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

TYPE RR-7 REGISTER REGULATOR

INSTRUCTIONS FOR INSTALLATION

INSTRUCTION BOOK 5670-36-C
(9-36)

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

EAST PITTSBURGH WORKS EAST PITTSBURGH, PA.

V - SPARE TUBES

The following tubes should preferably be kept as spares:

One SK-60 phototube
One RJ-571 amplifier tube.
One KU-627 or KU-636 grid glow tube.

VI - RENEWAL PARTS

Name of Part	Style
Milliampere meter	818504
Potentiometer, 20,000 ohms	846696
Potentiometer dial	869654
KU tube socket	793202
RJ-571 tube socket	831766
Rectox Rectifier	966513
Transformer for 60 cycle	966552
* Transformer for 25 cycle	------
Resistor tube	943670
Reactor	850583
Resistor 1 MEGOHM	860871
Resistor 500 ohms	943634
Resistor 0.25 MEGOHM	861041
Resistor 10,000 ohms	799952
Resistor 5 MEGOHM	829465
Capacitor AEROVOX 0.01 MF Type 284	------
Capacitor AEROVOX 4 MF Type 407	------
Capacitor	1014338

* Specify as 25-cycle Transformer for Type RR-7 Register Regulator.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Business Addresses

PARENT COMPANY

Headquarters, East Pittsburgh, Pa.

*AKRON, OHIO, 106 South Main St.
*ALBANY, N. Y., 360 Broadway
§ALEXANDRIA, VA., 121 Frazier Ave.
*ALLENTOWN, PA., 522 Maple St.
*APPLETON, WISC., #1 Bellaire Court, P. O. Box 206
†APPLETON, WISC., 1029 So. Outagamie St.
*†#ATLANTA, GA., 426 Marietta St., N. W.
xATTICA, N. Y.
*BAKERSFIELD, CALIF., 2224 San Emedio St.
*BALTIMORE MD., 118 E. Lombard St.
†BALTIMORE, MD., 501 East Preston Road
§BALTIMORE, MD., 40 S. Calvert St.
①* BEAUMONT, TEXAS, 2293 Broadway Ave., P. O. Box 2366
*BIRMINGHAM, ALA., 2030 Second Ave.
*BLUEFIELD, W. VA., 208 Bluefield Avenue, Box 848
§BOISE, IDAHO, P. O. Box 1597
*BOSTON, MASS., 10 High St.
†#BOSTON, MASS., 12 Farnsworth St.
*†BRIDGEPORT, CONN., Bruce Ave. & Seymour St.
*BUFFALO, N. Y., 814 Ellicott Square
†#BUFFALO, N. Y., 1132 Seneca St.
*BURLINGTON, IOWA, P. O. Box 197
*BURLINGTON, VER., 208 Park Ave.
①*# BUTTE, MONTANA, 129 West Park Street
*CANTON, OHIO, Market & Tuscarawas Sts.
*†#CHARLOTTE, N. C., 210 East Sixth St.
*CHATTANOOGA, TENN., 536 Market St.
*CHICAGO, ILL., 20 N. Wacker Drive, P. O. Box "b"
†#CHICAGO, ILL., 2201 W. Pershing Road, P. O. Box 1103
xCHICOPEE FALLS, MASSACHUSETTS
*†#CINCINNATI, OHIO, 207 West Third St.
*†x#CLEVELAND, OHIO, 1216 West Fifty-Eighth St., Box 5817
§COLUMBIA, S. C., 912 Lady St.
*COLUMBUS, OHIO, Gay & Third Sts.
*DALLAS, TEXAS, 209 Browder St.
#DALLAS, TEXAS, 1712 Carter St.
*DAVENPORT, IOWA, 206 E. Second St.
*DAYTON, OHIO, 30 North Main St.
*DENVER, COLORADO, 900 Fifteenth St.
#DENVER, COLORADO, 1700 Sixteenth St.
†DENVER, COLORADO, 2644 Walnut St.
xDERRY, PA.
①*DES MOINES, IOWA, 523 Sixth Ave.
*†#DETROIT, MICH., 5757 Trumbull Ave.
*DULUTH, MINN., 10 East Superior St.
*EASTPORT, ME., P. O. Box 764
*ELMIRA, N. Y., 338 East Water St.
*EL PASO, TEXAS, 303 N. Oregon St.
#EL PASO, TEXAS, 450 Canal St.
§EL PASO, TEX., % Zork Hdwe. Co., 309 N. El Paso St.
#*EMERYVILLE, CALIF., 5815 Peladeau St.
†EMERYVILLE, CALIF., 1466 Powell St.
xEMERYVILLE, CALIF., 6161 Green St.
*ERIE, PA., 1003 State St.
*EVANSVILLE. IND., 201 N. W. First St.
*†FAIRMONT, W. VA., 602 Cleveland Ave.
§FARGO, N. D., 319—12 Ave. N.
*FORT WAYNE, IND., 1010 Packard Ave.
*FORT WORTH, TEXAS, 501 Jones St.
*GARY, IND., 701 Washington St.
*GRAND RAPIDS, MICH., 507 Monroe Ave. N. W.
*GREENVILLE, S. C., West Earle St., P. O. Box 1591
*HAMMOND, IND., 235 167th St.
*HARTFORD, CONN., Main & Pearl Sts.
x†HOMEWOOD WORKS, Pittsburgh, Pa., 543 N. Lang Ave.
①*HOUSTON, TEXAS, 1314 Texas Ave.
#HOUSTON, TEXAS, 2313 Commerce Ave.
†HOUSTON, TEXAS, 2315 Commerce Ave.
*†#HUNTINGTON, W. VA., 209 Ninth St.
*INDIANAPOLIS, IND., 539 Madison Ave.
†INDIANAPOLIS, IND., 551 West Merrill St.
*ISHPEMING, MICH., 433 High St.
*JACKSON, MICH., 212 West Michigan Ave.
*†JOHNSTOWN, PA., 47 Messenger St.
*†#KANSAS CITY, MO., 2124 Wyandotte St.
*KNOXVILLE, TENN., Gay & Clinch St.
*LITTLE ROCK, ARK., 1115 West 24th St., P. O. Box 1052
§LITTLE ROCK, ARK., % Fones Bros. Hdwe., 2nd & Rock Sts.
*†#LOS ANGELES, CALIF., 420 So. San Pedro St.
*LOUISVILLE, KY., 322 West Broadway
*MADISON, WISC., 508 Edgewood Ave., P. O. Box 228
xMANSFIELD, OHIO, 200 East Fifth St.
*MARSHALL, TEXAS, 202 W. Merritt St., P. O. Box 442
*MEMPHIS, TENN., 130 Madison Ave.
*MIAMI FLA., 1036 N. Miami Ave., P. O. Box 590
*MILWAUKEE, WISC., 546 North Broadway
†MILWAUKEE, WISC., 1669 N. Water St.
*†#MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
*MONROE, LA., 1610 N. Fourth St.
*NASHVILLE, TENN., 219 N. Second Ave.
*NEWARK, N. J., 1180 Raymond Blvd.
†#NEWARK, N. J., Haynes Ave. & Lincoln Highway
xNEWARK, N. J., Plane & Orange St.
*NEW HAVEN, CONN., 42 Church St.
†*NEW ORLEANS, LA., 333 St. Charles St.
#NEW ORLEANS, LA., 527 Poydras St.
①*NEW YORK, N. Y., 150 Broadway
†NEW YORK, N. Y., 460 West Thirty-Fourth St.
*NIAGARA FALLS, N. Y., 205 Falls St.
*NORFOLK, VA., 254 Tazewell St.
*OKLAHOMA CITY, OKLA., 10 E. California St.
#OKLAHOMA CITY, OKLA., Third & Alie Sts.
*OMAHA, NEB., 409 South Seventeenth St.
§OMAHA, NEB., 117 N. 13th St.
*PEORIA, ILL., 104 E. State St.
*†#PHILADELPHIA, PA., 3001 Walnut St.
*PHOENIX, ARIZONA, 11 West Jefferson St.
xPITTSBURGH, PA., Nuttall Works, 200 McCandless Ave.
*PITTSBURGH, PA., 435 Seventh Ave.
x†PITTSBURGH, PA., 543 N. Lang Ave.
#PITTSBURGH, PA., 3000 Liberty Ave.
*PORTLAND, MAINE, 27 Deerfield Road, P. O. Box 1797
*PORTLAND, OREGON, 309 S. W. Sixth Ave.
†PORTLAND, OREGON, 2138 N. Interstate Ave.
#PORTLAND, OREGON, 720 N. Thompson St.
*†PROVIDENCE, R. I., 16 Elbow St.
*RALEIGH, N. C., 803 North Person St.
§RALEIGH, N. C., 322 S. Harrington St., P. O. Box 911
§READING, PA., 619 Spruce St.
*RICHMOND, VA., Fifth & Bytd
§ROANOKE, VA., 701 Carter Rd., Raleigh Court
*†ROCHESTER, N. Y., 410 Atlantic Ave.
*ROCKFORD, ILL., 130 South Second St.
*SACRAMENTO, CALIF., 719 "K" St.
*SALT LAKE CITY, UTAH, 10 West First South St.
†#SALT LAKE CITY, UTAH, 346 A Pierpont Ave.
§SALT LAKE CITY, UTAH, 235 W. S. Temple
*SAN ANTONIO, TEXAS, 212 East Houston St.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
*SEATTLE, WASH., 603 Stewart St.
†#SEATTLE, WASH., 3451 East Marginal Way
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., 158 Monroe St.
*SPRINGFIELD, ILL., 130 So. Sixth St., P. O. 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.
xST. LOUIS, MO., 3850 Bingham Ave.
*SYRACUSE, N. Y., 420 N. Geddes St.
*TACOMA, WASH., 1023 "A" St.
*TAMPA, FLA., 417 Ellamae Ave.
*TOLEDO, OHIO, 245 Summit St.
*TULSA, OKLA., 303 East Brady St.
*†UTICA, N. Y., 113 N. Genesee St.
*WASHINGTON, D. C., 1434 New York Ave., N. W.
*WATERLOO, IOWA, 328 Jefferson St., P. O. Box 416
*WICHITA, KAN., 400 South Emporia St.
*†WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
*†WORCESTER, MASS., 32 Southbridge St.
*YORK, PA., 143 So. George St.
*YOUNGSTOWN, OHIO, 25 E. Boardman St.
*THE HAWAIIAN ELECTRIC CO., LTD., HONOLULU, T. H., Agent

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

WESTINGHOUSE ELECTRIC SUPPLY COMPANY AND AGENT JOBBERS

Fully equipped sales offices and warehouses are maintained at all locations

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

①Changed or added since previous issue.

WESTINGHOUSE ELECTRIC ELEVATOR COMPANY

*AKRON, OHIO, 106 S. Main St.
*BOSTON, MASS., 10 High St.
*BUFFALO, N. Y., 826 Ellicott Sq. Bldg.
xCHICAGO, ILL., 1500 N. Branch St.
*CHICAGO, ILL., 222 No. Bank Drive
*CINCINNATI, OHIO, Third & Elm Sts.
*CLEVELAND, OHIO, 1006 Rockefeller Bldg.
*COLUMBUS, OHIO, Gay & Third Sr.
#*DALLAS, TEXAS, 209 Browder St.
①*DES MOINES, IOWA, 523 Sixth Ave.
#*DETROIT, MICH., 5757 Trumbull Ave.
*DUBUQUE, IOWA, 312 Seminary St.
①*JACKSON, MISS., 249 N. Pretiss St.
*KANSAS CITY, MO., 2124 Wyandotte St.
*LOS ANGELES, CALIF., 420 So. San Pedro Sr.
*NEW YORK, N. Y., 30 Rockefeller Plaza
#*PHILADELPHIA, PA., Thirtieth & Walnut Sts.
*PHOENIX, ARIZONA, 68 E. Hoover Ave.
†*PITTSBURGH, PA., 435 Seventh Ave.
*ST. LOUIS, MO., 411 North Seventh St.
#ST. LOUIS, MO., 717 S. Twelfth St.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
#SAN FRANCISCO, CALIF., 741 Natoma St.
*SEATTLE, WASH., 603 Stewart St.
*WASHINGTON, D. C., 1209 Eye St., N. W.

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY

①zNEW YORK CITY, N. Y., 150 Broadway
*LONDON, W. C. 2, ENGLAND, 2 Norfolk St., Strand
①*SYDNEY, AUSTRALIA, Box 2634-EE, G.P.O.
①*RIO DE JANEIRO, BRAZIL, Caixa Postal 687
*SANTIAGO, CHILE, Casilla 1897
①*SHANGHAI, CHINA, P. O. Box 959
*MILANO, ITALY, Piazza Crispi 3
*WELLINGTON, NEW ZEALAND, 19-23 Blair St.
①*LIMA, PERU, Edificio Wiese, S. A. Esquina Nunez y Filipinas
①*MANILA, P. I., P. O. Box 998
*SAN JUAN, Puerto Rico, P. O. Box 1539
*CIA. WESTINGHOUSE INTERNACIONAL S. A., Avenida de Mayo 1035, Buenos Aires, Argentine
*CIA. WESTINGHOUSE ELEC. DE CUBA, Calle Jose de San Martin Nos. 16 y 18, Apartado 2289, Havana, Cuba
*WESTINGHOUSE ELEC. CO. OF INDIA, Feltham House, Graham Road, Ballard Estate, Bombay, India
*CIA. WESTINGHOUSE ELEC. INTERNACIONAL Edificio la Nacional Apartado 78-Bis. Mexico, D. F. Mexico
*WESTINGHOUSE ELEC. CO. OF SOUTH AFRICA, LTD., P. O. Box 6067, Johannesburg, South Africa

WESTINGHOUSE LAMP COMPANY

#*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., 2201-2221 W. Pershing Road
*CINCINNATI, OHIO, Third & Elm Sts.
*CLEVELAND, OHIO, 1216 W. 58th St.
*COLUMBUS, OHIO, Gay & Third St.
①*DALLAS, TEXAS, 209 Browder St.
#DALLAS, TEXAS, 1118 Jackson St.
*DAVENPORT, IOWA, 209 East Second St.
*DENVER, COLO., 910 Fifteenth St.
*DES MOINES, IOWA, 218 West Second St.
#*DETROIT, MICH., 5757 Trumbull St.
*EMERYVILLE, CALIF., 1446 Powell St.
①*HOUSTON, TEXAS, 1314 Texas Ave.
*HUNTINGTON, W. VA., 209 Ninth St.
*INDIANAPOLIS, IND., 539 Madison Ave.
#*KANSAS CITY, MO., 2124 Wyandotte St.
#*LOS ANGELES, CALIF., 420 S. San Pedro St.
*LOUISVILLE, KY., 332 West Broadway
*MEMPHIS, TENN., 130 Madison St.
*MILWAUKEE, WISC., 534-546 North Broadway
*MINNEAPOLIS, MINN., 2303 Kennedy St., N. E.
#*NEW ORLEANS, LA., 516 Howard Ave.
①yNEW YORK, N. Y., 150 Broadway
*OKLAHOMA CITY, OKLA., 10 E. California Sr.
*OMAHA, NEB., Seventeenth & Harney Sts.
*PHILADELPHIA, PA., Thirtieth & Walnut Sts.
*PITTSBURGH, PA., 435 Seventh Ave.
#PITTSBURGH, PA., Try St. & Terminal Bldg.
①*RICHMOND, VA., 700 Franklin Street
*ROCHESTER, N. Y., 240 St. Paul St.
*SALT LAKE CITY, UTAH, 10 West First St.
*SAN ANTONIO, TEXAS, 212 E. Houston St.
*SAN FRANCISCO, CALIF., 1 Montgomery St.
*SAN FRANCISCO, CALIF., 60 Federal St.
*SEATTLE, WASH., 603 Stewart St.
①#SEATTLE, WASH., 3451 East Marginal Way
*ST. LOUIS, MO., 411 No. Seventh St.
①#ST. LOUIS, MO., 717 So. 12th Street
①*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.
*YOUNGSTOWN, OHIO, 25 E. Boardman St.

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.
*DALLAS, TEXAS, 335 N. St. Paul 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., 333 St. Charles St.
*NEW YORK, N. Y., 173 E. Eighty-Seventh St.
*OMAHA, NEB., 117 N. Thirteenth St.
*PHILADELPHIA, PA., 3001 Walnut St.
*PITTSBURGH, PA., 3710 Fifth Ave.
*SAN FRANCISCO, CALIF., 870 Market St.

BRYANT ELECTRIC COMPANY

*BOSTON, MASS., 10 High St.
zxBRIDGEPORT, CONN., Main Plant, 1421 State St.
①xBRIDGEPORT, 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

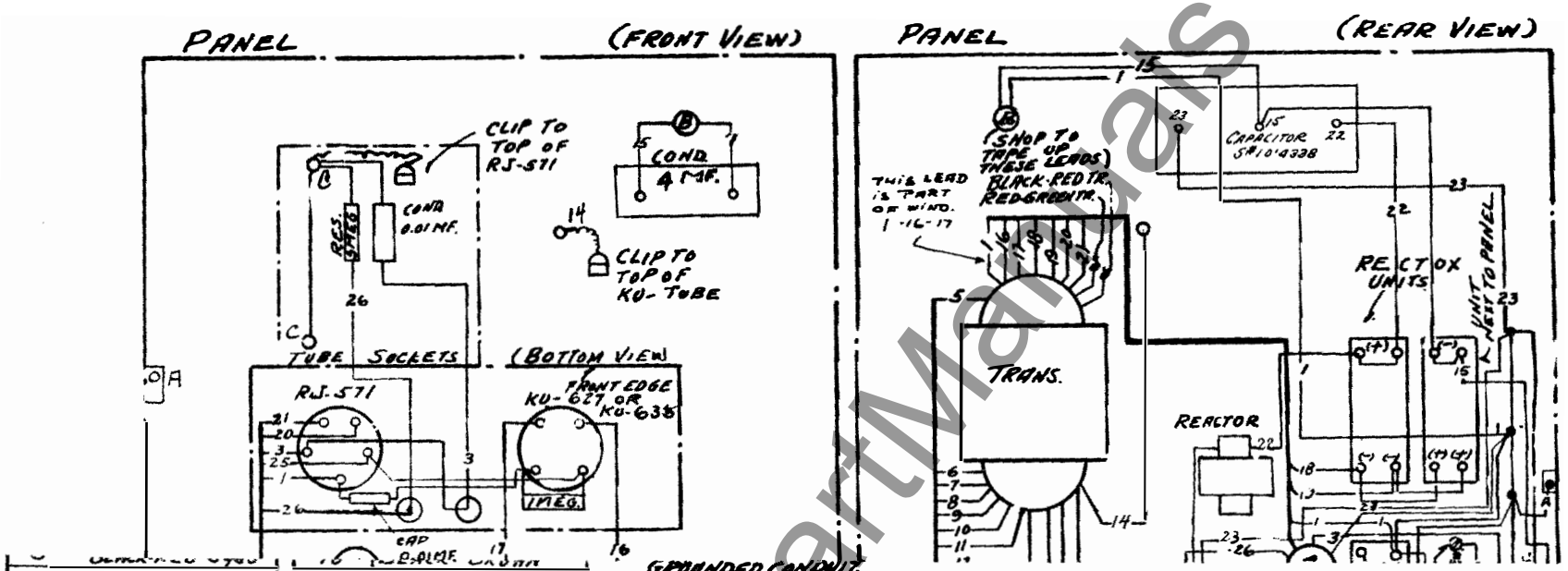
STATION KDKA, 310 Grant St., Pittsburgh, Pa.
STATION WBZ, 271 Tremont St., Boston, Mass.
STATION KYW, 1622 Chestnut St., Philadelphia, Pa.
STATION WBZA, Hotel Kimball, Springfield, Mass.

CANADIAN WESTINGHOUSE COMPANY, LIMITED

①*†#CALGARY, 320 Eighth Avenue West, Calgary, Alberta, Can.
#*EDMONTON, 10127, 104th St., Armstrong Block, Edmonton, Alberta, Can.
#*FORT WILLIAM, Cuthbertson Block, Fort William, Ontario, Can.
①#*HALIFAX, 158 Granville St., Halifax, Nova Scotia, Can.
①xz*HAMILTON, Hamilton, Ontario, Can.
①*MONTREAL, 1135 Beaver Hall Hill, Montreal, Quebec, Can.
●#MONTREAL, 400 McGill St., Montreal, Quebec, Can.
①†MONTREAL, 1844 William St., Montreal, Quebec, Can.
*OTTAWA, Ahearn & Soper Limited, P. O. Box 475, Ottawa, Ontario, Can.
*†#REGINA, 2408 Eleventh Ave., Regina, Saskatchewan, Can.
①*†#TORONTO, 355 King St. West, Toronto, Ontario, Can.
①*VANCOUVER, 1418 Marine Bldg., Vancouver, B. C., Can.
②†#VANCOUVER, 1090 Homer St., Vancouver, B. C., Can.
①#*†WINNIPEG, 158 Portage Ave. East, Winnipeg, Manitoba, Can.

*Sales Office †Service Office xWorks #Warehouse zHeadquarters yExecutive Office

①Changed or added since previous issue.



4	BLACK-BLUE	19	BLACK-BROWN
5	BROWN	20	BLUE-YELLOW
6	YELLOW	21	BLUE-YELLOW
7	GREEN	22	RED
8	RED	23	BROWN
9	WHITE	24	BLACK-RED TR.
10	BLUE	25	BLACK
11	BLACK	26	GREEN-YELLOW
12	GREEN-YELLOW		
13	WHITE	A	YELLOW
14	BLACK-YELLOW TR.	C	RED
15	BLACK		

GROUNDED CONDUIT.

(2) USE KU-627 TUBE IF AMBIENT AIR TEMPERATURE DOES NOT DROP BELOW 55 DEGREES F. USE KU-636 TUBE IF TEMPERATURE IS LESS THAN 55 DEGREES F. (PREFERRABLY USE THE KU-627 TUBE.) MAXIMUM AMBIENT AIR TEMPERATURE MUST NOT EXCEED 140 DEGREES F.

(3) WITH PHOTOTUBE DARK ADJUST POTENTIOMETER UNTIL KU-TUBE BREAKS DOWN AND ENERGIZES SOLENOID. THE POTENTIOMETER POSITION SHOULD BE APPROXIMATELY 85 AND THE MILLIAMPERE METER SHOULD READ APPROXIMATELY 0.35 ADJUST THE POTENTIOMETER TO GIVE 0.25 MA. WITH PHOTOTUBE DARK.

(4) WITH SOLENOID ENERGIZED, MEASURE THE SOLENOID CURRENT. THIS CURRENT MUST NOT EXCEED 0.4 AMPERE IF A KU-627 TUBE IS USED, OR 0.2 AMPERE IF A KU-636 TUBE IS USED. THE VOLTAGE APPLIED TO THE SOLENOID IS RECTIFIED A-C VOLTAGE. THE RECTIFIER SUPPLY VOLTAGE IS 120 VOLTS IF CONNECTION IS MADE TO TERMINAL "4" AND 210 VOLTS IF CONNECTED TO "5". IF NECESSARY CONNECT A RESISTOR IN SERIES WITH SOLENOID TO LIMIT THE SOLENOID CURRENT TO VALUES GIVEN ABOVE.

(5) THE A-C SUPPLY VOLTAGE MUST BE WITHIN 10 PERCENT OF VALUES GIVEN ON NAME PLATE.

(6) IMPORTANT:- KEEP MILLIAMPERE METER SHUNT SWITCH CLOSED UPWARDS EXCEPT WHEN ADJUSTING EQUIPMENT

(7) FOR FURTHER INFORMATION SEE I.B. 5670-36

73-B-444

Fig. 2 - Type RR-7 Photo-Troller Wiring Diagram (25-Cycle Application)

Dwg. 73-B-444-2

TYPE RX PHOTOTROLLER

Instructions for Installation

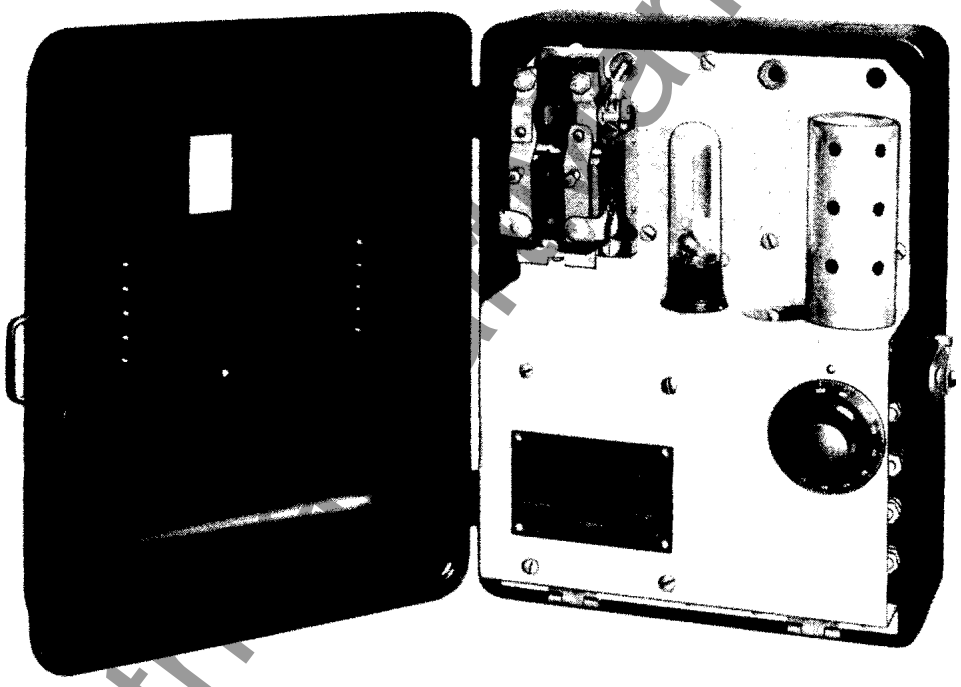


Figure 1 - The Type RX is Intended for General Purpose Industrial Applications.

Westinghouse Electric and Manufacturing Company
East Pittsburgh, Pa.

Printed in U.S.A. (6-38) I.B. 5670-43

Westinghouse Type RX Phototroller

INDEX

LIST OF ILLUSTRATIONS

Door Opening - Continued

At the maximum speed of operation, at least 0.2 seconds should be allowed between the centers of impulses, corresponding to 300 operations per minute. In order that this number of operations per minute may be obtained, the "on" and "off" intervals should be equal. However, the approximate minimum time of light change required to operate the relay is about 0.05 second. The maximum recommended rate of operation is 150 per minute.

If the phototube is mounted in a separate housing, it may be located up to 25 cable feet distant, although standard housings are furnished with 10 feet of cable, which is usually sufficient. Distances beyond 10 feet slow down the response 25%, and longer times than those given for operation must be allowed. The footcandle rating of the unit is then also increased to 6.5 footcandles.

