Westinghouse

Type SA-4 Solenoid Operated Mechanism for Oil Circuit-Breakers

INSTRUCTION BOOK

Westinghouse Electric & Manufacturing Company

East Pittsburgh Works East Pittsburgh, Pa.

I. B. 5467

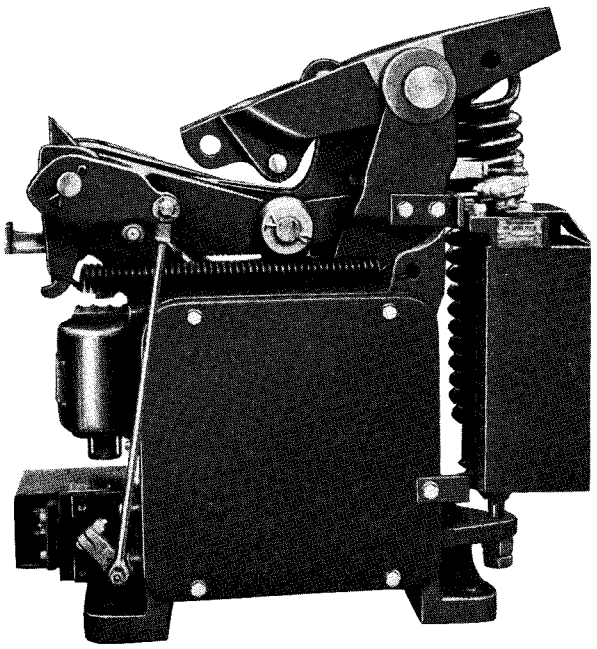

FIG. 1—MECHANISM—CLOSED POSITION

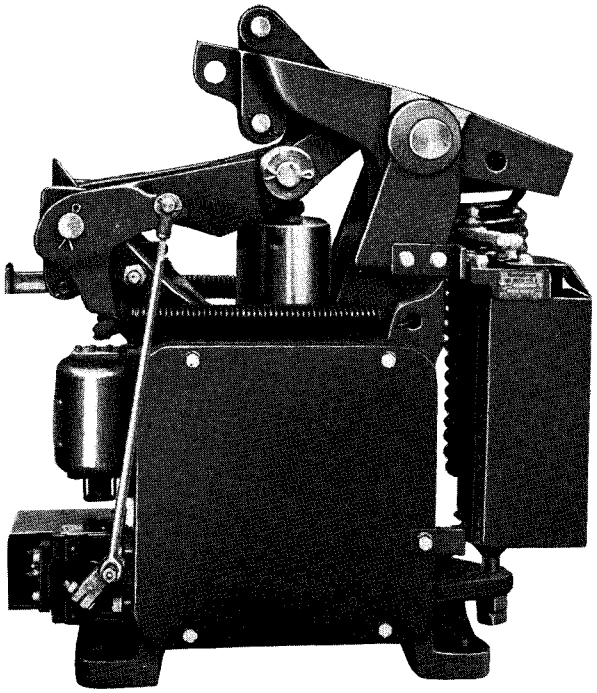

FIG. 2—MECHANISM—OPEN POSITION

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Type SA-4 Solenoid Operated Mechanism for Oil Circuit-Breakers

Introduction

This mechanism is the direct current solenoid type, mechanically full automatic, trip-free in all positions. It is applicable to indoor and outdoor service and is supplied complete with control panel on which is mounted the control relay, knife switch and terminals for external connections. The standard mechanism is equipped with single coil shunt trip, a 10-pole auxiliary switch and the control panel. Special combination may be obtained with a maximum of 22 auxiliary contacts, two of which act with the magnet core, a double shunt trip if desired, and a Veeder counter.

Shipment and Storage

Each mechanism is carefully inspected and tested at the factory and should be in good condition when received. It should be carefully inspected for damages caused in shipment, when received.

If the mechanism is to be stored for any length of time, it should be kept in a clean, dry place, protected from corrosion and moisture. It should never be allowed to stand where moisture can reach the insulated parts. It should be handled with reasonable care to prevent breakages.

Unpacking should be done carefully so as not to damage the mechanism. All parts should be checked with the shipping list and care taken not to leave any part in the packing material. An Instruction Book should accompany the mechanism along with proper identification tags.

Operation

Referring to Fig. 4, the operating lever connected to the breaker is linked to the main lever with the full automatic lever and a link. From the open position (Fig. 6) with the trigger engaged, the full automatic lever and main lever act as one, rotating counter-clockwise above the trigger end as the core moves downward. This rotates the operating lever clockwise. When the mechanism is closed, the main lever is held down by the holding latch which engages a pin on the main lever holding the breaker in the closed position. (Fig. 4.)

