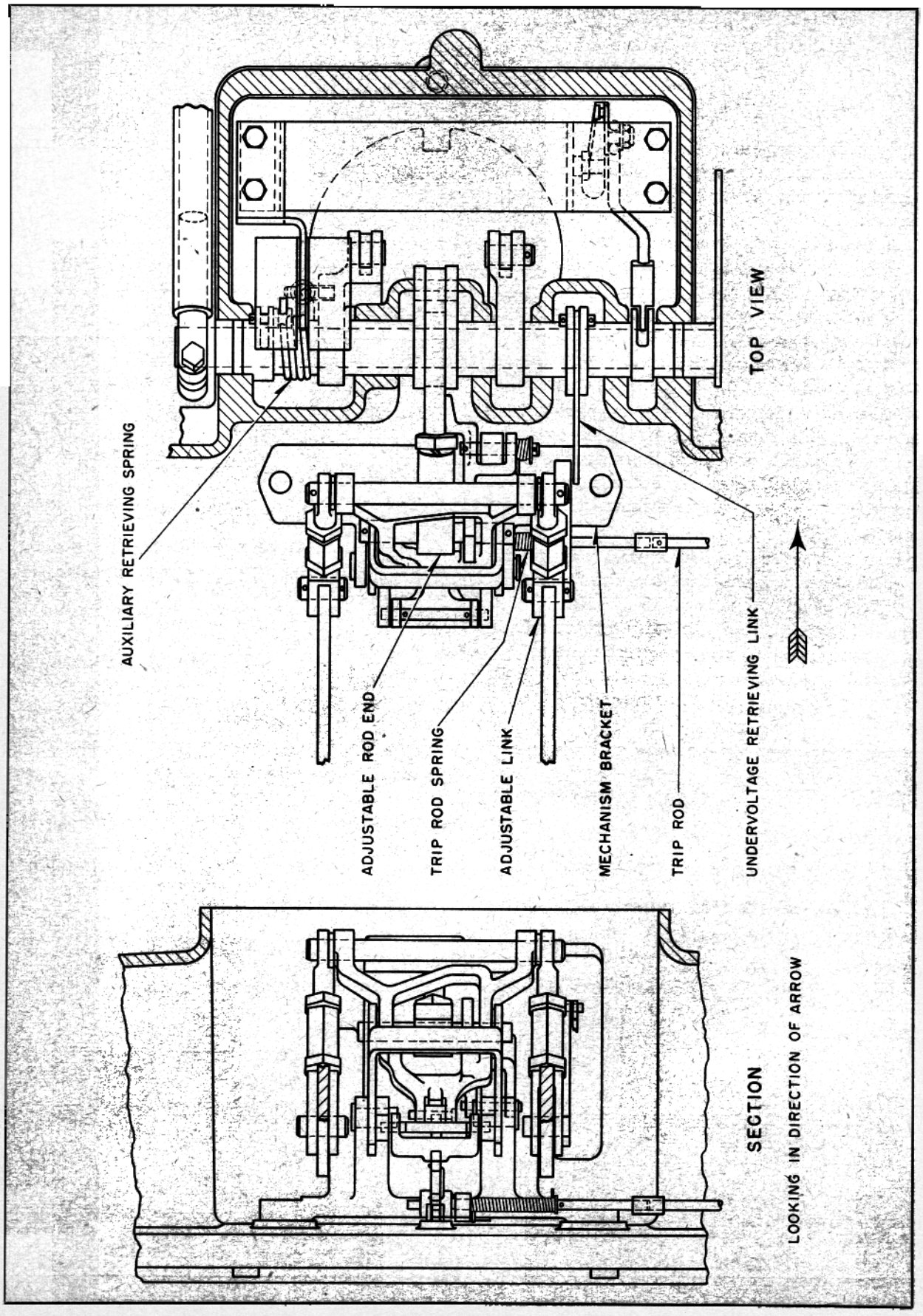

FIG. 6. Operating Mechanism (Top and End Views)

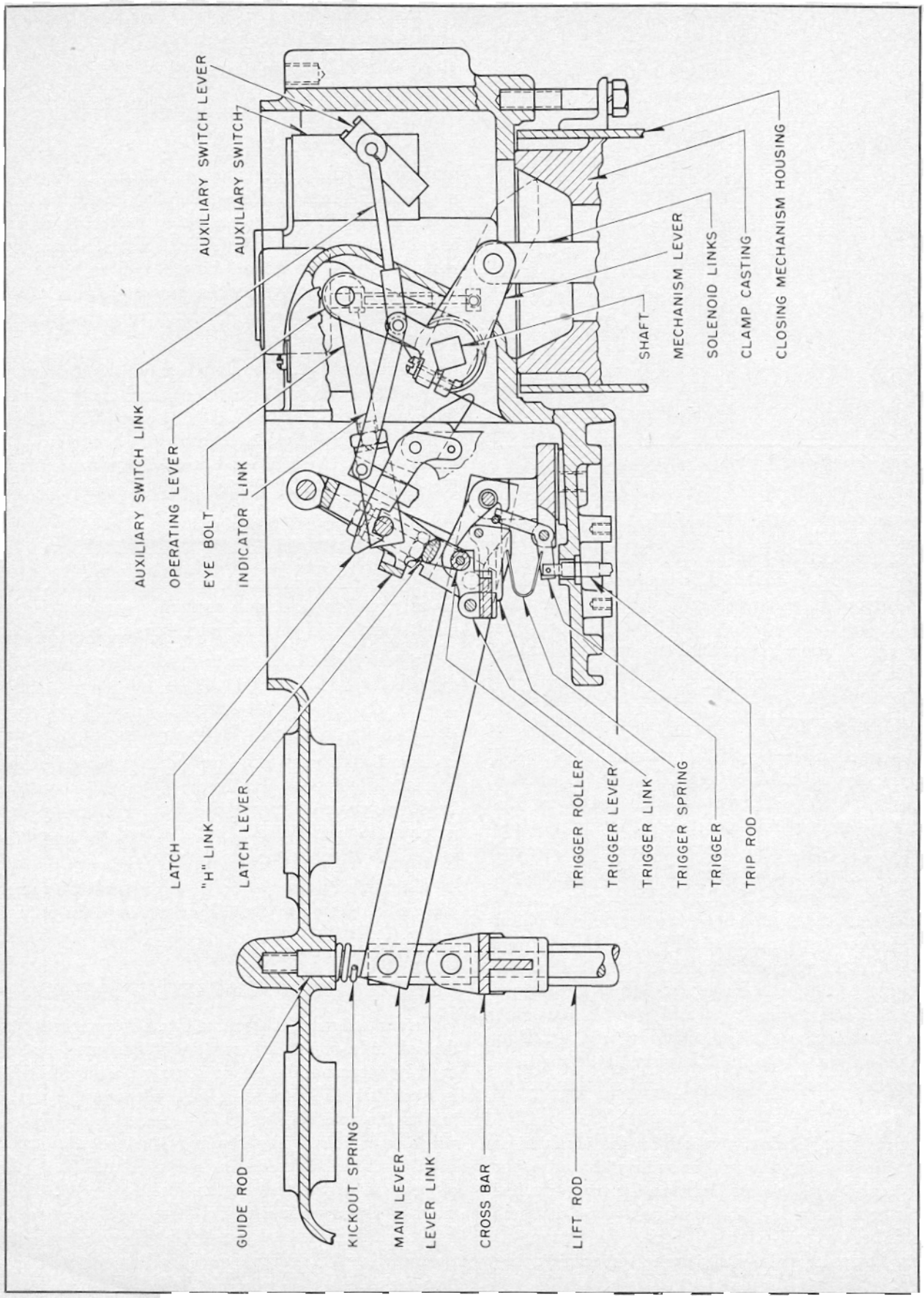

FIG. 7. Operating Mechanism (Side View)

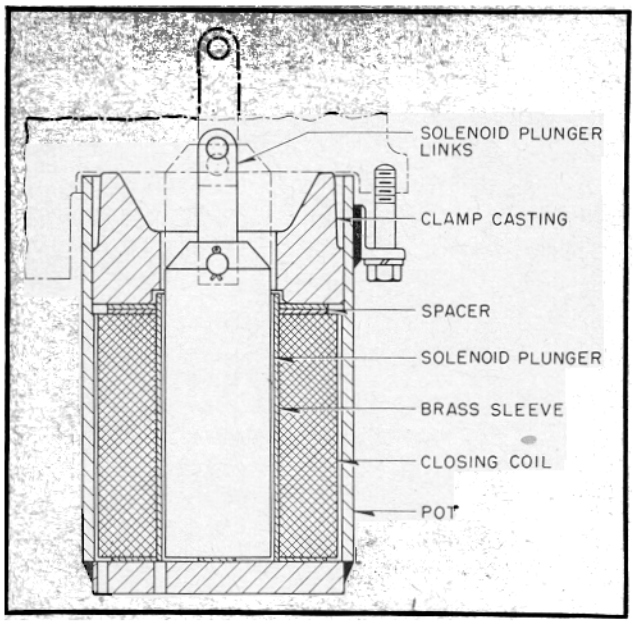

FIG. 8. Solenoid Operating Mechanism

MECHANISM

The guide rods, Fig. 7, are used to align and guide the moving contacts for straight line motion. The crossbar must move freely on these rods. The lower end of the guide rods and part of the crossbar 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 in the tank.