Safety Control for

Elevator doors
Pulverized fuel furnaces
Punch presses
Railroad crossings on industrial sidings

(2) HOW TO SELECT AND APPLY PHOTO-TROLLERS

The first fundamental in application of photo-trollers is that it is desirable to have as much excess illumination as possible beyond that required by the rating, in order that the safety factory will be increased.

Photo-trollers operate by variation of the quantity of light falling on the phototube. Ratings are given in terms of light intensity for greater convenience in application, and these ratings in terms of light intensity are based on the assumption that the full phototube or lens opening of the photo-troller will be used. Therefore, if the photo-troller is used in such a manner that only a portion of the phototube or lens opening is open, proportionately greater light intensity must be allowed.

If photo-electric equipment is to be operated in the vicinity of smoke, fog, dirt, steam or other similar conditions, it is necessary to add the best possible estimate of light-loss factor so that adequate safety margin will be insured.

Since photo-trollers operate by variation of the quantity of light falling on the phototube, it follows that the method of obtaining this variation is important. Two methods of varying illumination are in general use - variation of transmission and variation of reflection.

Transmission is varied by arranging an opaque, or partially opaque, object to intercept the beam of light which normally passes from light source to phototube. This is the most common method of operation and may be used for automobiles, people, paper sheets, steel sheets, packages, etc. Clear cellophane is obviously not very opaque and, therefore, does not vary the light beam much when intercepted by it. When operating with material of this nature whose capacity is not high, it is very important to know what this capacity is. Such applications are usually more difficult and it is recommended that they be referred to the nearest district office of the Westinghouse Company for recommendations.

Reflection is varied by arranging the optical system so that the light beam is reflected from the material to the phototube and the extent of this reflection is varied by the character of the surface of the material.

The RX Photo-troller does not have sufficient sensitivity for most reflected light applications and, therefore, should not be used for this purpose. The RX-1 Photo-troller, however, is specially designed for reflected light applications.

The actual procedure to be used in selecting the proper photo-trollers and light source is:

1 - Determine what portion of the light beam will be available under maximum illumination conditions.

2 - Determine what portion of the illumination will be intercepted by the controlling object.

3 - Select a photo-troller having the general characteristics desired, and then

4 - Select a combination of photo-troller and light source such that at the distances and operating conditions determined under paragraphs (1) and (2), adequate sensitivity will be obtained.

5 - Re-check all variable factors to make certain that adequate safety margin is provided in the selection.

(3) PHOTOTUBE HOUSINGS

The RX Photo-troller is arranged so that the phototube may be mounted inside the case. When this is done the knockout in the case door should be pressed out to permit the light to reach the phototube. In many applications it is preferable to mount the phototube in a separate housing, and for this purpose one of the housings shown in attached Price List 18-315 should be used.

(4) LIGHT SOURCES

Various types of light sources are shown in attached Price List 18-316 all of which, except the type L, can be used with the Type RX Photo-troller. In selecting the light source care must be taken that the minimum illumination on the photo-tube must not exceed the values given in fig. 2.

In this figure are shown different scales for the maximum illumination for different percentage changes in a-c line voltage. Using, for example, the basic 2% curve it is seen that if the maximum illumination is 30 foot candles, the minimum illumination must not exceed 15 foot candles. If, however, the maximum line voltage variation is 20 per cent and the maximum illumination is 30 foot candles at maximum a-c voltage, then the minimum illumination 10 foot candles is found by following the circle from A to B, then to C and D.

By using the curves in fig. 2 in combination with the light source curves in fig. 7 of Price List 18-316, the percentage reduction in light required can be determined.

Example

Light Source Type F.

Voltage Variations 10%.

Operating Distance 10 feet.

From fig. 7 Price List 18-316 is found: 17 F.C.
From fig. 2 : 17 F.C. at 10% voltage variation gives 7.5 F.C. minimum illumination.

Consequently: Illumination must be reduced from 17 F.C. to 7.5 F.C. or 56%.

PRINCIPLE OF OPERATION

(5) The schematic diagram, for the type RX photo-troller is shown in fig. 3. The photo-troller is equipped with a type WL-629 Thyratron tube which is controlled by a type WL-735 phototube. The WL-629 tube is a gas-filled discharge tube consisting of an anode connected to 15 in fig. 3, a heater winding connected to leads 8 and 10, a cathode connected to Lead 8, and a control grid connected to the 5 MEG. resistor. The characteristics of the WL-629 tube are such that when the grid has a negative potential exceeding approximately 6 volts relative to the cathode the tube does n not become ionized, and no current is conducted through the tube. If the grid potential is made more positive, the tube breaks down and conducts rectified current through relay coil I during the half cycles when lead 7 is positive in relation to lead 8.

The grid control voltage as shown in fig. 3 consists of the a-c voltage component between leads 8 and 13, obtained by means of the phase shift circuit consisting of resistor 9-13 and capacity 8-13, and the d-c voltage component C-13. Voltage 8-13 is advanced 135 degrees relative to voltage 8-7. The d-c voltage component C-13 changes its magnitude and polarity when the illumination on the phototube is varied, so that C is positive in relation to 13 when the degree of illumination on the phototube is high, and becomes negative when the illumination on the phototube is decreased.

In fig. 4 are shown the relation between the various control voltages. The curve E_c is the characteristic grid control curve for the WL-629 tube. In order to make the tube conduct current the instantaneous grid voltage must be more positive than shown by this curve. The grid control voltage as shown consists of the constant a-c voltage 8-13 superimposed on the variable d-c voltage C-13. In the position shown voltage E_g intersects voltage E_c at A, and at this point, therefore, the tube breaks down and conducts current during the remainder of the half cycle of voltage E_A. If now voltage C-13 be made more negagive by decreasing the illumination on the phototube, voltage curve E_g is moved down so that the curve does not intercept the critical grid voltage curve E_c. For this reason the WL-629 tube will not conduct current and the relay connected in series with the tube will be deenergized.

INSTALLATION

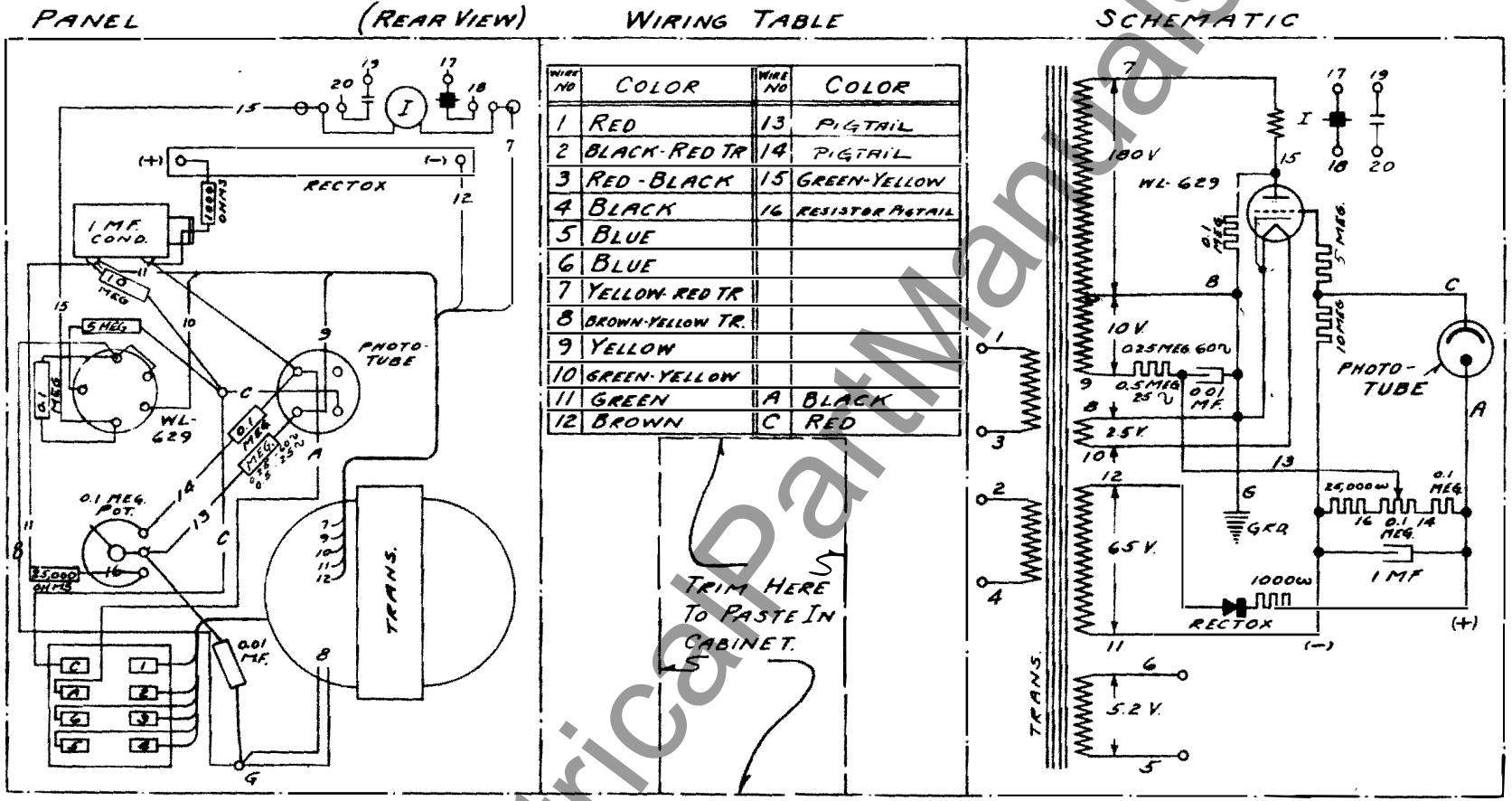
(6) Mounting

Mount the Photo-troller with the panel in a vertical position. If the phototube is to be mounted inside the Photo-troller case remove the knockout in the case door to permit light to reach the phototube. If the phototube is mounted in a separate housing, the housing may be mounted in any convenient position, up to 10 cable feet distant from the Photo-troller, or 25 cable feet if the Photo-troller is derated as outlined in paragraph 1.

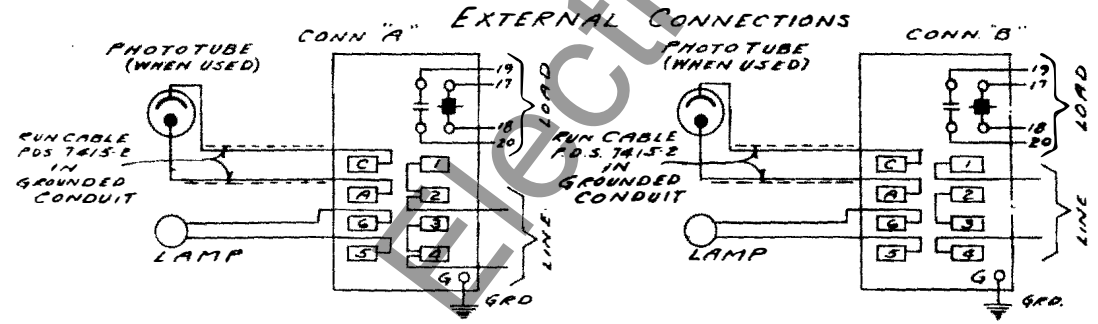
The light source may be mounted in any position except that the lamp base must not be higher than the lamp filament.

(7) Temperature Limits

The Photo-troller should be mounted in a location where the ambient air temperature does not exceed 110° F. If the Photo-troller is mounted near furnaces or other equipment radiating an excessive amount of heat, the Photo-troller should be shielded by means of a suitable shield. The maximum air temperature at the location of the phototube housing should not exceed 150° F.



WIRE NO	COLOR	WIRE NO	COLOR
1	RED	13	PIGTAIL
2	BLACK-RED TR	14	PIGTAIL
3	RED-BLACK	15	GREEN-YELLOW
4	BLACK	16	RESISTOR PIGTAIL
5	BLUE		
6	BLUE		
7	YELLOW-RED TR		
8	BROWN-YELLOW TR.		
9	YELLOW		
10	GREEN-YELLOW		
11	GREEN	A	BLACK
12	BROWN	C	RED



NAMEPLATE VOLTS	LINE VOLTS	CONN
115/230	115	A
115/230	230	B
220/440	220	A
220/440	440	B

Fig. 3 Type RX Phototroller. Diagram of Connections

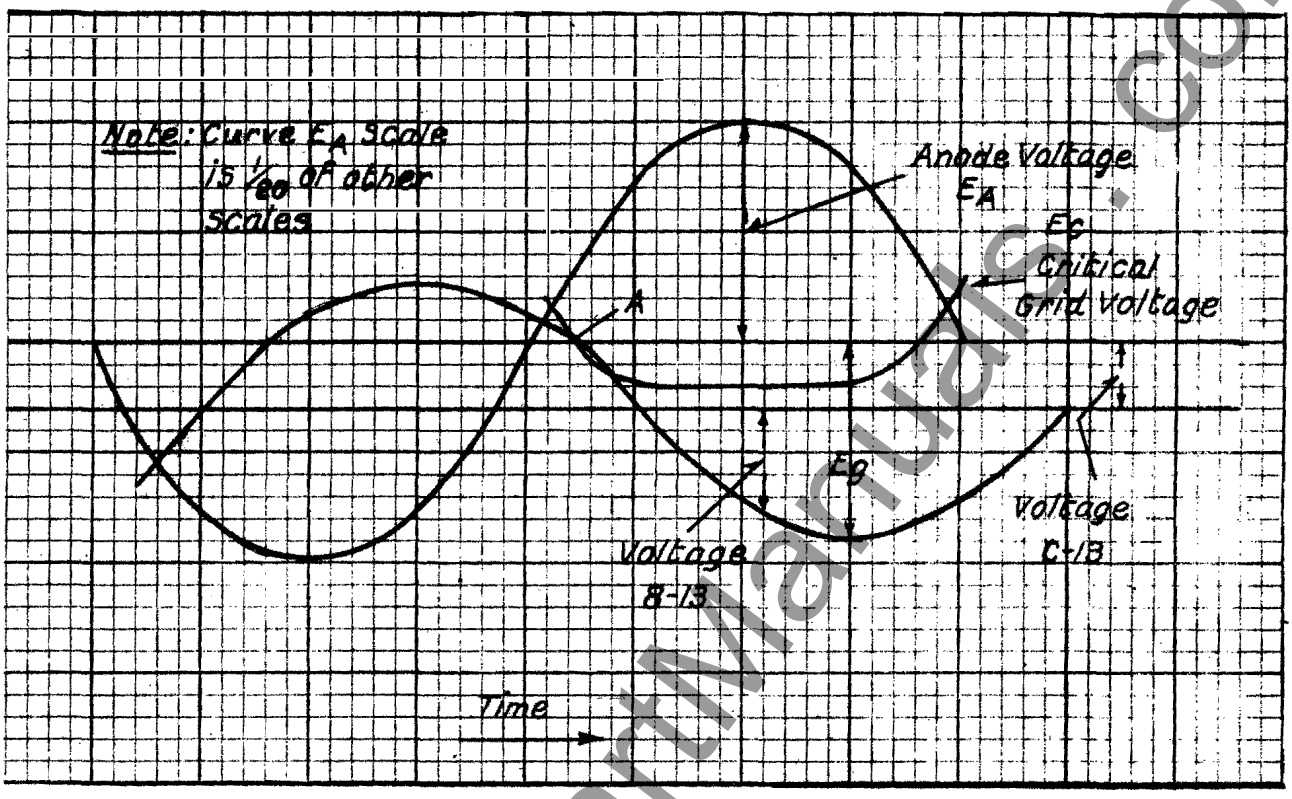


Fig. 4 Control Voltage Characteristics

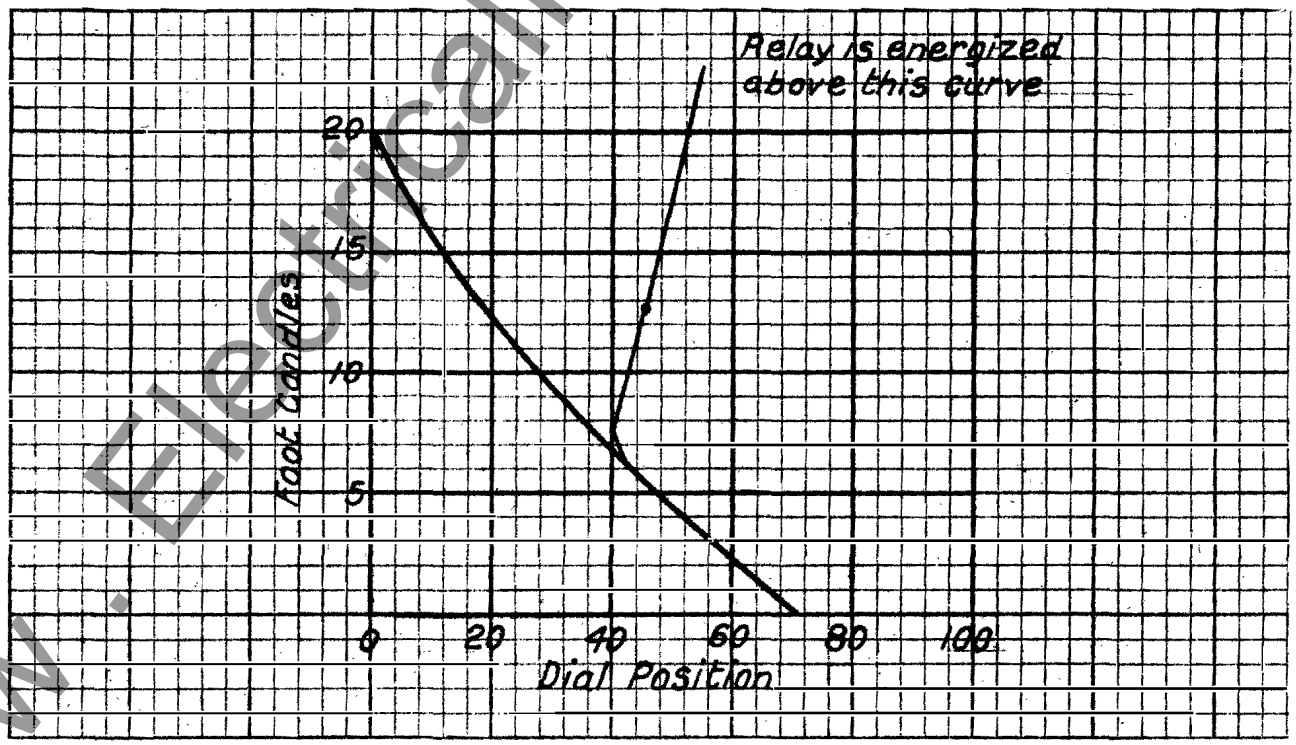


Fig. 5 Calibration Curve

Westinghouse

Type RM-1 Photo-Troller

Instructions for Operating

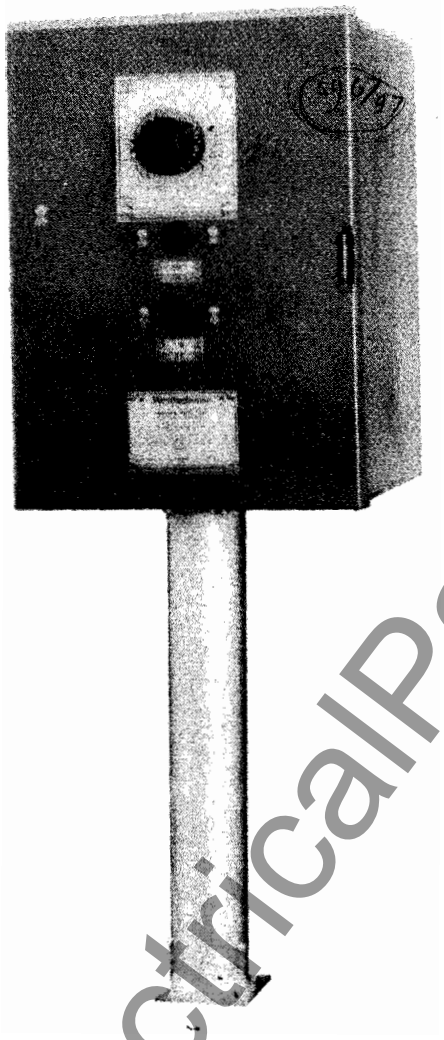


Fig. 1 - Type RM-1 Photo-Troller with Long Focusing Tube - Cover Closed

Application

The Westinghouse Type RM-1 Photo-Troller for heater control meets the requirement for a truly industrial device which operates from the light emitted from a piece of hot metal while being heated electrically. The light from the metal falls on a phototube controlling an amplifier tube, which in turn actuates a Thyratron tube directly. The Thyratron tube operates a contactor whose contacts will carry several amperes. The equipment automatically shuts off the power supply to a heater. Since the amount of light emitted is proportional to the temperature of the metal, the Photo-Troller can be arranged to trip the power supply at a predetermined temperature. Provisions are included in the Photo-Troller to lock out the power circuit immediately after the metal reaches the proper temperature and the operation is reinitiated only when the operator has put in a new piece of metal and depressed a starting button manually.

Description

The equipment is mounted in a sheet metal cabinet. The apparatus mounted in the cabinet consists of one RJ-571 amplifier tube, one KU-636 Thyratron tube and two 2-pole contactors. In addition, there is a phototube mounted on the lower end of the panel and facing toward the lens assembly. Sometimes the phototube and lens assembly is mounted remote from the cabinet. Behind the panel are located a transformer, rectifiers, capacitors, and other auxiliary parts. Extending from the bottom of the cabinet is a sight tube having mounted on its outer end a lens and a protective glass over the lens. On the front cover of the unit is mounted a pushbutton for emergency trip, a start pushbutton, a potentiometer for adjusting the operating points, and a dial to allow resetting of the equipment to a previously determined operating point.

Installation

Mounting:

The Photo-Troller must be mounted vertically in order to keep the relays in the proper operating position. The mounting of the Photo-Troller should be as rigid as possible to insure fixed alignment of the optical system.

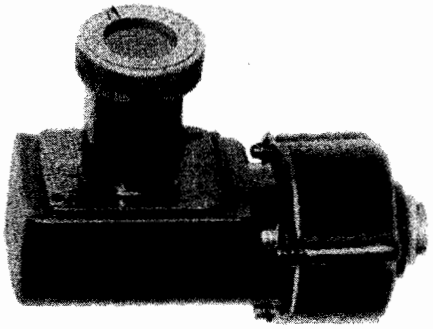
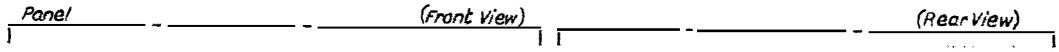


Fig. 2 - Type B Phototube Housing

The Photo-Troller will not be injured by any vibration which does not mechanically damage the apparatus, although vibration should be a minimum at the point of installation. The KU-636 Thyratron tube which is supplied with the Photo-Troller is not affected by temperature changes and therefore the Photo-Troller can be mounted in any location where the ambient temperature is between 140 degrees F. and -10 degrees F. If the Photo-Troller is being used on a heater for heating extremely large pieces of metal to high temperatures which result in a high radiation of energy, a shield or baffle of asbestos should be located between the Photo-Troller and the hot metal. The baffle should be so arranged that there is a free circulation of air provided around the Photo-Troller cabinet.

The Photo-Troller should be mounted so that the hot metal to be observed lies on the axis of the lens and metal tube. Locate the lens 12" from the metal. The axis of the metal bar should be parallel with the axis of the phototube in all cases.

up. Operate the milli-ampere meter switch to "off"



tube should break down and operate the relays. The milli-ampere meter should read approximately 0.4 when this occurs.

Make sure that the image of the hot metal is focused on the center of the phototube. The operation is initiated by operating the stop pushbutton. Adjust to the proper temperature for trip-out by turning the potentiometer knob on the front of the cabinet to operate at the desired point. If the potentiometer cannot be adjusted to make the unit trip out at a sufficiently high temperature, an aperture should be added in front of the phototube to reduce the amount of light reaching it and thus place the potentiometer in position to control at the desired point. It should always be the object to make adjustment in such a way that operation is obtained at the proper temperature when the potentiometer is as far from zero as possible. Do not operate with a smaller aperture than necessary. When properly adjusted as described, the operation should repeat itself accurately on successive heats.

To obtain satisfactory operation the potentiometer must be adjusted to give a milli-ampere meter reading when the phototube is dark, which is at least 0.05 milliampere higher than the milliampere current required to operate the relays. If, for example, the relays operate when the milli-ampere meter reads 0.4, the minimum potentiometer adjustment which can be used is that which gives 0.45 milliampere when the phototube is dark.

If the RM-1 Photo-Troller is used to control temperatures less than 1500 degrees F. it is important that no extraneous light, for example, sun light or artificial room illumination reaches the metal piece to be heated, because reflection may be of an intensity comparable with the light radiated from the metal at low temperatures. Under these circumstances it becomes necessary to carefully shield the metal from the extraneous light. It often happens that sparking will occur between the metal and the jaws when the metal is being inserted in the jaws. To prevent this sparking from prematurely tripping the Photo-Troller it may be necessary to arrange a shield to prevent the light emitted from these sparks from reaching the phototube. This shield may be in the form of a permanent aperture, shielding the outer rim of the metal, or may be arranged as a movable shield, mechanically or electro-magnetically operated which is interposed between the phototube and the metal until such a time when the initial sparking has subsided.

Maintenance

General:

The maintenance schedule for the Photo-Troller depends largely on the individual operating conditions. However, it is recommended that for service on heater control, the adjustment be checked each morning. It is particularly necessary that the lens and optical system be cleaned often enough to maintain maximum optical efficiency. In unusual cases, very frequent cleaning may be necessary, depending on the condition of the surrounding atmosphere. It must, of course, be expected that a dusty atmosphere will foul the glass surfaces more quickly than clean air. The glass window which protects the lens should be replaced when it becomes pitted due to

tube if milli-ampere meter reading is not 0.5 or higher.

2. Adjust potentiometer until milli-ampere meter reads 0.4. Observe potentiometer position. By turning the potentiometer 0.5 division counterclockwise from the observed position the milliampere meter reading should be 0.2 or less. If this is not the case, replace the RJ-571 tube.

3. If the KU-636 tube does not operate when the milli-ampere meter is between 0.25 and 0.45 replace the KU-636 tube.

4. If during the preceding tests the RJ-571 and KU-636 tubes have performed satisfactorily, but if unsatisfactory overall operation is obtained, replace the SK-60 phototube.

5. If replacement of tubes does not improve operation, and if satisfactory results cannot be obtained during the preceding tests, proceed as follows:

6. Milli-Ampere Meter Reads Always Zero:

   (a) Resistor 17-19 is open-circuited.

   (b) Milli-ampere meter is open-circuited.

   (c) RJ-571 tube socket does not make contact with tube prongs.