When the trip coil is energized, the trigger releases from the roller allowing the full automatic lever to rotate counter-clockwise about the core pin thus releasing the main lever from the holding latch. However, the operating lever attached to the breaker has already been released by rotation of the full automatic lever as indicated in Fig. 5 The main lever is retrieved to the **position shown in Fig. 6 by the** retrieving spring. Acceleration is provided by means of a spring on the back of the mechanism. It will be noted that the 10-pole auxiliary switch is connected to the operating lever, thus indicating the position of the circuit-breaker and that the two-pole switch is connected to the main lever thus indicating the position of the solenoid.

Hand closing is provided by means of a removable lever which rotates on the fulcrum of the operating lever and acts on a roller on the core pin.

Adjustment

When supplied with a breaker, this mechanism will be completely mounted and adjusted at the factory and it is only necessary to check to see that the adjustments are properly made. In case the mechanism is to be connected to a breaker in the field, considerable care must be taken to obtain the proper travel relation and to see that the setting of the stop in the breaker

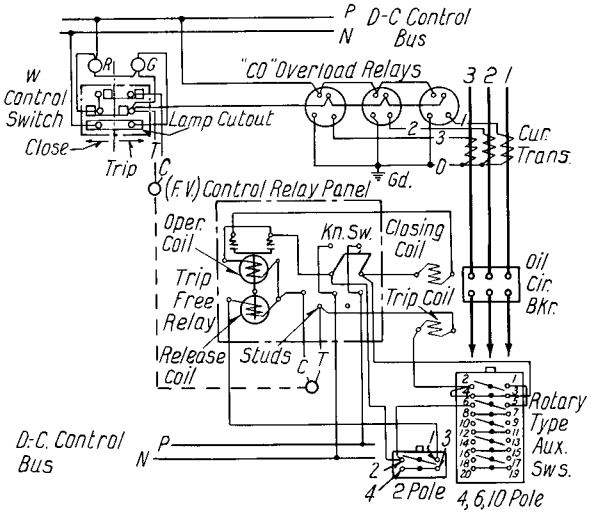


FIG. 3—WIRING DIAGRAM FOR MECHANISM

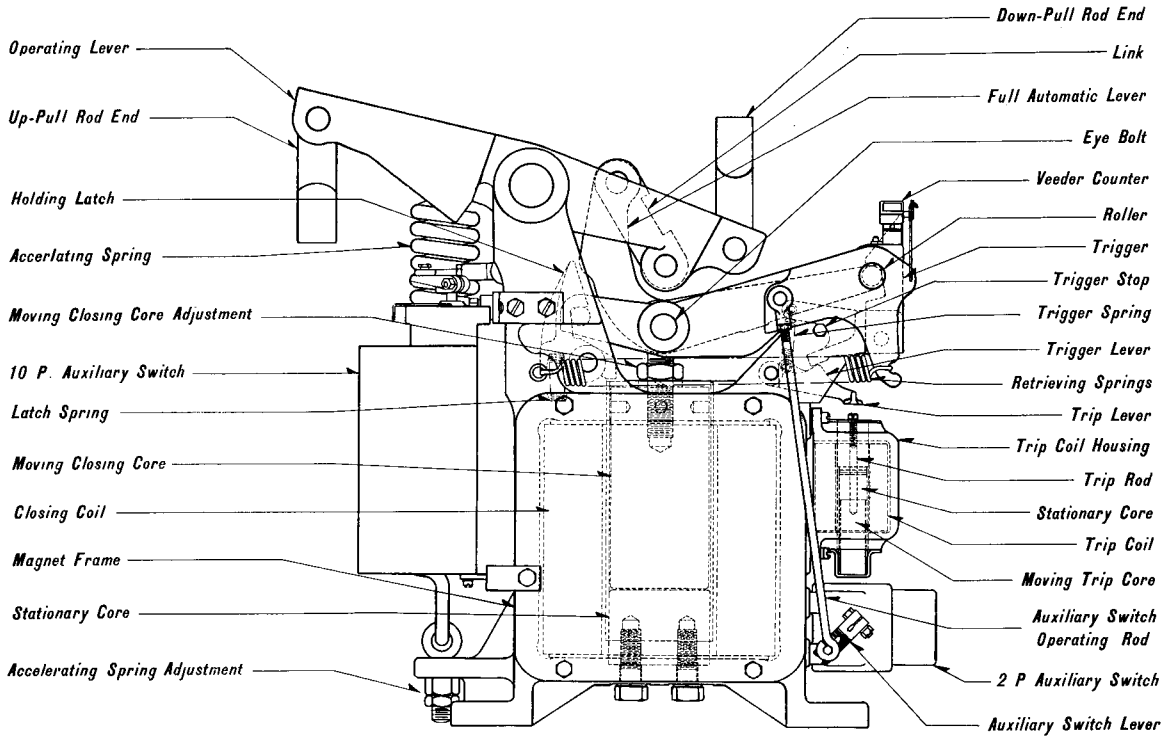


FIG. 4—MECHANISM DETAILS

and mechanism are in the proper relation.