When the operating shaft is rotated to the closed position, by either the solenoid or the operating handle, the operating shaft dog engages 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). This distance should be approximately 1/64 inch. Adjustment 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.

D-C OPERATION

Solenoid. The solenoid bolts directly to the under side of the top casting and is connected to the mechanism through the mechanism levers on the operating shaft. When replacing a closing coil it is only necessary to observe that the mechanism top rests firmly on the brass tube and coil and that the housing is placed against the proper groove in the top casting. The solenoid must operate without friction.

The solenoid plunger stops against the stationary core with not over 1/16 inch back-lash between the latch and the roller in the latch lever. This adjustment is secured by lengthening or shortening the eye-bolt and adjustable rod end linkage connecting the operating shaft and the mechanism.

SHUNT TRIP ATTACHMENT

The shunt trip attachment as shown in Fig. 9 is mounted in the right side of the top casting (facing mechanism end) by the two mounting bolts indicated.

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. The shunt trip circuit should be run through an auxiliary switch contact to interrupt the tripping current when the breaker opens. Check the control voltage on the name plate to make sure that it agrees with that on which the attachment is to be used.

When transformer trip coils are included a shunt trip coil as shown in Fig. 17 is used in place of that in Fig. 9.

UNDERVOLTAGE RELEASE ATTACHMENT

This attachment, shown in Fig. 10, is mounted in the left side of the top casting (facing mechanism end) by means of the two mounting bolts indicated. In operation the retrieving spring brings the armature to the position shown when the breaker opens, with the holding dog keeping it there when the breaker closes. The holding dog is moved back out of position at the end of the closing stroke. The magnet drops and trips the breaker through the tripping link if voltage is not impressed on the coil. Be sure that the set-up is rigid and agrees with the illustration.

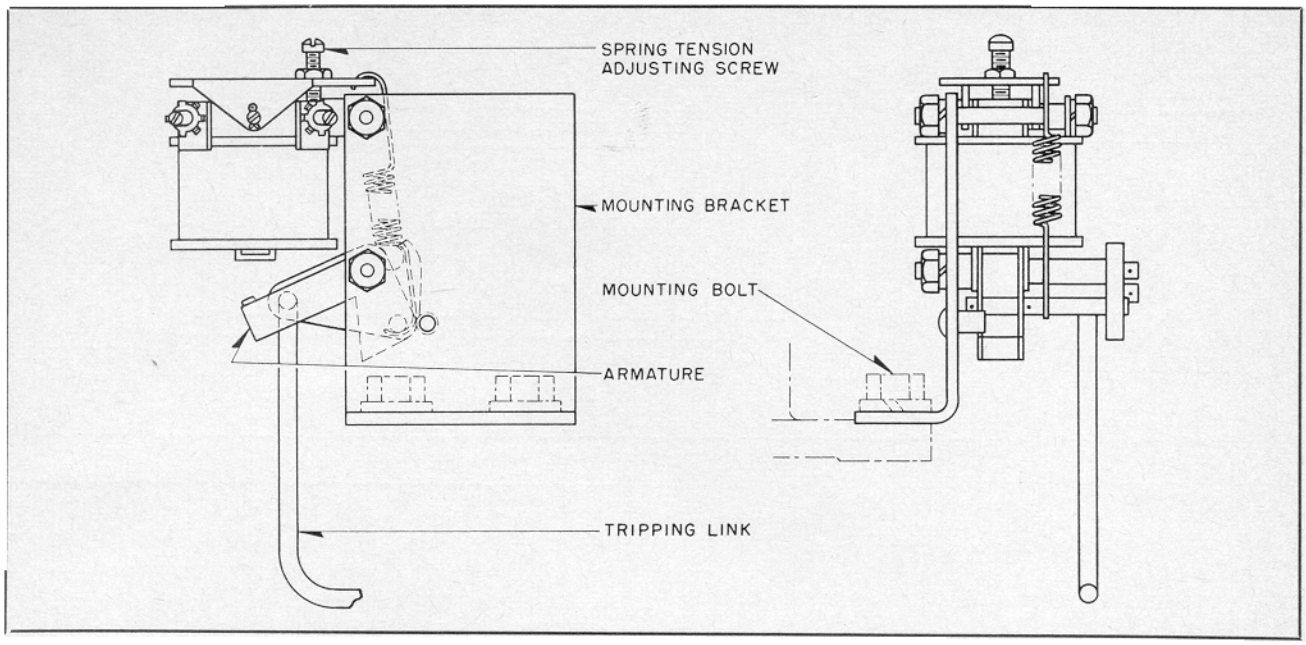

FIG. 9. Shunt Trip Assembly

Connect the 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. 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.

Make sure that the retrieving spring retrieves the armature to within 1/16 inch of the stationary core with the breaker in the open position. If this dimension is exceeded and normal voltage is applied, the coil will burn out. Check to see that armature is pulled up against stationary core when coil is energized.

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.