   (d) There is no voltage across 7-17 and 9-7. This voltage should be approximately 90 volts. Check by means of a d-c. voltmeter.

   (e) If there is no voltage across 7-17 and 9-7 check capacitors for short-circuit, Rectox 9-16 and 16-17 for open circuit, and check voltage across 16-12 which should be 65 volts a-c.

   (f) Make sure that the RJ-571 filament 30-31 is heated. Tube should feel warm after being in circuit for five minutes.

   (g) Check phototube leads for ground and short-circuit. Measure resistance between leads with phototube removed, and adapter removed from phototube socket. The resistance as measured by a megger should be 100 MEGS or higher.

7. Milli-Ampere Meter Reads Always 0.5 or Higher:

   (a) Check a-c. voltage 27-28 should be approximately 75 volts.

   (b) Check d-c. voltage 10-14 which should be approximately 100 volts.

   (c) Make sure that phototube leads are not grounded.

Tube Replacement:

out. It normally fails by clean up of the gas. This causes the tube to be more difficult to break down. This is evidenced by failure of the tube to break down even with the milli-ampere meter current as low as 0.3.

The best method of checking the tubes is to replace them one at a time by new tubes or better still, by tubes which operate satisfactorily in an identical Photo-Troller. Spare tubes should always be kept on hand.

The RJ-571 amplifier tube may fail due to burnout of the filament or by decreased overall amplification factor, caused either by decreased emission or by excessive grid current. The tube should be replaced if the test results outlined in paragraph 2 cannot be obtained.

Replacement Parts

Apparatus	Style	Apparatus	Style
Phototube	SK-60	Potentiometer (0.5 MEG)	966 591
Thyratron Tube	KU-636	Capacitor 0.01 MF.	1 014 540
Amplifier Tube	RJ-571	Capacitor, Cornell-Dubilier Type	EH-9808SL
Contactor with Coil, 50-60 Cycles	1 008 540	Resistor 0.5 MEG.	860 878
Contactor Coil, 50-60 Cycles	1 008 520	Resistor 10 MEG.	846 670
Transformer, 115/230 Volts, 50-60 Cycles.	966 515	Resistor 0.25 MEG.	861 041
Transformer, 220/440 Volts, 50-60 Cycles.	971 458	Pushbutton "Start"	511 813
Socket for RJ-571 Tube	831 726	Pushbutton "Stop"	588 353
Socket for SK-60 or KU-636 Tube	766 732	Knob and Pointer	845 309
Tube Clamp	968 211	Switch	919 068
Rectox (27-28)	966 513	KU-636 Grid Clip	829 334
Rectox (9-16-17)	971 170	RJ-571 Grid Clip	799 907
Milli-Ampere Meter	818 504		

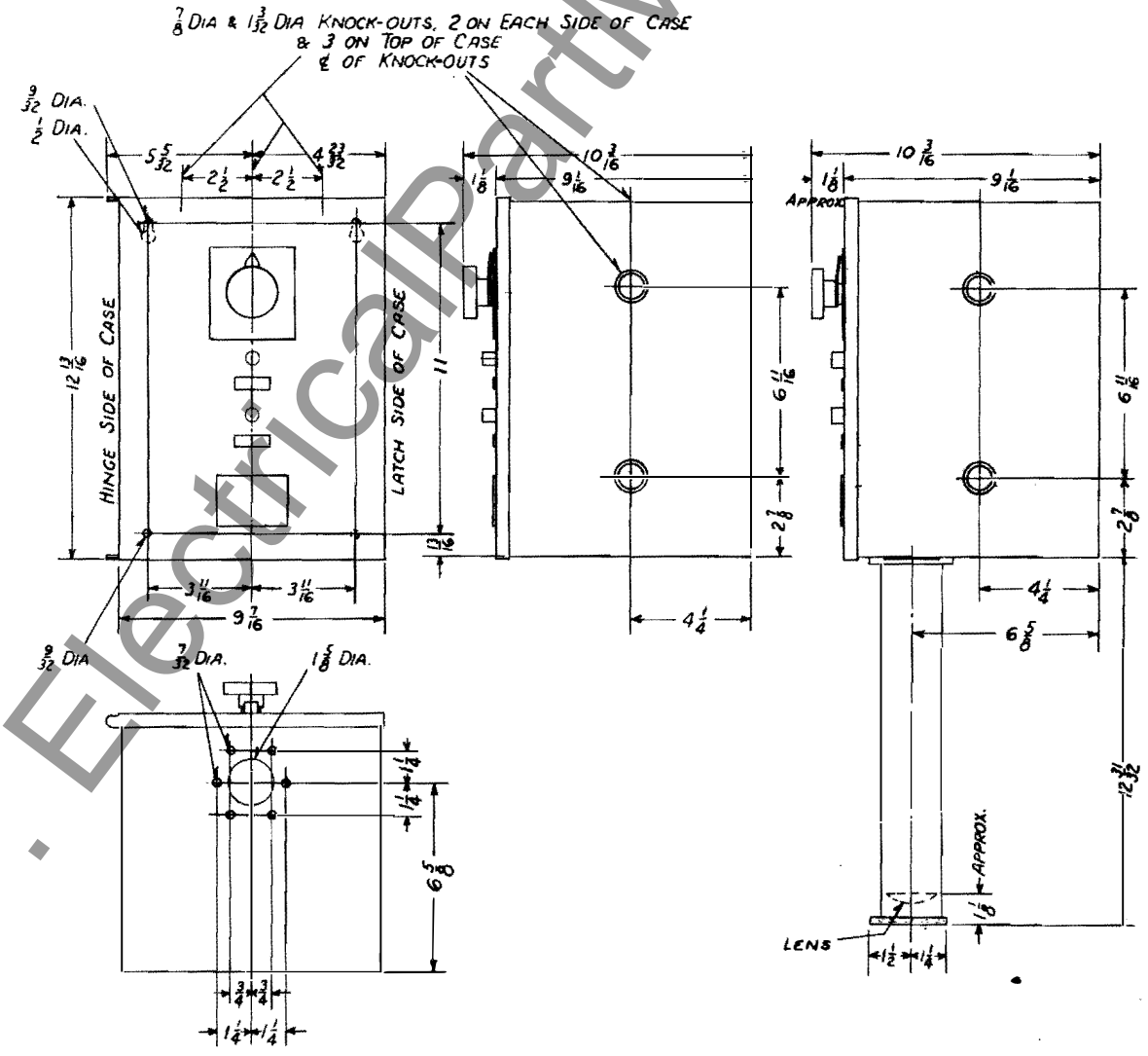


Fig. 6 - Outline Drawing for Photo-Troller without Focusing Tube and with long Focusing Tube

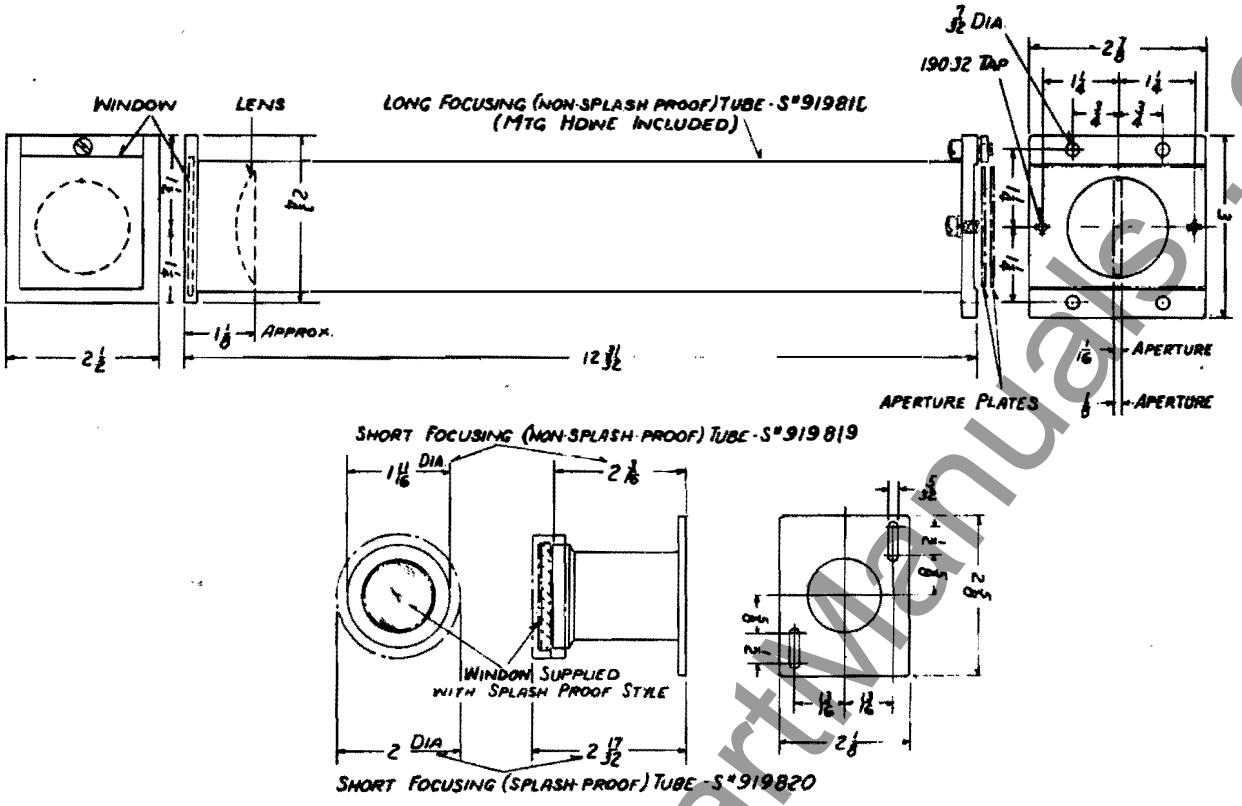


Fig. 7 - Outline Drawing for long Focusing Tube, Style No. 919818, and short Focusing Tube, Style No. 919820

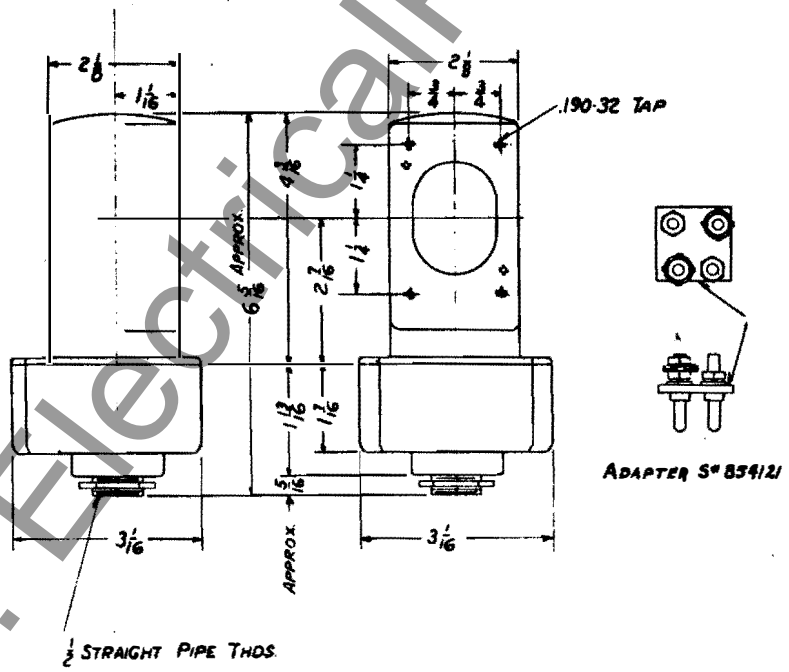


Fig. 8 - Outline Drawing for Phototube Housing with Adapter, Style No. 919821

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

I. B. 5670-50

Printed in U.S.A.
(500-7-37)

PURPOSE

The purpose of this instruction book is to give the reader the maximum of useful information and suggestions concerning construction, installation, operation and maintenance of Westinghouse Type RX-1 Photo-Troller.

The material contained herein has been assembled with a view toward facilitating installation and operation of the equipment and this book is intended to serve as a guide to installation and operating personnel so that the maximum useful life of the apparatus can be obtained.

COMMUNICATIONS

When communicating regarding a product covered by this Instruction Book, replies will be greatly facilitated by citing COMPLETE NAME PLATE READINGS of the involved products. Also, should particular information be desired, please be very careful to clearly and fully STATE THE PROBLEMS AND ATTENDANT CONDITIONS.

Westinghouse

Type RX-1 Photo-Troller

Instructions for Installation

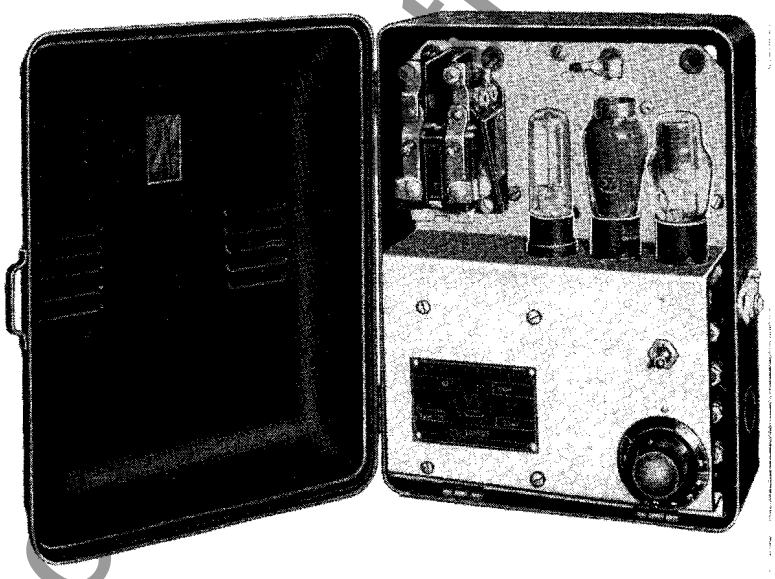


FIG. 1—TYPE RX-1 PHOTO-TROLLER

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

I.B. 5670-44-A

INDEX

LIST OF ILLUSTRATIONS

Westinghouse

Type RX-1 Photo-Troller

Instructions for Installation

(1) **PREFACE**

The RX-1 photo-troller is one type of a line of general purpose photo-electric relays operated by an increase or decrease in the amount of light falling on a phototube. They are arranged to initiate an electrical sequency in response to changes of illumination caused by partially or completely interrupting a light beam. A few installations are shown which are representative of the great variety of applications.

In order that maximum flexibility of application may be obtained, various types of light sources and phototube housings may be used as shown in attached Price Lists 18–310. Several types of photo-trollers are available, each of which is best adapted for particular applications.

LIST OF APPLICATIONS

Limit or "flag" switch where a mechanical switch is undesirable such as for

Paper mills — break indicator
Automatic weighing
Sheet catcher in steel mill
Oscillating grinder belt
Paper and cellophane bag machines
Registering wrapper trademark on packaging machines
Stopping mechanical devices at accurate position
Liquid level control
Initiating flying shear
Door opening.

Counting

Parts on production lines such as crankshafts, boxes, tin sheets
People entering or leaving buildings
Automobile traffic.

GENERAL DATA

The RX-1 photo-troller is arranged with a steel panel which is hinged at the bottom of the case and held in place by one screw at the top. The indoor units are provided with a rectangular knockout in the door which may be removed to serve as a light aperture if the phototube is mounted in the cabinet.

A type SG relay is operated directly from the tube circuit. Thus, no interposing sensitive relays, such as are usually needed if radio amplifiers are used, are required. This relay has two pairs of contacts which can be arranged to give two normally closed contacts or one normally open and one normally closed contact.

The RX-1 photo-troller provides the power supply for a light source with either a 6–8 volts, 32 candlepower lamp or a 6 volt, 5 ampere lamp, Style 849085.

A terminal board is provided at the rear of the panel for all connections except to the relay contacts which are on the relay itself in front of the panel. The terminal board is readily accessible for installation, since the removal of a single screw permits swinging the panel down on hinges to hang from the bottom of the cabinet.

The type RX-1 is equipped with a phototube, an amplifier tube and a thyratron tube. The output of the WL-735 phototube is amplified by a 57 tube. This output, in turn, operates a WL-629 thyratron which energizes the SG relay.

A switch is provided so that the unit may be used to energize the SG relay, when light on the phototube is either increased or decreased. For either arrangement, a minimum of 1.0 foot-candle light intensity is required to operate the relay. The light intensity must be reduced at least 50% to insure positive operation of the relay.

At least 0.2 second should be allowed between centers of light impulses, corresponding to 300 operations per minute. At this speed of operation, the 0.2 second must be divided equally between the "on" and "off" period. The maximum recommended rate of operation is 150 per minute. However, the approximate time of light change required to operate the relay is 0.05 second.

If the phototube is mounted in a separate housing, it may be located up to 25 cable feet distance, although standard housings are furnished with 10 feet of cable, which is usually sufficient. Distances beyond 10 feet slow down the speed of response 25%, and longer times than those given for operation must be allowed. The footcandle rating of the unit is then also increased to 1.5 footcandles.

(2) HOW TO SELECT AND APPLY PHOTO-TROLLERS

The first fundamental in application of photo-trollers is that it is desirable to have as much excess illumination as possible beyond that required by the rating, in order that the safety factor will be increased.

Photo-trollers operate by variation of the **quantity** of light falling on the phototube. Ratings are given in terms of light intensity for greater convenience in application, and these ratings in terms of light intensity are based on the assumption that the full phototube or lens opening of the photo-troller will be used. Therefore, if the photo-troller is used in such a manner that only a portion of the phototube or lens opening is open, proportionately greater light intensity must be allowed.

If photo-electric equipment is to be operated in the vicinity of smoke, fog, dirt, steam or other similar conditions, it is necessary to add the best possible estimate of light loss factor so that adequate safety margin will be insured.

Since photo-trollers operate by variation of the quantity of light falling on the phototube, it follows that the method of obtaining this variation is important. Two methods of varying illumination are in general use — variation of transmission and variation of reflection.

Transmission is varied by arranging an opaque, or partially opaque, object to intercept the beam of light which normally passes from light source to phototube. This is the most common method of operation and may be used for automobiles, people, paper sheets, steel sheets, packages, etc. Clear cellophane is obviously not very opaque and, therefore, does not vary the light beam much when intercepted by it. When operating with material of this nature whose opacity is not high, it is very important to know what this opacity is. Such applications are usually more difficult and it is recommended that they be referred to the nearest District Office of the Westinghouse Company for recommendations.

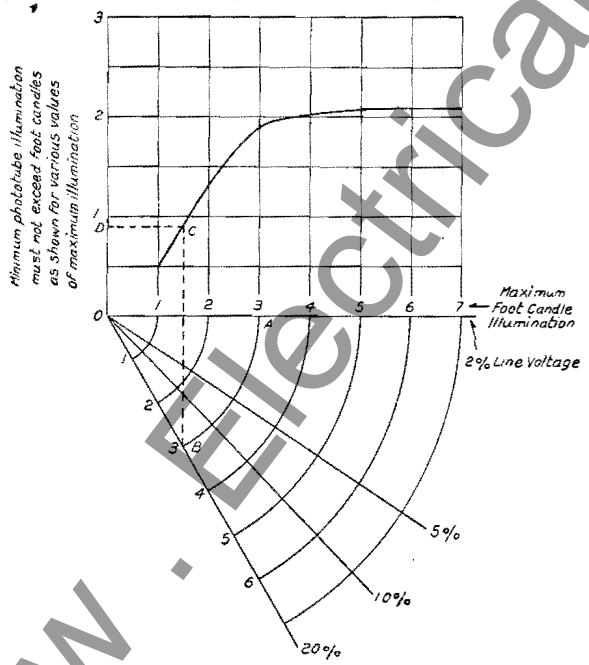


FIG. 2—CURVE SHOWING HOW MUCH THE PHOTOTUBE ILLUMINATION MUST BE DECREASED FOR VARIOUS VALUES OF A-C. LINE VOLTAGE VARIATION

Reflection is varied by arranging the optical system so that the light beam is reflected from the material to the photo-tube and the extent of this reflection is varied by the character of the surface of the material.

The actual procedure to be used in selecting the proper photo-trollers and light source is:

(1) Determine what portion of the light beam will be available under maximum illumination conditions.

(2) Determine what portion of the illumination will be intercepted by the controlling object.

(3) Select a photo-troller having the general characteristics desired, and then

(4) Select a combination of photo-troller and light source such that at the distances and operating conditions determined under paragraphs (1) and (2), adequate sensitivity will be obtained,

(5) Re-check all variable factors to make certain that adequate safety margin is proceeded in the selection.

(3) Phototube Housings

The RX-1 photo-troller is arranged so that the phototube may be mounted inside the case. When this is done the knock-out in the case door should be pressed out to permit the light to reach the phototube. In many applications it is preferable to mount the phototube in a separate housing, and for this purpose, one of the housings shown in attached Price List 18-310 should be used.

(4) Various types of light sources are shown in attached Price List 18-310, all of which, except the type L, can be used with the type RX-1 photo-troller. In selecting the light source care must be taken that the minimum illumination on the phototube must not exceed the values given in Fig. 2.

In this figure are shown different scales for the maximum illumination for different percentage changes in a-c line voltage. Using, for example, the

basic 2 per cent curve, it is seen that if the maximum illumination is 3 foot candles, the minimum illumination must not exceed 1.9 foot candles. If, however, the maximum line voltage variation is 20 per cent and the maximum illumination is 3 foot candles at maximum a-c voltage, then the minimum illumination 0.9 foot candles is found by following the circle from A to B, then to C and to D. By using the curves in Fig. 2 in combination with the light source curves in Fig. 7 of Price List 18-310, the required percentage reduction in illumination can be determined.

Example: Light Source: Type F
Voltage Variations: 10%
Operating Distance: 30 feet

From Fig. 7: Price List 18-310 is found, 2 footcandles.

From Fig. 2: 2 footcandles at 10 per cent voltage gives 0.8 footcandles. Minimum illumination.

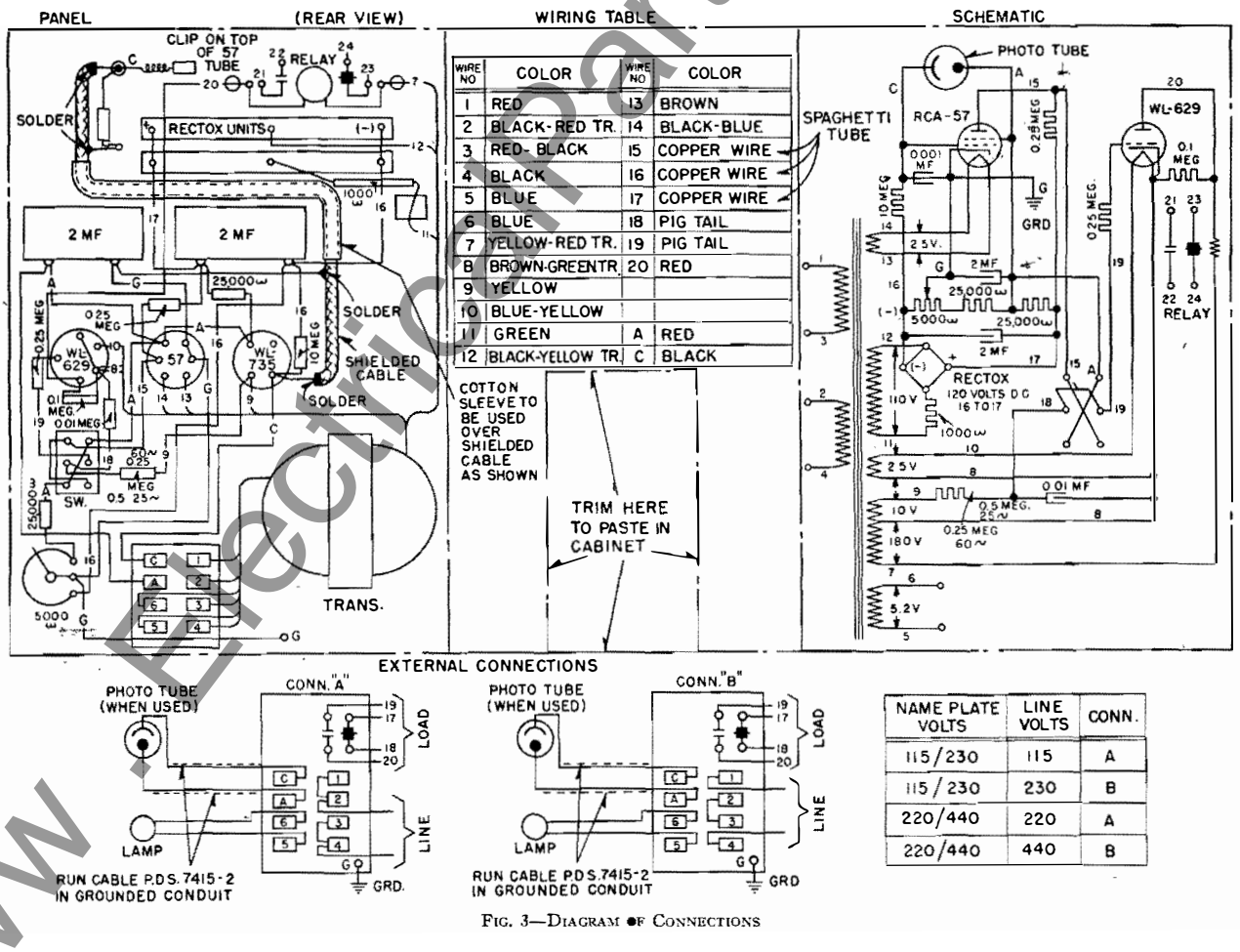
Consequently: The illumination must be decreased from 2 footcandles to 0.8 footcandles, or 60 percent.

(5) PRINCIPLE OF OPERATION

The RX-1 photo-troller as shown in Fig. 3 consists essentially of two different control circuits, namely the phototube-amplifier circuit and the Thyratron control circuit.

The Phototube-Amplifier Circuit

The purpose of this circuit is merely to amplify the variations in voltage caused by changing illumination on the phototube. The circuit consists of a d-c source supplied by the rectox rectifier connected between 16 and 17. A voltage divider, consisting of a 5000 ohm potentiometer and two 25000 ohm resistors, is connected across this d-c source. The phototube circuit consists of the WL-735 phototube connected between A and C and the 10 MEGOHM resistor C-16. If the illumination on the phototube is increased, an increasing amount of current flows through the tube, thus making Lead C more positive relative to the potentiometer tap G. The voltage between C and G is the grid control voltage for the 57 amplifier tube. This tube, which is of the screen grid type consists of a heater connected to 13-14, a cathode connected to G, a screen grid connected to A, a control grid connected to C and an anode connected to 15.



