W E S T I N G H O U S E

# TYPE RR-5 REGISTER REGULATOR

## INSTALLATION, OPERATION AND MAINTENANCE

INSTRUCTION BOOK 5751-A
(12-37)

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

EAST PITTSBURGH WORKS · EAST PITTSBURGH, PA.

# INDEX



## ILLUSTRATIONS

WESTINGHOUSE

TYPE RR-5 REGISTER REGULATOR

## I - DESCRIPTION

(1) The RR-5 Register regulator, Fig. 1, is a photo-electrcc relay, which, as shown in Fig. 2 may be connected to give various operating characteristics as needed by differnnt control applications. The register regulator is equipped with a relay operated from a grid glow tube. As shown in Fig. 2 this relay may be made to operate if the illumination on the phototube is either increased or decreased. By connecting the equipment for either "impulse" or "static" control the register regulator will respond to either a transient change in illumination or to a permanent variation in illumination. The equipment may be connected so that the grid glow tube and relay are energized by a d-c. voltage or an a-c. voltage. When d-c. voltage is used the relay will remain in the operated position regardless of subsequent changes in phototube illumination.

As shown in Fig. 2 an external solenoid may be used instead of the relay.

## II - OPERATION

(2) In Fig. 3 is shown the schematic diagram of connections. The phototube, shown in dotted lines, is connected so that when the illumination on the phototube is increased the grid - cathode voltage of the RJ-571 amplifier tube becomes more negative and the current through the tube decreases. This causes lead 30 to become more negative relative to lead 37. The voltage between 30 and 37 is applied to the grid circuit of the grid glow tube, provided terminals 5-6 are short-circuited. If switch 1 is in the "dark" position the grid glow tube will break down and carry current if the illumination on the phototube is decreased. With switch 1 in the "Light" position the grid glow tube will break down if the illumination on the phototube is increased. With terminals 5-6 open-circuited the grid glow tube cannot break down regardless of the amount of illumination on the phototube.

(3) The position of the plug connected to A determines whether "impulse" or "static" control is used. When "impulse" control is used the equipment responds only to a sudden transient coange in illumination, and does not respond to a gradual change in light intensity, caused for example by lamp voltage variations. When "static" control is used the operation is controlled by a definite value of illumination on the phototube.

II - OPERATION - Continued

(4) Depending upon the position of switch 2 either a-c, or d-c. voltage is applied to the grid glow tube. When a-c. is used the tube will carry current only so long as the grid voltage of the grid glow tube is more positive than required for breakdown of the tube. When d-c. is used the grid glow tube will continue to carry current regardless of the grid voltage until the switch between 3 and 4 in the anode circuit is opened, thus de-energizing the tube and relay.

III - GENERAL APPLICATION

(5) Mounting:

The RR-5 register regulator should be mounted in a vertical position, preferably in a location with no excessive mechanical vibrations. The phototube housing, the light source or the scanner may be mounted in any position, although the lamp base should not be higher than the lamp filament in order to prevent excessive heating of the lamp base.

(6) Temperature Limits:

The RR-5 register regulator will operate satisfactorily with ambient air temperatures between 50 degrees F. and 110 degrees F. when a KU-627 grid glow tube is used. When a KU-636 grid glow tube is used the ambient air temperature limits are 0 degrees F. to 150 degrees F. The phototube may be operated at ambient in temperatures between 0 degrees F. and 150 degrees F.

(7) A-C. Supply Voltage

The maximum variations in a-c. supply voltage should not exceed ± 10 per cent from rated voltage as given on the name plate. To obtain the best operating results the a-c. supply voltage should be kept as close to normal as possible. If the a-c. supply voltage is varying due to line drop it is recommended to run a separate line from the supply source to the register regulator in order to improve the voltage regulation.

(8) A-C. Supply Volt-Amperes:

The volt-ampere burden of the RR-5 register regulator is approximately 75 Va. when no solenoid is applied. When a solenoid is used the solenoid load must be added to give the total volt-ampere burden.

III - GENERAL APPLICATION - Continued

(9) Relay Contact Capacity:

The current interrupting capacity is as follows:

| | Interrupting Capacity in Amperes | | | | |
|---|---|---|---|---|---|
| Contacts | 110 V. A-C. | 220 V. A-C. | 440 V. A-C. | 125 V. D-C. | 250 V. D-C. |
| One "Make" | 20 | 12 | 7 | 2 | 0.7 |
| One "Break" | 10 | 6 | 3.5 | 1 | 0.4 |
| * Two "Make" in series | 30 | 20 | 10 | 3 | 1.0 |

* Reverse left hand stationary contact.

The continuous current carrying capacity of the relay contact is:

"Make" contacts : 12 amperes
"Break" contacts: 6 amperes

(10) Operations per Minute of Relay:

Maximum : 300
Recommended: 150

(11) Load Circuit Characteristic:

(A) A-C. Operation:

The voltage across terminals 1-3 with switch 2 connected for a-c. operation is half wave rectifier voltage having a crest value of 330 volts. The solenoid or external load must have sufficient reactance to limit the average current between 3 and 4 of Fig. 3 to 0.4 ampere if a KU-627 tube is used or 0.1 ampere if a KU-636 tube is used. These average currents should be read by a d-c. ampere meter. From Fig. 3 it may be seen that a Rectox rectifier is connected between 1 and 3. This Rectox will tend to smooth out the a-c. ripple caused by the rectified a-c. voltage in the load circuit if the reactance of the load is sufficiently high and the load current is low. As the load current is increased above 0.1 ampere the filtering effect of Rectox 1-3 rapidly decreases.

(B) D-C. Operation:

The load characteristic for d-c. operation is shown in Fig. I of Fig. 2. From these curves may be seen that the average d-c. voltage decreases with increasing load current. The load current as measured by a d-c. ampere meter must not exceed 0.3 ampere if a KU-627 tube is used or 0.1 ampere if a KU-636 tube is used.

III - GENERAL APPLICATION - Continued

(12) Grid Glow Tube:

It is recommended that a KU-627 grid glow tube be used except where the ambient air temperature exceeds the limits 50 degrees F. to 110 degrees F. In that case, use the KU-636 tube.

(13) Sensitivity:

(A) Static Operation:

The sensitivity of the type RR-5 register regulator when used with static control is 0.007 Lumen. This means that the equipment will operate satisfactorily if the quantity of light on the phototube is changed between zero and 0.007 Lumen. The definition of Lumen is:

$$L = FC \times A$$

where FC = illumination in foot candles
A = area in square feet of illuminated surface.

The area of the light sensitive cathode of the phototube is approximately 1 square inch and the amount of foot candles to operate the equipment or the sensitivity expressed in foot candles is therefore

$$\frac{FC}{\quad} = \frac{0.007}{\frac{1}{144}} \equiv \frac{1}{\quad} \text{ foot candle}$$

If an aperture $A_1$ square inches is used in front of the phototube the amount of foot candles will be

$$FC_1 = \frac{1}{A_1}$$

It should be noted that $A_1$ must be less than the area of the phototube cathode. The sensitivity values as given above are based on the assumption that the illumination on the phototube is changed between zero and 1 foot candle. If the illumination is changed from for example 10 to 11 foot candles at normal a-c. supply voltage, the illumination limits will decrease if the a-c. supply voltage is decreased. For this reason it becomes necessary to consider the minimum and maximum illumination at minimum and maximum a-c. supply voltage, and to make sure that the minimum illumination at maximum a-c. supply voltage is at least 1 foot candle lower than the maximum illumination at minimum a-c. supply voltage.

III - GENERAL APPLICATION - Continued

(B) Impulse Operation:

When impulse operation is used the RR-5 register regulator will operate on a variation in light of 0.015 Lumen corresponding to 2-foot-candle illumination on the phototube. The time during which this change in illumination occurs must not exceed 0.1 second.

(14) Speed of Response:

When the grid glow tube is connected for a-c. operation the illumination on the phototube must remain changed during two cycles of a-c. supply voltage in order to operate the relay. When d-c. operation is used the relay or solenoid will operate, if the illumination on the phototube remains changed during a time interval of 0.0002 seconds, provided the length of phototube leads does not exceed 6 feet. If longer leads are used the response will be slower due to the time lag caused by the capacity between the leads.

(15) Phototube Housing:

The SK-60 phototube should be mounted in a phototube housing, for example as shown in Fig. 1 (Price List 18-315). This phototube housing is of the general purpose type and does not have any aperture in front of the phototube. The phototube housing shown in Fig. 3 (Price List 18-315) is equipped with a 1/2" x 1/16" aperture and is particularly suited for register control applications as outlined in paragraph 18. The phototube should be connected to the RR-5 control panel by means of cable PDS-7129. For high speed response (0.01 second or faster) the length of the phototube leads must not exceed 6 feet. For other applications the phototube leads should not be longer than 25 feet. The phototube leads should be enclosed in a grounded metallic conduit, and there must be no other leads in this conduit.

(16) Light Sources:

A variety of light sources with different foot-candle characteristics are shown in Price List 18-316. By using the data given in paragraph 13 the maximum operating distances for static control with various light sources are found to be as follows:

| | MAXIMUM OPERATING DISTANCES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Light Source | Style 829396 829397 Type D | Style 849186 849187 Type E | Style 831706 Type F | Style 831704 Type G | Style 854118 Type H | Style 822109 Type K | 40 Watt Lamp | 60 Watt Lamp | 100 Watt Lamp |
| Distance from light source to phototube. | 25' | 80' | 25' | 25' | 40' | 25' | 6.3' | 7.8' | 10' |

(16) Light Sources - Continued

The type J light source gives an illumination of approximately 15,000 foot candles at a distance 3/8 inch from the lower end of the snout of the housing. The diameter of the beam of light is approximately 3/8 inch.

(17) Scanners for Reflected Light:

Two scanners for reflected light are shown in Fig. 7 and Fig. 8 of Price List 18-315. The scanner in Fig. 8 which should preferably be used has a broad light beam approximately 3/16 in. x 5/16 in. The scanner in Fig. 7 has a concentrated beam approximately 3/32 in. x 1/4 in.