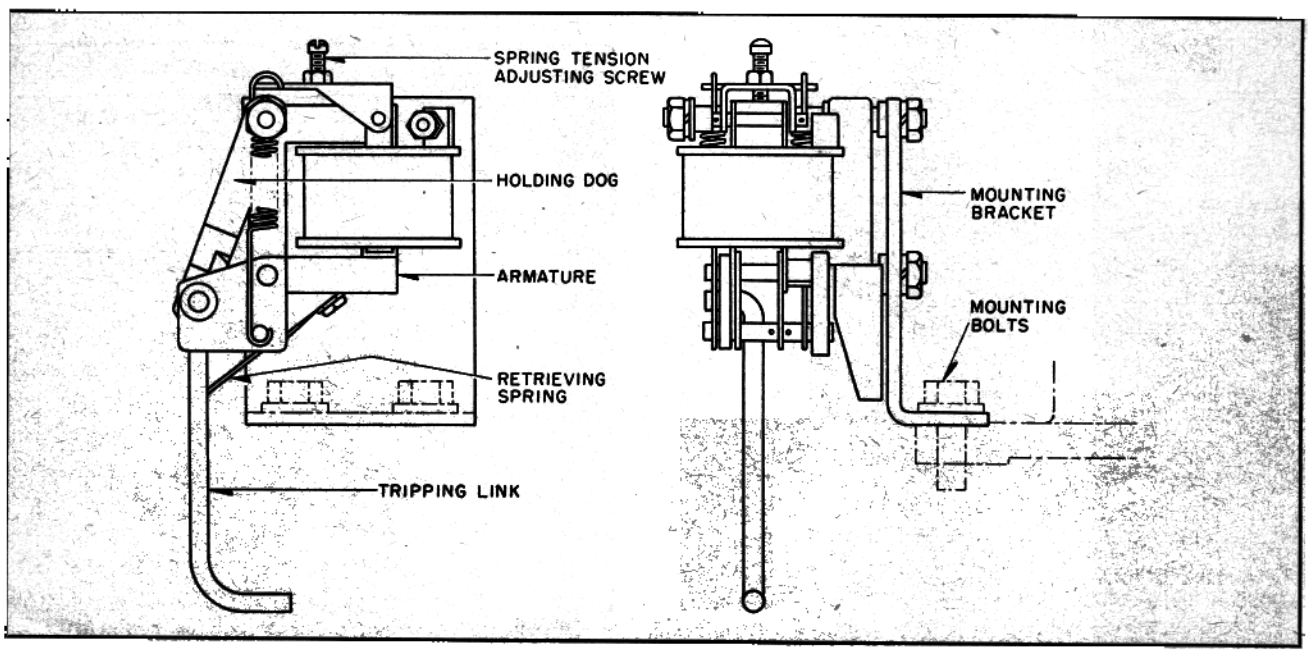

FIG. 10. Undervoltage Trip Assembly

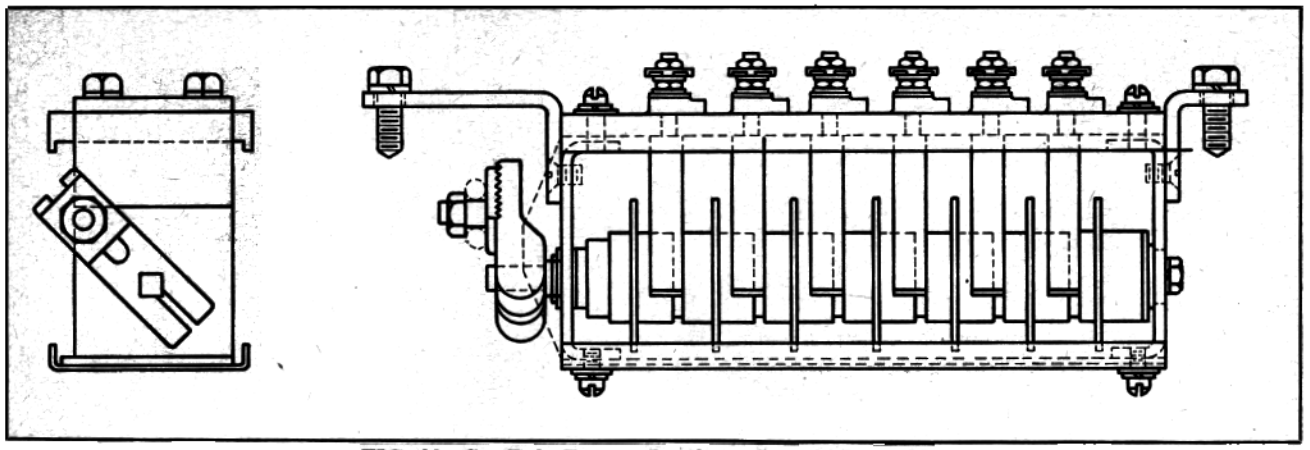

FIG. 11. Six-Pole Rotary Auxiliary Switch Assembly

AUXILIARY SWITCH

The auxiliary switch is mounted in the top casting and connected to the switch lever on the operating shaft as indicated in Figures 7 and 11. The contacts should be inspected from time to time to insure that burning has not proceeded to a point where stubbing is emminent, particularly on contacts carrying shunt trip circuit.

The individual contact fingers and the rotor segments are replaceable.

The rotor should travel approximately 90 degrees. Adjustment is obtained by changing the length of the operating arm. The fingers should be approximately centered on the rotor cam. Adjustment is obtained by lengthening or shortening adjustable link connecting to mechanism.

CUTOFF SWITCH

A plunger type switch (Fig. 12) mounted in line with rotary auxiliary switch closes its contacts when the breaker closes, and is connected in control relay panel circuit so as to open the relay and de-energize solenoid when breaker reaches closed position. A second, similar switch except with contacts normally closed is added when reclosing equipment is added.

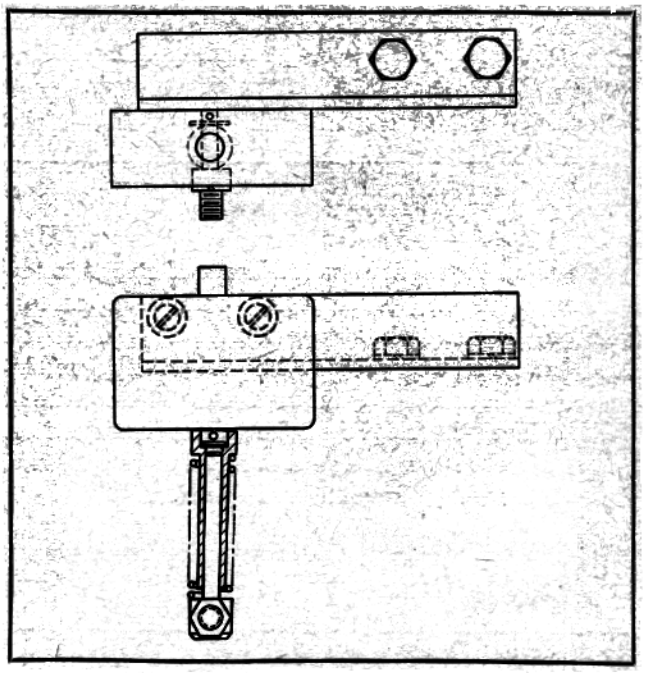

FIG. 12. Single Pole Plunger Switch

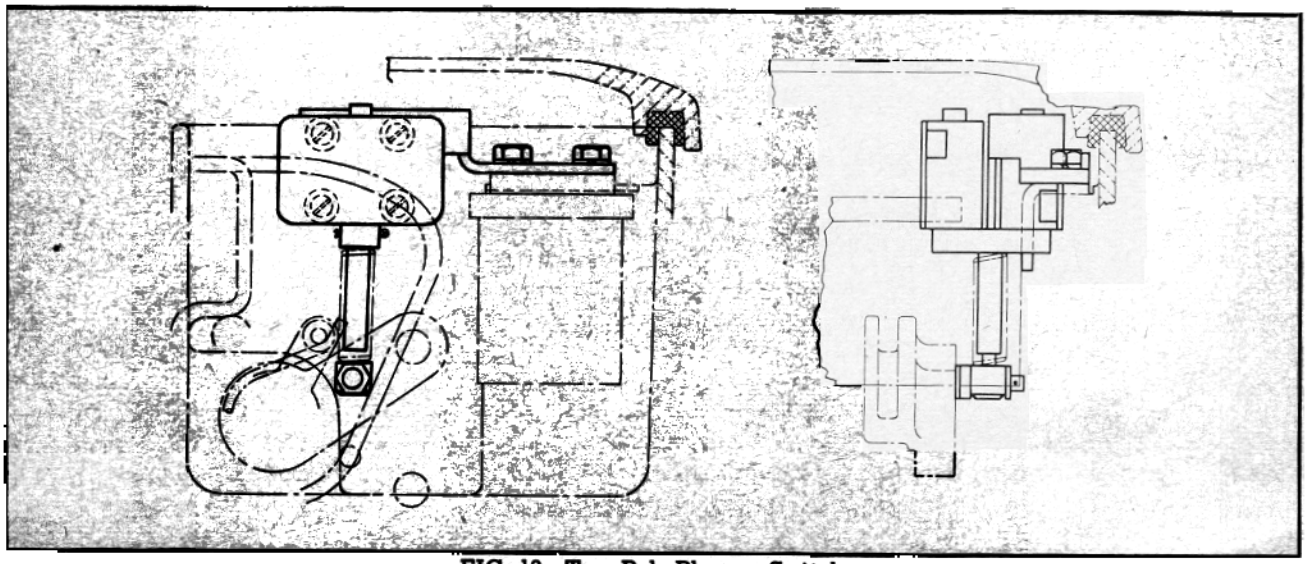

FIG. 13. Two-Pole Plunger Switch

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 14 and 15.

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 current. It is sometimes necessary to file the tops of the push rod so that the trigger is released, tripping the breaker, during the last 1/16 inch of the moving core travel. The greatest tripping power is developed when the moving and stationary cores are close together.

The calibration for the series trip coils can be changed 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.