WIRE NO	COLOR	WIRE NO	COLOR
1	RED	13	BROWN
2	BLACK-RED TR.	14	BLACK-BLUE
3	RED-BLACK	15	COPPER WIRE
4	BLACK	16	COPPER WIRE
5	BLUE	17	COPPER WIRE
6	BLUE	18	PIG TAIL
7	YELLOW-RED TR.	19	PIG TAIL
8	BROWN-GREEN TR.	20	RED
9	YELLOW		
10	BLUE-YELLOW		
11	GREEN	A	RED
12	BLACK-YELLOW TR.	C	BLACK

NAME PLATE VOLTS	LINE VOLTS	CONN.
115/230	115	A
115/230	230	B
220/440	220	A
220/440	440	B

FIG. 3—DIAGRAM OF CONNECTIONS

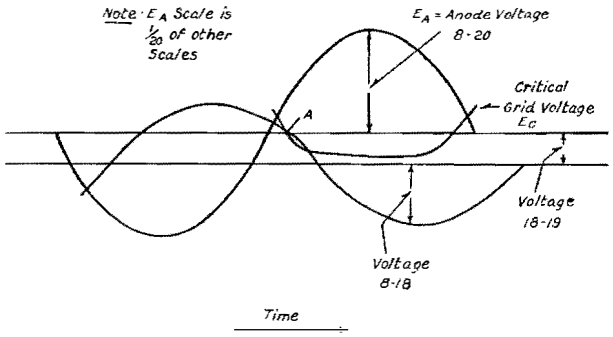


FIG. 4—THYRATRON TUBE OPERATING CHARACTERISTICS

The characteristics of the 57 tube are such that the tube will pass no current if the voltage between C and G is more negative than approximately 2 volts. If the grid voltage is made less negative the current through the tube will increase and will reach its maximum value when the grid voltage is approximately zero.

When the current through the 57 tube is zero the potential of 15 is positive in relation to the potential of A. As the 57 current is increased the potential difference between 15 and A is decreased to zero and then again increased so that the potential of 15 becomes negative relative to the potential of A.

From the preceding discussion it may be seen that when the illumination on the phototube is low the potential of 15 is positive relative to A, whereas with the phototube highly illuminated the potential of 15 is negative relative to A.

The Thyratron Control Circuit

The WL-629 Thyratron tube consists of a heater connected to 8–10, a cathode connected to 8, an anode connected to 20 and a control grid connected to the 0.25 MEG resistor connecting to lead 19. The anode is connected in series with the SG relay coil to lead 7, and the cathode is connected to lead 8. When the tube becomes ionized the resistance of the tube between 20 and 8 changes from an infinite value to a low value, and rectified a-c current flows from 7 through the relay coil to 20, through the tube and to 8. The voltage between the grid and the cathode determines whether the tube conducts current or not.

If this voltage is more negative than approximately 6 volts, the tube does not become ionized, no current flows, and the SG relay is deenergized. If the grid voltage is made more positive, the tube conducts current and the relay is closed.

The control voltage for the WL-629 is a combination of a 135 degree phase shifted a-c voltage component obtained from capacitor 8–18, and a d-c component obtained from the amplifier tube circuit 15-A, and which is applied to the grid circuit 18–19 by means of the double pole reversing switch.

The control voltage characteristics for the WL-629 tube are shown in Fig. 4 in which E_c represents the critical grid voltage needed. It will be seen that when voltage 18–19 is made more positive the WL-629 tube breaks down at A at the beginning of the a-c voltage wave, and conducts current during the remainder of the half cycle.

The purpose of the reversing switch is to reverse the operation of the relay relative to the change of phototube illumination. With the switch in the "UP" position the relay is closed when the phototube is illuminated. With the switch in the "down" position the relay is energized when the phototube is dark.

INSTALLATION

(6) Mounting

Mount the photo-troller with the panel in a vertical position. If the phototube is to be mounted inside the photo-troller case, remove the knockout in the case door to permit light to reach the phototube. If the phototube is mounted in a separate housing, the housing may be mounted in any convenient position, up to 10 feet distant from the photo-troller, or 25 feet if the photo-troller is derated as outlined in paragraph 1.

The light source may be mounted in any position except that the lamp base must not be higher than the lamp filament.

(7) Temperature Limits

The photo-troller should be mounted in a location where the ambient air temperature does not exceed 110°F. If the photo-troller is mounted near furnaces or other equipment radiating an excessive amount of heat, the photo-troller should be shielded by means of a suitable shield. The maximum air temperature at the location of the phototube housing should not exceed 150°F.

(8) A-C Voltage Variations

The a-c supply voltage should be within ± 10 per cent of rated voltage. If the a-c voltage varies more than 2 per cent. total, the conditions outlined in paragraph 4 should be considered.

(9) External Connections

Connect the photo-troller as shown in Fig. 3, making sure that connections to terminals 1 to 4 are made as shown in the table in this figure. Connect the light source to terminals 5–6, using cable with 30 amperes capacity. When an extended photo-tube is used, do not place the phototube in the socket inside the case, but connect the phototube housing to terminals A-C by means of cable PDS-7415-2 as supplied with the phototube housing. Make sure that terminal A on the photo-troller terminal board is connected to terminal A in the phototube housing.

Run the cable in grounded metallic conduit, with no other leads in this conduit. The length of the phototube cable must not exceed 10 feet unless the photo-troller is derated as outlined in paragraph 1, in which case cable up to 25 feet long may be used. Do not splice the phototube cable, and use no friction tape or other types of tape at the ends of the cable.

Ground terminal G inside the photo-troller case to a waterpipe.

Run leads connecting to the relay contacts directly to the knockouts on the left hand side of the photo-troller case. Do not run relay leads across the photo-troller either in front or in rear.

(11) Operation

With the switch in "up" position the relay is closed when the phototube is illuminated. With the switch in the "down" position, the relay is closed when the phototube is dark.

(10) Relay Characteristics

Contact Interrupting Capacity

	110 Volts A-C	220 Volts A-C	440 Volts A-C	125 Volts D-C	250 Volts D-C
One "Make"	20	12	7	2	0.7
One "Break"	10	6	3	1	0.4
*Two "Make" in series	30	20	10	3	1.

*Reverse left hand stationary contact.

Note: Two "Break" Contacts cannot be used.

Contact Carrying Capacity

One "make" contact: 12 amp. continuous.
One "break" contact: 6 amp. continuous.

Operations per Minute

Maximum 300. Recommended 150. (See paragraph 1.)

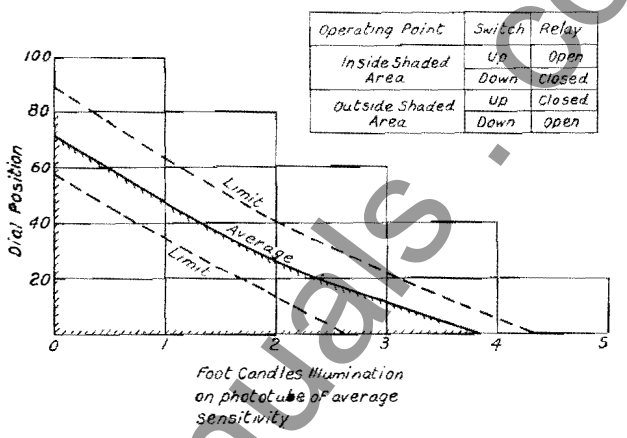


FIG. 5—CURVES SHOWING DIAL POSITION AS A FUNCTION OF PHOTOTUBE ILLUMINATION

(12) Sensitivity

With the phototube dark the relay will operate as shown in Fig. 5, when the dial of the potentiometer is approximately at position 70. With one foot-candle illumination on the phototube the dial position is approximately 45 when the relay operates, and at dial position 0 approximately 4 foot-candles are required to operate the relay. The sensitivity of the photo-troller conservatively rated, is, therefore, 1 foot-candle. Due to this high sensitivity it is preferable to limit the maximum illumination on the phototube to 10 foot-candles in order to obtain long phototube life. To obtain reliable operation the illumination on the phototube when the light intensity is minimum should not exceed the values as indicated in Fig. 2.

The location of the curves vary considerably with varying phototube sensitivity as shown by the upper and lower limit curves in Fig. 5.

(13) **Adjustments:**

(1) Turn on power and allow unit to warm up 5 minutes.

(2) Focus light source.

(3) With phototube entirely dark turn potentiometer until relay operates. The dial position should now be approximately 70.

(4) With maximum a-c supply voltage and minimum illumination on the phototube adjust the dial until the relay operates. Observe dial position D max. If necessary reduce the illumination by throwing the light beam out of focus so that D max. is not less than 40. With minimum a-c supply voltage and maximum illumination on the phototube cut off ½ of the light by means of an opaque object in front of the phototube, and adjust the dial until the relay operates. Read the dial position D min. To assure reliable operation, D minimum should be at least 15 divisions less than D maximum. If 15 divisions are not obtained the intensity of illumination must be increased by moving the light source nearer the phototube, or the difference between maximum and minimum illumination must be increased. If, with one-half of maximum illumination, it is not possible to obtain relay operation, it is recommended that the illumination be decreased until the relay operates with the dial at the 0 position.

WHAT TO DO IF THE PHOTO-TROLLER DOES NOT OPERATE SATISFACTORILY

(14) **General Tests**

(a) Make sure that terminal G is grounded to a water pipe.

(b) Disconnect the ground wire from terminal G and measure by means of a Megger the resistance between terminal G and ground. This resistance should be 20 MEGOHMS or higher.

(c) Inspect the tubes to see that the filaments are heated.

(d) Make sure that the cable to the phototube housing is in a grounded metallic conduit with no other leads in the conduit.

(e) Make sure that terminal A on the terminal board is connected to terminal A in the phototube housing.

(f) Measure, by means of a d-c voltmeter with resistance 1000 ohms per volt, the voltage across 16–17. This voltage should be approximately 120 volts.

(15) **Special Tests**

I. The WL-629 tube does not break down.

(a) Replace the WL-629 tube.

(b) Measure the a-c voltage between 8 and 20. This voltage should be approximately 190 volts.

(c) Connect a clip lead between 8 and 19. If the tube breaks down with this clip lead connected, but does not break down without the clip lead connected the trouble is either in the reversing switch or in the amplifier tube circuits.

(d) Check amplifier circuit as outlined in III.

II. The WL-629 tube breaks down regardless of phototube illumination or potentiometer position.

(a) Replace the WL-629 tube.

(b) Check to see that the circuit from 18, through the switch to 19 to grid is not open.

(c) Check the amplifier circuit as outlined in III.

III. Amplifier circuit does not operate properly.

(a) Remove the phototube from its socket and insert a milliampere meter in lead 15.

Adjust the potentiometer to position 100. The current through the milliampere meter should now be 0.3 MA or more. Turn the potentiometer towards zero. The current should now decrease and should be less than 0.05 MA with the potentiometer in position 40. If this condition is not obtained make the following tests:

(b) Replace the 57 amplifier tube.

(c) Measure the voltage across the potentiometer. This voltage should be approximately 12 volts. Use a d-c voltmeter with resistance 1000 ohms per volt for this test.

(d) Inspect circuit 16-C to see that the circuit is not open, and that C is not grounded.

(e) Make sure that resistor 15–17 is not open.

IV. The SG relay does not open when de-energized.

(a) Inspect resistor 8–20 to see that this resistor is not open.

(b) Inspect to see that the relay leads do not rub against the armature.

V. The sensitivity is lower than when the equipment was originally installed.

(a) Clean lens in light source.

(b) Replace the lamp in the light source.

(c) Replace the phototube and the amplifier tube.

(d) Inspect the phototube housing to see that there is no leakage between terminals A and C or between the terminals and ground.

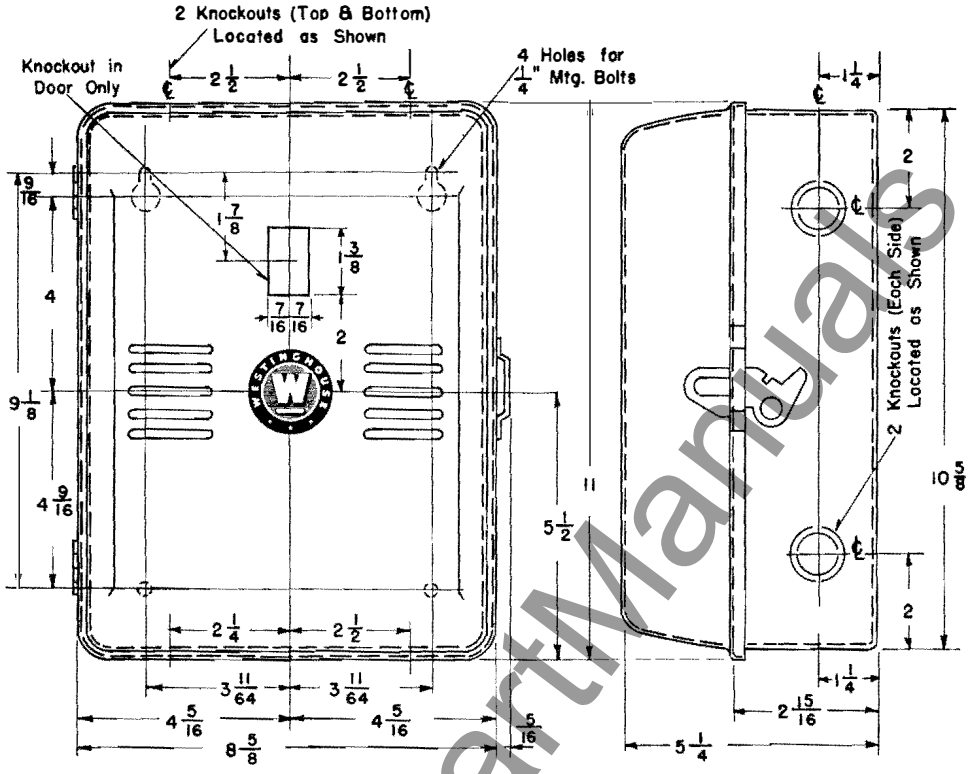


FIG. 6 OUTLINE DRAWING FOR 60 CYCLE

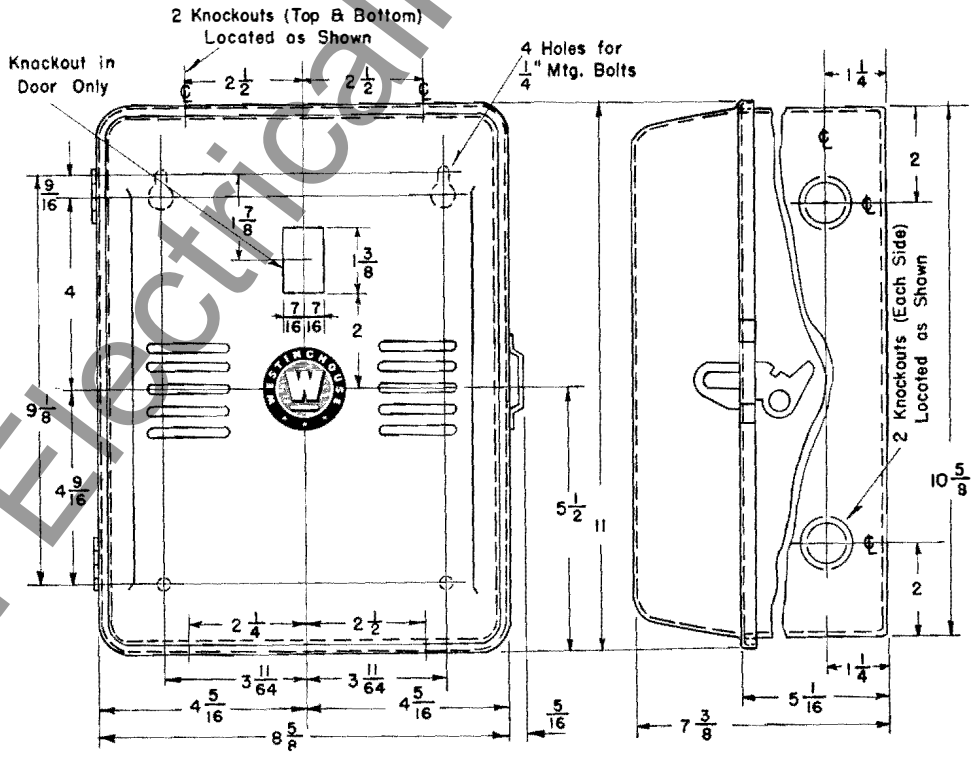


FIG. 7—OUTLINE DRAWING FOR 25 CYCLE

(16) **Spare Tubes**

1 — Phototube WL-735.
1 — RCA-57 Amplifier Tube.
1 — WL-629 Thyratron Tube.

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES

(See Descriptive Data 18-310) **(For Other Photo-Trollers See Price List 18-312)**

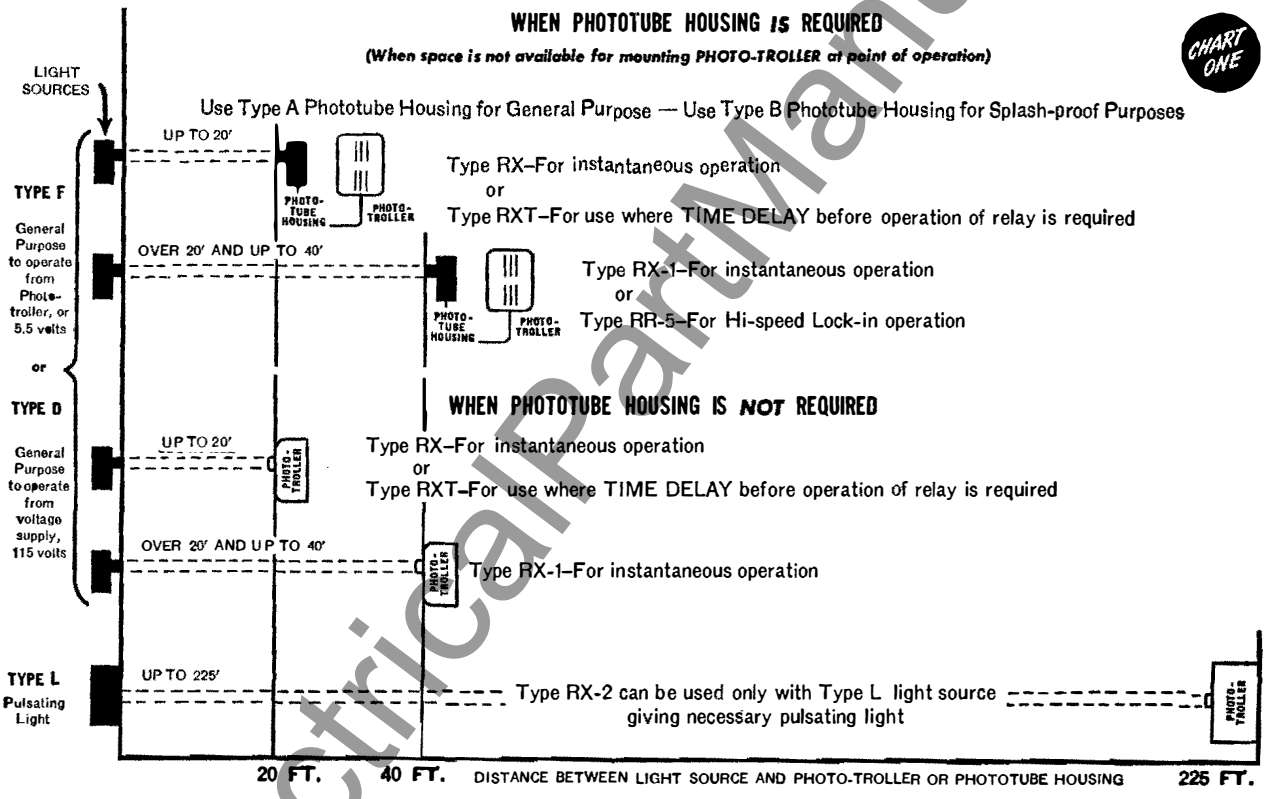
SELECTION OF EQUIPMENT

Before recommending equipment for any application, the customer's problem should be thoroughly understood and the following information should be obtained:

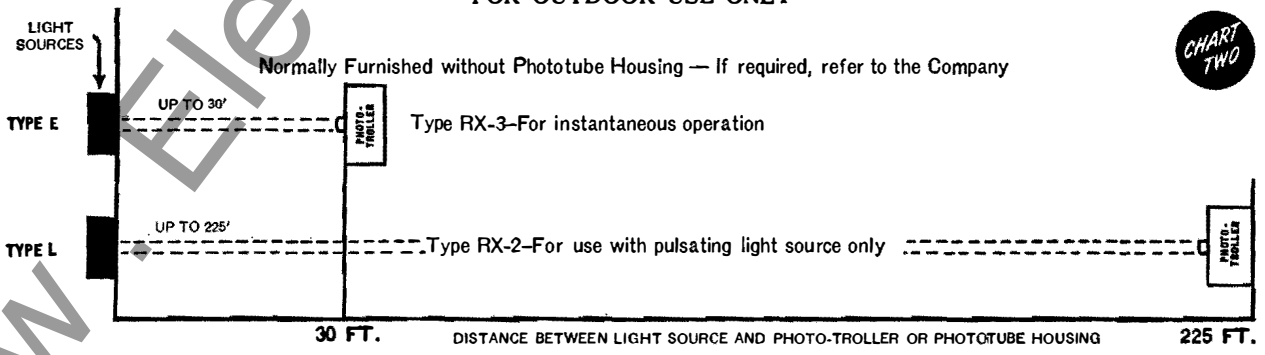
1. Distance between light source and phototube.
2. Interruption of 50% of light beam, based on a 1¼" diameter beam, necessary for maximum operating distance.
3. Operating conditions such as temperature, dust and weather conditions (indoor or outdoor).
4. Speed of operation. { a. Number of operations per minute. b. Time of single operation.
5. Space available for mounting the light source, phototube housing and/or Photo-Troller.

Having obtained above information, consult the charts below to select the proper equipment. For register regulator applications see Price Lists 18-311 and 18-513.

FOR INDOOR USE ONLY



FOR OUTDOOR USE ONLY



PRICES: See tables on page 2 for prices and ordering information.

Prices are subject to change without notice.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

W-2

●rg. B. Y, Cust. U only

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES—Continued

PHOTO-TROLLERS

Type	Description	Style Including Tubes	Power Supply		Tubes Included			PRICE Including Tubes
			Volts	Cycles	Number	Type	Description	
RX	Indoor	1 083 311	115/230	50/60				$ 58
		1 083 312	220/440	50/60	1	WL-735	Phototube	58
		1 083 313	115/230	25	1	WL-629	Thyratron	60
		1 083 314	220/440	25				60
*RX-1	Indoor	1 083 315	115/230	50/60	1	WL-735	Phototube	78
		1 083 316	220/440	50/60	1	WL-629	Thyratron	78
		1 083 317	115/230	25	1	'57	Amplifier	80
		1 083 318	220/440	25				80
RX-2	Indoor	1 083 319	115/230	50/60	1	WL-735	Phototube	
		1 083 320	220/440	50/60	1	WL-629	Thyratron	108
					1	'57	Amplifier	108
RX-2	Outdoor	1 083 321	115/230	50/60	1	WL-735	Phototube	165
		1 083 322	220/440	50/60	1	WL-629	Thyratron	165
					1	'57	Amplifier	
RX-3	Outdoor	1 224 834	115/230	50/60				119
		1 224 835	220/440	50/60	1	WL-735	Phototube	119
		1 227 682	115/230	25	1	WL-629	Thyratron	125
		1 227 966	220/440	25				125
RXT	Indoor Time Delay 1-5 Seconds	1 083 323	115/230	50/60				97
		1 083 324	220/440	50/60	1	WL-735	Phototube	97
		1 083 325	115/230	25	2	WL-629	Thyratron	99
		1 083 326	220/440	25				99
*RR-5	Indoor Hi-Speed	966 579	115/230	50/60	1	WL-735	Phototube	
		1 032 195	115/230	25	1	RJ-571	Amplifier	192
					1	KU-627	Thyratron	202

* See Price List 18-513, for Register Regulator Applications.

LIGHT SOURCES

Type	Description	Style Incl. Lamp	Power Supply			Shipping Weight, Lbs.	PRICE Incl. Lamp
			Volts	Cycles	Watts		
D	General Purpose, with transformer,	829 396	115/230	25–60	21	11	$21.50
D	indoor, visible light only	829 397	220/440	25–60	21	11	21.50
E	High intensity, with transformer.	849 186	115/230	25–60	35	18	27.00
E	Indoor, or outdoor, visible light	849 187	220/440	25–60	35	18	27.00
L	Long range with motor driven in-	1 083 460	115/230	50–60	65	30	92.00
L	terrupter, indoor or outdoor	1 083 461	220/440	50–60	65	30	92.00
..	Infra red filter for types E and L only. 10% transmission.	1 033 919	... ...	.. ..	..	1	10.00
..	Infra red filter for types E and L only. 20% transmission.	1 083 482	... ...	.. ..	..	1	10.00
F	General purpose, indoor, visible light only. For operation from Photo-Troller.	831 706	5.5	a-c. or d-c.	18	4	15.00

PHOTOTUBE HOUSINGS

Type	Description	Style Without Tubes	Shipping Weight, Lbs.	PRICE Not Incl. Tubes
A	General Purpose, with 10 foot leads. Indoor only.	1 073 380	5	$12
B	Splash-Proof with 10 foot leads. Indoor only.	1 073 382	5	14

ORDERING INSTRUCTIONS

When the proper Photo-Troller has been selected, specify the following when ordering: (1) style, (2) type, (3) description, (4) voltage, (5) frequency-cycles.

The accessory light source and phototube housing should be entered as separate items.

TUBES

Spare tubes should be ordered as separate items on the order. Tube prices are found in Price Lists 86-520 and 86-530. Renewal tubes for equipment in operation should be ordered direct from the Special Products Sales Department, Bloomfield Works.

Return of tubes for any reason should be made in accordance with Selling Instructions 86-500.

PRICES

Photo-Troller prices include all necessary tubes.

Light source prices include the lamp.

Phototube housing prices do not include phototube.

No reductions are made for the omission of cabinets on Photo-Trollers.

Semi-dust-tight cabinets may be ordered for all Photo-Trollers except the type RX-2 outdoor model. Add **$3** to price listed above.

When leads longer than the standard 10 feet furnished with phototube housings are desired specify required length of PDS 7415-2 cable as a separate item on order. Cable **$.15** per foot, **W-2** for length over 10 feet.

Prices are subject to change without notice.

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES—Continued

APPLICATION INFORMATION ON GENERAL PURPOSE PHOTO-TROLLERS AND ACCESSORIES—FOR TRANSMITTED LIGHT

DESCRIPTION OF TYPES

Type RX

For general purpose indoor, industrial application where the change in light on the phototube is more than 50% and where less than 150 operations per minute with equal "off"—"on" periods are required.

Type RX-1

For the same applications as the type RX above except where greater distances (up to 40 feet maximum) must be covered.