The trigger stop, indicated in Fig. 4 controls the action of the trigger. Adjustment is made by loosening the nut on the eccentric bolt and rotating it to the proper position. The nut must be securely tightened after such adjustment. This setting is made at the factory so that the throat of the trigger clears the roller by approximately 1/16". This setting effects the minimum trip voltage of the mechanism.

The cut-off of the closing coil is accomplished through the auxiliary switch and relay as indicated on the wiring diagram, Fig. 3. The setting made at the factory gives the best condition of operation and should not be changed. Cut-off must come very near the end of the stroke so that the mechanism will close completely.

No dashpots are used on this mechanism and its action should be free throughout the stroke. Some adjustment can be had by changing the position of the nut on the tie bolt at the bottom of the large spring in the rear. This setting is made at the factory and should not be changed unless it is found necessary.

The magnet core has a range of adjustment and is set at the factory so that there is approximately 1/16" over-travel at the holding latch or when the core is pulled clear down. If the core is too high and does not strike, the levers will be put under excessive strain and if it is set down too far, the holding latch will not be pulled into proper engagement.

A check should be made of the setting of the toggle stop at the breaker with relation to the setting of the core and to the holding latch. With the mechanism in the latched position, the breaker toggle stops should be set with a clearance as given in the breaker instruction book.

The auxiliary switches are set up with the mechanism and tested at the factory and should need no adjustment. However, if it becomes necessary to make adjustment on the switches, the length of the rod can be changed by turning the rod end and the travel can be adjusted by changing the length of the switch lever, which is adjustable. In this way a change of cut-off can be made.

In case it is necessary to make any of the above adjustments, the complete operation of the mechanism should be observed after making such adjustments. This should include a check of the opening and closing times, the minimum closing and trip voltage, and the operation at maximum voltage. Be sure that all nuts are properly tightened after making any adjustments. It is desirable to make a number of operations after any adjustment, to be sure that the setting is permanent.

A lug is provided on this mechanism on which the Veeder counter may be mounted, if it is desired to keep a record of the operation.

The control relay should need no adjustment when the breaker is installed, as it has been carefully tested at the factory. The function of the control relay is to handle the operating coil current, thus obviating

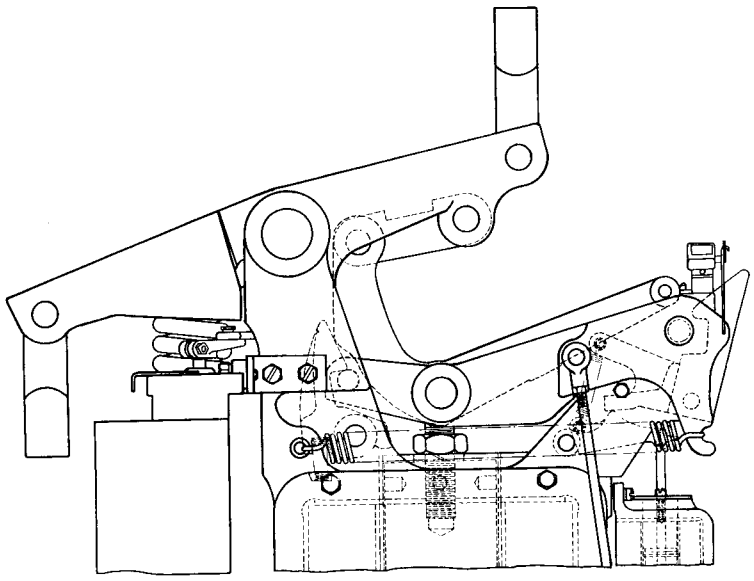


FIG. 5—MECHANISM TRIPPED FREE

the necessity of running heavy leads to the switchboard and also to relieve the control switch of the heavy current required to close the breaker. The panel also provides an additional full automatic feature which makes it impossible to hold the solenoid in the closed position against predetermined conditions of overload in the line. It is also impossible to keep the current on the closing coil after the breaker is closed. A knife switch is provided for the purpose of isolating the mechanism from the control circuit when work is being done on it. Standard connections of this mechanism are shown in the wiring diagram supplied with it. Other arrangements can be used as the mechanism can be provided with a maximum of 22 auxiliary contacts.

When it is desired to close the circuit-breaker, the control relay on the panel is energized by the control switch. Energizing the coil closes the main control relay contacts and allows the current to flow through the solenoid closing coil and operates the mechanism. As the breaker approaches the closed position, the contacts on the auxiliary switch close the circuit to the release coil of the control relay and the moving core rises, opening the relay contacts. The release coil thus de-energizes the main closing solenoid as soon as the breaker is properly latched and leaves it ready to be tripped out at once.