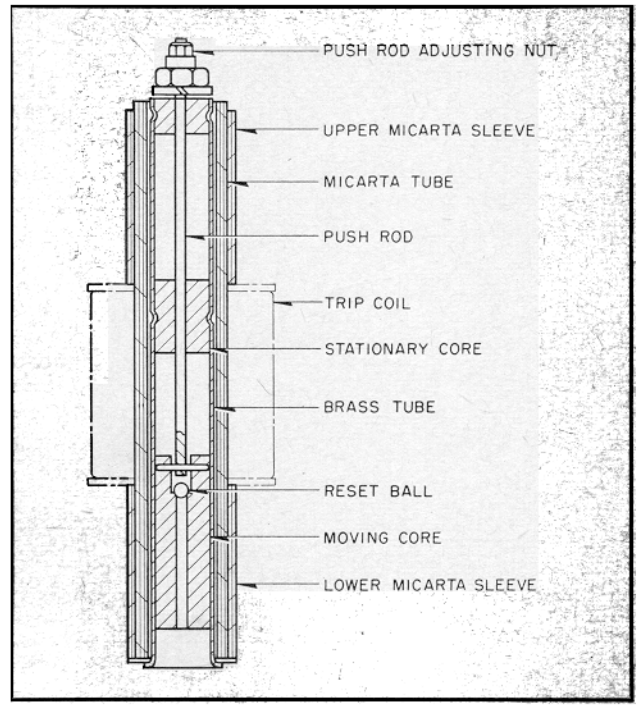

FIG. 14. Series Trip Attachment

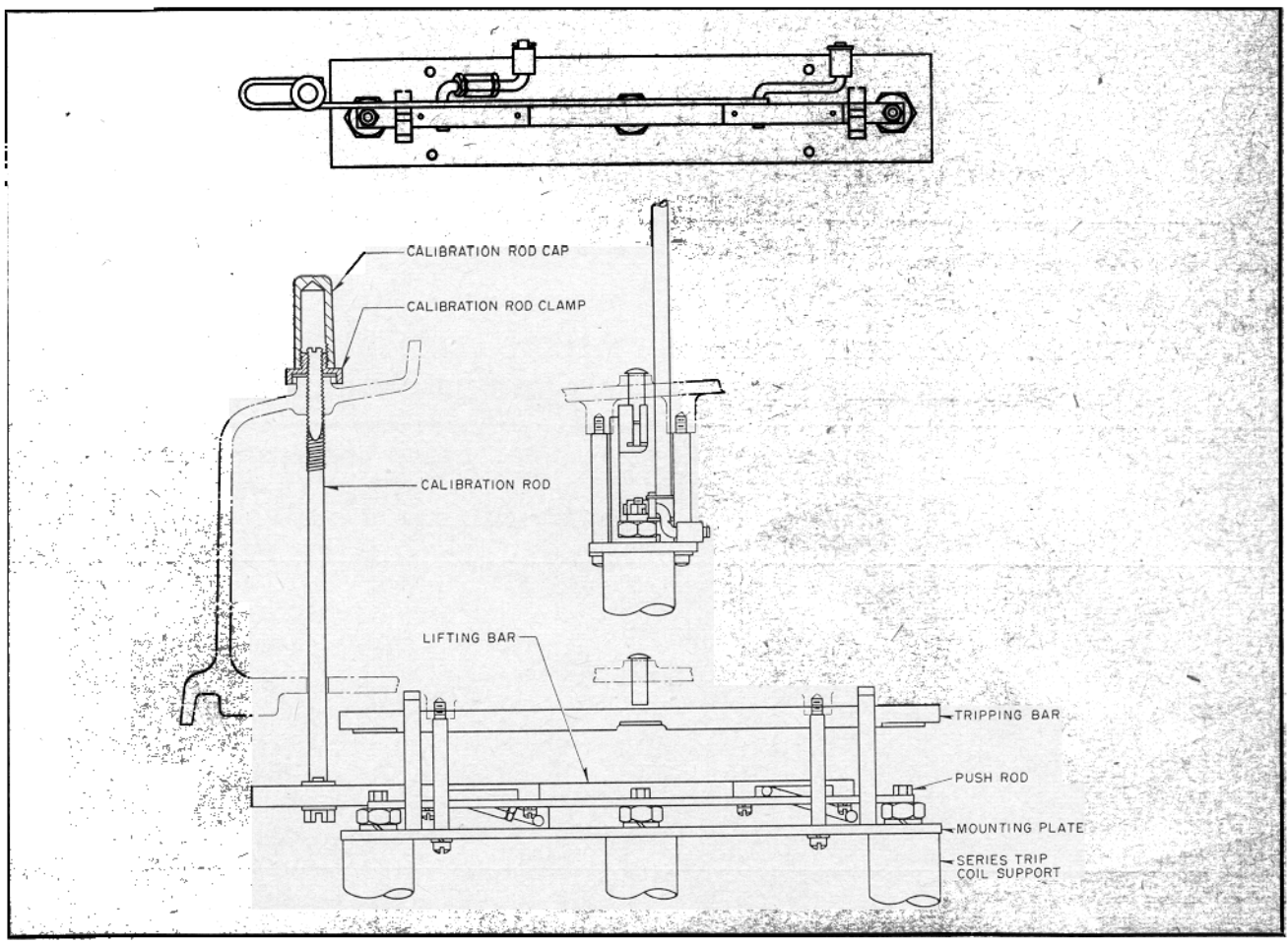

FIG. 15. Series Trip Assembly

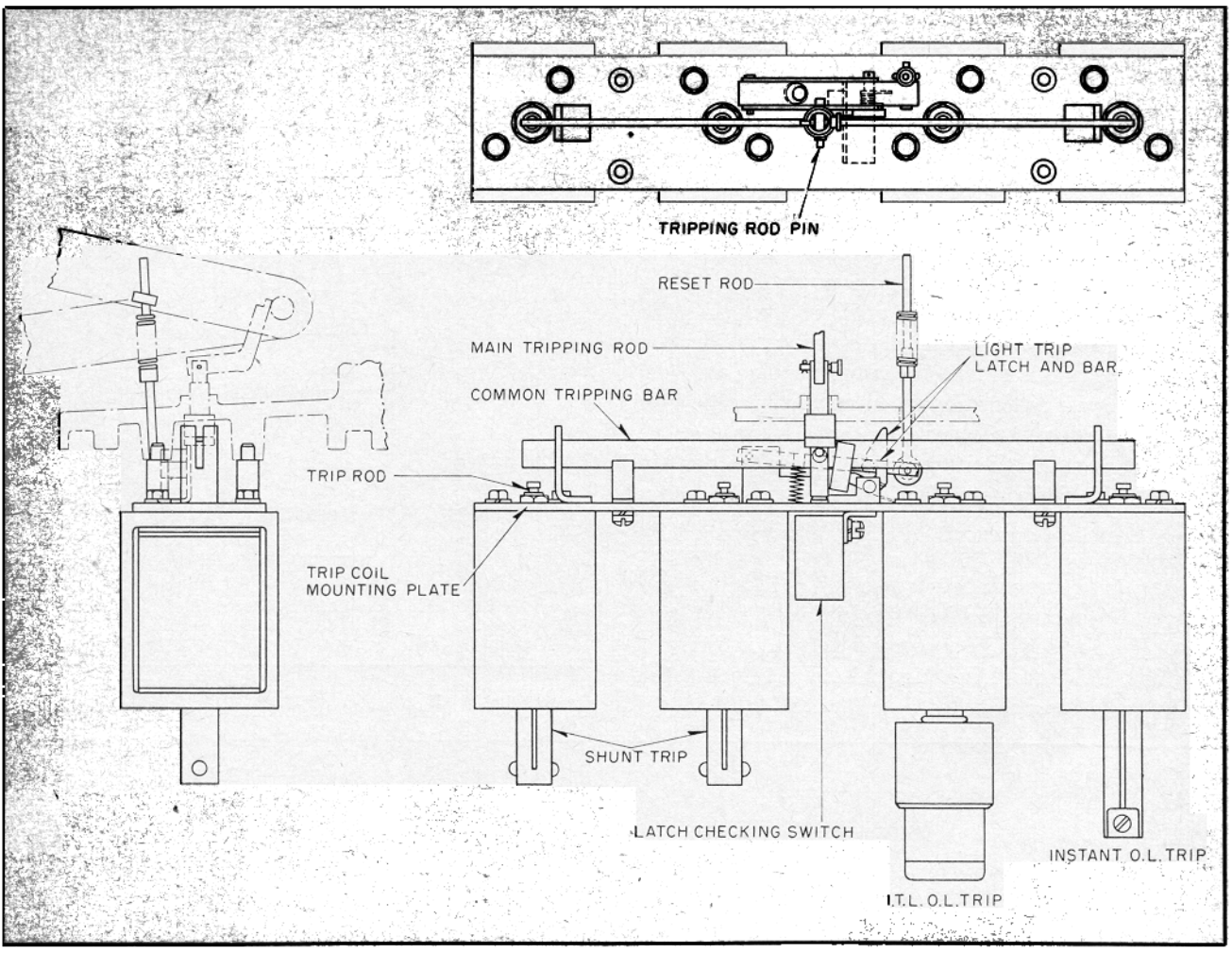

FIG. 16. Transformer Trip Assembly

MINIMUM PRIMARY TRIPPING CURRENT OF FO-22-A 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.