IV - REGISTER REGULATOR APPLICATIONS

(18) General:

When the RR-5 register regulator is used to control the register of paper or some other material, a spot should be printed on the material and should be used as the register mark. When the material is transparent, as for example cellophane or glassine paper, a dark spot should be printed on it and the type J light source and type D phototube housing should be arranged on opposite sides of the material so that the spot intercepts the beam of light projected on the phototube. When the material is non-transparent a spot with a color contrasting the color of the paper should be printed on the material and a type E or type F scanner for reflected light should be used.

(19) Color of Printed Spot:

The spot should preferably have a color which differs photoelectrically as much as possible from the color of the paper. If the color of the paper is white or light yellow the spot color should be black or dark blue. Red colors or colors with red components give approximately the same phototube response as white, light yellow or light blue. Red color should therefore not be used as a "dark" register mark. If the color of the paper is black, dark blue or brown, a yellow, white or red spot may be used. The color combinations which may be used in register control applications depend upon the maximum speed of the paper, the length of the phototube leads, and maximum variation in line voltage. Even though two colors may look similar to the human eye, they may give different response when viewed with a phototube. For this reason it is not practicable to give definite operating limits for various color combinations. It is therefore recommended that, before using color combinations which are not sufficiently contrasting, the color response be measured by scanning the two colors with the phototube and observing

(19) Color of Printed Spot - Continued

the deflection on the milliampere meter of the RR-5 register regulator when the equipment is connected for "static" control. If the difference in milliampere meter deflection for the two colors exceeds 0.3 milliampere, the colors may be used for register control applications.

(20) Size of Printed Spot:

The size of the printed spot should be 1/16" wide or more in the direction of travel of the paper. The length of the spot should be 1/2 inch plus the maximum sideways movement of the paper during normal operation.

(21) Impulse or Static Control:

Either "impulse" or "static" control may be used for register control applications. Because the calibration of the equipment is not affected by a-c. line voltage variations or by variations in paper color if impulse control is used, the "impulse" method of control is recommended.

(22) Maximum Paper Speed:

The maximum permissable paper speed depends upon (1) the difference between paper color and spot color, (2) the length of the phototube leads, and, (3) if "static" control is used the variations in a-c. supply voltage. If a black spot on white paper is used a maximum paper speed of 1500 feet per minute may be used, provided the length of the phototube leads does not exceed 6 feet. If the lead length is increased the maximum paper speed will decrease. If the "static" indication by the milliampere meter (between paper color and spot color) is 0.5 milliamperes, and the length of the phototube leads does not exceed 6 feet, a maximum paper speed of 600 feet per minute may by used.

(23) Selector or Limit Switches:

As shown in Fig. 2, selector or limit switches are used for the purpose of closing the grid glow tube, grid control circuit 5-6 or to interrupt the anode circuit 3-4. These switches may be in the form of cam-operated contacts designed to suit any particular application or may be commutator type switches as indicated in Fig. 2. In either case it is important that the switch be designed so that the insulating resistance between switch segments, or between segments and ground is at least 10-million ohms. A commutator type switch, designed for this application, is shown in Fig. 4

V - INSTALLATION

(24) Before installing the RR-5 register regulator read paragraphs 5 to 23 of this instruction book, then install equipment as shown in Fig. 2.

## VI - ADJUSTMENTS

(25) (a) Insert RJ-571 amplifier tube and grid glow tube in their sockets and connect clips to top of tubes.

(b) Turn on a-c. power and allow unit to warm up for five minutes.

(c) "Static" Control:

If upper right hand switch is in "DARK" position, and the illumination on the phototube is maximum, turn potentiometer to zero position. Turn potentiometer slowly clockwise until tube breaks down. Observe reading of milliampere meter at tube breakdown. Turn potentiometer counter-clockwise until milliampere meter reading is decreased 0.2 milliampere.

The grid glow tube should now be de-energized. Decrease the illumination on the phototube. This should energize the grid glow tube.

If upper right hand switch is in "LIGHT" position and the illumination on the phototube is minimum, turn potentiometer all in clockwise. Turn potentiometer slowly counter-clockwise until tube breaks down. Observe reading of milliampere meter at tube breakdown. Turn potentiometer clockwise until the milliampere meter reading is increased 0.2 milliampere.

The grid glow tube should now be de-energized. Increase the illumination on the phototube. This should energize the grid glow tube.

(d) The potentiometer adjustments outlined in preceding paragraphs are suitable if maximum sensitivity is needed. If the variation in light intensity is considerable it may be preferable to adjust the potentiometer as follows:

With minimum illumination on the phototube adjust the potentioneter until the grid glow tube breaks down, and observe the potentiometer position. Repeat the test with maximum illumination on the phototube. Make final potentiometer position adjustment midway between the two observed potentiometer positions.

(e) "Impulse" Control:

When "impulse" control is used the adjustment should be made as follows:

(e) "Impulse" Control - Continued

If upper right hand switch is in "Dark" position turn potentiometer clockwise from zero until grid glow tube breaks down and observe the milliampere meter reading at breakdown. Turn the potentiometer counter-clockwise while the milliampere meter current is reduced 0.2 milliampere.

If upper right hand switch is in "LIGHT" position turn potentiometer from 100 until grid glow tube breaks down. Observe reading of milliampere meter at breakdown. Turn potentiometer clockwise until milliampere meter reading is increased 0.2 milliampere.

(f) IMPORTANT

KEEP MILLIAMPERE METER SHUNT SWITCH CLOSED EXCEPT WHEN TESTING EQUIPMENT.

## VII - TESTING

(26) RJ-571 Tube:

(a) Observe that the tube filament is glowing when the tube is energized. If the filament is not glowing replace the tube.

(b) With phototube dark, or preferably removed from its socket, adjust the potentiometer to give 0.4 milliampere RJ-571 current. The potentiometer should now be approximately at the 55 position. By moving the potentiometer 3 divisions, the milliampere meter reading should change from 0.4 to at least 0.3. If this does not obtain replace the RJ-571 tube.

(27) Grid Glow Tube:

The grid glow tube should be replaced with a new tube if with switch 1 in the "DARK" position and terminals 5-6 closed it is necessary to change the RJ-571 current more then 0.1 milliampere in order to cause the grid glow tube to break down, and prevent it from breaking down.

(28) If any faulty or erratic operation is observed, first make sure that terminal 7 is properly grounded. Disconnect external leads to terminals 1 to 6 and a-c. and measure the resistance between each external lead and ground. This resistance must be 5-million ohms or higher.

## VIII- RENEWAL PARTS

| Name | Style |
|---|---|
| RJ-571 Amplifier Tube | RJ-571 |
| KU-627 or KU-636 Grid Glow Tube | KU-627 or KU-636 |
| SK-60 Phototube | SK-60 |
| Milliampere Meter | 818504 |
| Potentiometer 20,000 ohms | 1038329 |
| Toggle Switch 2 P. D.T. | 966576 |
| Toggle Switch S.P. S.T. | 1014539 |
| Socket 4-prong | 793202 |
| Socket 5-prong | 831726 |
| Capacitor | 948995 |
| Rectox, small | 971301 |
| Rectox, large | 966512 |
| Transformer, 115/230 V., 60 cycle | 966552 |
| Transformer, 220/440 V., 60 cycle | 966553 |
| Resistor, 13000 ohms | 943670 |
| Reactor | 850583 |
| Resistor, 5 megohms | 829465 |
| Resistor, 1 megohm | 860871 |
| Resistor, 0.25 megohm | 861041 |
| Resistor, 0.1 megohm | 860000 |
| Resistor, 10,000 ohms | 799952 |
| Resistor, 500 ohms | 943634 |
| Capacitor 0.01 MF | 1014540 |
| Grid clip for KU tube | 829334 |
| Grid clip for RJ-571 tube | 799907 |
| Relay with coil for 60 cycle | 1009784 |