It will be noted that at any point during the closing operation, should the trip coil become energized, the circuit-breaker will open at once and the closing core will complete its cycle and return to the open position.

Inspection

The electric solenoid closing mechanism contains a number of moving joints and operating parts all of which are subject to wear or sticking, if not kept in the proper condition. It is desirable to inspect the mechanism at regular intervals and be assured of its good condition by making a number of operations, regular adjustments and repair. It is desirable to apply a light lubricating oil to the various pins but it should not be done to the extent of causing the joints to become gummed or stuck. It is necessary to keep the moving parts, particularly the trigger and switches, clean and free from foreign matter.

In case there is any trouble in operation, the mechanism should be taken out of service at once and put into the proper condition. The circuit-breaker is highly dependent on the proper functioning of the mechanism and therefore it should always be kept in good condition.

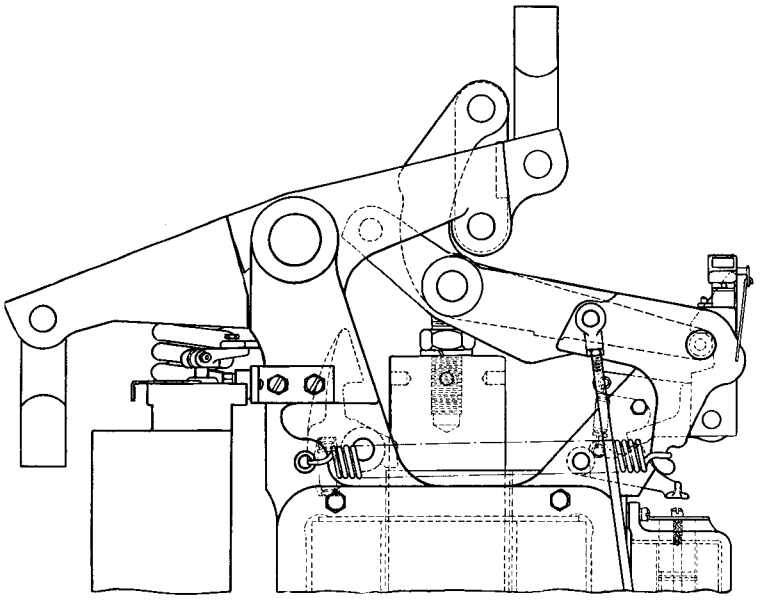


FIG. 6—MECHANISM OPEN

Renewal Parts

Ordering Instructions

When ordering renewal parts, specify the name of the part wanted and give the type and stock order number of the mechanism which will be found on the nameplate.

Refer to the back of this book for the nearest Sales Office from which to order parts.

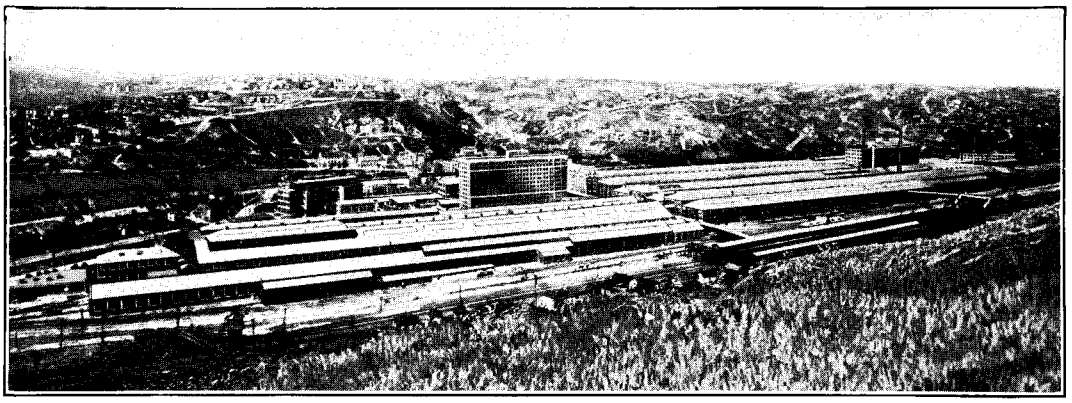
Recommended Stock of Renewal Parts

Below 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 to damage or breakage due to possible abnormal conditions. The maintenance of such stock will minimize service interruptions due to breakdowns.

Recommended Stock of Renewal Parts

Total number of Mechanisms up to and including		2	5	15
Name of Part	No. Per Breaker	Recommended for stock		
Electrically Operated Mechanism	1	0	0	1
10 Pole Auxiliary Switch	1	0	0	1
2 Pole Auxiliary Switch	1	0	0	1
Latch Spring	1	0	1	2
Holding Latch	1	0	1	1
Retrieving Spring	2	0	1	2
Trigger	1	0	1	1
Trigger Spring	1	0	1	2
Accelerating Spring	1	0	1	1
Trip Coil	1	0	0	1
Closing Coil	1	0	0	1

Parts indented are included in the part under which they are indented.
Recommendations for stocking Renewal Parts for your complete equipment will be supplied upon request to the nearest Sales Office.