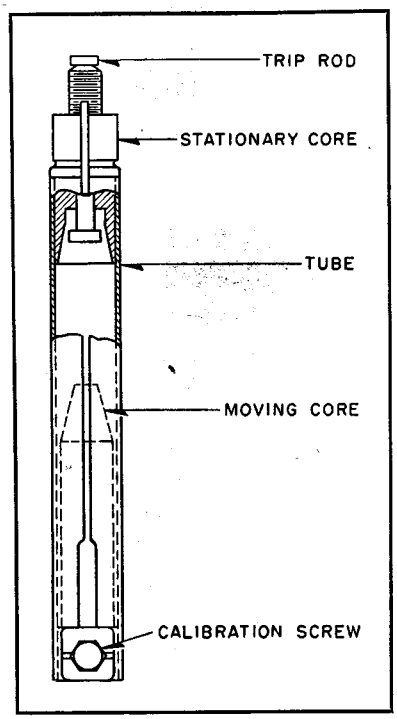

FIG. 17. Overload Attachment

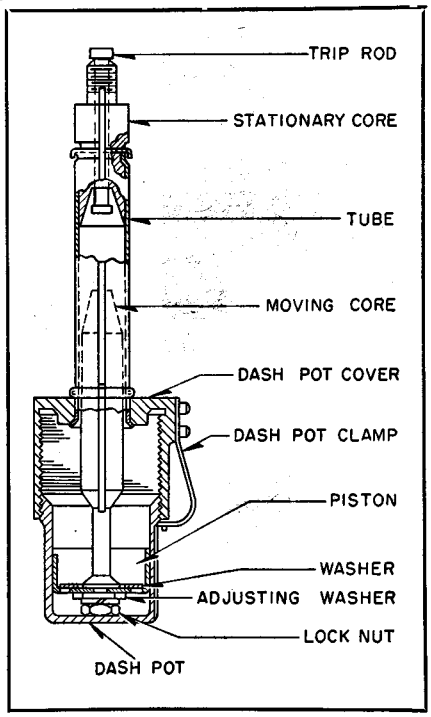

FIG. 18. Inverse Time Limit Attachment

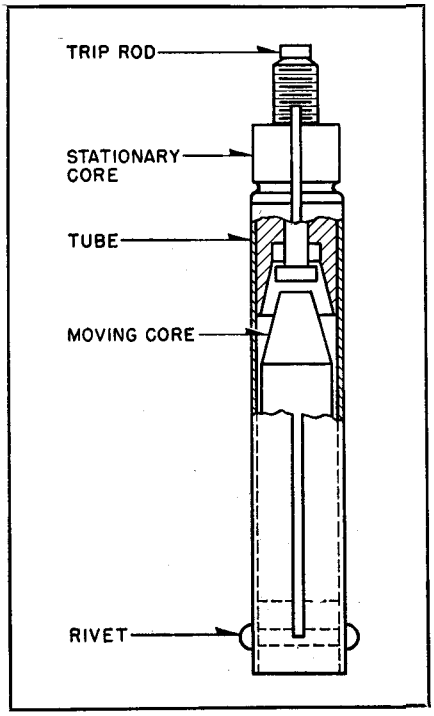

FIG. 19. Shunt Trip Attachment

BUSHING TYPE CURRENT TRANSFORMERS

The breaker may be equipped with a maximum of six multi-tap type current transformers. The table on page 12 indicates the minimum primary tripping currents for the various attachments.

TRANSFORMER TRIP ATTACHMENTS

Space is provided for a maximum of three trip coils to operate from the bushing current transformers. They may be instantaneous in action or have a dashpot to give delayed action. They are assembled as shown in Fig. 16. They are calibrated 5 to 9 amperes. Calibration is changed on the instantaneous type by loosening the clamping screw and shifting the calibration plate as desired. This changes the air gap between the stationary and tripping cores.

On time delay type the pot is screwed in or out of the stationary member so as to vary the air gap. Variation in the time delay is obtained by shifting the disk inside the dashpot so as to uncover more or fewer holes. The loose washer acts as a check valve to permit rapid resetting.

The time delay is proportional to the viscosity of the oil used in the dashpot and to the amount of overload. When extremes of heat or cold are encountered special oils may be required. The curves in Fig. 20 show some of the variations that can be expected.

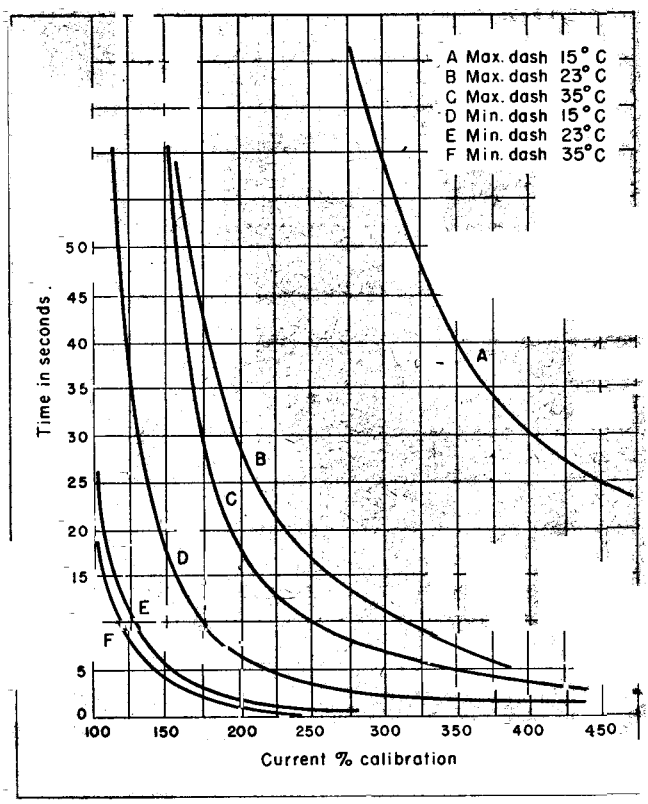

FIG. 20 Approximate Time Overload Characteristics of the Inverse Time Limit Attachment Used with Standard Dashpot Oil as Supplied