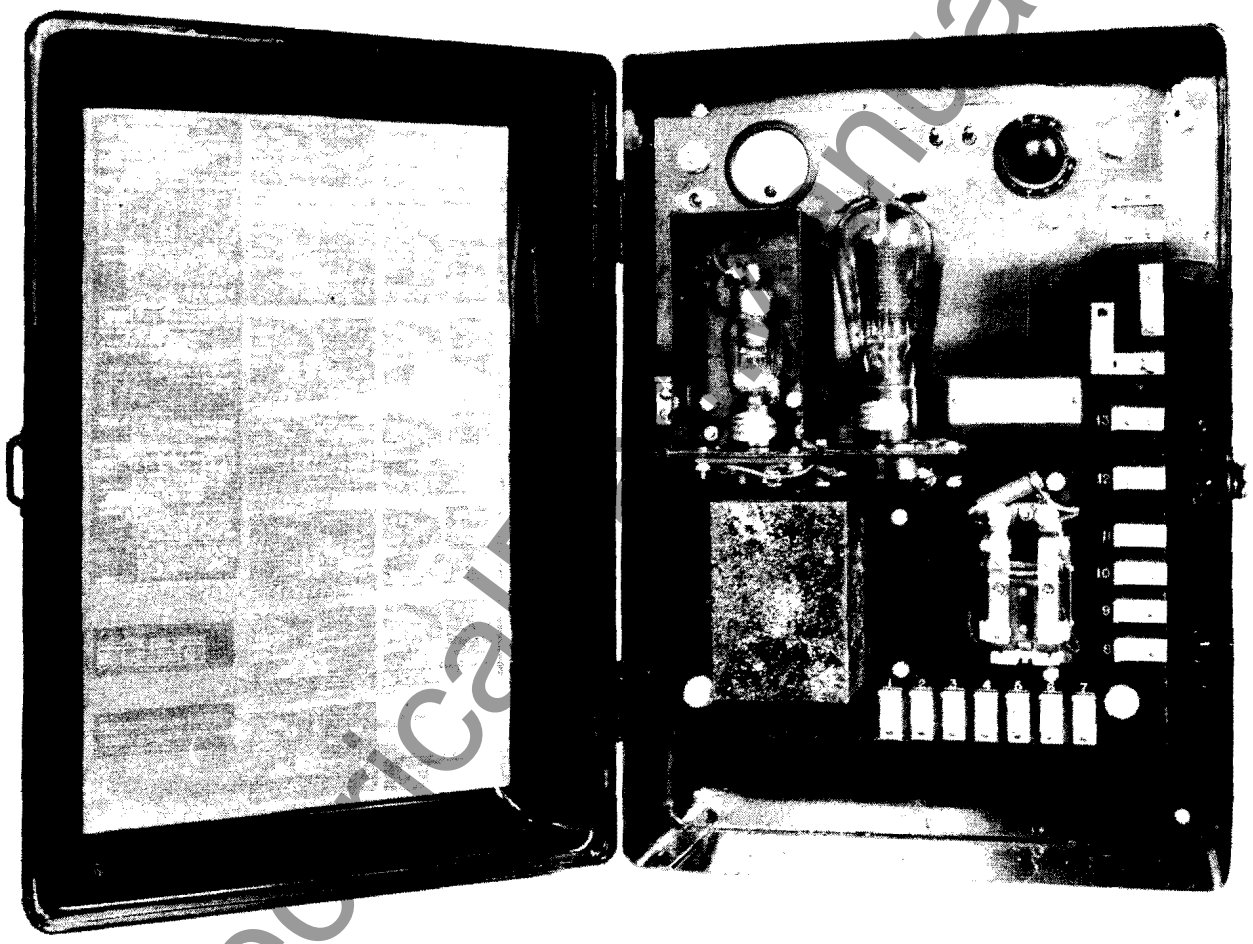


Fig. 1 - Type RR-5 Register Regulator
Photo 232257

INSTRUCTIONS FOR INSTALLATION
(For More Complete Information - See I.B. 5761)

**MOUNTING:** RR-5, Register Regulator vertical
Phototube Housing, any position.
Light Source, any position except that lamp base must not be higher than lamp filament.

**TEMPERATURE:** RR-5: (With KU-627 tube, maximum 110°F. Minimum 50°F.
(With KU-636 tube, maximum 150°F. Minimum 0°F.

Phototube: Maximum 160°F. Minimum 0°F.

**A.C. VOLTAGE VARIATIONS:** ± 10% of rated voltage, maximum, (See I.B. 5761)

**CONNECTIONS:** Use either of connections A to M.
Connect Links as shown in Fig. N.
Connect Lamp as shown in fig. O.
Operate "DARK" - "LIGHT" switch per fig. P.

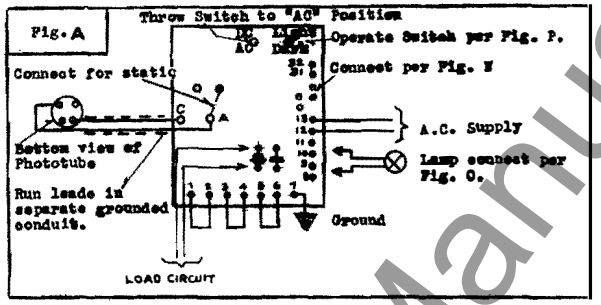
| External Connection | Relay | Solenoid | A-C | D-C | Impulse | Static | Grid Selector | Anode Selector |
|---|---|---|---|---|---|---|---|---|
| A | X | | X | | | X | | |
| B | X | | | X | X | X | | F.B. |
| C | X | | X | | | X | X | |
| D | X | | | X | X | X | | X |
| E | X | | | X | X | X | X | F.B. |
| | | | | | | | | X |

| Style | Rated Volts | Rated Amperes | Connect to Terminals |
|---|---|---|---|
| 842108 | 6-8 | 3.3 | 9-11 |
| 849088 | 6 | 5 | 9-10 |
| 856455 | 10 | 7.5 | 8-11 |
| 10-4463 | 8.5 | 4 | 8-10 |

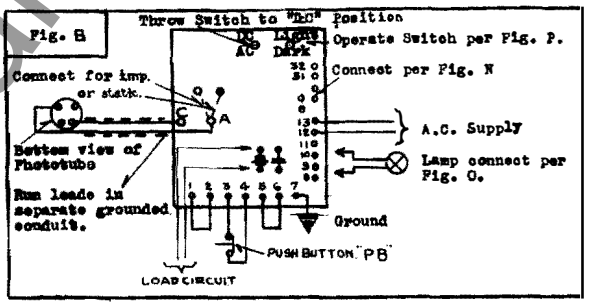
Fig. P.
Throw switch to "dark" position when relay or solenoid should be energized when the illumination on the phototube is decreased.

Throw switch to "light" position when relay or solenoid should be energized when the illumination on the phototube is increased.

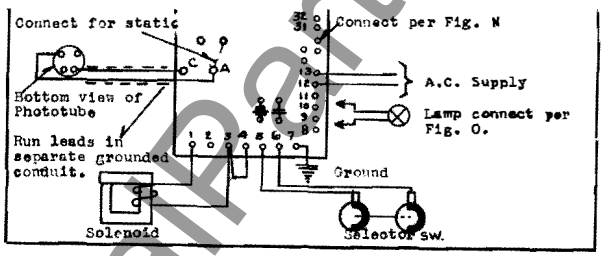
Fig. 2 - External Connections
For Type RR-5 Register Regulator
Dwg. 13-J-925



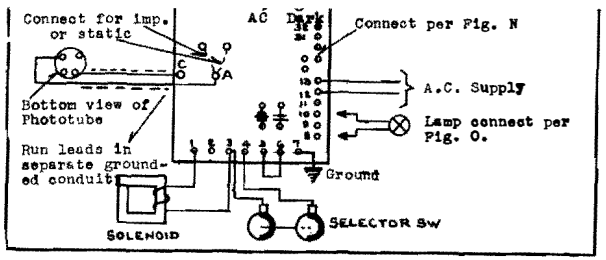

The relay will be energized when the illumination on the phototube is decreased for "dark" connection or increased for "light" connection. The relay will again be de-energized when the illumination returns to the original value.



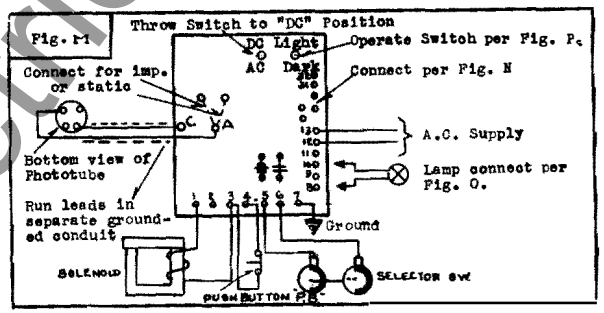

The relay will be energized if the illumination on the phototube is varied. The relay will then remain energized until reset by pushbutton PB.



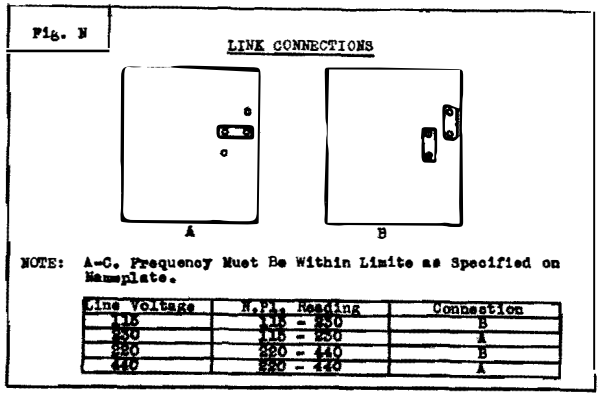

The solenoid will be energized if the illumination is varied provided the selector switch is closed. The solenoid is de-energized if the illumination returns to the original value or if the selector switch is opened.




The solenoid will be energized if the illumination on the phototube is momentarily changed provided the selector switch is closed. The solenoid remains energized until the selector switch is opened, regardless of further changes in phototube illumination.




The solenoid will be energized if the illumination on the phototube is momentarily changed provided the selector switch circuit is closed. The solenoid will remain energized, regardless of illumination and selector switch position until push button PB is opened.




NOTE: A-C. Frequency Must Be Within Limits as Specified on Nameplate.

| Line Voltage | M.P.L. Reading | Connection |
|---|---|---|
| 115 | 115 - 230 | B |
| 230 | 115 - 230 | A |
| 220 | 220 - 440 | B |
| 440 | 220 - 440 | A |

IMP - Sudden change
STATIC - Show moving spot.