Type RX-2

For indoor or outdoor installations where distances greater than 50 feet and up to 225 feet must be spanned. Since it is built to operate on modulated light it must be used with the special type L light source which produces modulated light.

Type RX-3

This Photo-Troller is designed for outdoor service at distances up to 30 feet between the light source and phototube when used with the type E outdoor light source.

Type RX-T

This Photo-Troller has a time delay which begins when light is removed from the phototube and is adjustable from 1 to 5 seconds. The time delay is automatically reset any time light is again placed on the phototube.

Type RR-5

A special Photo-Troller to be used where high-speed action or "lock-in" operation is required. It can also be used for register regulator applications. See Price List 18-513.

The RR-5 is intended primarily for operation from the current received from a phototube. In addition, it may be operated by contacts and variable resistances or voltages in special applications. It is particularly applicable if the light change is of too short duration to actuate a magnetic relay coil using ordinary 18-310 Photo-Trollers.

APPLICATIONS

"Photo-Troller" is the Westinghouse trade name for a photo-electric relay. For operation, Photo-Trollers depend upon the interruption of a light beam falling upon a phototube. In industrial practice photo-electric control usually consists of at least two units, namely: a light source and a Photo-Troller. In this case the Photo-Troller must contain the phototube. However if the Photo-Troller cannot be mounted at the desired location because of size or appearance, the phototube may be placed in a phototube housing and mounted away from the Photo-Troller as far as 10 feet. This distance is limited by the speed required. The closer the phototube is placed to the Photo-Troller the faster the relay can act.

The Photo-Troller can be used to perform automatically many tasks which were formerly performed by manually operated relays. It should be remembered that a Photo-Troller is primarily a control device and therefore, is always used in conjunction with other electrical devices which perform the actual operation. Following is a brief list of uses for Photo-Trollers:

1. As a limit switch or flag switch:

(a) In paper or rubber mills to indicate a break in paper or rubber web.

(b) For automatic weighing.

(c) For stopping mechanical devices at accurate or limit positions.

(d) For liquid level.

2. As a safety device for:

(a) Elevator doors.

(b) Pulverized fuel furnaces.

(c) Punch presses, bending and shearing machines.

(d) Railroad crossings on industrial sidings.

(e) Electric test floors.

3. As controls for:

(a) Alarms indicating the approach of unauthorized persons to forbidden areas.

(b) Alarms indicating the approach to dangerous areas in chemical plants, powder mills, etc. or areas in which overhead cranes are operating.

4. For counting of:

(a) Parts on production lines such as boxes, tin or paper sheets, packages, and numerous other items.

(b) People entering or leaving buildings.

(c) Automobile traffic.

5. Opening of doors to garages, public buildings and factories.

6. Automatic drinking fountain control.

7. Temperature limit indicators for hot metals.

LITERATURE REFERENCE

Type	Instruction Book	Instruction Leaflet
RX	5670-43	2640
RX-1	5670-44	2641
RX-2	5670-45	2646
RX-3	5670-43	2640
RX-T	5670-46	2647
RR-5	5751	....

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES—Continued

PHOTO-TROLLER CONTACTOR RATINGS

Contacts Provided	Rating Per Contact A-C.	
	Amps.	Volts
One Normally Open	20.	110 A-C.
	12.	220 A-C.
	7.	440 A-C.
	2.	125 D-C.
	0.7	250 D-C.
One Normally Closed	10.	110 A-C.
	6.	220 A-C.
	3.	440 A-C.
	1.	125 D-C.
	0.4	250 D-C.
Two Normally Open in Series	30.	110 A-C.
	20.	220 A-C.
	10.	440 A-C.
	3.	125 D-C.
	1.	250 D-C.

Max. Continuous Carrying Capacity
Normally Open—12 Amps.
Normally Closed—6 Amps.

POWER CONSUMPTION, DIMENSIONS AND WEIGHTS

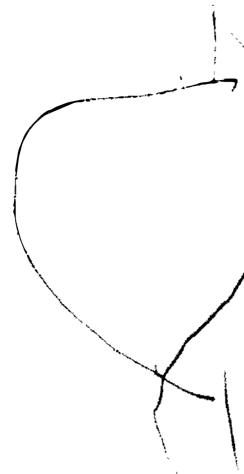
Type	Approximate Power Consumption Watts		Approximate Overall Dimensions In Inches 60 Cycles Only			Approximate Shipping Weight, Lbs.
	Without Light Source	With Light Source	Width	Height	Depth	
RX Indoor	30	48	9	11	5¼	22
RX-1 Indoor	35	53	9	11	5¼	22
RX-2 Indoor			9	11	5¼	22
RX-2 Outdoor	35	53	13	17	9½	45
RX-3	30	48	13	17	9½	46
RX-T	35	53	9	11	5¼	22
RR-5	100	125	15	20	12	60

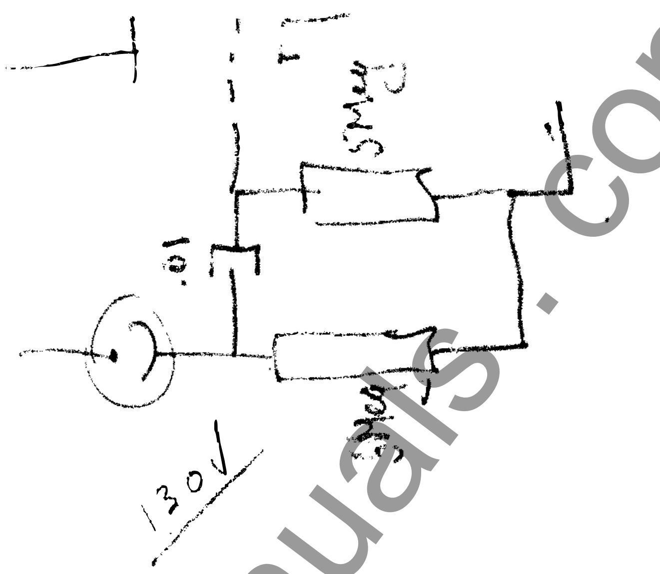
Memorandum
(Use Ink)

Memorandum
(Use Ink)

O.	62-27...	1
D.	...	

D.	CHANGE	
SO	62-25033-1 WAS OLD TRACING 6SL7 WAS RCA57 8R+9R WERE NOT ON 6/14/48 R. KELLER J. I. Bailey 6/17/48	2



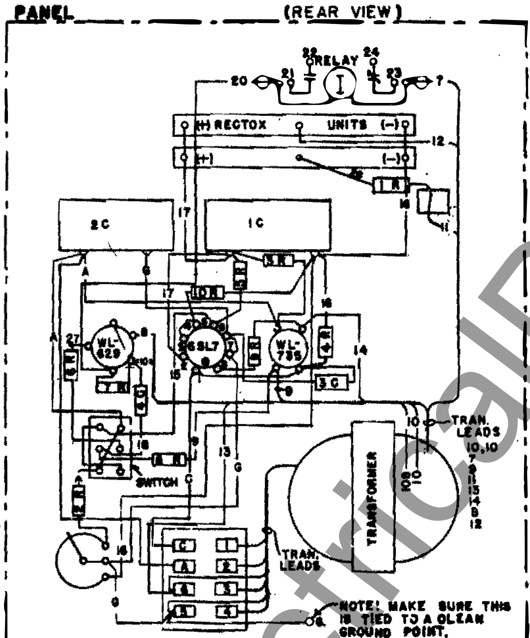


RX-1 PHOTOTROLLER

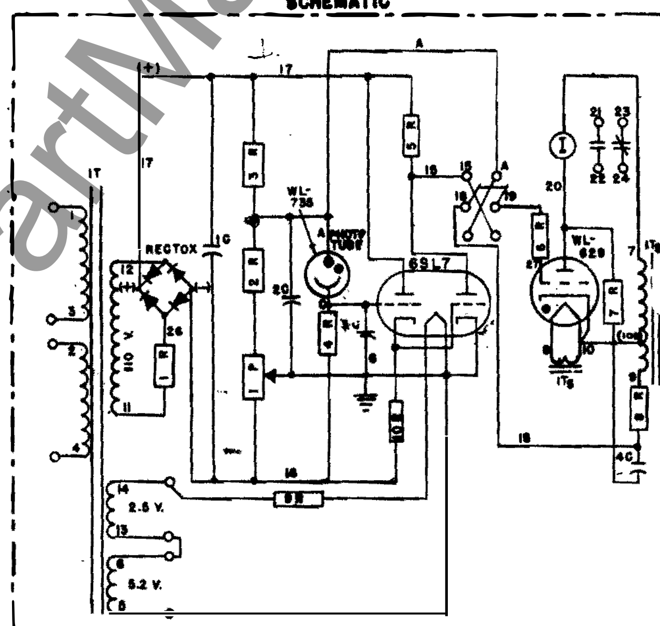
WIRING DIAGRAM

DWG. NO. 18-B-4235
SUB. NO. 1

PANEL (REAR VIEW)



SCHEMATIC



RESISTOR & POT. TABLE

NO.	VALUE IN OHMS	STYLE NO.
1 R	1000	1250332
2 R	22000	1496899
3 R	22000	1496899
4 R	10000000	1441770
5 R	220000	1496886
6 R	220000	1496886
7 R	100000	1496903
8 R	220000	1496886
1 P	5000	1249080

TRANSFORMER TABLE

NO.	N.P. VOLTS	STYLE NO.
1 T	115—230	1039904
1 T	220—440	1039905

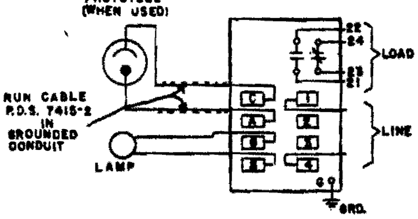
NO.	VALUE IN OHMS	STYLE NO.
10R	47000	1496898
9R	6.8	1406114

CAPACITOR TABLE

NO.	VALUE IN MFD	STYLE NO.
1C	2.0	1039932
2C	2.0	1039932
3C	.001	1039933
4C	.01	1039935

RELAY STYLE NO 1003884
RECTOX STYLE NO. 1039843

EXTERNAL CONNECTIONS



NAME PLATE VOLTS	LINE VOLTS		TERMINAL BLOCK JUMPERS
115 / 230	115		
115 / 230	230		
220 / 440	230		
220 / 440	460		

ALL WIRING TO BE 16 X .010" 7420-2 BLACK CABLE EXCEPT WHEN TRANSFORMER LEADS OR SHIELDED CABLE IS SPECIFIED.

REF DWG 23-A-1408 LINE 5,6,7,8,8

WESTINGHOUSE ELECTRIC CORPORATION
TITLE RX-1 PHOTOTROLLER WIRING DIAGRAM
DE CAROLIS
F. I. Bailey
CONTROL
18-B-4235

E. T. HUGHES

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

TYPE SC-1 REGISTER REGULATOR FOR WINDER CONTROL

INSTRUCTIONS FOR OPERATION

INSTRUCTION BOOK 5670-72
(1-39)

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

EAST PITTSBURGH WORKS EAST PITTSBURGH, PA.

INDEX TO CONTENTS

DRAWING LIST

5670-72

C A U T I O N

(1) NEVER OPERATE "RIGHT", "LEFT", OR "AUTO" PUSH BUTTON UNTIL A-C. VOLTAGE HAS BEEN APPLIED FOR AT LEAST TWO MINUTES

(2) IF A-C. SUPPLY SOURCE IS GROUNDED THE GROUNDED TERMINAL SHOULD BE CONNECTED TO TERMINAL 2.

(3) NEVER OPERATE THE 10-POLE TRANSFER SWITCH OR THE TOGGLE SWITCH #1 WITHOUT FIRST DISCONNECTING THE A-C. SUPPLY VOLTAGE.

(4) IN OPERATING, CARE SHOULD BE TAKEN THAT THE SCANNER CABLE DOES NOT RUB AGAINST THE RUNNING WEB OR ANY OF THE ROTATING PARTS OF THE MACHINE.

I-DESCRIPTION

1 - The type SC-1 Register Regulator consists of a control cabinet, scanner, push button, d-c. reversing motor, two limit switches, and a transfer switch as shown in diagram 2-A-7813.

2 - Control Cabinet

The main parts of the control cabinet are a power transformer, five tubes, one impulse transformer, and various Rectox rectifiers, resistors and capacitors. The purpose of RCA-83 rectifier tube is to supply d-c. current to the d-c. reversing motor field. The two KU-628 thyratron tubes are used to supply and reverse the armature voltage of the reversing motor, and the two KU-627 thyratron tubes operate to control the KU-628 tubes in accordance with the position of the paper as described later in this instruction book.

3 - Scanner

The scanner consists of a synchronous motor with a lens assembly, lamp, WL-735 phototube and RCA-57 amplifier tube.

4 - Push Button and Transfer Switch

The push button is used for removing automatic control from the motor, and for manual control of the motor. The 10-pole double-throw transfer switch is used to reverse the motor field, limit switch and push button connections when toggle switch No. 1 is operated from "UP" to "DOWN" position or vice versa.

5 - Limit Switches

The purpose of the limit switches is to disconnect the motor if the reel carriage reaches the mechanical limit position of its travel.

II-OPERATION

6 - Referring to diagram 2-A-7813, it will be seen that the synchronous motor in the scanner is connected to terminals 12,13, 14 and the lenses, therefore, have a definite position in relation to the a-c. voltage wave, and also the position of the light beam from any particular lens has a definite phase relation to the supply voltage wave. When a light beam intercepts the edge of the paper or the line printed on the paper, the illumination on the phototube is changed and through the RCA-57 amplifier tube an impulse is therefore produced in the secondary winding of the impulse transformer. It will be apparent that the point on the a-c. voltage wave where this impulse occurs depends upon the position of the printed line or paper edge relative to the center of the light circle on the paper produced by the rotating lenses.

7 - This impulse is applied to the grid circuit of tube III, and this tube, therefore, will break down and conduct current earlier or later in the a-c. voltage wave, dependent upon the position of the paper. By means of a phase-shifted, rectified, a-c. grid control circuit consisting of capacitor 41-42, resistor 42-45 and a Rectox rectifier 39-42, tube II is caused to break down at a definite point on the a-c. voltage wave, corresponding to approximately 90 degrees delayed phase angle. Resistor 43-49 is connected in the grid circuit of tube II, so that tube II cannot break down if during that particular half cycle tube III is already conducting current. By means of this circuit, selective operation of tube II is obtained as a function of the position of the paper, i.e., tube II will conduct current or will not conduct current dependent upon the position of the paper relative to the light circle.

8 - Tube II supplies voltage to resistor 22A-49 so that 22 is negative in relation to 40 if current flows through tube II. If no current flows through tube II the voltage from 49-40 is applied across 22-40 and lead 22 is positive in relation to lead 40. The voltage across 22-40 is applied to the grid of tubes I and IV so that tube IV conducts current when 22 is positive and tube I conducts current when 22 is negative.

9 - From the diagram will be seen that reversal of voltage across armature A1-A2 will result when current is transferred from tube I to tube IV, and consequently the direction of motor operation is reversed.

III-INSTALLATION

10 - Mounting of Cabinet

Mount the cabinet (when not already built into the winder) at least 2 inches from a wall so that sufficient ventilation is obtained. Do not cover up the large hole in the bottom of the cabinet. This hole is used to ventilate the cabinet. Mount the scanner according to information given in drawing 2-A-4278.

5670-72

11 - Mounting and Location of Scanner

As shown in drawing 2-A-4278 the scanner mounting and location depends upon the type and color of the material being controlled, as well as the arrangement of the printing on the material. One of combinations No. 1 to No. 30, as shown in table I of Drawing 2-A-4278 should be used. To facilitate the selection of the correct combination, a summary is shown in table II of Drawing 2-A-4278. From this table will be seen that the equipment can be used to register according to a dark colored line printed on light colored paper or light colored printed foil or cellophane. The equipment may also be arranged to control the position of the edge of paper, foil or cellophane of either dark or light colors. Before using Table No. 2 of Drawing 2-A-4278 the following facts must be known:

1 - Whether line control or edge control is to be used.

2 - Type of material (foil, paper or cellophane).

3.- Color of material (Dark or light).

4 - Arrangement of printing on either side of the line or near the edge if edge control is used.

To illustrate the use of table No. 2 examples are shown as follows:

A - Conditions: (1) Line control.
(2) Foil printed light colors.
(3) Dark line color.
(4) Light-colored printing on either side of line but no dark-colored printing within 3/4" on left side of line.

Selected Combination: 4

B - Conditions: (1) Edge control.
(2) Dark-colored paper.
(3) No light-colored printing within 1/8" or right edge.

Selected Combination: 16

In selecting the various combinations for edge control it should be noted that best results are obtained if the combination with the lowest number is used.

12 - When the correct combination is selected according to table No. 2 of Drawing 2-A-4278, proceed to arrange the scanner as shown in 2-A-4278 as follows:

(1) Operate scanner switch to "Dark" or "Light" position as specified in table No. 1.

(2) Mount as per position A or B.

(3) Operate toggle switch No. 1 on control panel to "UP" or "DOWN" position.

(4) Locate scanner in locations 1, 2 or 3.

(5) Cover roll with material as specified.

13 - Connections

Make external connections using wire with 1500 volts insulation as shown in diagram 2-A-7813. Make sure that the a-c. frequency is within 3 per cent of rated frequency. Measure the a-c. voltage and connect the link between terminal 61 and either of terminals 58, 59, 60 as outlined in the table in diagram 2-A-7813 so that the a-c. line voltage does not exceed the terminal rating. If the a-c. supply source is grounded, the grounded side must be connected to terminal 2. Do not use the series field on the d-c. reversing motor. Connect terminal 15 to a water pipe by means of a No. 10 copper wire, and connect terminal 15 to the mounting strap on the machine to which the scanner is assembled. Make preliminary connection of jumper 11 attached to the left hand side of the 10-inch resistor tubes mounted at top front of the panel so that no sections of the resistor tubes are short circuited, and change later if necessary as outlined in paragraph 20 of these instructions. A 2-pole fusible line disconnecting switch or safety switch should be provided which is readily accessible to the machine operator. Line fuses of 15-ampere capacity should be installed.

IV-PLACING INTO SERVICE

14 - Preliminary Tests.

Place the tubes in their sockets. Press push button to "MANUAL" position. Operate toggle switch No. 1 on the control panel to the position as outlined in paragraph 12 and operate the 10-pole transfer switch to the corresponding position. Inspect the scanner to see that the lenses are clean and that the motor shaft is turning freely. Close the a-c supply switch. While the synchronous motor is running disconnect the a-c. supply voltage and measure the time required for the motor to reach standstill. If this time is less than 8 seconds, there is too much friction in the motor bearings and the motor bearings should be cleaned or replaced. Inspect the tubes to see that the filaments are glowing with a dull red glow, and observe that the lenses are rotating in direction as specified in table I of Drawing 2-A-4278, viewing it from inside the scanner case when the door is open. Check to see that the d-c. reversing motor field is supplied with voltage by observing that there is a bluish glow in the RCA-83 rectifier tube.

Place a piece of the material without any printing on the roll below the scanner and turn the potentiometer dial on the control panel "all in" clockwise to position 100. There should now be a bluish glow in tube II, and no glow in tube III. If there is a glow in tube III the scanner is not properly lined up in relation to the roll, or the ground connections are not properly made.

15 - Operation of Tubes

To test the operation of the scanner and tubes II and III, place the material in its normal position beneath the scanner. Turn potentiometer to position 100. Place the line or edge in the approximate diametrical center of the light circle and move to left and right. Observe tube II which should be "ON" as indicated by a bluish glow or "OFF" approximately within the regions as indicated by Fig. 1 and 2 of Drawing 2-A-4278. It will be noted that tube II will be on or off if the line or edge is moved slightly away from the diametrical position. If this "ON - OFF" position is not approximately in the diametrical position the location can be changed by turning the lens holder slightly in relation to the motor shaft, although this should not be necessary because adjustment of the lens holder has been made at the factory, and the correct position of the lens holder is indicated by a mark on the motor shaft opposite a mark on the lens holder bushing.

It may be found in some cases that more points of control exist than are shown in Fig. 1 and Fig. 2 of Drawing 2-A-4278 By turning the potentiometer towards zero this condition can be eliminated.

By observing tube III it will be seen that when the line is moved in the direction of travel of the light beam or rotation of the scanner nearest the phototube the glow in the tube will decrease, and when the line is moved away from the diametrical position opposite to the travel of light beam or scanner the glow will increase.

In Fig. 1 and Fig. 2 of Drawing 2-A-4278 is shown the range of the control zone. If the line is located outside this zone the equipment will not operate to bring the line back to the normal control position.

16 - Adjustment of Toggle Switch No. 1

The position of Toggle switch No. 1 determines the direction of rotation of the synchronous motor in the scanner. Viewing the lens assembly from inside the case with the door open the lenses will rotate counter-clockwise with switch No. 1 up, and will rotate clockwise with switch No. 1 down. Switch No. 1 should be in a position as shown in table No. I of Drawing 2-A-4278.

It should be noted that the a-c. supply voltage must be disconnected and the motor must come to standstill before switch No. 1 is operated. If switch No. 1 is operated while the synchronous motor is running, the direction of rotation of the motor will not reverse.

When this equipment is installed on a winder prior to shipment all external interconnections have been properly made and the machine has been tested, therefore no changes in external wiring should be made unless proper operation cannot be obtained. Paragraphs 17, 18 and 19 are included for this purpose.

17 - Connection of Motor Field Leads 5-6

The equipment has been tested after having been mounted on the winder machine and the connection of the motor field leads should be correct. In order to make sure that this is the case proceed as follows:

Open the a-c. switch, operate push button to "MANUAL" position and operate the 10-pole transfer switch to same position as toggle switch No. 1. Close the a-c switch and place the material with the line or edge within 1/8 inch of the diametrical center of the light circle. Wait two minutes them operate push button to "AUTOMATIC" position. Observe that tube I glows when tube II glows, and that tube IV glows when tube II does not glow. If in doing the above the control equipment operates to shift the line or edge to another point not at the approximate diametrical position, the leads 5 and 6 should be reversed. Operate the "MANUAL" push button, close the line switch, wait two minutes then close the "AUTOMATIC" push button, and repeat the above test. The position of the paper should now be maintained within a 1/32-inch range, and the mill roll control motor will rapidly oscillate back and forth.

18 - Adjustment of Limit Switches

With the 10-pole transfer switch in the same position as toggle switch No. 1, "inch" motor along under manual control by operating the "LEFT" or "RIGHT" push button until one limit switch is opened. If opening the limit switch does not stop motor travel, reverse connections to the limit switches.

19 - Left, Right, Automatic, Manual Push Buttons

The "AUTOMATIC" push button places the equipment under automatic control, with the "LEFT" and "RIGHT" push buttons permitting manual control to bring the line or edge to the normal operating position. If the "MANUAL" push button is operated, only manual control can be obtained. If manual control only is desired for any continued run the scanner should be moved so that the light circle falls entirely on the rubber roll.

With the 10-pole transfer switch in the same position as toggle switch No. 1 operate the push buttons and observe the operation of the motor. If necessary, interchange connections between right and left push buttons, to make the paper move to the right or left when viewing it from the finishing end of the winder.

20 - Connections of Jumper 11 to Resistor Terminals

The two 10-inch resistor tubes mounted at the top of the panel are connected in series with the motor armature. By short-circuiting part of these resistors it is possible to increase the response of the reversing motor. It should be noted that under no circumstances should more than two sections of the resistors be short-circuited as this would damage the KU-628 tubes. The machine has been previously operated and the connection giving satisfactory torque has been indicated and left thus connected. However, if different response or rate of connection is needed jumper 11 may be connected to a different resistor terminal.

21 - Reconnection of Scanner for Light or Dark Operation

As shown in drawing 2-A-4278 the scanner switch should be operated to "DARK" or "LIGHT" position as indicated in Table I.

V-ARRANGEMENT OF PRINTING AND COLOR OF MATERIAL

22 - Arrangement of Printing

In Table I of Drawing 2-A-4278 are shown different arrangements of the printing. The following general rules apply:

5670-72

A - Line Control

(1) The color of the line must be considerably darker than the color of the material.

(2) The width of the line must not be less than 1/16 inch.

(3) The width of the line may be more than 1/16 inch, for example a printed border 1 inch wide may be used for register, since operation is obtained from the nearest edge of printing.

(4) There must be a 3/4-inch space on one side of the line within which space there is no dark printing.

(5) The line may be located 1/8 inch distant from the edge of the material provided the roll is covered with the material.

B - Edge Control

(1) The color of the material may be either dark or light.

(2) If the color is dark and dark edge control is used there must be no light printing within 1/8 inch of the edge.

(3) If the color is light, and light edge control is used, there must be no dark printing within 1/8 inch of the edge.

23 - Color of Material

A - Line Control

When dark line control is used, the color of the material must be either white, yellow, red, pink, light green or light blue, or any combination of light colors. The line or printed border should be either black, dark blue, dark green, brown or any combination of dark colors. It should be noted that foil appears dark to the phototube.

B - Edge Control

The material may be either dark or light-colored provided the roll is covered with a contrasting color as outlined in table I of Drawing 2-A-4278

VI-ROUTINE OPERATION

5670-72

24 - Adjustment of Potentiometer

It will be found that if there is sufficient contrast between the paper color and the color of the line, the equipment may operate satisfactorily with any potentiometer adjustment between 0 and 100. In order to determine approximately the best operating position place the material in its normal position, when the web is not unwinding or the machine is not in operation. With the potentiometer in position 100, the line or edge should be maintained in the approximate diametrical center location of the light circle. Turn potentiometer slowly towards 0 until operation becomes erratic, then turn the potentiometer to a position midway between 100 and the erratic position, but turn at least 30 divisions and use this position for operation. If satisfactory operation is obtained at position 0 use for permanent adjustment position 50. Now start the winder and adjust the potentiometer slightly to either side of the position found with the winder stationary, until the best operating adjustment has been determined.

25 - Starting

A - Starting from Complete Shutdown

(1) Make sure that the 10-pole transfer switch is in same position as toggle switch No. 1.

(2) Operate "MANUAL" push button.

(3) Close line switch.

(4) Wait 5 minutes.

(5) Operate "AUTOMATIC" push button.

B - Starting from "MANUAL" Operation

(1) Operate "AUTOMATIC" push button.

26 - Stopping

A - Stopping for Prolonged Shutdown

(1) Open line switch.

(2) Operate "MANUAL" push button.

B - Stopping Temporarily

(1) Operate "MANUAL" push button.

27 - 10-Pole Transfer Switch

If toggle switch No. 1 is operated from "UP" to "DOWN" position the transfer switch should be operated correspondingly. Never operate these switches unless the line switch has been operated to disconnect power to the equipment.

VII-TUBE TESTS

28 - (A) Replace tube I if this tube fails to glow when tube II glows.

Replace tube I if this tube glows when tube II does not glow.