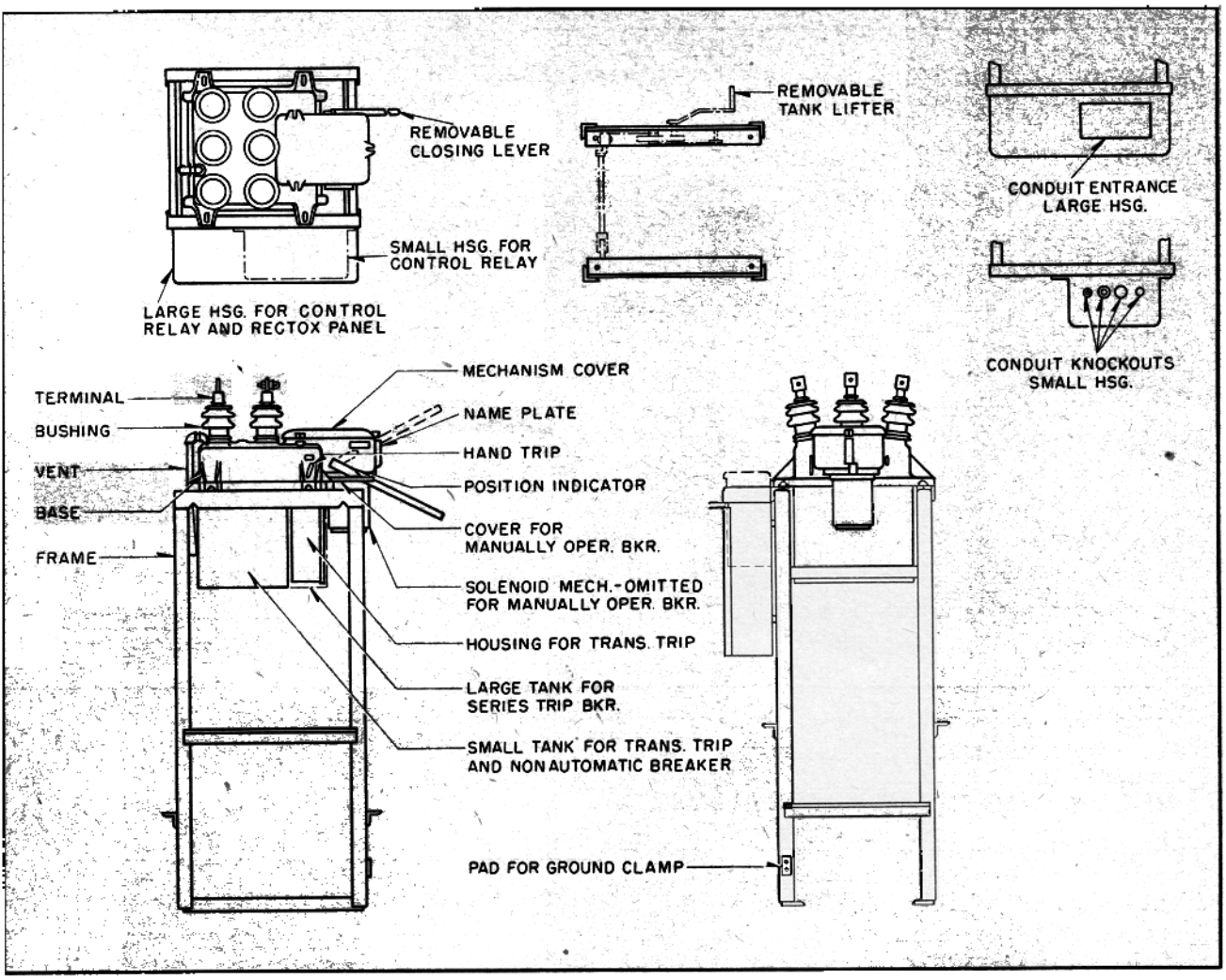

FIG. 21. Side Mounted Housings

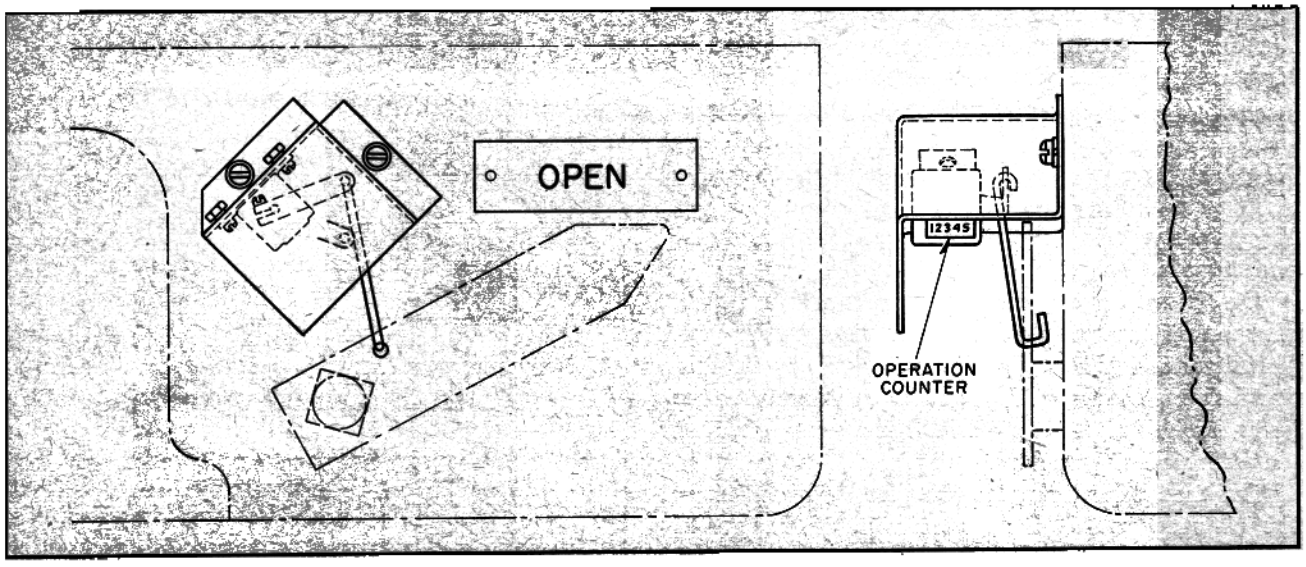

FIG. 22. Operation Counter Assembly

Note: Operation counter is supplied on special order. Standard with reclosing equipment.