The Company's Works at East Pittsburgh, Pa.

Westinghouse Products

A few of the Westinghouse Products are listed below and will furnish some idea of the great variety of electrical apparatus manufactured by the Company and the many extensive fields for their use.

For Industrial Use

Instruments
Motors and controllers for every application, the more important of which are: Machine shops, woodworking plants, textile mills, steel mills, flour mills, cement mills, brick and clay plants, printing plants, bakeries, laundries, irrigation, elevators and pumps.
Welding outfits
Gears
Industrial heating devices, such as: Glue pots, immersion heaters, solder pots, hat-making machinery and electric ovens.
Lighting systems
Safety switches

For Power Plants and Transmission Lines

Carrier current equipment
Circuit-breakers and switches
Condensers
Controllers
Control switches
Frequency changers
Fuses and fuse blocks
Generators
Insulating material
Instruments
Lamps, incandescent and arc
Lightning arresters
Line material
Locomotives
Meters
Motors
Motor-generators
Portable Power Stands, 110 volts
Rectifiers
Regulators
Relays
Solder and soldering fluids
Stokers
Substations, portable and automatic
Switchboards
Synchronous converters
Transformers
Turbine-generators

For Transportation

Locomotives
Railway equipment
Marine equipment

For Mines

Automatic substations
Lamps
Locomotives
Motors for hoists and pumps
Motor-generators
Portable substations
Switchboards
Line material
Ventilating outfits

For Farms

Fans
Household appliances
Motors for driving churns, cream separators, corn shellers, feed grinders, pumps, air compressors, grindstones, fruit cleaning machines and sorting machines.
Generators for light, power and heating apparatus.
Portable Power Stands, 32 Volts
Radio Apparatus
Transformers

For Office and Store

Electric radiators
Fans
Arc lamps
Incandescent lamps
Sol-Lux lighting fixtures
Small motors for driving addressing machines, dictaphones, adding machines, cash carriers, moving window displays, signs, flashers, envelope sealers, duplicators, etc.
Ventilating outfits

For Electric and Gasoline Automobiles and the Garage

Battery charging outfits
Charging plugs and receptacles
Lamps
Instruments
Motors and controllers
Small motors for driving lathes, tire pumps, machine tools, polishing and grinding lathes.
Solder and soldering fluids
Tire vulcanizers

For the Home

Electric ware, including: Table stoves, toasters, irons, warming pads, curling irons, coffee percolators, chafing dishes, disc stoves, radiators and sterilizers.
Automatic electric ranges
Fans
Incandescent lamps
Radio apparatus
Sol-Lux lighting fixtures
Small motors for driving coffee grinders, ice cream freezers, ironing machines, washing machines, vacuum cleaners, sewing machines, small lathes, polishing and grinding wheels, pumps and piano players.
Sew-motors.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