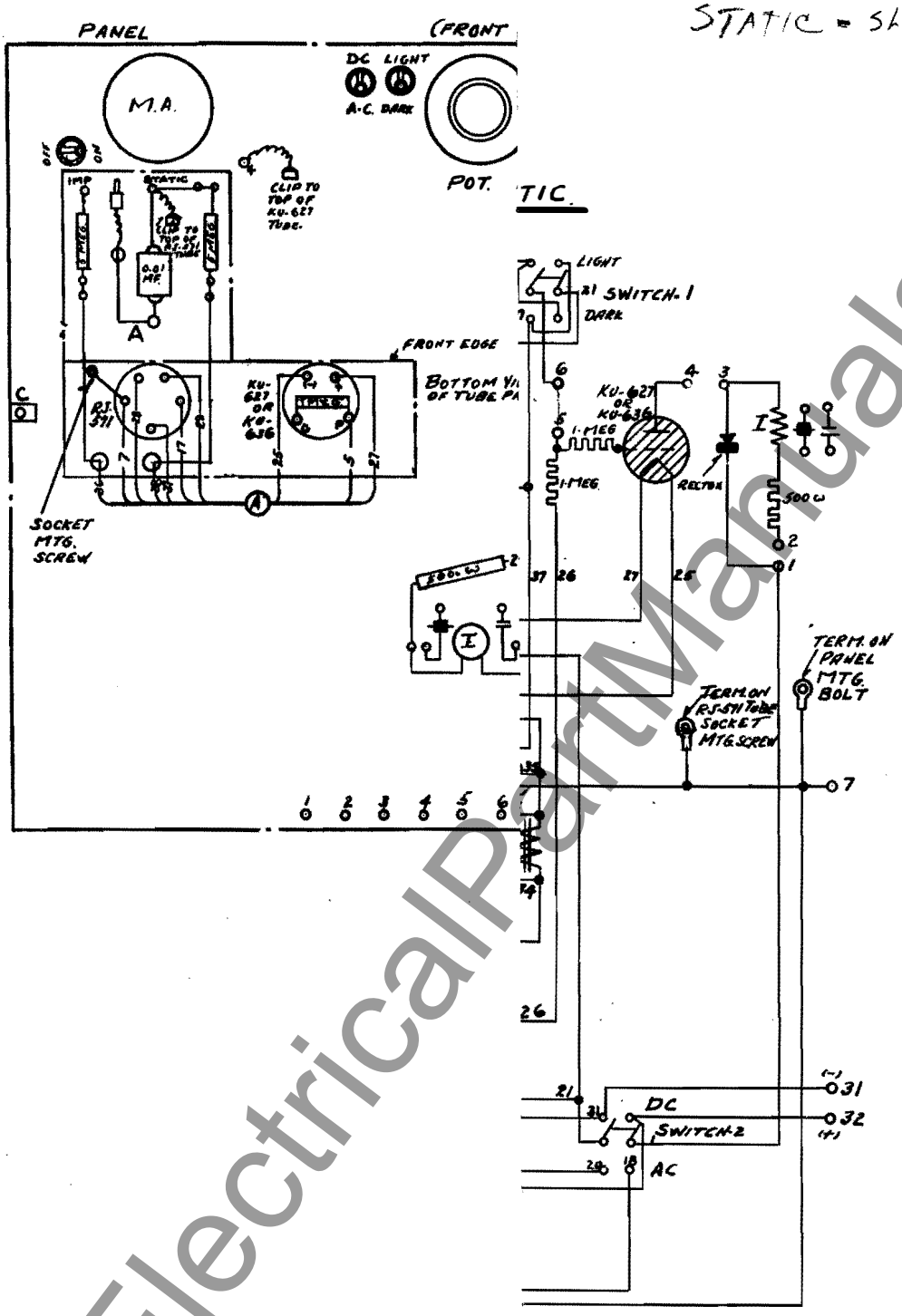



Fig. 3 - Schematic Diagram of Connec
Dwg. 70-B-724-2

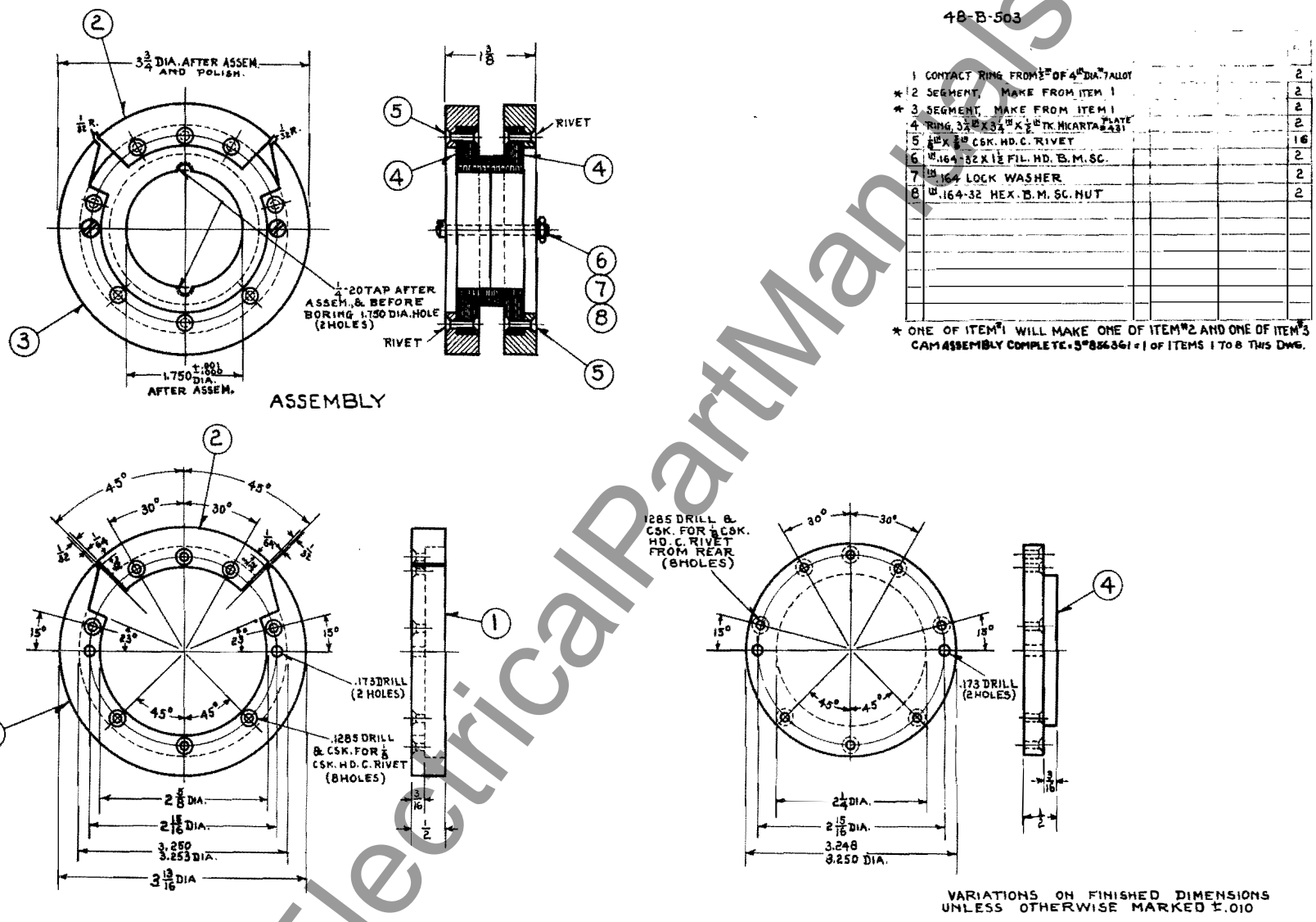



Fig. 4 - Selector Switch for Type RR-5 Register Regulator
Dwg. 48-B-503

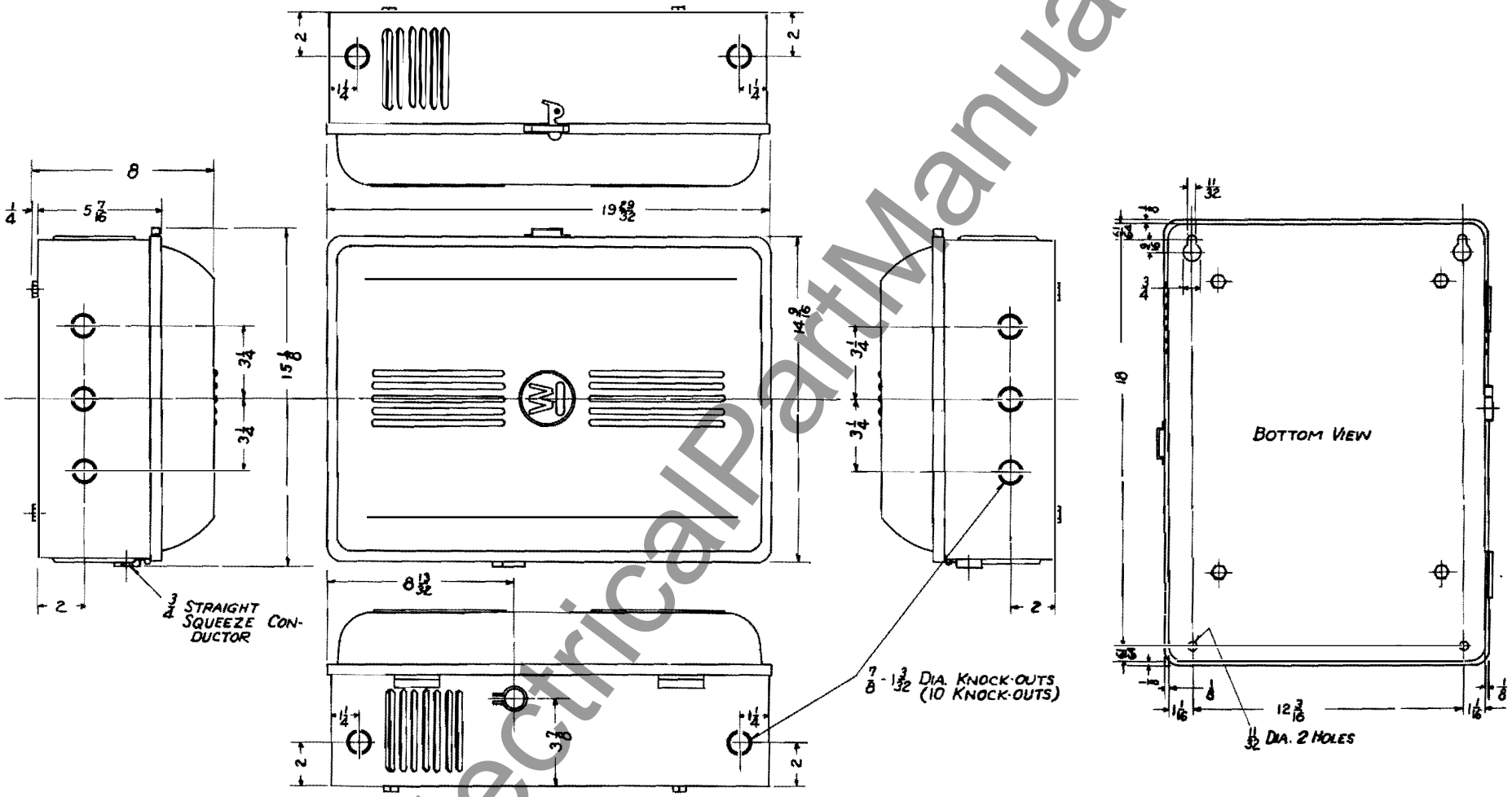



Fig. 5 - Type RR-5 Register Regulator - Outline Dimensions
Dwg. 39-C-545-3

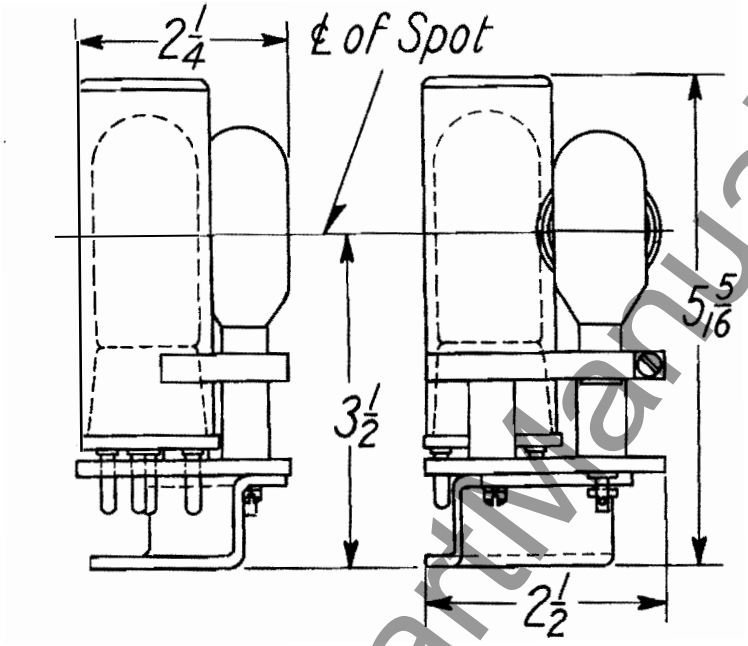



Fig. 6 - Type E Reflected Light Scanner
Dwg. T-67239

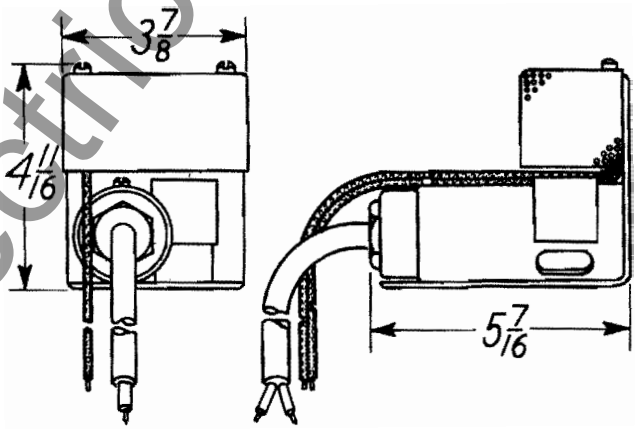



Fig. 7 - Type F Reflected Light Scanner
Dwg. T-67237

# PHOTOTUBE HOUSINGS AND SCANNERS

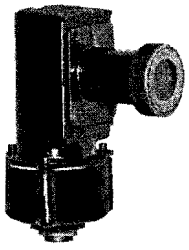


FIG. 1—TYPES A AND B GENERAL PURPOSE PHOTOTUBE HOUSINGS.

FIG. 2—TYPE C PHOTOTUBE HOUSING.

FIG. 3—TYPE D PHOTOTUBE HOUSING.

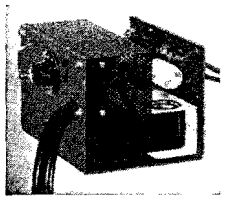


FIG. 4—TYPE H COMPENSATED SCANNER FOR REFLECTED LIGHT.

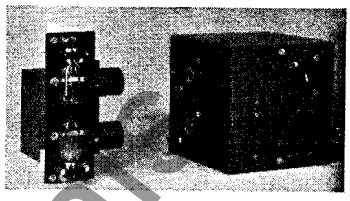


FIG. 5—TYPE G COMPENSATED SCANNER FOR TRANSMITTED LIGHT.

COMPLETE COMPENSATION FOR VARIATIONS IN BACKGROUND COLOR OR GLOSSINESS AND FOR LINE VOLTAGE IS OBTAINED BY UNIQUE CIRCUIT.

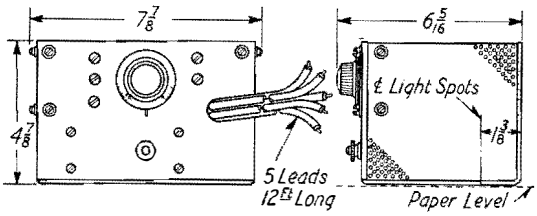



FIG. 6—TYPE H REFLECTED LIGHT SCANNER.

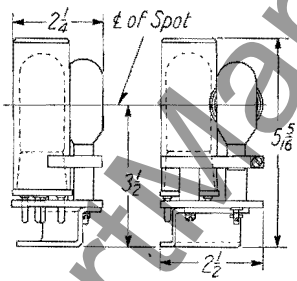



FIG. 7—TYPE F REFLECTED LIGHT SCANNER.

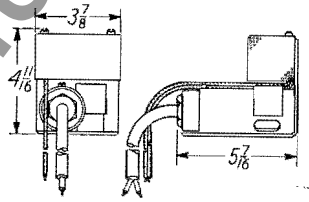



FIG. 8—TYPE F REFLECTED LIGHT SCANNER.

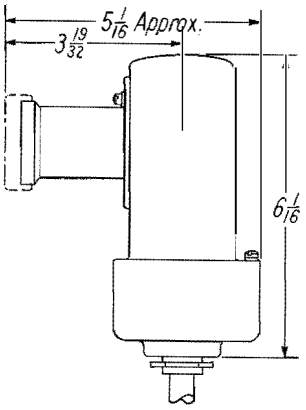



FIG. 9—TYPES A AND B PHOTOTUBE HOUSINGS
The Type D Housing is similar except that the light admittance cylinder is replaced by a plate having a plain aperture. The horizontal dimensions are reduced approximately 2 1/16 inches. The general overall dimensions of the type C Housing are: Height O.A. 8½"; Width O.A. 2"; Depth O.A. 3¾".

**TABLE 1—PHOTOTUBE HOUSINGS**

| Type | Description | Style Without Tubes ① | Approx. Ship. Wt. | Price Incl. Tubes ① |
|---|---|---|---|---|
| A ② | General Purpose, with 10 Ft. leads | ②831 710 | 5 | $19.00 |
| B ② | Splash-Proof, with 10 Ft. leads | ②831 708 | 5 | 21.00 |
| C ② | Used Where Space is Limited, no leads | 854 117 | 4 | 23.00 |
| D | For Close-Up Work, 10 ft. leads | ②849 083 | 4 | 23.00 |

① Phototube 18-030, Type SR-50 or SK-60 Must be Ordered as Separate Items. Omission Price $7.00. W-2
② Stocked