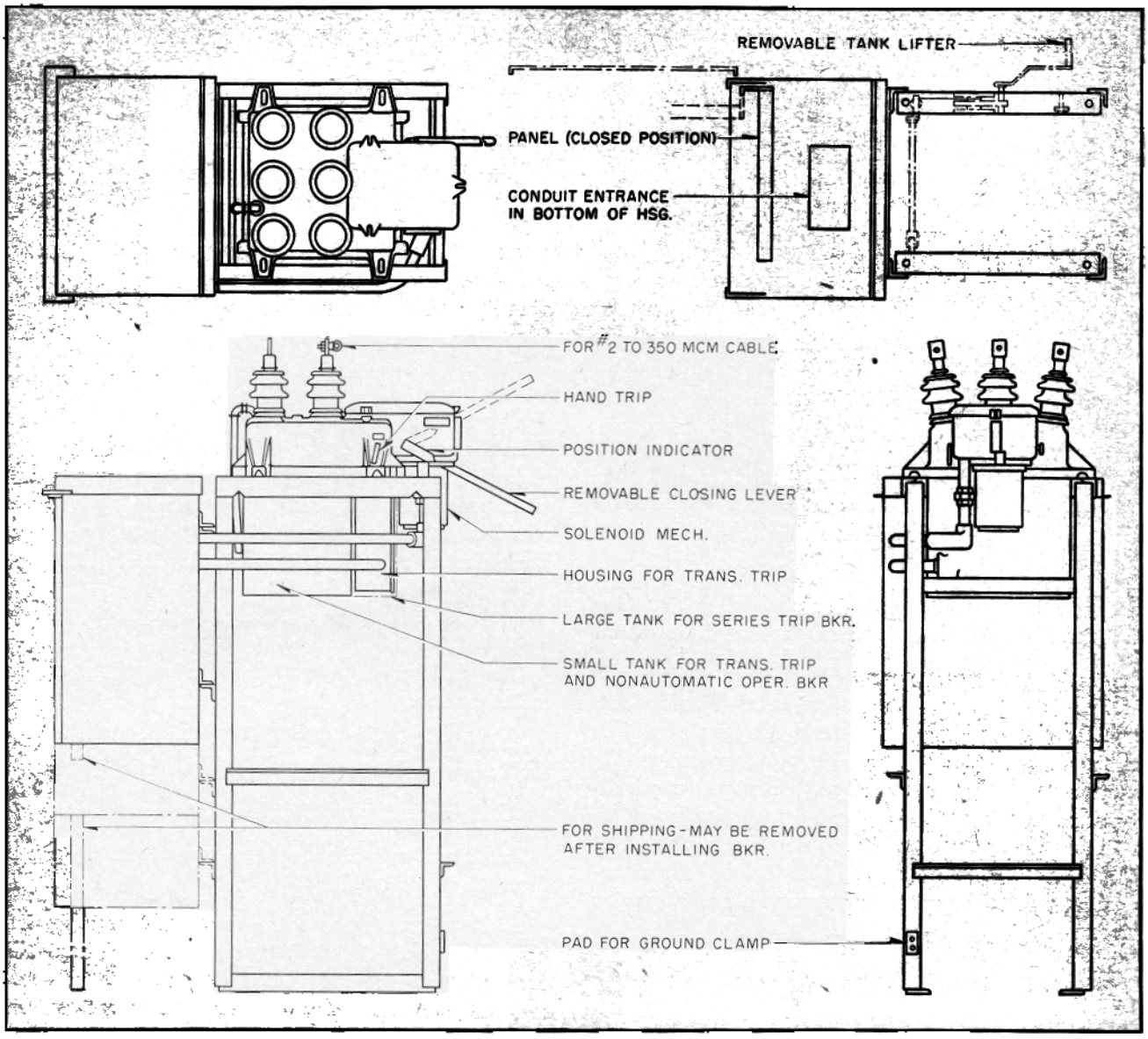

FIG. 23. Outline—Rear Mounted Relay Housings

MAINTENANCE

INSULATING OIL

Dielectric test of the oil should be made after particularly frequent or heavy duty or at approximately 6-month intervals. Moisture or sludge developed during operation tends to settle in the bottom of the tank. To obtain an average operate the breaker several times before taking the test sample.

CARE OF INSULATING OIL

The care of insulating oil in circuit breakers is of the utmost importance in 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,

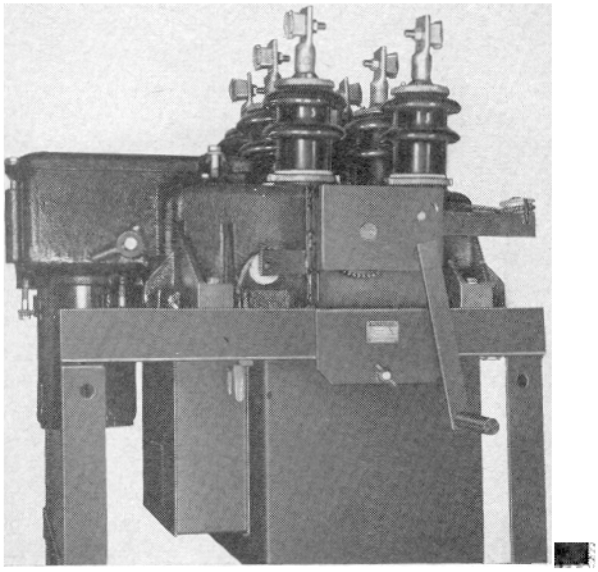

FIG. 24. Tank Lifter Assembly

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 oil such as Wemco "C" or other approved oil, should be used in the breakers. The oil should be new or 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 in a standard test cup between 1-inch diameter discs spaced 0.1 inch apart.

Before filling, the tanks should be thoroughly cleaned and flushed out with insulating oil. In doing this, rags which will leave lint should not be used as this absorbs and holds moisture.

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 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.

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

TANK LIFTER

When preparing to lower the tank mount the tank lifter on the frame on the right side and clamp in place. Remove the left rear and right front tank bolts, loosen the other two tank bolts. Hook the cable ends into the bolt loops in the tank and take up a slight tension on the lifter cable. Remove the other two bolts and lower tank. In replacing tank do not attempt to pull tank home into final position with the lifter. Use the bolts, tightening them evenly, to put the tank into final position.

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 revarnished with three coats of good quality, clear, air-drying varnish. Each coat should be allowed to dry 24 hours.

MAINTENANCE PROCEDURE

The following points should be observed in maintenance.

1. Before touching the breaker make sure that all lines are electrically dead.

2. Be sure the breaker frame is grounded.

3. Do not operate the breaker excessively when the tank is removed.

4. Examine all contacts occasionally and especially after short-circuit interruption. See that the contacts are properly aligned. Smooth off any roughness with a file. Replace arcing contacts when burns penetrate 1/16 inch or more.

5. After making any adjustments, operate the apparatus carefully by hand to make sure that it operates smoothly and correctly.

6. Inspect the oil and check with standard test cup. If test is below 17 kv replace the oil.

7. When replacing oil thoroughly clean the tanks, tank liners, lift rods, and terminal bushings. Use only washed rags so as to avoid lint.

8. Whenever breaker is opened inspect all spring cotters and bolts to see that they are in place.

9. Keep the bearing surfaces of the mechanism and breaker adequately oiled.

WESTINGHOUSE ELECTRIC CORPORATION

HEADQUARTERS: 401 LIBERTY AVE., P. O. BOX 2278, PITTSBURGH 30, PA.