5670-72

(B) Replace tube IV if the tube glows when tube II glows, or if tube IV fails to glow when tube II does not glow.

(C) If tube II glows continually regardless of the position of the line, first check potentiometer adjustment per paragraph 24, then replace tube III, the RCA-57 tube in the scanner and the WL-735 phototube, one at a time.

(D) Replace the RCA-83 tube if the voltage across 5-6 is less than 190 volts.

VIII-SPARE TUBES

29 - Keep the following spare tubes in stock:

1 - RCA-57

1 - RCA-83

2 - KU-627

2 - KU-628

1 - WL-735

2 - Lamp, S#1014663

IX-SENSITIVITY OF CONTROL

30 - As outlined in paragraph 16 the equipment will maintain the paper in an oscillatory condition within a 1/32-inch range when the web is stationary. If this condition is not obtained, the cause may be either in the scanner and electrical circuits or in the mechanical characteristic of the mill roll shifting mechanism.

31 - To check the scanner and the electrical equipment disconnect the chain to the reversing motor and make the motor reverse by moving the paper with the line slightly relative to the light circle about the diametrical control point. If 1/64-inch movement of the line causes reversal of the motor, the scanner and the electrical control is in good condition. If more than 1/64-inch movement is required check:

(a) Synchronous motor for friction per paragraph 14.
(b) Potentiometer adjustment per paragraph 24.
(c) Tubes per paragraph 28.

32 - If the equipment tests satisfactorily according to paragraph 31 but does not meet the requirements outlined in paragraph 30, mechanical adjustments are needed on the mill roll shifting mechanism to eliminate any lost motion between the reversing motor and the paper carrying roll and paper support roll. First check all chains to see that they are not too slack and take up all lost motion in linkages and worm screws. To test the mechanical equipment move motor shaft by hand until paper roll moves. Now turn the motor shaft 15 mechanical degrees in the reverse. direction. This should cause the paper roll to move in the opposite direction. If this condition is not obtained there is too much lost motion in the mechanical connections, and this condition must be improved before successful register control will result.

33 - It is also important to check the operation of the motor over the entire operating range of the paper roll between the two limit switches to make sure that there is no excessive friction in the mechanical linkage at any point within the operating range.

34 - After the stationary tests in paragraphs 30 to 33 have been made the register control should operate satisfactorily at low paper speeds, for example 100 feet per minute. As the speed of the paper is increased eventually a point may be reached where the variation in the position of the paper expressed in inches per second exceeds the rate of correction, and obviously, under these conditions, satisfactory regulation will not result. Assuming that, for example, the rate of correction is 1/4 inch per second and that the paper roll is wound so that a variation in paper

position of 1/4 inch is obtained in 5 feet of paper, it is apparent that the maximum paper speed for which the regulator will maintain the position of the line is 300 feet per minute. If the rate of correction is increased or if the variation in paper position for 5 feet of paper is decreased the maximum operating speed will increase in proportion.

X-WHAT TO DO IF EQUIPMENT DOES NOT OPERATE PROPERLY

5670-72

35 - General Tests

(a) Remove ground connection to terminal 15 and remove cable plug from scanner. Test resistance between terminal 15 and ground. This resistance should be 5 megohms or more.

(b) Measure the voltage across terminals 5-6. This voltage should be 190 volts or more.

(c) Check to see that all tube filaments are heated when the a-c. voltage is supplied.

(d) Test to see if the a-c. supply source is grounded. If grounded connect the grounded side to terminal 2.

36 - A - D-C MOTOR DOES NOT OPERATE

Tests (1) Measure voltage between 7 and 8. This voltage should be 110 volts a-c. or more. If no voltage check circuit from 1 to 8.

(2) Measure d-c. voltage across 5-6 (190 volts or higher) and make sure that motor field is magnetized.

B - TUBE I DOES NOT CONDUCT CURRENT WHEN TUBE II CONDUCTS CURRENT

Tests (1) Make sure that the push buttons and limit switches are closed.

(2) Measure with d-c. voltmeter with resistance 1000 ohms per volt, the d-c. voltage between 40 and 22. This voltage should be at least 80 volts. 22 should be negative.

(3) Replace tube I.

C - TUBE IV-DOES NOT CONDUCT CURRENT WHEN TUBE II DOES NOT CONDUCT CURRENT

Tests (1) Make sure that the push buttons and limit switches are closed.

(2) Measure, using d-c. voltmeter with resistance 1000 ohms per volt, the d-c. voltage between 40 and 22. This voltage should be at least 80 volts.

(3) Replace tube IV.

D - TUBE II DOES NOT CONDUCT CURRENT WHEN TUBE III DOES NOT CONDUCT CURRENT

Tests (1) Replace tube II.

(2) Check voltage between top connection of tube II and the filament terminal 49. This voltage should be approximately 220 volts a-c.

E - TUBE II BREAKS DOWN CONTINUALLY

Tests (1) Replace tube II.

(2) Check continuity of grid circuit 49-43-44-GRID.

(3) Measure d-c. voltage across 43-44 which should be approximately 40 volts.

(4) Measure the d-c. voltage across 15-17 which should be approximately 130 volts.

F - TUBE III DOES NOT BREAK DOWN

Tests (1) Replace tube III.

(2) Measure the a-c. voltage between 51 and 49, which should be approximately 220 volts.

(3) Replace the RCA-57 amplifier tube and the WL-735 phototube.

G- REGULATION IS UNSTABLE

Tests (1) While the synchronous motor is running disconnect the a-c. supply voltage and measure the time required for the motor to reach standstill. If this time is less than 8 seconds there is too much friction in the motor bearings and the motor bearings should be cleaned or replaced.

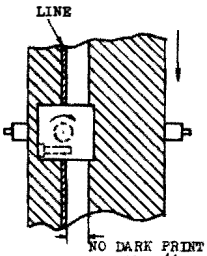
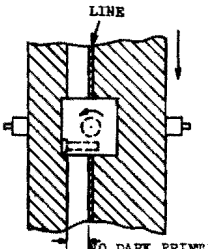
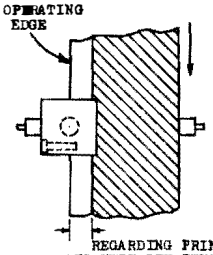
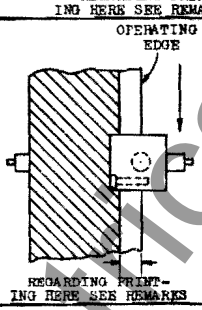
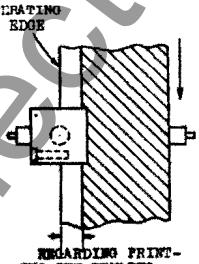
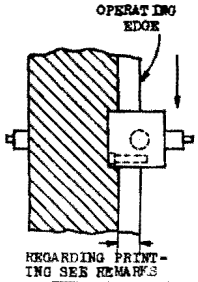
(2) Adjust the potentiometer as outlined in paragraph 24.

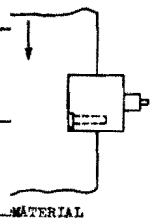
(3) Replace the phototube and the RCA-57 amplifier tube.

3250

Westinghouse
Scanner Arrangement and Operating Combinations

ABLE II

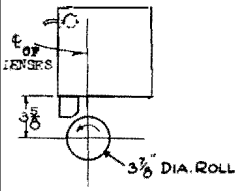
GROUP	TYPE OF CONTROL	ARRANGEMENT OF PRINTED DESIGN	MATERIAL	SC MO OR OF NE	NO PRINTING OF COLOR INDICATED WITHIN RANGE AS SHOWN IN INCHES				COMBINATION NUMBER
					LEFT SIDE OF OPERATING POSITION		RIGHT SIDE OF OPERATING POSITION		
					LIGHT	DARK	LIGHT	DARK	
A	DARK LINE ON LIGHT MATERIAL		FOIL	K				3/4	1
				K				3/4	2
			PAPER	K				3/4	3
				K		3/4			4
				K		3/4			5
			CELLOPHANE	K		3/4			6
							1/8		8
B	DARK LINE ON LIGHT MATERIAL (PREFERABLY USE GROUP A)		FOIL		1/8				14
							3/4		20
					3/4				26
			PAPER					3/4	7
						3/4			13
								1/8	19
			CELLOPHANE			1/8			25
							1/8		10
					1/8				16
C	LEFT EDGE CONTROL		FOIL				3/4		22
					3/4				28
								3/4	9
			PAPER			3/4			15
								1/8	21
						1/8			27
			CELLOPHANE				1/8		12
					1/8				18
							3/4		24
D	RIGHT EDGE CONTROL (PREFERABLY USE GROUP C)		FOIL		3/4				30
								3/4	11
			PAPER			3/4			17
								1/8	23
						1/8			29
			CELLOPHANE						
E	LEFT EDGE CONTROL (USE ONLY WHEN GROUP C CANNOT BE USED)		FOIL						
			PAPER						
			CELLOPHANE						
F	RIGHT EDGE CONTROL (USE ONLY WHEN GROUP E CANNOT BE USED)		FOIL						
			PAPER						
			CELLOPHANE						



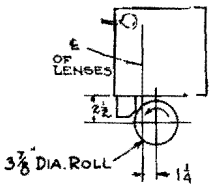
TATIONS AS FROM INSIDE WHEN DOOR

SCANNER MOUNTING POSITIONS

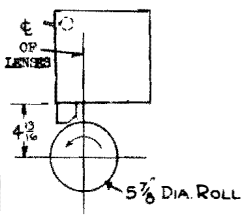
POSITION A1



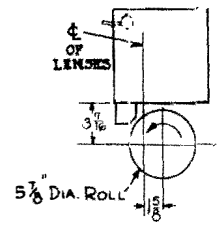
POSITION B1



POSITION A2



POSITION B2



Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

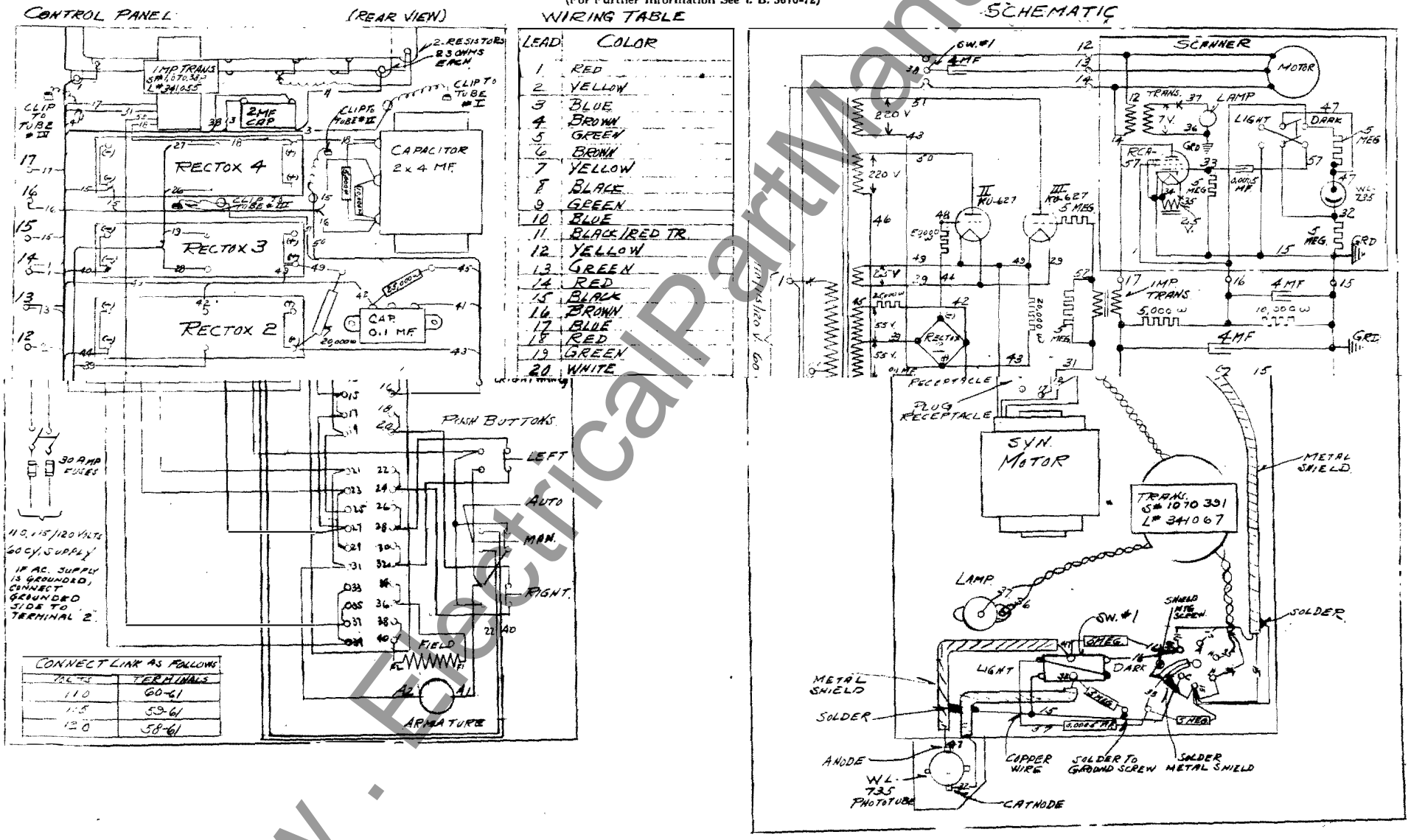
Printed in U.S.A. (1-39)

Dwg. 2-A-4278

Westinghouse
Type SC-1 Register Regulator
Wiring Diagram

(For Further Information See I. B. 5670-72)

I. L. 3091



Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

WESTINGHOUSE BUSINESS ADDRESSES

Headquarters—306 4th Ave., Pittsburgh 30, Pa., P.O. Box 1017

*AKRON 8, OHIO, 106 South Main St.
*ALBANY 4, N. Y., 456 No. Pearl St.
①*ALLENTOWN, PA., Farr Bldg., 739-741 Hamilton Street
*APPLETON, WISC., 340 W. College Ave., P.O. Box 206
*ASBURY PARK, N. J., 601 Bangs Ave., Room 708, Electric Bldg.
¶#†*ATLANTA 2, GA., 1299 Northside Drive, N. W., P.O. Box 4808
xATTICA, N. Y.
*†AUGUSTA, MAINE, 9 Bowman St.
*BAKERSFIELD, CALIF., 2224 San Emedio St.
¶*BALTIMORE 2, MD., 118 E. Lombard St.
†BALTIMORE 24, MD., 4015 Foster Ave.
xBALTIMORE 3, MD., 2519 Wilkens Ave.
†BATON ROUGE, LA., 555 Choctaw Drive
*BEAUMONT, TEXAS, 1213 American National Bank Bldg.
*BINGHAMTON 62, N. Y., Suite 704, Marine Midland Bldg., 86 Court St.
①*BIRMINGHAM 3, ALA., 1407 Comer Bldg.
①¶*BLUEFIELD, W. VA., Appalachian Elec. Power Co. Bldg., Room 620, 704 Bland St., P.O. Box 848
①#BOSTON 10, Mass., 146 Summer St.
¶*BOSTON 10, MASS., 10 High St.
①†BOSTON 27, MASS., 235 Old Colony Ave., So. Boston, Mass.
¶*†BRIDGEPORT 8, CONN., 540 Grant St.
①¶*BUFFALO 3, N. Y., 814 Ellicott Square Bldg.
①#BUFFALO 2, N. Y., 445 Pearl St.
†BUFFALO 10, N. Y., 1132 Seneca St.
*BURLINGTON, VT., 208 Flynn Ave.
*BUTTE, MONTANA, 52 East Broadway
#BUTTE, MONTANA, 50 East Broadway
*CANTON 2, OHIO, 901 First National Bank Bldg., 120 W. Tuscarawas
xCANTON 4, OHIO, Canton Ordnance Division, P.O. Box 710
*CEDAR RAPIDS, IOWA, 361 21st St., S. E., P.O. Box 148
xCENTER LINE, MICH., 23500 Mound Road
*CHARLESTON, S. C., 89 G. Smith St., P.O. Box 303
*CHARLESTON 23, W. VA., 610 Union Bldg., P.O. Box 911
¶*†#CHARLOTTE 1, N. C., 210 East Sixth St.
*CHATTANOOGA 2, TENN., Volunteer State Life Bldg., Georgia Ave. & East Ninth St.
¶*CHICAGO 6, ILL., 20 N. Wacker Drive, P.O. Box B
†CHICAGO 9, ILL., 2211 W. Pershing Road, P.O. Box 1103
#CHICAGO 23, ILLINOIS, 3201 S. Kedzie Ave.
¶*†CINCINNATI 2, OHIO, 207 West Third St.
xCLEVELAND I, OHIO, 1216 W. Fifty-Eighth St.
¶*CLEVELAND 13, OHIO, The Standard Bldg., 1370 Ontario Street
†CLEVELAND 2, OHIO, 5901 Breakwater Avenue, Station A
#CLEVELAND 14, OHIO, 1748 E. 22 Street
*COLUMBUS 15 OHIO, 85 E. Gay St.
*DALLAS I, TEXAS, 209 Browder St.
#DALLAS 2, TEXAS, 1712 Laws St.
*DAVENPORT, IOWA, 206 E. Second St., P.O. Box 29
*DAYTON 2, OHIO, 30 North Main St.
¶*DENVER 2, COLORADO, 910 Fifteenth St.
#DENVER 2, COLORADO, 1700 Sixteenth St.
†DENVER 4, COLORADO, 988 Cherokee St.
xDERRY, PA.
*DES MOINES 8, IOWA, 1400 Walnut St.
¶*†#DETROIT 31, MICH., 5757 Trumbull Ave., P.O. Box 828
¶*DULUTH 2, MINN., 10 East Superior St.
x#EAST PITTSBURGH, PA.
*EL PASO, TEXAS, Oregon and Mills St.
#EL PASO, TEXAS, 450 Canal St.
†*EMERYVILLE 8, CALIF., 5915 Green St.
#EMERYVILLE 8, CALIF., 6101 Green St.
*ERIE, PA., 1003 State St.
*EVANSVILLE 8, IND., 201 N. W. First St.
#*†FAIRMONT, W. VA., 10th and Beltline, P.O. Box 1147
*FORT WAYNE 6, IND., 1010 Packard Ave.
*GARY, IND., 846 Broadway
*GRAND RAPIDS 2, MICH., 148 Monroe Ave., N.W.
*GREENVILLE, S. C., 106 W. Tallulah Drive, P.O. Box 1591
*HAMMOND, IND., 235 Locust St.
*HARTFORD 3, CONN., 36 Pearl St.
*HONOLULU, T. H., Hawaiian Elec. Co., Agt.
¶*HOUSTON 2, TEXAS, 1314 Texas Ave.
#HOUSTON 2, TEXAS, 2301 Commerce Ave.
†HOUSTON 2, TEXAS, 2315 Commerce Ave.
①¶*†#HUNTINGTON 1, W. VA., 1029 Seventh Ave., P.O. Box 1150
¶*INDIANAPOLIS 9, IND., 137 S. Penna. St.
†INDIANAPOLIS 2, IND., 551 West Merrill St.
*JACKSON, MICH., 212 West Michigan Ave.
*JACKSON, MISS., 1011 Pecan Blvd., P.O. Box 2064
*JACKSONVILLE 3, FLA., 37 South Hogan St., P.O. Drawer K
#*†JOHNSTOWN, PA., 107 Station St.
¶*KANSAS CITY 6, MO., 101 W. Eleventh St.
#KANSAS CITY 8, MO., 2020-2024 Walnut Street, c/o Walnut Warehouse, Inc.
*KNOXVILLE 8, TENN., Gay & Clinch St.
LESTER 13, PA., Merchant Matine Plant, P.O. Box 9177, Phila., Pa.
xLIMA, OHIO
¶*†#LOS ANGELES 13, CALIF., 420S. San Pedro St.
*LOUISVILLE 2, KY., 332 West Broadway
xLOUISVILLE 1, KY., P.O. Box 1860
*MADISON 3, WISC., 1022 E. Washington Ave.
xMANOR, PA., Benolite Corporation
xMANSFIELD, OHIO, 246 E. Fourth St.
*MEMPHIS 3, TENN., 130 Madison Ave.
*MIAMI 4, FLA., 11 N. E. Sixth St., P.O. Box 590
¶*MILWAUKEE 2, WISC., 538 N. Broadway
†MILWAUKEE 3, WISC., 424 North Fourth St.
¶†*#MINNEAPOLIS 13, MINN., 2303 Kennedy St., N.E.
*MONROE, LA., 1107 N. 2nd St., P.O. Box 1851
*NASHVILLE 3, TENN., 219 Second Ave., N.
*NEWARK 2, N. J., 1180 Raymond Blvd.
#NEWARK 2, N. J., 123-7 Plane St.
xNEWARK 1, N. J., Plane & Orange Sts.
†NEWARK 1, N. J., Haynes Ave. & Lincoln Hwy.
*NEW HAVEN 8, CONN., 42 Church St., P.O. Box 1817
¶*NEW ORLEANS 12, LA., 333 St. Charles St.
xNEW PHILADELPHIA, OHIO, Power Train Div., 406 Mill Ave., Drawer 912
¶*NEW YORK 5, N. Y., 40 Wall St.
*NIAGARA FALLS, N. Y., 253 Second St.
*NORFOLK 1, VA., 2600 Hampton Boulevard, P.O. Box 2120
#NORWOOD, OHIO, Mentor & Houston Aves.
*OKLAHOMA CITY 2, OKLA., 120 N. Robinson Street
*OMAHA 2, NEB., 409 South Seventeenth St.
*PEORIA 2, ILL., 418 S. Washington St.
¶*†#PHILADELPHIA 4, PA., 3001 Walnut St.
*PHOENIX, ARIZONA, 11 West Jefferson St.
xPITTSBURGH, PA., Nuttall Works, 200 McCandless Ave.
¶z*PITTSBURGH 30, PA., 306 4th Ave., Box 1017
†PITTSBURGH 8, PA., 543 N. Lang Ave.
#PITTSBURGH 6, PA., 6526 Hamilton Ave.
¶*PORTLAND 4, OREGON, 309 S.W. Sixth Ave.
†PORTLAND 12, ORE., 626 North Tillamock St.
#PORTLAND 9, ORE., 1518 N.W. Marshall St.
¶*†PROVIDENCE 3, R. I., 16 Elbow St.
*RALEIGH, N. C., 803 North Person St., P.O. Box 2146
*RICHMOND 19, VA., 301 S. Fifth St.
*ROCHESTER 7, N. Y., 1048 University Ave.
*ROCKFORD, ILL., 130 South Second St.
*SACRAMENTO 14, CALIF., Rooms 411 & 412 Ochsner Building, 719 K St.
¶*ST. LOUIS 1, MO., 411 North Seventh St.
†ST. LOUIS 2, MO., 717 South Twelfth St.
#ST. LOUIS 2, MO., 815 South Eleventh St.
*SALT LAKE CITY 1, UTAH, 10 West First S. St.
†SALT LAKE CITY 7, UTAH, 346A Pierpont Ave.
#SALT LAKE CITY 11, UTAH, 235 West South Temple St.
*SAN ANTONIO 5, TEXAS, 115 W. Travis St.
*SAN DIEGO 1, CALIF., 861 Sixth Ave.
¶*SAN FRANCISCO 4, CALIF., 1 Montgomery St.
§SAN FRANCISCO 3, CALIF., 1355 Marker St.
SAN FRANCISCO, CALIF., Western Publicity Div. Rooms 205-6 Hobart Bldg., 582 Market St.
①SAN FRANCISCO 11, Cal. Shore Based Warehouse 215 Embarcadero St.
¶#†*SEATTLE 4, WASH., 3451 East Marginal Way
§SEATTLE 4, WASH., 1051 First Ave., So.
xSHARON, PA., 469 Sharpsville Ave.
*SIOUX CITY 17, IOWA, 2307 Kennedy Drive
*SOUTH BEND 4, IND., 216 East Wayne St.
xSOUTH PHILA. WKS., Essington 13, Pa. First-class mail, P.O. Box 7348, Phila. 1, Pa.
①*SPOKANE 8, WASH., 1023 W. Riverside Ave.
*SPRINGFIELD, ILL., 601 E. Adams St., Box 37
¶*†SPRINGFIELD 1, MASS., 395 Liberty St.
xSPRINGFIELD 2, MASS., 653 Page Boulevard
xSUNBURY, PA., 1354 Susquehanna Ave.
*SYRACUSE 4, N. Y., 420 N. Geddes St.
†SYRACUSE, N. Y., 961 Genesee St.
*TACOMA 2, WASH., 1115 "A" St.
*TAMPA 1, FLA., 417 Ellamae Ave., Box 230
*TOLEDO 4, OHIO, 245 Summit St.
xTRAFFORD, PA.
*TULSA 3, OKLA., 303 East Brady St.
¶*†#UTICA 1, N. Y., 113 N. Genesee St.
¶*WASHINGTON 6, D. C., 1625 K Street, N.W.
*WICHITA 2, KANSAS, 233 S. St. Francis Ave.
†¶*WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
*WILLIAMSPORT 1, PA., 348 W. Fourth St.
*WORCESTER 8, MASS., 507 Main St.
①*YORK, PA., 137 So. George St., P.O. Box 1466
*YOUNGSTOWN 3, 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 AGENT JOBBERS

Westinghouse Electric Supply Company—Headquarters—40 Wall St., Wall St. Station, P.O. Box 25, New York 5, N.Y.