③ When leads longer than 10 ft. are desired and may be used with the Photo-Troller, add a separate item specifying desired length of leads PDS-5344. This does not apply to Table 2. Cable $0.15 per foot W-2 for length over 10 feet.

**TABLE 2—SCANNERS**

| Type | Description | Style Without Tubes ① | Price Incl. Tubes ① | Tubes Required: No. | Class | Type | Description | Ship. Wt. |
|---|---|---|---|---|---|---|---|---|
| E | Reflected Light Narrow Beam 12 ft. leads | 856 471 | $40.00 | 1<br>1 | 18–030<br>18–050 | ③<br>856 455 | Phototube<br>Lamp | 4 |
| F | Reflected Light Broad Beam 12 ft. leads | 850 679 | 40.00 | 1<br>1 | 18–030<br>18–050 | ③<br>856 455 | Phototube<br>Lamp | 4 |
| G | Transmitted Light Compensated 12 ft. leads | ④856 424 | 93.00 | 1<br>2<br>2 | 18–010<br>18–030<br>18–050 | RJ-550<br>SR-50<br>856 455 | Amplifier<br>Phototube<br>Lamp | 7 |
| H | Reflected Light Compensated 12 ft. leads | ④850 640 | 93.00 | 1<br>2<br>2 | 18–010<br>18–030<br>18–050 | RJ-550<br>SR-50<br>856 455 | Amplifier<br>Phototube<br>Lamp | 7 |

① When ordering, enter a separate item for tubes as listed, since they are not included in Scanner Style. For omission prices on tubes see Price List 18-060.
③ Either SR-50 or SK-60 tubes may be used depending upon application.
④ Stocked.
General changes since previous issue.

## ORDERING INSTRUCTIONS

**Phototube Housings** consist of housing complete with an 18-030 Phototube. Style Numbers do not include Phototube, and a separate item for SR-50 or SK-60 must be entered on order. Prices include Phototube.

**Scanners** consist of light-source, lens system, phototube mounting and tubes as listed in Table 2. Tubes and lamps must be entered as separate items according to Table 2, since they are not included in scanner style number.

**When Ordering**—Specify: (1) Class 18-315, (2) Type, (3) Style, and (4) Application.

PHOTOTUBE HOUSINGS AND SCANNERS—Continued

# PHOTOTUBE HOUSINGS

## APPLICATION

18-315 Phototube Housings are general purpose industrial devices for use with 18-316 light sources, and are for the purpose of supplying a socket and housing for phototubes when mounted separately from the photo-electric controller or Photo-Troller, on an extended lead, or on the controller cabinet.