WESTINGHOUSE SALES OFFICES

ABILENE, KAN., 300 Cedar St. N.
ABILENE, TEX., 109 Second St. N.
AKRON, OHIO, 714 United Bldg., Main and Market Sts.
ALBANY, N. Y., Home Savings Bank Bldg., 11 Pearl St. N.
*ATLANTA, GA., Westinghouse Elec. Bldg., 426 Marietta St.
BAKERSFIELD, CALIF., 2224 San Emedio St.
BALTIMORE, MD., Lexington Bldg., Lexington and Liberty Sts.
BAY CITY, MICH., 2109 Sixth St.
BEAUMONT, TEX., 2008 McFadden St.
BIRMINGHAM, ALA., 1406-11 Comer Bldg., Second Ave. and 21st St.
BLUEFIELD, W. VA., Peery Bldg., Bland and Federal Sts.
BOSTON, MASS., Rice Bldg., 10 High St.
*BRIDGEPORT, CONN., Bruce Ave. and Seymour St.
*BUFFALO, N. Y., Ellicott Square Bldg., 814 Ellicott Square
BURLINGTON, IOWA, 118 Jefferson St.
*BUTTE, MONT., Montana Elec. Co. Bldg., 52 E. Broadway
CANTON, OHIO, First Nat. Bank Bldg., Market Ave. and Tuscarawas St.
CEDAR RAPIDS, IOWA, 1314 E. Third Ave.
CHARLESTON, W. VA., Kanawha Nat. Bank Bldg., Capitol and Virginia Sts.
*CHARLOTTE, N. C., Westinghouse Elec. Bldg., 210 E. Sixth St.
CHATTANOOGA, TENN., 811 Tenn. Elec. Power Bldg., 536-540 Market St.
*CHICAGO, ILL., Conway Bldg., 111 W. Washington St.
*CINCINNATI, OHIO, Westinghouse Elec. Bldg., Third and Elm Sts.
*CLEVELAND, OHIO, Westinghouse Elec. Bldg., 2209 Ashland Rd. S. E.
COLUMBUS, GA., 1225 Fifth Ave.
COLUMBUS, OHIO, Interurban Terminal Bldg., Third and Rich Sts.
*DALLAS, TEX., Magnolia Bldg., Ackard and Commerce Sts.
DAVENPORT, IOWA, United Light and Power Bldg., 208 E. Second St.
DAYTON, OHIO, 1334 Third National Bldg., 36 Main St. N.
*DENVER, COLO., Gas and Electric Bldg., 910 15th St.
DES MOINES, IOWA, Equitable Bldg., W. Sixth and Locust Sts.
*DETROIT, MICH., Westinghouse Elec. Bldg., 5757 Trumbull Ave.
DUBUQUE, IOWA, 303 Federal Bank Bldg.
DULUTH, MINN., Bradley Bldg., Lake Ave. and Superior St.
ELMIRA, N. Y., Hulett Bldg., 338-42 E. Water St.
*EL PASO, TEX., 910 Mills Bldg., Oregon and Mills Sts.
ERIE, PA., Erie Trust Bldg., State and Tenth Sts.
FAIRMONT, W. VA., 602 Cleveland Ave.
FERGUS FALLS, MINN., Kadatz Hotel
FORT WAYNE, IND., 1010 Packard Ave.
FRESNO, CALIF., Hotel Fresno
GARY, IND., 1514 W. Fifth Ave.
GRAND RAPIDS, MICH., 507 Monroe Ave. N. W.
HAMMOND, IND., 135 Oakwood Ave.
*HOUSTON, TEX., Union Nat. Bank Bldg., Main St. and Congress Ave.
*HUNTINGTON, W. VA., Westinghouse Elec. Bldg., Second Ave. and Ninth St.
*INDIANAPOLIS, IND., Westinghouse Elec. Bldg., 820 Senate Ave. N.
ISHPEMING, MICH., 507 Fifth St. N.
JACKSON, MICH., Consumers Power Bldg., 212 W. Michigan Ave.
JACKSON, MISS., 820 Carlisle St.
JACKSONVILLE, FLA., 719 W. Forsyth St.
*JOHNSTOWN, PA., 47 Messenger St.
JOPLIN, MO., P. O. Box 653
*KANSAS CITY, MO., Westinghouse Elec. Bldg., 2124 Wyandotte St.
KNOXVILLE, TENN., 413 Bankers Trust Bldg.
LOUISVILLE, KY., Citizens Bldg., Sixth and Jefferson Sts.
*LOS ANGELES, CALIF., Westinghouse Elec. Bldg., 420 San Pedro St. S.
MADISON, WIS., 508 Edgewood Ave.
MEMPHIS, TENN., Exchange Bldg., 130 Madison Ave.