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

ALBANY 4, N. Y., 454 No. Pearl St.
①ALLENTOWN, PA., Farr Bldg., 739-741 Hamilton St.
①AMARILLO, TEXAS, First & Taylor Sts.
ATLANTA 2, GA., 1299 Northside Drive, N.W.
AUGUSTA, MAINE, 90 Water St.
BALTIMORE 2, MD., 40 South Calvert St.
BANGOR, MAINE, 175 Broad St.
BINGHAMTON 60F, N. Y., 87 Chenango St.
BOSTON 10, MASS., 88 Pearl St.
BURLINGTON, VT., 208 Flynn Ave.
BUTTE, MONTANA, 50 East Broadway
CHARLOTTE 1, N. C., 210 East Sixth St.
CHICAGO 7, ILL., 113 North May St.
§CINCINNATI 6, OHIO, 2329-2331 Gilbert Ave.
CLEVELAND 3, OHIO, 6545 Carnegie Ave.
COLUMBIA, S. C., 915 Lady St.
①COLUMBUS 16, OHIO, 266 North 4th St.
CORPUS CHRISTI, TEXAS, North end of Mesquite St.
DALLAS 2, TEXAS, 405 No. Griffin St.
DAVENPORT, IOWA, 402 E. Fourth St.
DES MOINES 8, IOWA, 1400 Walnut St.
DETROIT 2, MICH., 547 Harper Ave.
DULUTH 2, MINN., 308 W. Michigan St.
ERIE, PA., 1013 State St.
①EVANSVILLE 8, IND., 201 N. W. First St.
FORT WAYNE 2, IND., 612 S. Harrison St.
FORT WORTH, TEXAS 210 Jones St.
GRAND RAPIDS 2, MICH., 511 Monroe Ave., N.W.
GREENVILLE S. C., 226 Pendleton
①GREEN BAY, WISC., 619 Main St.
HOUSTON 2, TEXAS, 1903 Ruiz St.
INDIANAPOLIS 9, IND., 137 S. Pennsylvania St.
JACKSONVILLE 3, FLA., 37 South Hogan St.
LOS ANGELES 54, CALIF., 905 East Second St.
MADISON 3, WISC., 1022 E. Washington Ave.
MEMPHIS 1, TENN., 366 Madison Ave., Box 157
MIAMI 4, FLA., 11 N. E. Sixth St.
MILWAUKEE 2, WISC., 546 N. Broadway
MINNEAPOLIS 5, MINN., 515 South Seventh St.
NEWARK 5, N. J., 49 Liberty St.
NEW HAVEN 8, CONN., 240 Cedar St.
NEW ORLEANS 6, LA., 420 South Peters St.
zNEW YORK 5, N. Y., 40 Wall St., Wall St. Sta., P.O. Box 25
*#NEW YORK 13, N. Y., 150 Varick St.
NORFOLK 1, VA. 2600 Hampton Blvd., P.O. Box 2120
OAKLAND 7, CALIF., Tenth & Alice Sts.
OKLAHOMA CITY 2, OKLA., 850 N. W. 2nd St.
OMAHA 2, NEB., 117 North Thirteenth St.
PEORIA 2, ILL., 412 S. Washington St.
PHILADELPHIA 7, PA., 141 North Eleventh St.
PHOENIX, ARIZONA, 315 West Jackson St.
PITTSBURGH 19, PA., 575 Sixth Ave.
PORTLAND 9, OREGON, 134 N. W. Eighth St.
PROVIDENCE 1, R. I., 66 Ship St.
RALEIGH, N. C., 319 W. Martin St.
READING, PA., 4th and Elm Sts.
RICHMOND 19, VA., 301 South Fifth St.
ROANOKE, VA., 726 First St., S. E.
ROCHESTER 7, N. Y., 1048 University Ave.
SACRAMENTO 14, CALIF., Room 413 Ochsner Building, 719 K St.
ST. LOUIS 2, MO., 1011 Spruce St.
ST. PAUL 1, MINN., 259 E. Fourth St.
SALT LAKE CITY 11, UTAH, 235 West South Temple St.
SAN ANTONIO 6, TEXAS, 1211 E. Houston St., P.O. Box 1700
SAN FRANCISCO 1, CALIF., 260 Fifth St.
SEATTLE 4, WASH., 1051 First Ave., So.
SIOUX CITY 4, IOWA, 1005 Dace St.
SPOKANE 1, WASH., 152 So. Monroe St.
SPRINGFIELD 3, MASS., 46 Hampden St.
SYRACUSE 4, N. Y., 961 W. Genesee St.
TACOMA 2, WASH., 1115 "A" St.
TAMPA 1, FLA., 417 Ellamae St.
TOLEDO 2, OHIO, 1920 N. Thirteenth St.
TRENTON 10, N. J., 444 S. Broad St.
TULSA 3, OKLA., 307 East Brady St.
UTICA 1, N. Y., 113 N. Genesee St.
WASHINGTON, D. C., 1216 "K" St., N.W.
①WATERLOO, IOWA, 300 West 3rd St.
WHEELING, W. VA., 1117 Main St.
WICHITA 2, KANSAS, 233 So. St. Francis Ave.
WILLIAMSPORT 1, PA., 348 W. Fourth St.
①WILMINGTON 99, DEL., 216 E. Second St.
WORCESTER 4, MASS., 17 Mulberry St.
①YORK 2, PA., 143 S. George St., P.O. Box 867

Other Than Westinghouse Electric Supply Company

AKRON 8, OHIO, The Moock Electric Supply Co.
BIRMINGHAM 2, ALA., Moore Handley Hdw. Co.
BLUEFIELD, W. VA., Superior-Sterling Co.
BUFFALO 2, N. Y., Buffalo Electric Co., Inc.
CANTON 2, OHIO, The Moock Electric Supply Co.
‡CHATTANOOGA, TENN., Mills & Lupton Supply Co.
CHICAGO 6, ILL., Hyland Electrical Supply Co.
†DENVER 17, COL., The Mine & Smelter Supply Co.
†EL PASO, TEX., The Mine and Smelter Supply Co.
HUNTINGTON 6, W. VA., Banks Miller Supply Co.
KANSAS CITY 8, MO., Columbian Elec'l. Co.
KANSAS CITY 8, MO., Continental Elec. Co.
LEXINGTON 31, KY., Tafel Elec. & Supply Co.
LOUISVILLE 2, KY., Tafel Electric & Supply Co.
NASHVILLE 2, TENN., Tafel Electric Supply Co.
§NEW YORK 10, N. Y., Times Appliance Co., Inc.
RENO, NEV., Saviers Electrical Products Corp.
SAN DIEGO, CALIF., The Electric Supplies Distributing Co.
SCRANTON 9, PA., Penn Electrical Eng'nrg Co.
YOUNGSTOWN 1, OHIO, The Moock Electric Supply Co.

* Sales Office † Mfg. and Repair Shop x Works
# Warehouse § Merchandising Products Only
z Headquarters ¶ District Eng. and Service Dept.

①**Changed or added since previous issue.**

February, 1945
Supersedes Issue dated December, 1944

Other Westinghouse Agents

ABILENE, KANSAS, Union Electric Co.
ALLENTOWN, PA., H. N. Crowder, Jr., Co.
BATTLE CREEK, MICH., B. C. Electric Supply Co.
BECKLEY, WEST VA., Beckley Machine & Electric Co.
BLOOMSBURG, PA., E. R. Beers Electric Co.
BRIDGEPORT, CONN., Sprague Electric Supplies, Inc.
BRISTOL, VA., Service Appliance Co.
CINCINNATI 2, OHIO, Johnson Electric Supply Co.
COLUMBUS, GA., Columbus Iron Works Co.
DAYTON 2, OHIO, The Nichols Electric Co.
EASTON, PA., H. N. Crowder, Jr. Co.
FALL RIVER, MASS., Smith Electric Supply Co.
FT. WAYNE 2, IND., The National Mill Supply Co.
HARLAN, KY., Kentucky Mine Supply Co.
HARTFORD, CONN., Electrical Supplies, Inc.
HONOLULU, T. H., The Hawaiian Electric Co.
KNOXVILLE, TENN., Roden Electrical Supply Co.
MOBILE, ALA., McGowin Lyons Hdw. & Supply Co.
MUSKEGON, MICH., Industrial Electric Supply Co.
NEW ORLEANS, LA., Electrical Supply Co.
ROCKFORD, ILL., Forest City Electrical Supply Co.
SAGINAW, MICH., J. Geo. Fischer & Sons, Inc.
SOUTH BEND 4, IND. The McCaffery Co.

WESTINGHOUSE ELECTRIC & MFG. CO., LAMP DIVISION

Headquarters—MacArthur Ave., Bloomfield, N. J.

*ALBANY 4, N. Y., 454 N. Pearl St.
#*ATLANTA 2, GA., 1299 Northside Drive N.W. P.O. Box 4898
*BALTIMORE 2, MD., 118 E. Lombard St.
xBELLEVILLE, N. J., 720 Washington Ave.
zxBLOOMFIELD, N. J., Mac Arthur Ave.
*BLOOMFIELD, N. J., Mac Arthur Ave.
yBLOOMFIELD, N. J., Mac Arthur Ave.
*BOSTON 10, MASS., 10 High St.
#BOSTON 10, MASS., 44 Fatnsworth St.
*BUFFALO 3, N. Y., 295 Main Street
*CHICAGO 6, ILL., 20 North Wacker Drive
#CHICAGO 9, ILL., 4339 S. Winchester Ave.
*CINCINNATI 2, OHIO, 207 West Third St.
*CLEVELAND 2, OHIO, Standard Bldg. 1370 Ontario St.
*COLUMBUS 15, OHIO, 85 E. Gay St.
*DALLAS 1, TEXAS, 209 Browder St.
*DAVENPORT, IOWA, 206 East Second St.
*DAYTON 2, OHIO, 30 N. Main St.
*DENVER 2, COLO., 910 Fifteenth St.
#*DETROIT 31, MICH., 5757 Trumbull Ave.
*EMERYVILLE 8, CALIF., 5915 Green St.
#xFAIRMONT, W. VA., P.O. Box 1312
*HOUSTON 2, TEXAS, 1314 Texas Ave.
*HUNTINGTON, W. VA., 1029 Seventh Ave.
*INDIANAPOLIS 9, IND., 137 So. Penna. St.
*KANSAS CITY 6, MO., 101 W. Eleventh St.
#*LOS ANGELES 13, CALIF., 420 S. San Pedro St.
*LOUISVILLE 2, KY., 332 West Broadway
*MEMPHIS 3, TENN., 130 Madison St.
*MILWAUKEE 2, WISC., 538 North Broadway
*MINNEAPOLIS 13, MINN., 2303 Kennedy St., N.E.
*NEW ORLEANS 12, LA., 333 St. Charles St.
*NEW YORK 13, N. Y., 150 Varick St.
*OKLAHOMA CITY 2, OKLA., 850 N.W. Second St.
*OMAHA 2, NEB., 409 So. Seventeenth St.
*#ORANGE, N. J., Joyce St.
*PHILADELPHIA 4, PA., 3001 Walnut St.
*PITTSBURGH 30, PA., 306 4th Ave., Box 1017
*#PITTSBURGH 22, PA., 32 Boulevard of Allies
PORTLAND 4, OREGON, 309 S. W. Sixth Ave.
*RICHMOND 19, VA., 301 South 5th Street
*ROCHESTER 7, N. Y., 1048 University Ave.
*ST. LOUIS 1, MO., 411 N. Seventh St., Room 1524
#ST. LOUIS 3, MO., 1219 Gratoit St.
*SAN FRANCISCO 4, CALIF., 1 Montgomety St.
#SAN FRANCISCO 7, CALIF., 60 Federal St.
*#SEATTLE 4, WASH., 3451 East Marginal Way
*SYRACUSE 4, N. Y., 961 W. Genesee St.
#xTRENTON 7, N. J., 400 Pennington Ave.
*WASHINGTON 6, D. C., 1625 K Street, N.W.

WESTINGHOUSE ELECTRIC & MFG. CO., X-RAY DIVISION

Headquarters and Works—2519 Wilkens Ave., Baltimore 3, Md.

①*ALLENTOWN, PA., Farr Bldg., 739-741 Hamilton St.
*ATLANTA 2, GA., 1299 Northside Drive, N.W.
*BALTIMORE 2, MD., 118 East Lombard St.
*BIRMINGHAM 5, ALA., 1032 So. 20th St.
*BOSTON 16, MASS., 270 Commonwealth Ave.
*BUFFALO 3, N. Y., 814 Ellicott Square Bldg.
①*CHARLESTON 3, W. VA., 110 East "E" St.
①*CHARLOTTE 1, N. C., 210 E. Sixth St.
*CHICAGO 6, ILL., 20 N. Wacker Drive
*CINCINNATI 2, OHIO, 207 W. Third St.
#*CLEVELAND 3, OHIO, 7016 Euclid Ave.
*COLUMBUS 15, OHIO, 85 E. Gay St.
*DALLAS 1, TEXAS, 209 Browder St.
*DENVER 2, COLO., 910 Fifteenth St.
*DES MOINES 8, IOWA, 1400 Walnut St.
#*DETROIT 31, MICH., 5757 Trumbull Ave., P.O. Box 828
*DURHAM, N. C., 1004 Monmouth St.
*GRAND RAPIDS 2, MICH., 511 Monroe Ave., N.W.
*HOUSTON 2, TEXAS, 1314 Texas Ave.
*HUNTINGTON, W. VA., 1029 7th Ave.
*KANSAS CITY 6, MO., 101 W. Eleventh St.
*#LOS ANGELES 13, CALIF., 420 S. San Pedro St.
*MIAMI 4, FLA., 11 N.E. Sixth St.
*MILWAUKEE 2, WISC., 538 North Broadway
*NEWARK 2, N. J., 1180 Raymond Blvd.
*NEW HAVEN 8, CONN., 42 Church St., P.O. Box 1817
*NEW ORLEANS 13, LA., 427 Baronne St.
*NEW YORK 16, N. Y., 386 Fourth Ave.
*OMAHA 2, NEB., 409 So. Seventeenth St.
*PHILADELPHIA 4, PA., 3001 Walnut St.
#*PITTSBURGH 13, PA., 3702 Fifth Ave.
*PORTLAND 5, OREGON, 1210 S.W. Morrison St.
*RICHMOND 19, VA., 301 South 5th Street
*ROCHESTER 7, N. Y., 1048 University Ave.
SACRAMENTO 14, CALIF., Rooms 411 & 412 Ochsner Building, 719 K St.
*SAGINAW, MICH., 1013 N. Fayette St.
*SAN DIEGO 1, CALIF., 861 Sixth Ave.
*SALT LAKE CITY 1, UTAH, 10 W. First So. St.
ST. LOUIS 1, MO., 411 North 7th St.
*#SAN FRANCISCO 8, CALIF., 450 Sutter St.
*SEATTLE 4, WASH., 3451 E. Marginal Way
*SYRACUSE 4, N. Y., 420 N. Geddes St.
①*SPOKANE 8, WASH., 1023 W. Riverside Ave.
*WASHINGTON 6, D. C., 1625 K Street N.W.
*WICHITA 2, KANSAS, 233 S. St. Francis Ave.
*WILKES-BARRE, PA., 267 N. Pennsylvania Ave.
①*YORK 2, PA., 137 S. George St., P.O. Box 1466

WESTINGHOUSE ELECTRIC ELEVATOR COMPANY

Headquarters—150 Pacific Ave., Jersey City 4, N. J.

①*ATLANTA 3, GA., 308 Peachttee St., N. E.
BALTIMORE 1, MD., 35-49 West Lexington Ave., Room 1101 Lexington Bldg.
◆BIRMINGHAM, ALABAMA, c/o W.E.&M.Co.
BOSTON 10, MASS., 10 High St.
BROOKLYN 2, N. Y., 32 Court St.
BUFFALO 3, N. Y., 802 Ellicott Square Bldg.
①CHICAGO 10, ILL., 506 S. Dearborn St.
CINCINNATI 2, OHIO, 419 Provident Bank Bldg., Vine and Seventh Sts.
CLEVELAND 13, OHIO, 842 Rockefeller Bldg.
◆COLUMBUS 15, OHIO, 85 Gay St., Ohio Savings Bank Bldg.
DALLAS 2, TEXAS, 405 North Griffin Street
◆DENVER 2, COLO., 1052 Gas & Electric Bldg.
◆DES MOINES 8, IOWA, 1408 Walnut St.
DETROIT 8, MICH., 5757 Trumbull Ave.
◆DUBUQUE, IOWA, Roshek Stores
①◆FLINT 7 MICH., 5447 Lapeer Road
◆HARTFORD 3, CONN., 410 Asylum St.
◆HOUSTON 2, TEXAS, 1314 Texas Ave.
◆INDIANAPOLIS 2, IND., 551 W. Merrill St.
xzJERSEY CITY 4, N. J., 150 Pacific Ave.
◆KANSAS CITY 6, MO., 101 W. Eleventh St.
①◆LANSING 6, MICH., 1117 Eureka St.
LOS ANGELES 13, CALIF., 420 So. San Pedro St.
◆LOUISVILLE 8, KY., 2500 Concord Drive
NEWARK 2, N. J., 17 Academy St.
NEW YORK 20, N. Y., 9 Rockefeller Plaza
NEW YORK 51, N. Y., 260 E. 161st St., Bronx
PHILADELPHIA 4, PA., 3001 Walnut St.
PITTSBURGH 19, PA., 435 Seventh Ave.
①◆RALEIGH, N. C., 601 Dutham Life Ins. Bldg.
◆SACRAMENTO 17, CALIF., 719 "K" St.
ST. LOUIS 1, MO., 1601 Ambassador Bldg.
SAN FRANCISCO 4, CALIF., 110 Sutter St.
◆SHREVEPORT 24, LA., Commercial Bldg., 389 Texas Ave.
◆TULSA 3, OKLA., 303 East Brady St.
WASHINGTON 6, D. C., 1112 21st St., N.W.
◆WHEELING, W. VA., 1117 Main St.
①◆WICHITA 2, KANSAS, 233 S. St. Francis Ave.

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY

Headquarters—40 Wall St., New York 5, N. Y., U.S.A.

①*ARGENTINA, BUENOS AIRES, Westinghouse Electric Co., S. A.
*AUSTRALIA, WATERLOO, N.S.W., P.O. Box 23
*BRAZIL, RIO DE JANEIRO, Westinghouse Electric Co. of Brazil, Caixa Postal 1320
*COLOMBIA, BARRANQUILLA, Westinghouse Electric Co., S. A. Apartado Nacional 405 Apartado Aereo 41
*CHILE, SANTIAGO, c/o Wessel Duval & Cia., Casilla 86-D
①*CUBA, HAVANA, Westinghouse Electric Co., S. A.
*ENGLAND, LONDON, W.C. 2, 2 Norfolk St., Strand
*INDIA, BOMBAY, Westinghouse Electric Co. of India Ltd., 294A Bazargate St.
*MEXICO, MEXICO D.F., Cia. Westinghouse Electric Internacional, Edifico La Nacional, Apartado 78-Bis
*MEXICO, MONTERREY, N.L., Apartado 294
*PANAMA, R. P., PANAMA, Westinghouse Electric Co., S. A., Apartado 742.
*PERU, LIMA, Casilla 1685
*PUERTO RICO, San Juan, P.O. Box 1748
*SAN PEDRO, CALIF., 428 13th St., Ralph E. Pierson, Regional Representative
①*SOUTH AFRICA, JOHANNESBURG, P.O. Box 6067
*VENEZUELA, CARACAS, P.O. Box 1889
*WASHINGTON 8, D. C., Wardman Park Hotel, Suite 400-D

THE BRYANT ELECTRIC COMPANY

Headquarters—1421 State St., Bridgeport 2, Conn.

zxBRIDGEPORT 2, CONN., Main Plant, 1421 State St.
xBRIDGEPORT 2, CONN., Plastics Division Plant, 1105 Railroad Ave.
*#CHICAGO 7, ILL., 844 West Adams St.
*#LOS ANGELES 13, CALIF., 420 S. San Pedro St.
*NEW YORK 17, N. Y., 101 Park Ave.
*#SAN FRANCISCO 3, CALIF., 525 Eighth St.
STATION KDKA, Grant Bldg., Pittsburgh 19, Pa.

WESTINGHOUSE RADIO STATIONS, INC.

Headquarters—1619 Walnut St., Philadelphia 3, Pa.

①Station KEX, Portland 5, Ore., 815 S.W. Yamhill St.
STATION KYW, 1619 Walnut St., Philadelphia 3, Pa.
STATION WBZ, 275 Tremont St., Boston 16, Mass.
STATION WBZA, Hotel Kimball, Springfield 3, Mass.
STATION WOWO, 925 So. Hartison St., Fort Wayne 2, Ind.
STATION WGL, 925 So. Harrison St., Fort Wayne 2, Ind.
STATION WBOS, 275 Tremont St., Boston 16, Mass.

CANADIAN WESTINGHOUSE COMPANY, LIMITED

Headquarters—Hamilton, Ontario, Canada

*†#CALGARY, 320 Eighth Avenue, West Calgary, Alberta, Can.
#*EDMONTON, 10127 104th St., Armstrong Block, Edmonton, Alberta, Can.
#*FORT WILLIAM, 112 McVicar St., P.O. Box 10, Fort William, Ontario, Can.
#*HALIFAX, 158 Granville St., Halifax, Nova Scotia, Can., P.O. Box 547
zx*HAMILTON, Hamilton, Ontario, Can.
*LONDON, 504 Huron & Erie Bldg., London, Ontario, Can.
*MONTREAL, 720 Dominion Sq. Bldg., Montreal, Quebec, Canada
§MONTREAL, 400 McGill St., Montreal, Quebec, Can.
#†MONTREAL, 1844 William St., Montreal, Quebec, Can.
#*OTTAWA, Ahearn & Soper Limited, P.O. Box 794, Ottawa, Ontario, Can.
*†#REGINA, 2408 Eleventh Ave., Regina, Saskatchewan, Can.
#*SASKATOON, 238 First Ave. N., Saskatoon, Saskatchewan, Can.
†#*SWASTIKA, Swastika, Ontario, Can.
*†#TORONTO, 355 King St., West, Toronto, Ontario, Can.
*TRAIL, B. C., Room 3, Strand Theater Block, 1350 Cedar Ave.
*VANCOUVER, 1418 Marine Bldg., Vancouver, B. C., Can.
†#VANCOUVER, 1090 Homer St., Vancouver, B. C., Can.
#*†WINNIPEG, 158 Portage Ave. East, Winnipeg, Manitoba, Can.

* Sales Office † Mfg. and Repair Shop x Works # Warehouse z Headquarters y Executive Office § Merchandising Products Only ‡ Apparatus Products Only
◆ Service Office Only

①Changed or added since previous issue.

Printed in U. S. A.

TYPE RR-8 REGISTER REGULATOR

INSTALLATION, OPERATION AND MAINTENANCE

INSTRUCTION BOOK 5670-74-A

Westinghouse Electric & Manufacturing Company

East Pittsburgh, Pa.

Reprinted 8-42

INDEX TO CONTENTS

LIST OF ILLUSTRATIONS

TYPE RR-8 REGISTER REGULATOR

I - Description

(1) The RR-8 register regulator is a photo-electric device which may be made to operate either from a sudden decrease in illumination or from a sudden increase in illumination on the phototube. The register regulator responds only to sudden changes in illumination, and does not respond to a gradual slow change in level of illumination.

A change in phototube illumination persisting 0.0002 second or longer will cause operation with the result that the type SG relay becomes energized and remains closed during a time of 0.05 second to 0.1 second, depending upon the adjustment of the timing potentiometer.

(2) A selector switch may be connected to the equipment as shown in connection 2 of the wiring diagram so that the register regulator operates only if this external selector switch is closed. This arrangement is used for example in register control applications for wrappers, paper bags, or other material where it is desired to control the speed of the paper relative to the cutter so as to cut the paper according to designs or characters previously printed on it.

In some designs of packaging and wrapping machines a mechanical interlock or selector is used, so that although the register regulator relay operates each time a spot on the paper interrupts the light beam, mechanical correction of the paper position is obtained only if the paper is out of register. With this arrangement the selector switch is not used, and terminals 10-11 are short-circuited as shown in connection 1 of the diagram.

II - General Application Requirements

(3) The RR-8 register regulator may be applied to control the cutting of paper or other material which by means of a pair of feed rolls, is being continually fed to a rotary cutter, so that the cut will always have a definite position in relation to any printed design on the paper. The photo-electric indication of the paper position is obtained by means of light reflected from or transmitted through a spot printed on the paper. In applying the device, it should be borne in mind that the photo-electric control equipment is not a cure-all for any erratic paper cutter or wrapping machine, and in new applications therefore, the performance and the mechanical features of the machine should be given serious consideration.

(4) The basic requirement for successful operation of the photo-electric control equipment is that the position of the paper in relation to the cutter be controlled instead of the speed of the paper. Position control is usually obtained by connecting a mechanical differential or solenoid-operated gear shift mechanism between the feed rolls and the cutter as shown in Fig. 2.

The paper is usually arranged to feed slightly too fast. As the paper advances too far the register regulator relay energizes a solenoid or some other suitable mechanism which activates the mechanical differential or gear shift mechanism to temporarily decrease the speed of the paper, and in this manner causes the paper to attain its correct position relative to the cutter knife.

Many machines are equipped with a variable speed transmission between the cutter and the feed rolls. This variable speed device will usually prove adequate for manual control of the paper position; it should, however, not be attempted to use these means alone for automatic control of register cutting, since such an attempt most likely would result in considerable hunting caused primarily by lost motion and slippage in the variable speed transmission. When a mechanical differential or gear shift mechanism is being used to control the position of the paper it should be realized that the mechanical equipment can only correct for a definite range of change in paper speed, determined by the mechanical characteristic. If variations in average paper speed exceed this range, due to varying slip between the feed rolls and the paper, it becomes necessary to either change the tension on the paper, or change the speed ratio between the rotary cutter and the feed rolls in order to keep within the control range.

In order to obtain stable operation of the control equipment, it is essential that the range of mechanical differential or gear shift mechanism control be limited so that the position of the paper will not be changed more than 3/32 inch if the relay of the register regulator is closed by hand during a 1-second interval. If a wider range of control is attempted, excessive hunting may be experienced, and the result will be decreased sensitivity.

III - Description of Parts

(5) Item 1 - RR-8 Register Regulator (Outline Fig. 3)

115-230 Volts, 60 Cycles, Style No. 1116697. The style number does not include tubes. The following tubes are used: Two WL-629 Thyratron Tubes.

The RR-8 register regulator consists of an assembly of two thyratron tubes, a transformer, a relay and various Rectox rectifiers, capacitors and resistors.

Item 2 - Scanner (Type K-1)

Scanner for reflected light, with lamp but without tubes, Style No. 1116733. Outline Fig. 6.

Scanner for transmitted light, with lamp but without tubes, Style No. 1116735. Outline Fig. 7.

Additional parts to change reflected light scanner to transmitted light scanner, Style No. 974402. Outline Fig. 8.

Scanner for transmitted light without light source assembly, without tubes, Style No. 1116737. Outline Fig. 9.

Type J Light Source for above scanner with lamp, Style No. 849084. Outline Fig. 10 of Price List 18-316.

The scanners consist of a Type 57 Amplifier Tube and a Type SK-60 Phototube mounted in a sheet steel housing. A cable connector is supplied with the scanner. A lamp (8.5 volts, 4 amperes) Style No. 1014663 is supplied with the scanners. The type J light source is equipped with a 6-volt, 5-ampere lamp, Style No. 849085.

Item 3 - Selector Switch (Outline Fig. 4)

The selector switch, Style No. 856361, consists of two Micarta discs mounted together for assembly on a 1.75-inch diameter shaft. Each disc is equipped with two separate brass segments covering 90 degrees and 270 degrees of the circumference.

Item 4 - Brush Assembly (Outline Fig. 5)

The brush assembly, Style No. 856464, consists of two carbon brushes with holders. These brushes should be used with the selector switch item 3.