APPARATUS SALES OFFICES

ABILENE, TEXAS, 1134 N. First St.
AKRON 8, OHIO, 106 South Main St.
ALBANY 5, N. Y., 19 Railroad Ave.
ALBUQUERQUE, N. MEX., 1115½ Central Ave., N. E.
ALLENTOWN, PA., 739 Hamilton St.
AMARILLO, TEXAS, 503 Amarillo Bldg., 301 Polk St.
APPLETON, WIS., 321 W. College Ave., P.O. Box 206
ATLANTA 2, GA., 1299 Northside Drive, N. W., P.O. Box 4808
AUGUSTA, MAINE, 9 Bowman St.
BAKERSFIELD, CALIF., 1210 18th St.
BALTIMORE 2, MD., 501 St. Paul Pl.
BEAUMONT, TEXAS, 515 American National Bank Bldg.
BIRMINGHAM 3, ALA., 1407 Comer Bldg.
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BOISE, IDAHO, 318 Capitol Blvd., P.O. Box 1518
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BRIDGEPORT 10, CONN., 540 Grant St.
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BUTTE, MONT., 1 East Broadway
CANTON 2, OHIO, 120 W. Tuscarawas St.
CEDAR RAPIDS, IOWA, 512 Dows Bldg., P.O. Box 1828
CHARLESTON, S. C., 6 Parish Road, Moreland, P.O. Box 303
CHARLESTON 1, W. VA., 179 Summers St., P.O. Box 911
CHARLOTTE 1, N. C., 210 East Sixth St.
CHATTANOOGA 2, TENN., Volunteer State Life Bldg.
CHICAGO, ILL., Merchandise Mart Plaza
CINCINNATI 2, OHIO, 207 West Third St.
CLEVELAND 13, OHIO, 1370 Ontario St.
COLUMBIA, S. C., 1608 Eladden St., P.O. Box 5283
COLUMBUS 16, OHIO, 262 N. 4th St.
COPUS CHRISTI, TEXAS, 205 N. Chaparral St.
DALLAS 1, TEXAS, 1232 Fidelity Union Life Bldg.
DAVENPORT, IOWA, 2212 E. 12th St.
DAYTON 2, OHIO, 32 North Main St.
DENVER, COLO., 910 Fifteenth St.
DES MOINES 8, IOWA, 1408 Walnut St.
DETROIT 32, MICH., 5757 Trumbull Ave., P.O. Box 502
DULUTH 2, MINN., 10 East Superior St.
EL PASO, TEXAS, 718 Mills Bldg.
EMERYVILLE 8, CALIF., 5815 Peladeau St.
ERIE 2, PA., 1003 State St.
EVANSVILLE 8, IND., 106 Vine St.
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FORT WAYNE 2, IND., 610 S. Harrison St.
FT. WORTH 2, TEXAS, 408 West Seventh St.
FRESNO 1, CALIF., 2608 California Ave.
GARY, IND., 846 Broadway
GRAND RAPIDS 2, MICH., 148 Monroe Ave., N.W.
GREENSBORO, N. C., 1008 Pamlico Drive, P.O. Box 3072
GREENVILLE, S. C., 160 W. Tallulah Drive, P.O. Box 1591
HAGERSTOWN, MD., 5 Public Square
HAMMOND, IND., 6341 Indianapolis, Blvd.
HARTFORD 3, CONN., 119 Ann St.
HOUSTON 2, TEXAS, 507 Dallas Ave.
HUNTINGTON 1, W. VA., 1029 Seventh Ave., P.O. Box 1150
HUNTSVILLE, ALA., P.O. Box 42
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JACKSON, MICH., 120 West Michigan Ave.
JACKSON, MISS., Fondren Station, P.O. Box 4296
JACKSONVILLE 6, FLA., 545 E. 4th St., P.O. Box Drawer K
JOHNSON CITY, N. Y., 419 Grand Ave.
JOHNSTOWN, PA., Wallace Bldg., 406-410 Main St.
KANSAS CITY 6, MO., 101 W. Eleventh St.
KINGSPORT, TENN., 145 Commerce St.
KNOXVILLE 8, TENN., Gay and Clinch St.
LAKE CHARLES, LA., P.O. Box 1336
LINCOLN, NEBR., 401 Federal Securities Bldg.
LITTLE ROCK, ARK., 707 Boyle Bldg., 103 W. Capitol St.
LONG BEACH, CALIF., 529 E. Roosevelt Rd.
LOS ANGELES 17, CALIF., 600 St. Paul Ave.
LOUISVILLE 2, KY., 332 West Broadway
MADISON 3, WIS., 1022 E. Washington Ave.
MEDFORD, ORE., 38 N. Bartlett St., P.O. Box 1308
MEMPHIS 3, TENN., 130 Madison Ave.
MIAMI 32, FLA., 731 Ingraham Bldg.
MILWAUKEE 2, WIS., 538 N. Broadway
MINNEAPOLIS 13, MINN., 2303 Kennedy St., N.E.
MOBILE, ALA., 1605 Merchants Nat'l Bank Bldg.
NASHVILLE 4, TENN., 401—6th Ave. S.
NEWARK 2, N. J., 1180 Raymond Blvd.
NEW HAVEN 8, CONN., 42 Church St., P.O. Box 1817
NEW ORLEANS 12, LA., 288 St. Charles St.
NEW YORK 5, N. Y., 40 Wall St.
NIAGARA FALLS, N. Y., 253 Second St.
NORFOLK 10, VA., 915 W. 21st St.
OKLAHOMA CITY 2, OKLA., 120 N. Robinson St.
OLEAN, N. Y., 201 N. Union St.
OMAHA 2, NEBR., 117 North Thirteenth St.
PEORIA 3, ILL., 2800 N. Adams St.
PHILADELPHIA 4, PA., 3001 Walnut St.
PHOENIX, ARIZ., 1102 N. 21st Ave., P.O. Box 6144
PITTSBURGH 30, PA., 306 4th Ave., P.O. Box 1017
PORTLAND 4, ORE., 309 S. W. Sixth Ave.
PROVIDENCE 3, R. I., 51 Empire St.
RALEIGH, N. C., 803 North Person St., P.O. Box 2146
READING, PA., 524 Court St.
RICHMOND 19, VA., 1110 East Main St.
RIVERSIDE, CALIF., Suite 12, 3614—9th St.
ROANOKE 4, VA., Kirk Ave. and First St.
ROCHESTER 3, N. Y., 1 McKee Rd.
ROCKFORD, ILL., 323 South Main St.
RUTLAND, VT., 98 Merchants Row
SACRAMENTO 14, CALIF., 1720—14th St.
SAGINAW, MICH., 221 So. Jefferson St.
ST. LOUIS, MO., 411 North Seventh St.
SALT LAKE CITY 1, UTAH, 235 W. South Temple St.
SAN ANTONIO 5, TEXAS, 115 W. Travis St.
SAN DIEGO 1, CALIF., 525 E. St.
SAN FRANCISCO 8, CALIF., 40 Bush St.
SEATTLE 4, WASH., 3451 East Marginal Way
SHREVEPORT, LA., 412 Milam St.
SIOUX CITY 7, IOWA. 1005 Dace St.
SOUTH BEND 4, IND., 216 East Wayne St.
SPARTANBURG, S. C., 331 High Point Road, P.O. Box 289
SPOKANE 1, WASH., North 1023 Monroe St.
SPRINGFIELD, ILL., 517 Illinois Bldg., P.O. Box 37
SPRINGFIELD 3, MASS., 26 Vernon St.
SYRACUSE 4, N. Y., 700 W. Genesee St.
TACOMA 2, WASH., 1930 Pacific Ave.
TAMPA, FLA., 608 Tampa St.
TOLEDO 4, OHIO, 245 Summit St.
TRENTON 8, N. J., 28 W. State St.
TULSA 3, OKLA., 600 S. Main St.
UTICA, N. Y., 241 N. Genesee St.
WALLA WALLA, WASH., Denny Bldg., P.O. Box 182
WASHINGTON 6, D. C., 1625 K St., N. W.
WATERLOO, IOWA, 300 West 3rd St.
WATERTOWN, N. Y., 245 State St.
WHEELING, W. VA., 12th and Main St.
WICHITA, KANS., 211 So. Main St.
WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
WILLIAMSPORT, PA., 460 Market St.
WORCESTER 8, MASS., 507 Main St.
YORK, PA., 11 W. Market St.
YOUNGSTOWN 3, OHIO, 25 E. Boardman St.

MANUFACTURING AND REPAIR DEPARTMENT OFFICES

ATLANTA 2, GA., 1299 Northside Drive, N. W., P.O. Box 4808
AUGUSTA, MAINE, 9 Bowman St.
BALTIMORE 24, MD., 4015 Foster Ave.
BATON ROUGE 2, LA., 555 Choctaw Drive
BIRMINGHAM 5, ALA., 3401 Third Ave., S.
BOSTON 27, MASS., 235 Old Colony Ave., So. Boston
BRIDGEPORT 10, CONN., 540 Grant St.
BROOKLYN 6, N. Y., 1 Harrison Place (Windsor M & R Corp.)
BUFFALO 10, N. Y., 1132 Seneca St.
CHARLOTTE 1, N. C., 210 East Sixth St.
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CINCINNATI 37, OHIO, 1050 Laidlaw Ave.
CLEVELAND 2, OHIO, 5901 Breakwater Ave.
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FORT WORTH 7, TEXAS, 100 Rupert St., P.O. Box 1696
HILLSIDE 5, N. J., 1441 Chestnut Ave.
HOUSTON 20, TEXAS, 5730 Clinton Dr.
HUNTINGTON 1, W. VA., 1029 Seventh Ave., P.O. Box 1150
HUNTINGTON PARK, CALIF., 3383 E. Gage Ave., P.O. Box 629
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JOHNSTOWN, PA., 107 Station St.
KANSAS CITY 6, MO., 1300 Oak St.
LOS ANGELES, CALIF., (See Huntington Park, Calif.)
MILWAUKEE 9, WIS., 1500 W. Cornell St.
MINNEAPOLIS 13, MINN., 2303 Kennedy St., N. E.
PHILADELPHIA 34, PA., Erie Ave. & "D" St.
PITTSBURGH 8, PA., 543 N. Lang Ave.,
PORTLAND 12, ORE., 626 North Tillamook St.
PROVIDENCE 3, R. I., 16 Elbow St.
ST LOUIS 10, MO., 1601 S. Vandeventer Ave.
SALT LAKE CITY 1, UTAH, 235 W. South Temple St.
SEATTLE 4, WASH., 3451 East Marginal Way
SPRINGFIELD 1, MASS., 395 Liberty St.
SUNNYVALE, CALIF. (Sunnyvale Plant), P.O. Box 37
SYRACUSE 4, N. Y., 700 West Genesee St.
UTICA 1, N. Y., 113 N. Genesee St.
WILKES-BARRE, PA., 267 N. Pennsylvania Ave.

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SAN FRANCISCO 8, CALIF., 410 Bush St.
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SPOKANE 8, WASH., 1023 W. Riverside Ave.
SPRINGFIELD 3, MASS., 26 Vernon St.
SYRACUSE 4, N. Y., 700 W. Genesee St.
TOLEDO 4, OHIO, 245 Summit St.
UTICA, N. Y., 241 N. Genesee St.
WASHINGTON 6, D. C., 1625 K Street, N. W.
WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
YOUNGSTOWN 3, OHIO, 25 E. Boardman St.


WESTINGHOUSE
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