MIAMI, FLA., 1125 Ingraham Bldg., 25 Second Ave. S. E.
MILWAUKEE, WIS., First Wisconsin Nat. Bank Bldg., 425 E. Water St.
*MINNEAPOLIS, MINN., Northwestern Terminal, 2303 Kennedy St., N. E.
NASHVILLE, TENN., 109 Ninth Ave. S.
NEWARK, N. J., Academy Bldg., 17-25 Academy St.
NEW HAVEN, CONN., Liberty Bldg., 152 Temple St.
*NEW ORLEANS, LA., 708 Masonic Temple Bldg., 333 St. Charles St.
*NEW YORK, N. Y., Westinghouse Elec. Bldg., 150 Broadway
NIAGARA FALLS, N. Y., Gluck Bldg., 205 Falls St.
NORFOLK, VA., National Bank of Commerce Bldg., 300 Main St.
*OKLAHOMA CITY, OKLA., Perrine Bldg., Robinson and First Sts.
OMAHA, NEB., 712 Electric Bldg., 409 17th St. S.
ORLANDO, FLA., P. O. Box 98 (Telegrams 806 Lucerne Terrace)
PEORIA, ILL., 104 State St.
*PHILADELPHIA, PA., Westinghouse Elec. Bldg., 30th and Walnut Sts.
*PHOENIX, ARIZ., 412 Luhrs Bldg., 11 W. Jefferson St.
PINE BLUFF, ARK., 1603 W. 17th Ave.
*PITTSBURGH, PA., Chamber of Commerce Bldg., Seventh Ave and Smithfield St.
PORTLAND, ME., 61 Woodford St.
*PORTLAND, ORE., 901-3 Porter Bldg., Sixth and Oak Sts.
POUGHKEEPSIE, N. Y., Bardavon Bldg., 35 Market St.
PROVIDENCE, R. I., 393 Harris Ave.
PUEBLO, COLO., 222 Colorado Bldg., Fourth and Main Sts.
RALEIGH, N. C., 803 Person St. N.
RIVERSIDE, CALIF., 176 Rosewood Place
ROCHESTER, N. Y., Gas and Electric Bldg., 89 East Ave.
ROCKFORD, ILL., 414 Stewart Bldg., 206 Main St. S.
SACRAMENTO, CALIF., 209 Hagelstein Bldg., 1106 Ninth St.
*SALT LAKE CITY, UTAH, McCornick Bldg., First South and Main Sts.
SAN ANTONIO, TEX., 403 First National Bank Bldg.
SAN DIEGO, CALIF., 411 Electric Bldg., 863 Sixth St.
*SAN FRANCISCO, CALIF., Crocker First National Bank Bldg., 1 Montgomery St.
*SEATTLE, WASH., Lloyd Bldg., Sixth and Stewart Sts.
SHREVEPORT, LA., 219 Wilkinson St.
SIOUX CITY, IOWA, 2311 George St.
SOUTH BEND, IND., 803 Sherland Bldg.
SPOKANE, WASH., 1322-23 Old Nat. Bank Bldg., Riverside and Stevens Sts.
SPRINGFIELD, ILL., Public Service Bldg., 130 Sixth St. S.
*ST. LOUIS, MO., Ambassador Bldg., 411 Seventh St. N.
STOCKTON, CALIF., 125 W. Main St.
SYRACUSE, N. Y., 801 Loew Bldg., Salina, Jefferson and Clinton Sts.
TACOMA, WASH., 1004 Washington Bldg., 1021 Pacific Ave.
*TAMPA, FLA., Westinghouse Elec. Bldg., 417 Ellamae Ave.
TERRE HAUTE, IND., 309 Terre Haute Trust Bldg., Seventh and Wabash Sts.
TEXARKANA, ARK., P. O. Box 662
TOLEDO, OHIO, Ohio Bldg., Madison Ave. and Superior St.
*TULSA, OKLA., Mid-Continent Bldg., Fifth St. and Boston Ave.
*UTICA, N. Y., Utica Gas and Electric Bldg., Genesee St.
WASHINGTON, D. C., Washington Bldg., 15th St., G St and New York Ave., N. W.
WATERLOO, IOWA, 305 W. Fourth St.
WICHITA, KAN., P. O. Box 1226
WILKES-BARRE, PA., Westinghouse Elec. Bldg., 267 Pennsylvania Ave. N.
WILMINGTON, CALIF., 303 Avalon Bldg.
WORCESTER, MASS., Park Bldg., 507 Main St.
YOUNGSTOWN, OHIO, 810 First National Bank Bldg., 16 Central Square
The HAWAIIAN ELECTRIC CO., Ltd., Honolulu, T. H.—Agent