## INDIVIDUAL CHARACTERISTICS

**Type A**—is a cast aluminum housing for general purpose applications. When mounted directly on the Photo-Trollers, it assumes the form of a turret and can be readily turned on its mounting to face any direction required, thereby making it possible to mount the Photo-Troller in any convenient position without regard to the direction faced by the phototube. When the phototube is to be mounted separately from the Photo-Troller cabinet, and not more than 10 feet away, the housing with the 10-foot leads should be ordered.

**Type B**—is identical with the type A with 10 foot leads except that it is arranged for mounting in applications where it must be splash-proof.

**Type C**—consists of a sheet metal housing developed for indoor applications where space limitations require a housing which is not in excess of two inches in width.

**Type D**—comprises a cast aluminum housing similar to that used with type A except that the light admittance cylinder through which the light enters is replaced simply by a flat plate in which a window is mounted so that the phototube may be placed closer to the material viewed. The glass window prevents any collection of dust or dirt in the housing and may be used for a surface over which such materials as paper, cellophane or cloth may pass in cutting applications.

## INSTALLATION

Phototube Housings may be located in any convenient position and location where mechanical vibration is not so great as to mechanically cause damage and **must** be rigidly mounted to insure constant alignment with the light beam. While the housings may be mounted up to the maximum distances from the cabinets indicated in the Photo-Troller Price Lists, they should be mounted as near as possible to reduce the length of lead which must be composed of the cable recommended and run without other wires in grounded conduit. It is absolutely necessary that leads as specified be used with this equipment.

These Phototube Housings must not be operated in an ambient temperature above 160°F. If they are subject to radiant heat as from hot metals, special cooling or heat filters may be requested.

# SCANNERS

## APPLICATION

18-315 Scanners are a combination of light source, lens assembly, and phototube mounting for applications requiring scanning or viewing moving material for controlling its motion. These equipments are especially designed for controlling the cutting of paper, cellophane, and similar material in accordance with advertising matter or other printed designs.

## INDIVIDUAL CHARACTERISTICS

**Type G**—is equipped with two phototubes, two lamps, and one amplifier tube so connected that the difference in response of the two phototubes feeds into the single amplifier tube enabling the equipment to automatically compensate for differences in glossiness or polish of the paper or material being scanned and at the same time providing great sensitivity. Furthermore, compensation is provided for changes in tube characteristics, variations in line voltage, and other factors which ordinarily seriously affect the operation of such equipment unless balanced out. The practice of mounting the amplifier tube in the scanner also increases the sensitivity and stability of the equipment. The leads to the scanner should be installed in separate grounded conduits. The cable supplied with the scanner must be used in order to reduce the capacity between leads and to make sure that the resistance to ground is high.

**Type H**—This equipment is identical in operation to Type E, but is to be used when the light is transmitted through the paper rather than reflected from it.

**Type E**—comprises a single lamp, lens system and phototube mounting and is to be used for reflected light applications where a simpler equipment than the compensated type is required.

**Type F**—also consists of a single lamp, lens system and phototube and is for reflected light applications where a slightly larger beam or spot of light is required.

## INSTALLATION

Scanners should be mounted rigidly in a location as free from vibration as possible and near the Photo-Troller to reduce the length of leads. These scanners must not be used in an ambient temperature above 125°F.

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# LIGHT SOURCES

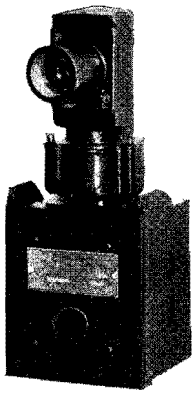


FIG. 1—TYPE D, LIGHT SOURCE

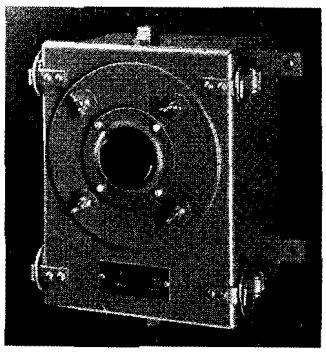
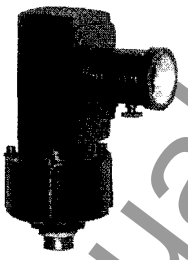


FIG. 2—TYPE E, LONG-RANGE LIGHT SOURCE.



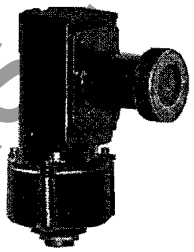


FIG. 3—TYPE F, GENERAL PURPOSE LIGHT SOURCE

FIG. 4—TYPE G, SPLASH-PROOF LIGHT SOURCE

FIG. 5—TYPE H, COMPACT LIGHT SOURCE

## ORDERING INSTRUCTIONS

### When Ordering

Specify: (1) 18-316, (2) type, (3) description, (4) style number, (5) volts, (6) cycles, and (7) give application.

**Note**—For special applications where listed light sources will not fill requirements, refer to Works, giving complete details including illumination requirements in foot candles, distance from light source to phototube, atmospheric conditions and application.

**Lamps**—Types D, F and G light sources are supplied with 6-8 volt, 32 candle-power lamp. Spare lamps should be ordered as 18-050, Style 842108 at **$.30 W-31.**

Types E, H, J and K light sources are supplied with a 6 volt, 5 ampere lamp especially designed for light source service. Spare lamps should be ordered as 18-050, Style 849085 at **$1.65 W-31.**

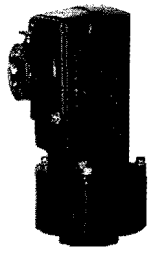


FIG. 6—TYPE J, CONCENTRATED BEAM LIGHT SOURCE

**TABLE 1**

| Type | Description | Style No. Incl. Lamp | Power Supply | | | Min. Dist. From Lens At Which Beam Converges To a Point | Approx. Dia. of Beam | | Shipping Weight Lbs. | Price Incl. Lamp |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Volts | Cycles | Watts | | At Converging Point | At 10 Feet | | |
| D | General Purpose, with Transformer. Indoor only. | ①829 396 | 115/230 | 25–60 | 21 | 3″ | ¼″ | 10″ | 11 | $24.00 |
| D | | ①829 397 | 220/440 | 25–60 | 21 | 3″ | ¼″ | 10″ | 11 | 24.00 |
| E | High Intensity, with Transformer. Indoor and Outdoor. | ①849 186 | 115/230 | 25–60 | 35 | Infinity | ... | 5″ | 18 | 27.00 |
| E | | ①849 187 | 220/440 | 25–60 | 35 | Infinity | ... | 5″ | 18 | 27.00 |
| F | General Purpose. Indoor only. | ① 831 706 | ②5.5 | ②a-c. or d-c. | 18 | 3″ | ¼″ | 10″ | 4 | 15.00 |
| G | Splash-Proof. Indoor only. | 831 704 | ②5.5 | ②a-c. or d-c. | 18 | 3″ | ¼″ | 10″ | 4 | 16.50 |
| H | 2″ Wide. Indoor only | 854 118 | ③6 | ③a-c. or d-c. | 30 | Infinity | ... | 6″ | 4 | 19.00 |
| J | Concentrated Beam. Indoor only. | ①849 084 | ③6 | ③a-c. or d-c. | 30 | 1″ | $\frac{3}{16}$″ | ... | 4 | 19.00 |
| K | General Purpose. Indoor only. | 882 109 | ③6 | ③a-c. or d-c. | 30 | 3″ | ⅛″ | 10″ | 4 | 18.00 |

① Stocked.
② Connect to any Class 18-310 Photo-Troller except Types LR & LT.
③ Connect to any Class 18-311 Photo-Troller. May also be used with 18-310 RH, RK, and RL Photo-Trollers if ordered similar to Style except to have 6-8 volt, 32 Candlepower lamp, Style 842108 with $0.30 W-31 price omission.

**NOTE:** All light sources except Type J can be supplied with an Infra-red Filter to obtain an almost invisible light beam. Price addition $10.00 W-2 for Type E; $2.00 W-2 for other types.

General changes since previous issue.

## LIGHT SOURCES—Continued

### CHARACTERISTICS

**Type D**—consists of Type F Light Source mounted on cabinet which encloses transformer.

**Type E**—Extremely powerful beam for long range work.

**Type F**—Compactness and adaptability. May be mounted on Photo-Troller cabinet or on rigid or flexible conduit.

**Type G**—Similar to Type F except made splash-proof by use of suitable gaskets and glass window.

**Type H**—For use where mounting space is at a premium.

**Type J**—Produces a small, intense and highly concentrated spot of light for accurate close-up work.

### DISTINCTIVE FEATURES

Installation costs reduced by eliminating transformer on many types.

High efficiency obtained by convenient and positive focusing adjustments.

Adaptability to application assured by wide selection of types.

Installation simplified by standard conduit fittings or knock outs.

Lamps are easily replaced without disturbing the adjustment of focus.

### APPLICATION

18-316 Light sources are for the purpose of supplying a beam of light for actuating industrial type photo-electric controllers and light relays. They are especially adapted for Westinghouse 18-310 and 18-311 Photo-Trollers.

The proper light source for operating the photo-electric controller when located at a convenient distance from the phototube should be selected from Fig. 7. It is recommended that as great an excess of illumination as practicable be provided. The minimum illumination required for the operation of Westinghouse Photo-Trollers is listed in Price Lists 18-310 and 18-311.

When the light beam must pass through a dusty atmosphere or material that is light absorbing, such as water or glass, the illuminating values as shown in Fig. 7 should be decreased by a percentage which is a conservative estimate of the per cent absorption of the atmosphere or material.

When the light beam must be reflected from some surface before it reaches the phototube, the illumination values as shown in Fig. 7 must be multiplied by the reflection coefficient of the surface to obtain an estimate of the illumination that will be available at the phototube.