*Warehouse located in this city.

WESTINGHOUSE AGENT-JOBBERS

ABILENE, KAN., Union Electric Co.
ALBANY, N. Y., H. C. Roberts Electric Supply Co.
ASHEVILLE, N. C., Carolina States Electric Co.
ATLANTA, GA., Gilham Electric Co.
BALTIMORE, MD., H. C. Roberts Elec. Sup. Co.
BINGHAMTON, N. Y., H. C. Roberts Electric Supply Co.
BIRMINGHAM, ALA., Moore-Handley Hdw. Co.
BLUEFIELD, W. VA., Superior Supply Co.
BOSTON, MASS., Wetmore-Savage Elec. Sup. Co.
BROOKLYN, N. Y., Alpha Electric Co.
BUFFALO, N. Y., McCarthy Bros. & Ford
BUTTE, MONT., Fobes Supply Co.
CANTON, OHIO, The Moock Electric Supply Co.
CHARLOTTE, N. C., Carolina States Electric Co.
CHATTANOOGA, TENN., Mills & Lupton Supply Co.
CHICAGO, ILL., Illinois Electric Co.
CINCINNATI, O., The Johnson Elec. Sup. Co.
CLEVELAND, OHIO, 2209 Ashland Rd., S. E.
COLUMBIA, S. C., Mann Electric Supply Co.
COLUMBUS, O., The Hughes Peters Elec. Corp.
DALLAS, TEX., Electric Appliance Co., Inc.
DENVER, COLO., The Mine & Smelter Sup. Co.
DES MOINES, IA., Julius Andrae & Sons Co.
DETROIT, MICH., Commercial Elec. Sup. Co.
DULUTH, MINN., Great Northern Elec. App. Co.
EL PASO, TEX., The Mine & Smelter Supply Co.
ERIE, PA., Star Electrical Co.
EVANSVILLE, IND., The Varney Elec'l Sup. Co.
FARGO, N. D., Great Northern Elec. App. Co.
FLINT, MICH., Commercial Elec. Sup. Co.
GRAND RAPIDS, MICH., Com'l Elec. Sup. Co.
GREENSBORO, N. C., Carolina States Electric Co.
GREENVILLE, S. C., Mann Electric Supply Co.
HOUSTON, TEX., Tel-Electric Co.
HUNTINGTON, W. Va., Banks-Miller Sup. Co.
INDIANAPOLIS, IND., The Varney Electrical Supply Co.
JACKSONVILLE, FLA., Pierce Electric Co.
JERSEY CITY, N. J., Newark Electrical Supply Co.
KANSAS CITY, MO., Columbian Electrical Co.
LOS ANGELES, CALIF., Illinois Electric Co.
LOUISVILLE, KY., Tafel Electric Co.
MASON CITY, IOWA, Julius Andrae & Sons Co.
MEMPHIS, TENN., Commercial Elec'l Sup. Co.
MIAMI, FLA., Pierce Electric Co.
MILWAUKEE, WIS., Julius Andrae & Sons Co.
MINNEAPOLIS, MINN., Great Northern Electric Appliance Co.
NEWARK, N. J., Newark Electrical Supply Co.
NEW HAVEN, CONN., The Hessel & Hoppen Co.
NEW ORLEANS, LA., Electrical Supply Co.
NEW YORK, N. Y., Alpha Electric Co.
NEW YORK, N. Y., Times Appliance Co., Inc.
OAKLAND, CALIF., Fobes Supply Co.
OKLAHOMA CITY, OKLA., Electric Appliance Co., Inc.
OMAHA, NEB., McGraw Electric Co.
PEORIA, ILL., Illinois Electric Co.
PHILADELPHIA, PA., H. C. Roberts Electric Supply Co.
PHOENIX, ARIZ., Illinois Electric Co.
PITTSBURGH, PA., Iron City Electric Co.
POCATELLO, IDA., Inter-Mountain Elec. Co.
PORTLAND, ORE., Fobes Supply Co.
PROVIDENCE, R. I., Wetmore Savage Electric Supply Co.
RALEIGH, N. C., North State Elec. Sup. Co.
READING, PA., H. C. Roberts Elec. Supply Co.
RICHMOND, VA., Tower-Binford Elec. & Mfg. Co.
ROCHESTER, N. Y., Rochester Electrical Sup. Co.
ST. JOSEPH, MO., Columbian Electrical Co.
ST. LOUIS, MO., Commercial Elec'l Supply Co.
ST. PAUL, MINN., Great Northern Elec. App. Co.
SALT LAKE CITY, UTAH, Inter-Mountain Electric Co.
SAN ANTONIO, TEX., Electric Appliance Co.
SAN FRANCISCO, CALIF., Fobes Supply Co.
SCRANTON, PA., Penn Electrical Engineering Co.
SEATTLE, WASH., Fobes Supply Co.
SIOUX CITY, IOWA, McGraw Electric Co.
SPOKANE, WASH., Fobes Supply Co.
SPRINGFIELD, MASS., Wetmore-Savage Electric Supply Co.
SYRACUSE, N. Y., H. C. Roberts Elec. Sup. Co.
TAMPA, FLA., Pierce Electric Co.
TRENTON, N. J., H. C. Roberts Elec. Sup. Co.
TULSA., OKLA., Electric Appliance Co., Inc.
UTICA, N. Y., 113 North Genesee St.
WASHINGTON, D. C., H. C. Roberts Elec. Sup. Co.
WATERLOO, IOWA, Julius Andrae & Sons Co.
WILMINGTON, DEL., H. C. Roberts Elec. Sup. Co.
WORCESTER, MASS., Wetmore-Savage Electric Supply Co.
YOUNGSTOWN, O., The Moock Elec. Sup. Co.

WESTINGHOUSE SERVICE SHOPS

ATLANTA, GA., 426 Marietta St.
BALTIMORE, MD., 501 East Preston St.
BOSTON, MASS., 12 Farnsworth St.
BRIDGEPORT, CONN., Bruce Ave. and Seymour St.
BUFFALO, N. Y., 141-157 Milton St.
CHARLOTTE, N. C., 210 E. Sixth St.
CHICAGO, ILL., 2201 W. Pershing Road
CINCINNATI, OHIO, Third and Elm Sts.
CLEVELAND, OHIO 2209 Ashland Rd., S. E.
DENVER, COLO., 1909-11-13-15 Blake St.
DETROIT, MICH., 5757 Trumbull Ave.
FAIRMONT, W. VA., 602 Cleveland Ave.
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