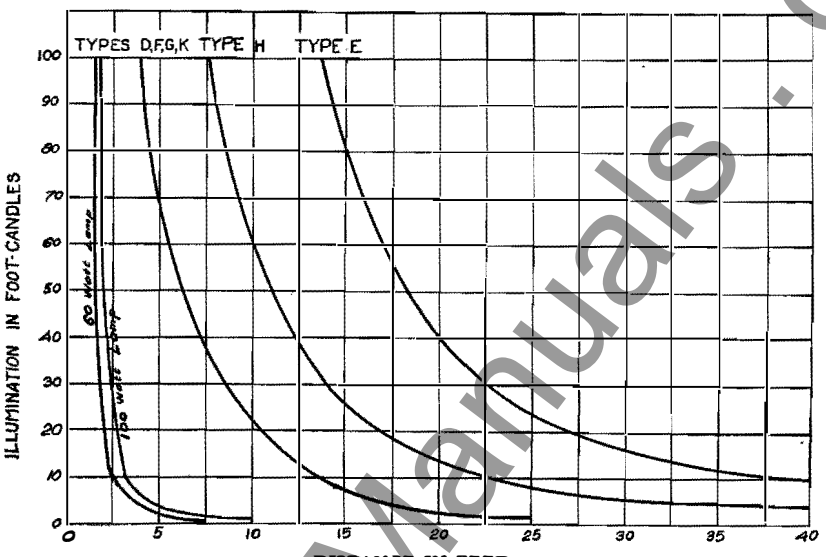



FIG. 7—ILLUMINATION INTENSITIES OF VARIOUS TYPES OF LIGHT SOURCES

When an infra-red filter is used for supplying an invisible beam of light, the illumination values shown in Fig. 7 will be reduced to approximately 1/10 of the values shown.

### INDIVIDUAL CHARACTERISTICS

All light sources except the Types D and E are designed to receive power from the Photo-Troller, or a separate transformer. These two types built for supplying their own power, have their own transformer, and may be used for Photo-Troller applications where it would not be practical to run leads from the Photo-Troller to the light source.

**Type D**—consisting of a cast aluminum lamp housing which may be mounted separately or on the sheet metal transformer box, is a general purpose indoor light source operated directly from an a-c. power supply rather than from transformer taps of the Photo-Troller. Provision is made for convenient focussing of the light beam.

**Type E**—is the most powerful light source and is particularly adapted to applications where the operating distance is necessarily large. Like the Type D, it also is operated directly from an a-c. power supply. As it has a 1/8 inch thick sheet metal cabinet adequately gasketed, it is suitable for indoor or outdoor application. A 3-inch diameter, 4 inch focal length lens is used for concentrating the light from the lamp.

**Type F**—is very compact consisting simply of a cast aluminum lamp housing. Unusual versatility of application is provided by its design which permits it to be mounted directly on the Photo-Troller cabinet or on 1/2 inch flexible or rigid conduit shaped to meet the individual application. A lens slide locked by a thumb screw provides convenient adjustment of the focus of the light beam.

**Type G**—is similar to Type F, but is splash-proof.

**Type H**—consists of a sheet metal lamp housing and was developed for indoor applications where space limitations require a light source which is not in excess of 2 inches in width.

**Type J**—comprises a cast aluminum housing and a special fixed focus lens system which gives a concentrated beam of high intensity for accurate close-up work where the distance between the phototube and light source does not exceed 2 inches.

**Type K**—is essentially the same in appearance and dimensions as the Type F, but has ventilating holes in the sides like the Type J to provide for the greater heat dissipation necessitated by the more powerful lamp. It is especially suited for general purpose use with the Class 18-311 Photo-Trollers.

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HOUSTON, TEXAS, 2313 Commerce Ave.
†HOUSTON, TEXAS, 2315 Commerce Ave.
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*KANSAS CITY, MO., 101 W. Eleventh St.
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†PORTLAND, OREGON, 2138 N. Interstate Ave.
PORTLAND, OREGON, 720 N. Thompson St.
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*RALEIGH, N. C., 803 North Person St.
§RALEIGH, N. C., P. O. Box 443.
§READING, PA., 619 Spruce St.
*RICHMOND, VA., Fifth & Byrd
*§ROANOKE, VA., 726 First St., S. E.
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*SACRAMENTO, CALIF., 1805 20th St.
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†SALT LAKE CITY, UTAH, 346 A Pierpont Ave.
§SALT LAKE CITY, UTAH, McCormick Bldg.
*SAN ANTONIO, TEXAS, 115 W. Travis St.
①§SAN FRANCISCO, CALIF., 1355 Market St.
°SAN FRANCISCO, CALIF., 1 Montgomery St.
*SEATTLE, WASH., 603 Stewart St.
†SEATTLE, WASH., 3451 East Marginal Way
xSHARON, PA., 469 Sharpsville Ave.
*SIOUX CITY, IOWA, 2311 George St.
*SOUTH BEND, IND., 216 East Wayne St.
§SOUTH BEND, IND., 107 E. Jefferson St.
xSOUTH PHILA. WKS., Essington, Pa.
°SOUTH PHILA. WKS., P. O. Box 7348, Philadelphia, Pa.
*SPOKANE, WASH., So. 158 Monroe St.
*SPRINGFIELD, ILL., 601 E. Adams St., Box 37
*†SPRINGFIELD, MASS., 395 Liberty St.
xSPRINGFIELD, MASS., 653 Page Boulevard
*ST. LOUIS, MO., 411 North Seventh St.
†ST. LOUIS, MO., 717 South Twelfth St.
*SYRACUSE, N. Y., 420 N. Geddes St.
*TACOMA, WASH., 1023 "A" St.
*TAMPA, FLA., 417 Ellamae Ave., Box 230
*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., P. O. Box 598.
*WICHITA, KAN., 233 So. 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.

**Where address and P. O. box are both given, send mail to P. O. box, telegrams to address indicated.**

# WESTINGHOUSE ELECTRIC SUPPLY COMPANY

**Fully equipped sales offices and warehouses are maintained at all addresses**

ALBANY, N. Y., 454 No. Pearl St.
ALLENTOWN, 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., 87 Chenango St.
BOSTON, MASS., 76 Pearl St.
BURLINGTON, VT., 208 Flynn Ave.
BUTTE, MONTANA, 50 East Broadway
CHARLOTTE, N. C., 210 East Sixth St.
CHICAGO, ILL., 113 North May St.
CLEVELAND, OHIO, 3950 Prospect Ave.
COLUMBIA, S. C., 915 Lady St.
DALLAS, TEXAS, 409 Browder St.
DES MOINES, IOWA, 218 W. Second St.
DETROIT, MICH., 547 Harper Ave.
DULUTH, MINN., 308 W. Michigan St.
EVANSVILLE, IND., 201 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.
INDIANAPOLIS, IND., 137 S. Pennsylvania St.
JACKSONVILLE, FLA., 37 South Hogan St.
LOS ANGELES, CALIF., 905 East Second St.
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.
NEWARK, N. J., 49 Liberty St.
NEW HAVEN, CONN., 240 Cedar St.
zNEW YORK, N. Y., 150 Varick St.
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.
PORTLAND, OREGON, 134 N.W. Eighth Ave.
PROVIDENCE, R. I., 66 Ship St.
RALEIGH, N. C., 322 S. Heartington St.
READING, PA., 619 Spruce St.
RICHMOND, VA., 301 South Fifth St.
ROANOKE, VA., 726 First St., S. E.
ROCHESTER, N. Y., 240 St. Paul St.
ST. LOUIS, MO., 1011 Spruce St.
ST. PAUL, MINN., 145 East Fifth Sr.
SACRAMENTO, CALIF., 20th and R Sts.
SALT LAKE CITY, UTAH, 235 West South Temple St.
SAN ANTONIO, TEXAS, 1201 E. Houston St.
SAN FRANCISCO, CALIF., 260 Fifth St.
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, 233 So. St. Francis Ave.
WILMINGTON, DEL., 216 E. Second St.
WORCESTER, MASS., 24 Southbridge St.
YORK, PA., 143 S. George St.

* Sales Office † Service Shop x Works ‡ Warehouse °First Class Mail Only § Merchandising Products Only z Headquarters ‡Apparatus Products Only
①Changed or added since previous issue.

October, 1937

# WESTINGHOUSE AGENT JOBBERS

ABILENE, KAN., Union Electr c Co.
AKRON, OHIO, The Moock Electric Supply Co.
BIRMINGHAM, ALA., Moore-Handley Hdwe. Co.
BLUEFIELD, W. VA., Superior-Sterling Co.
BUFFALO, N. Y., McCarthy Bros. & Ford
CANTON, OHIO, The Moock Electric Supply Co.
‡CHATTANOOGA, TENN., Mills & Lupton Supply Co.
CHICAGO, ILL., Hyland Electrical Supply Co.
CINCINNATI, OHIO, The Johnson Electric Supply Co.
§COLUMBUS, OHIO, The Hughes Peters Electric Corporation
COLUMBUS, OHIO, Pixley Electric Supply Co.
‡DENVER, COL., The Mine & Smelte Supply Co.
EL PASO, TEX., Zork Hardware Co.
ERIE, PA., Star Electrical Co.
HUNTINGTON, W. VA., Banks-Miller Supply Co.
KANSAS CITY, MO., Columbian Elec'l Co.
KANSAS CITY, MO., Continental Elec. Co.
LOUISVILLE, KY., Tafel Electric Co.
MONROE, LA., Monroe Hardware Co.
①NASHVILLE, TENN., Tafel Electric Co.
NEW ORLEANS, LA., Electrical Supply Co.
NEW YORK, N. Y., Times Appliance Co., Inc.
PITTSBURGH, PA., Iron City Electric Co.
SAN DIEGO, CALIF., The Electric Supplies Distributing Co.
SCRANTON, PA., Penn Elect'l Engineering Co.
YOUNGSTOWN, OHIO, Moock Electric Supply Co.

# WESTINGHOUSE ELECTRIC & MFG. CO., LAMP DIVISION

§*ATLANTA, GA., 426 Marietta St.
*BALTIMORE, MD., 118 E. Lombard St.
xBELLEVILLE, N. J., 720 Washington Ave.
zxBLOOMFIELD, N. J., Clearfield Ave.
*BOSTON, MASS., 10 High St.
§BOSTON, MASS., 12 Farnsworth St.
*BUFFALO, N. Y., 295 Main St.
*CHICAGO, ILL., 20 North Wacker Drive
§CHICAGO, ILL., 2211 W. Pershing Road
*CINCINNATI, OHIO, Third & Elm Sts.
*CLEVELAND, OHIO, 1216 W. 58th St.
*COLUMBUS, OHIO, Gay & Third St.
*DALLAS, TEXAS, 209 Browder St.
*DAVENPORT, IOWA, 206 East Second St.
*DENVER, COLO., 910 Fifteenth St.
*DES MOINES, IOWA, 218 West Second St.
§*DETROIT, MICH., 5757 Trumbull Ave.
*EMERYVILLE, CALIF., 1446 Powell St.
*HOUSTON, TEXAS, 1314 Texas Ave.
*HUNTINGTON, W. VA., 1029 Seventh Ave.
*INDIANAPOLIS, IND., 137 So. Penna. Ave.
*JACKSON, MICH., Consumers Power Bldg.
*KANSAS CITY, MO., 101 W. Eleventh St.
§*LOS ANGELES, CALIF., 420 S. San Pedro St.
*LOUISVILLE, KY., 332 West Broadway
*MEMPHIS, TENN., 130 Madison St.
*MILWAUKEE, WISC., 546 North Broadway
*MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
*NEW ORLEANS, LA., 333 St. Charles St.
yNEW YORK, N. Y., 150 Broadway
*OKLAHOMA CITY, OKLA., 10 E. California St.
*OMAHA, NEB., 409 So. Seventeenth St.
*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 306 4th Ave., Box 1017
§PITTSBURGH, PA., Try St. Terminal Bldg.
①*RICHMOND, VA., 301 South Fifth St.
*ROCHESTER, N. Y., 240 St. Paul St.
*SALT LAKE CITY, UTAH, 10 West First South St.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
§SAN FRANCISCO, CALIF., 60 Federal St.
*SEATTLE, WASH., 603 Stewart St.
§SEATTLE, WASH., 3451 East Marginal Way
*ST. LOUIS, MO., 411 No. Seventh St.
§ST. LOUIS, MO., 717 So. 12th Street
*SYRACUSE, N. Y., 109 So. Warren Street
*TOLEDO, OHIO, 245 Summit St.
xTRENTON, N. J., 400 Pennington Ave.
*WASHINGTON, D. C., 1434 N. Y. Ave., N.W

# WESTINGHOUSE ELECTRIC ELEVATOR COMPANY

①BALTIMORE, MD., 39 Lexington Ave.
①BOSTON, MASS., 168 Stuart St.
①BROOKLYN, N. Y., 528 Bergen St.
BUFFALO, N. Y., 826 Ellicott Sq. Bldg.
①xCHICAGO, ILL., 1500 North Branch St.
CHICAGO, ILL., 222 No. Bank Drive
CINCINNATI, OHIO, Third & Elm Sts.
CLEVELAND, OHIO, 842 Rockefeller Bldg.
COLUMBUS, OHIO, Gay & Third Sts.
DALLAS, TEXAS, 209 Browder St.
①DENVER, COLO., 1052 Gas & Electric Bldg.
DES MOINES, IOWA, 523 Sixth Ave.
DETROIT, MICH., 5757 Trumbull Ave.
DUBUQUE, IOWA, c/o Roshek Store
①HARTFORD, CONN., 410 Asylum St.
①INDIANAPOLIS, IND., 551 W. Merrill St.
①zxJERSEY CITY, N. J., 150 Pacific Ave.
KANSAS CITY, MO., 101 W. Eleventh St.
LOS ANGELES, CALIF., 420 So. San Pedro St.
①NEWARK, N. J., 14 Bridge St.
①NEW YORK, N. Y., 9 Rockefeller Plaza
①NEW YORK, N. Y., 128 E. 149 St.
PHILADELPHIA, PA., 3001 Walnut St.
PITTSBURGH, PA., 435 Seventh Ave.
ST. LOUIS, MO., 411 North Seventh St.
SAN FRANCISCO, CALIF., 1 Montgomery St.
STEUBENVILLE, OHIO, 306 Nad. Exch. Bldg.
①WASHINGTON, D. C., 1112 21st St., N. W.

# WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY

zNEW YORK CITY, N. Y., 150 Broadway
*LONDON, W. C. 2, ENGLAND, 2 Norfolk St., Strand
*SYDNEY, AUSTRALIA, Box 2634-EE, G.P.O.
*RIO DE JANEIRO, BRAZIL, Caixa Postal 687
*SANTIAGO, CHILE, Casilla 1897
*SHANGHAI, CHINA, P. O. Box 959
*MILANO, ITALY, Piazza Crispi 3
*WELLINGTON, NEW ZEALAND, 2 Taranaki St.
*LIMA, PERU, Edificio Wiese, Esquina N nez y Filipinas
*MANILA, P. I., P. O. Box 998
*PANAMA, Republic of Panama, P.O. Box 112
*SAO PAULO, BRAZIL, Caixa Postal 636
*SAN JUAN, Puerto Rico, P. O. Box 1539
*CIA. WESTINGHOUSE INTERNACIONAL S. A., Avenida de Mayo 1035, Buenos Aires, A gentine
*CIA. WESTINGHOUSE ELEC. DE CUBA, Calle Jose de San Martin Nos. 16 y 18, Apartado 2289, Havana, Cuba
*WESTINGHOUSE ELEC. CO. OF INDIA LTD. Feltham House, Graham Road, Ballard Estate, Bombay, India
*CIA. WESTINGHOUSE ELEC. INTERNACIONAL Edificio la Nacional Apartado 78-Bis. Mexico, D. F. Mexico
*MEXICO, (West Coast) Mr. John H. Knost, 1248 East Fifth St., Tuscon, Arizona
*WESTINGHOUSE ELEC. CO. OF SOUTH AFRICA, LTD., P. O. Box 6067, Johannesburg, South Africa

# WESTINGHOUSE X-RAY COMPANY, INC.

*ATLANTA, GA., 565 W. Peachtree St., N. E.
*BALTIMORE, MD., 118 East Lombard St.
*BOSTON, MASS., 270 Commonwealth Ave.
*CHICAGO, ILL., 512 S. Peoria St.
*CLEVELAND, OHIO, 7016 Euclid Ave.
*DALLAS, TEXAS, 207 Browder St.
§*DETROIT, MICH., 5757 Trumbull Ave.
zxLONG ISLAND CITY, N. Y., 21-16 43rd Ave.
*LOS ANGELES, CALIF., 420 S. San Pedro St.
*MILWAUKEE, WISC., 534 North Broadway
*NEW ORLEANS, LA., 608 Commercial Place
*NEW YORK, N. Y., 173 E. Eighty-Seventh St.
*OMAHA, NEB., 117 N. Thirteenth St.
*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 3702 Fifth Ave.
*ROCHESTER, N. Y., 41 Chestnut St.
*SAN FRANCISCO, CALIF., 870 Market St.

# BRYANT ELECTRIC COMPANY

*BOSTON, MASS., 10 High St.
zxBRIDGEPORT, CONN., Main Plant, 1421 State St.
xBRIDGEPORT, CONN., Plastics Division Plant, 1105 Railroad Ave.
*§CHICAGO, ILL., 844 West Adams St.
*NEW YORK, N. Y., 100 East Forty-Second St.
*§SAN FRANCISCO, CALIF., 325 Ninth St.

# WESTINGHOUSE RADIO STATIONS

STATION KDKA, 310 Grant St., Pittsburgh, Pa.
STATION WBZ, 271 Tremont St., Boston, Mass.
STATION KYW, 1622 Chestnut St., Philadelphia, Pa.
STATION WBZA, Hotel Kimball, Springfield. Mass.
STATION WOWO, 925 So. Harrison St., Fo t Wayne, Ind.
STATION WGL, 925 So. Harrison St., Fort Wayne, Ind.

# CANADIAN WESTINGHOUSE COMPANY, LIMITED

*†§CALGARY, 320 Eighth Avenue West, Calgary, Alberta, Can.
§*EDMONTON, 10127, 104th St., Armstrong Block, Edmonton, Alberta, Can.
§*FORT WILLIAM, 112 McVicar St., Fort William, Ontario, Can.
§*HALIFAX, 158 Granville St., Halifax, Nova Scotia, Can.
§*HAMILTON, Hamilton, Ontario, Can.
*LONDON, 504 Huron & Erie Bldg., London, Ontario, Canada
*MONTREAL, 1135 Beaver Hall Hill, Montreal, Quebec, Can.
§MONTREAL, 400 McGill St., Montreal, Quebec, Can.
§†MONTREAL, 1844 William St., Montreal, Quebec, Can.
§*OTTAWA, Ahearn & Soper Limited, P. O. Box 779, Ottawa, Ontario, Can.
*†§REGINA, 2408 Eleventh Ave., Regina, Saskatchewan, Can.
①*SASKATOON, 304 Avenue Bldg., Saskatchewan, Canada
†§*SWASTIKA, Swastika, Ontario, Canada
*†§TORONTO, 355 King St. West, Toronto, Ontario, Can.
*VANCOUVER, 1418 Marine Bldg., Vancouver, B. C., Can.
†§VANCOUVER, 1090 Homer St., Vancouver, B. C., Can.
§*†WINNIPEG, 158 Portage Ave. East, Winnipeg, Manitoba, Can.

①Changed or added since previous issue.

* Sales Office † Service Shop x Works § Warehouse z Headqua ters y Executive Office § Merchandising Products Only ‡ Apparatus Products Only