IV - Principle of Operation

(6) In Fig. 1 is shown the diagram for the RR-8 register regulator. The 57 amplifier tube, which is a high-vacuum tube, consists of an anode connected to 4, a heater connected to 5-6, a cathode and a suppressor grid connected to 5, a screen grid connected to 2, and a control grid connected to 38. The characteristics of this tube is such that the resistance of the tube is extremely high if the potential of 38 relative to the cathode 5 is more negative than approximately 3 volts. If the grid voltage is made more positive the tube resistance is decreased, and a current flows from the positive terminal 19, through resistor 19-4, through the tube from 4 to 5, and back to the negative terminal 3 of the d-c. voltage supply 3-19.

The SK-60 phototube consists of an anode A and a cathode C. The resistance of the tube decreases as the illuminationon the tube is increased so that with increasing illumination current flows from the positive terminal 57 through the phototube from A to C, through resistor 39-3 and back to 3 which is the negative terminal of the d-c. supply. It will be seen that the grid of tube 57 is connected to the negative d-c. supply by means of resistor 38-3. The cathode is connected to the tap of potentiometer P1. By moving this tap towards 3, the grid voltage of the 57 tube is made more positive and the current through the

tube is increased. A capacitor is connected between 38 and 39. Assume now that the phototube is illuminated, and that therefore 39 is highly positive relative to 3. This causes capacitor 38-39 to become charged so that 39 will be positive relative to 38. If now the illumination on the phototube is suddenly decreased, 39 is made more negative and capacitor 38-39 discharges through resistor 38-3, thus making the grid 38 more negative relative to the cathode. This causes the current through the 57 tube to decrease, and terminal 4 is made highly positive.

(7) The #1 WL-629 tube is a thyratron tube which consists of an anode 30, a heater connected to 21-22, a cathode connected to 20 and a grid connected to 29. If a positive voltage is applied between the anode and the cathode, the tube will conduct current if the potential of the grid relative to the cathode is made less negative than 6 volts. After the tube starts conducting current, the current flow can only be interrupted by lowering the potential between the anode and the cathode to a value less than approximately 15 volts.

It will be seen that, when 10-11 is short-circuited, the tube is connected in series with resistor 11-19 across the d-c. supply source 20-19, where 19 is positive relative to 20. If under these conditions lead 4 is made temporarily positive relative to 20, the capacitor 11-20 which is charged up to the potential of 20-19 will discharge through the #1 WL-629 tube. This discharge will persist until the voltage across the capacitor is approximately 15 volts, when the #1 WL-629 tube becomes non-conducting. Capacitor 11-20 now starts to charge up through resistor 11-19.

During this charging period the grid 27 of the #2 WL-629 tube is made highly positive and the #2 WL-629 tube therefore conducts current and energizes relay I. The time during which relay I remains energized can be decreased by moving the tap of potentiometer P_2 towards 24.

(8) From the previous description it may be apparent that if the illumination on the phototube is decreased by a dark spot intercepting the beam of light from the light source, relay I will be caused to ramain closed a definite time, depending upon the adjustment of potentiometer P_2.

If a light spot on dark paper is used the same operation results if the scanner connections are changed to connections for light spot operation.

V - Application Data

(9) A-C. Supply Voltage

The equipment is designed for operation from an a-c. source, 105 to 125 volts, or 210 to 250 volts. The frequency should be withing ± 10 per cent of name plate rating. It should be noted that the a-c. supply voltage limits given above apply only if the voltage is changing

gradually. If the voltage changes quickly over a wide range the sudden variation in lamp voltage may cause incorrect operation of the equipment. To obtain best performance, therefore, the a-c, voltage should be as constant as possible, and it is recommended that the lighting circuit be used as power supply. It is preferable to run the a-c. leads directly to the load center and to have no other variable load connected to this circuit.

The maximum permissible instantaneous line voltage variation depends upon the color of the spot. If there is a considerable difference between the spot color and the paper color a large variation may be permitted. For the average application a sudden voltage variation of 4 per cent will be found to be quite satisfactory. As a general rule it may be stated that if the voltage variations are sufficiently slow so that they are not noticeable on a 100-watt Mazda lamp the voltage supply is suitable for the RR-8 regulator.

Attention is called to the fact that even though a voltage dip may occur occasionally, exceeding the 4 per cent range, it would hardly affect the register of the paper to a noticeable degree. If the equipment is used to operate from a spot whose color differs slightly from the paper color, as for example a red spot on white paper, and if there are frequent sudden voltage variations exceeding 2 per cent, it is recommended that the lamp voltage be supplied by a constant voltage-regulating transformer with 7.5 volts, 4 amperes output. The volt-ampere load of the RR-8 regulator is 60.

(10) Transmitted or Reflected Light

When the register regulator is applied to exclusively control the register of cellophane or glassine paper, it is recommended to use a transmitted light scanner, as shown in Fig. 7. If both cellophane and ordinary opaque paper is used on the same machine, a reflected light scanner, shown in Fig. 6 is recommended. In order to use the reflected light scanner in connection with cellophane, either a dark spot should be printed on the cellophane, and the cellophane sheet should be arranged to slide on top of a white tile plate so that ample reflection of the light is obtained when the printed spot does not intercept the light beam, or a white spot should be printed on the cellophane and no reflecting plate used on the reverse side of the cellophane.

(11) Size and Position of Spot

It is recommended to use a spot 1/8 inch wide in the direction of travel of the paper although a spot 1/16 inch wide can be used. The spot may be made wider than 1/8 inch if desired. The length of the spot should be at least 1/4 inch plus the maximum sideways

travel of the paper. If, for example, the lateral travel of the paper is 1/4 inch, the spot should be made 1/2 inch long. It is preferable to arrange the spot so that there is no other printing between the spots. Under no circumstances must there be any printing within a distance from the spot corresponding to 10 per cent of the length of cut.

(12) Color of Spot

(a) Reflected Light

In reflected light applications it is essential that care be exercised in selecting the color of the indicating spot. Since the color sensitivity of the phototube is not equivalent to the color sensitivity of the human eye it will frequently be found that no phototube response is obtained from a spot even though considerable contrast is apparent between the spot and the paper when viewed with the eye. It is recommended to use a black, dark blue or dark green spot although other dark hue colors may be used, if the paper color is light, and to connect the scanner for "dark spot" operation. If the color of the paper is dark blue, black, gray or green, a yellow, white or red spot may be used. In that case the scanner should be connected for "light spot" operation.

The glossiness of the spot affects the phototube response to some extent, so that increased glossiness tends to increase the response from the phototube. For this reason it is desirable to print the spot with ink to give minimum glossiness if the equipment operates from a dark spot on a light colored paper, and to arrange a glossy spot if the phototube is connected to operate from a light colored spot on a dark colored paper. In order to test whether a spot can be used proceed as outlined in paragraph 25.

(b) Transmitted Light

If transmitted light is used, the density of the spot is more important than the color. A white spot on cellophane will thus give satisfactory operation with a scanner connected for "dark" spot operation. To get reliable operation, the difference between the transmittancy of the spot and the capacity of the paper should be at least 5 per cent.

If, for example, the paper transmits 80 per cent of the light the spot should transmit 75 per cent or less.

When a watermark is used as an indicating spot it is preferable to use a watermark with higher transmittancy than the paper i.e., a spot which is less dense than the paper. The minimum difference is

transmittancy between the paper and the watermark should be 5 per cent as defined above. In order to test whether a spot can be used proceed as outlined in paragraph 25.

(13) Sensitivity

The sensitivity is ± 1/32 inch or better. This means that the equipment will operate if the paper moves 1/32 inch off the normal register position. Whether or not the register will be kept within the ± 1/32-inch range depends upon the mechanical characteristic of the machine. If the friction is varying widely, sudden variation in paper position exceeding ± 1/32 inch may result, and obviously the register regulator cannot start correction before the change in position has occurred.

(14) Paper Speed

The maximum paper speed depends upon the relative color of the spot and the paper. If a black or dark blue spot on white paper is used, satisfactory operation at speeds up to 3000 feet per minute can be obtained. If the difference between spot color and paper color is slight, the maximum operating speed is 500 feet per minute.

(15) Temperature

The RR-8 register regulator will operate with ambient air temperatures between 0° and 150° F. The scanner can also be used in ambient air temperatures between 0° and 150° F.

(16) Tubes

Two Thyratron Tubes WL-629. Amplifier Tube RCA-57. Phototube SK-60, Lamp Style No. 1014663.

(17) Dimensions of Light Spot

Approximately 1/16" x 5/16". (Also see paragraph (11).

(18) Relay Contact Capacity

110 Volts A-C.	220 Volts A-C.	440 Volts A-C.	125 Volts D-C.	250 Volts D-C.
20	12	7	2	0.7

Current carrying capacity - 10 amperes continuous.

VI - Installation

(19) Mounting

(a) RR-8 Register Regulator

The register regulator should be mounted with the panel in a vertical position, preferably in a location with no excessive mechanical vibrations. The register regulator should be mounted within 10 feet of the scanners.

(b) Scanner.

(1) Reflected Light

For reflected light applications the scanner assembly shown in Fig. 6 should be used. The paper should be arranged to slide on the bottom of the housing as indicated by the line marked "Reflecting Surface". The scanner must be mounted so that the base of the lamp is in the same horizontal line or lower than the lamp filament.

(2) Transmitted Light

For transmitted light applications the assembly shown in Fig. 7 should be used. The paper should be arranged to slide on top of the circular glass window. The scanner mounting must be arranged so that the lamp is in the same horizontal line or lower than the lamp filament.

(c) Selector Switch

The selector switch should be geared or coupled to the cutter shaft so that a ratio of 1:1 is obtained. It is preferable to couple the selector directly to the cutter shaft by means of a flexible coupling. If direct coupling cannot be arranged, a gear connection may be used. The number of teeth of the gears should, however, be chosen so that the lost motion in the gears does not exceed 1 degree.

(20) Connections (See Fig. 1)

(a) Grounding:

Ground terminal B and the scanner housing to a reliable ground, preferably a water pipe.

(b) Scanner Connections

Connect scanner cable to terminals 1 to 6. The violet lead of the scanner cable marked B † AMP. is not used and should be cut off. Run the cable in BX conduit. There must be no other wires in this conduit. The scanner is connected for operation from a spot darker than the paper. If operation from a spot lighter than the paper is needed reconnect leads 2, 3 and 39 and resistor 3-39 as shown in Fig. 1.

(c) Lamp Connections:

Connect the lamp using cable with cross section of 10,000 circular mills or more. If the lamp is rated 8.5 volts connect to terminals 7 and 9. If the lamp is rated 6 volts connect to terminals 7 and 8.

(d) Arrange the wiring so that the wires will be brought out to nearest knockout as specified in instruction (3) of Fig. 1. Do not bring any other leads into the RR-8 cabinet.

VII - Placing into Service

(21) A-C. Voltage

Measure the a-c. voltage and make sure to see that it is within the limits specified in paragraph 9.

(22) Tubes

With a-c. power off insert the tubes and the lamp in their sockets. Then apply a-c. voltage.

(23) Scanner Adjustment

(a) Reflected Light

With the paper sliding against the bottom of the scanner housing, adjust the position of the lamp by moving it towards or away from the lens to give a clearly focused light spot, approximately 1/16" x 5/16".

(b) Transmitted Light

When transmitted light is used it is necessary to make sure that the illumination on the phototube is not too high. Too high illumination will increase the phototube current and decrease the voltage across the phototube so that the sensitivity of the equipment is material reduced. The scanner is equipped with a fixed aperture 1/32 inch x 1/4 inch. By adjusting the distance between the housing and the lamp (Dimension A, Fig. 7) the maximum amount of light may be varied so that the maximum phototube sensitivity for different paper transmittancies may be obtained. If, for example, cellophane is used it will be found that the maximum sensitivity is obtained if Dimension A is either 1/2 inch or 1-1/2 inches.

The reason for this is that the illumination on the 1/32-inch x 1/4-inch aperture is decreased when the lamp is adjusted up or down from the focused position and the illumination at A - 1/2 inch is approximately equal to the illumination at A - 1 - 1/2 inches. This adjustment will give satisfactory operation with cellophane or paper with transmittancy from 100 per cent to 60 per cent. For paper with lower transmittancy the lamp position should be adjusted to give higher illumination on the aperture. It is immaterial whether the dimension A - 1/2 inch or A - 1-1/2 inch be used, however A - 1/2 inch is recommended unless for operating reasons it is desirable to have more clearance between the scanner and the lamp.

(24) 57 Tube Test

With terminals 10-11 short-circuited and no illumination on the phototube turn the lower potentiometer dial to position 100. The relay should now be de-energized. Turn the potentiometer dial towards 0. The relay should operate with the dial between positions 35 and 65.

(25) Phototube Test

Place the paper in front of the scanner in its normal position. Adjust the lower potentiometer P_1 until the relay is de-energized. Turn the dial 5 divisions more towards 100. Now move the paper quickly so that the spot intercepts the light beam. This should cause relay I to operate and remain closed during a time interval of from 0.05 seconds to 0.1 seconds, depending upon whether the upper potentiometer dial P_2 is in position 0 or position 100.

(26) Selector Adjustment

As shown in Fig. 2 the relation between the scanner location and the selector switch or the mechanical selector must be correct in order to cut the paper at the right location. To obtain the right conditions either the scanner may be moved or the selector switch may be adjusted relative to the cutter. Assuming that the paper normally feeds too fast, the relative location of cutter, selector and scanner should be such that when the spot just enters the beam of light, the brushes should just engage the trailing edge of the selector switch, assuming of course that the paper is in the correct position relative to the cutter.

The selector switch brush engagement may be varied by either staggering the electrically connected segments of the switch, or by staggering the brushes so that contact may be made during any angle of rotation of the selector switch from 0 to 270 degrees. The maximum angle of brush engagement is determined by the distance between the spots and the distance between a spot and the printing between the spots if such printing is present. If, for example, the distance between the spots is A and the distance between a spot and the nearest printing is B, the maximum angle of selector switch contact should not exceed $\frac{300\ B}{A}$ degrees. The most desirable selector

switch adjustment can be found only under actual operating conditions. It is suggested that a 30-degree angle be tried first and that the operation of the equipment be observed. Subsequently the selector switch should be adjusted to give a larger and a smaller angle of brush engagement, to determine the conditions most suitable to the particular application.

(27) Adjustment of Basic Paper Speed

The basic paper speed should be adjusted so that if the variation in paper speed with relay I closed permanently is A, and the correct paper speed is B, the maximum paper speed with relay I de-energized should preferably be B + 0.5A.

(28) Color of Spot

To determine if the color of the spot is suitable, test as outlined in paragraph 25. It is preferable to use a spot contrasting the paper as much as possible as described in paragraph 12. If the color differential is high it will be found that operation is obtained even with the lower potentiometer P_1 in position 100. The spot color cannot be used if operation of the relay is not obtained when the equipment is tested according to paragraph 25.

VIII - Final Adjustment

(29) (a) Lower Potentiometer:

With the machine not in operation turn potentiometer P_1 until relay I is de-energized. Observe potentiometer position P_1 min. With the machine in operation turn potentiometer P_1 clockwise until relay I fails to operate. Observe this position of the potentiometer P_1 max. For final adjustment use a potentiometer adjustment midway between P_1 min. and P_1 max.

(b) Upper Potentiometer:

Adjust the upper potentiometer P_2 to give a time of relay operation which gives most accurate register control. By turning the potentiometer clockwise the time during which the relay remains closed is increased.

IX - Testing

(30) General Tests

If the equipment fails to operate properly first replace all tubes to see that no tube is defective. Measure the a-c. line voltage to see that it never varies more than 10 per cent from the voltage rating given on the name plate. Make sure that the scanner and the control cabinet are grounded.

(31) Special Tests

(a) A-C Voltages

With rated voltage applied to the equipment the a-c. voltages with tubes inserted in their sockets should be within the following limits:

Leads	Volts Max.	Min.
16-11	200	180
18-20	116	106
11-17	2.55	2.45
21-22	2.55	2.45
5-6	2.55	2.45
9-8	2.4	2.25
8-7	5.5	5.1

(b) D-C. Voltages

With a voltmeter having a resistance of 1000 ohms per volt measure the d-c. voltages which should be within the following limits:

Leads	Volts Max.	Min.
3-20	150	130
20-19	140	120
2-3	70	60

(32) Trouble Shooting

(1) Relay I does not operate	(a) Replace the #2 WL-629 tube
	(b) Measure the voltage across 11-28. This voltage should be approximately 190 volts. If there is no voltage check relay coil for open circuit.
	(c) Connect a clip lead between 11 and 25. If relay operates now, the circuit for the #1 WL-629 tube is defective or the #1 WL-629 is defective.
(2) Relay I remains closed regardless of adjustment of potentiometer P_1.	(a) Replace the #2 WL-629 tube
	(b) Check to see that circuit 27-25 is not open.
	(c) Check resistor 11-28 to see that it is not open.

	(d) Test capacitor 11-20 to see that it is not short-circuited.
(3) The #1 WL-629 tube glows continually regardless of adjustment of potentiometer P_2.	(a) Replace the 57 tube.
	(b) Make sure that ground connections are properly made.
	(c) Check circuit 4-29 to see that it is not open.
	(d) Replace the #1 WL-629 tube.
(4) The #1 WL-629 tube does not glow with potentiometer P_2 in position 0.	(a) Replace the #1 WL-629 tube.
	(b) Replace the 57 tube.
	(c) Make sure that connection 10-11 is closed.
	(d) Test the capacitor 11-20 to see that it is not open-circuited.
	(e) Check circuit 19-11 to see that it is not open-circuited.
(5) The sensitivity is lower than when equipment was originally installed.	(a) Replace the phototube.
	(b) Replace the 57 tube.
	(c) Replace the lamp.
	(d) Make sure that the ground connections are properly made.

X - Spare Tubes and Lamps.

(33) It is recommended that the following spare tubes and lamps be kept in stock.

Description	Recommended Stock for Number of Register Regulators		
	1	5	10
WL-629 Thyratron Tube	2	4	6
57 Amplifier Tube	2	4	6
8.5-Volt Lamp, Style 1014663	2	4	6
* 6-Volt Lamp, Style 849085	2	4	6

* If type J Light Source is used.

XI - Renewal Parts

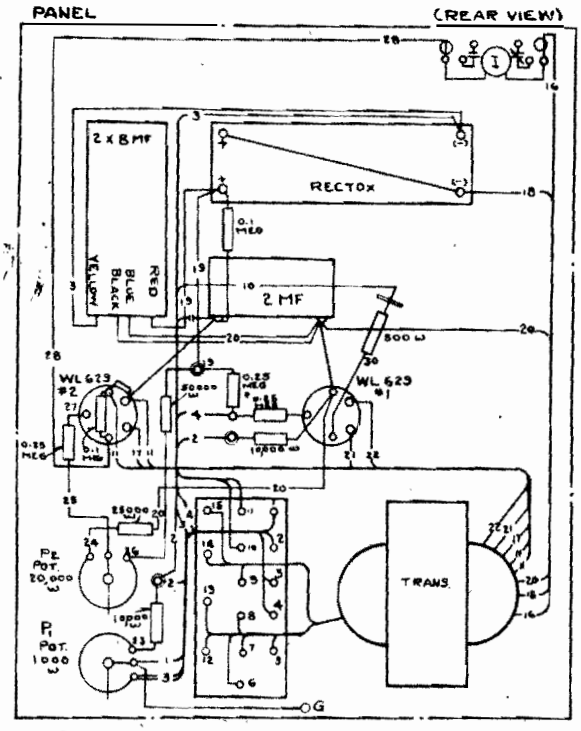
(34) Type RR-8 Register Regulator without tubes, Style 1116697.

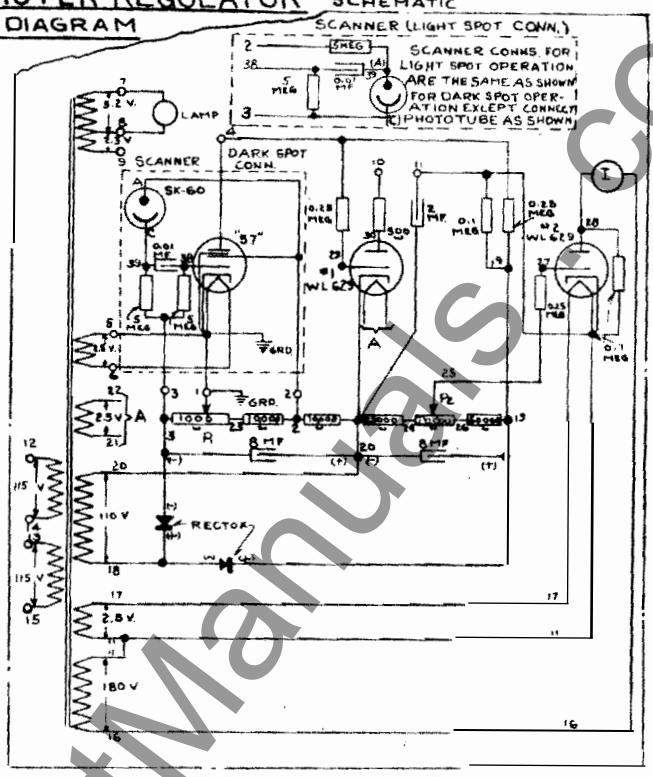
Description	Style No.
5 Prong Socket	1 073 482
Tube Shield	1 073 478
Capacitor 2 MF.	1 039 932
Capacitor 2 x 8 MF	1 039 930
Rectox Rectifier	1 039 843
Relay	1 038 884
Potentiometer Dial	869 654
Resistor 500 Ohms	943 634
10000 Ohms	895 572
25000 Ohms	1 038 165
50000 Ohms	860 004
100000 Ohms	860 002
250000 Ohms	846 668
Transformer 115/230 Volts 50/60 Cycles	1 116 692
Potentiometer 1000 Ohms	1 115 046
20000 Ohms	1 038 329
Insulator	1 115 315

(35) Scanner

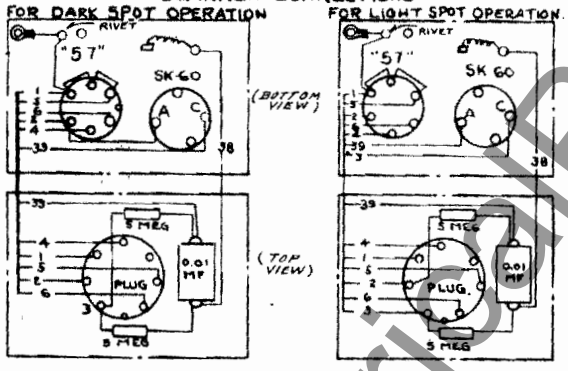
Description	Style No.
Resistor 5 Meg.	1 018 949
Capacitor 0.01 MF.	1 014 540
Lens	849 887
Window	849 991
Cable and Connector Complete	974 405
Grid Clip	799 907

FIG. 1-RR8 REGISTER REGULATOR WIRING DIAGRAM



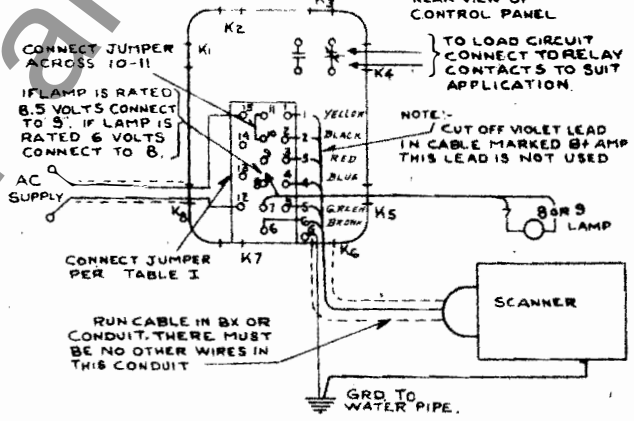


SCANNER CONNECTIONS

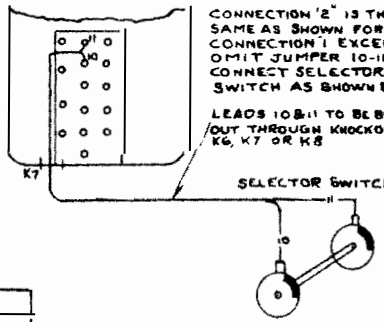


EXTERNAL CONNECTIONS

CONNECTION 1 — WITHOUT SELECTOR SWITCH



CONNECTION 2 — WITH SELECTOR SWITCH



IMPORTANT WIRING INSTRUCTIONS

1. RUN SCANNER CABLE IN BX OR CONDUIT. THERE MUST BE NO OTHER WIRES IN THIS CONDUIT. CUT OFF VIOLET SCANNER LEAD MARKED "B+ AMP"
2. GROUND TERMINAL "G" AND THE SCANNER CASE BY CONNECTING TO A WATER PIPE.
3. ARRANGE WIRING SO THAT WIRES WILL BE BROUGHT OUT TO NEAREST KNOCKOUT. USE ONLY KNOCKOUTS K6, K7 AND K8 FOR THE A.C. SUPPLY LEADS. USE ONLY KNOCKOUTS K3 AND K4 FOR THE LEADS CONNECTING TO THE RELAY CONTACTS. USE KNOCKOUTS K5 AND K6 OR K7 FOR THE SCANNER CABLE. USE KNOCKOUTS K5, K6 OR K7 FOR THE LAMP LEADS. DO NOT USE KNOCKOUTS K1 AND K2.
4. CONNECT A JUMPER ACROSS TERMINALS 10-11 FOR CONN. 1. CONNECT THE SELECTOR SW. ACROSS TERMINALS 10-11 FOR CONN. 2.
5. IF LAMP IS RATED 8.5 VOLTS CONNECT LAMP TO TERMINALS 7 AND 9. IF LAMP IS RATED 6 VOLTS CONNECT LAMP TERMINALS TO 7 AND 8.

WIRING TABLE

LEAD	COLOR
1	YELLOW
2	BLACK
3	RED
4	BLUE
5	GREEN
6	BROWN
7	YELLOW / RED TR.
8	GREEN/YELLOW
9	BLACK/RED
10	BLACK/BLUE
11	BLACK/YELLOW TR.
12	BLACK / BLUE TR.
13	BLUE / YELLOW
14	BLACK / RED TR.
15	BLACK / BROWN
16	BLACK / YELLOW TR.
17	RED / GREEN TR.
18	BROWN / GREEN TR.
19	COPPER WIRE SPAGHETTI TUBING (RED AT CAPACITOR)
20	BLACK / BLUE
21	BLUE / YELLOW TR.
22	BLACK
23	RES. PIGTAIL
24	RES PIGTAIL
25	RES. PIGTAIL
26	RES. PIGTAIL
27	RES. PIG TAIL
28	BLUE
29	RES. PIGTAIL
30	RES PIGTAIL
38	BLACK / YELLOW TR.
39	BLACK / BROWN

TABLE I

NAME PLATE MARKING VOLTS	A.C. SUPPLY VOLTS	CONNECTION (12 13 14 15)
115 / 230	115	12 13 14 15
115 / 230	230	12 13 14 15

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Printed in U. S. A. (1-40)

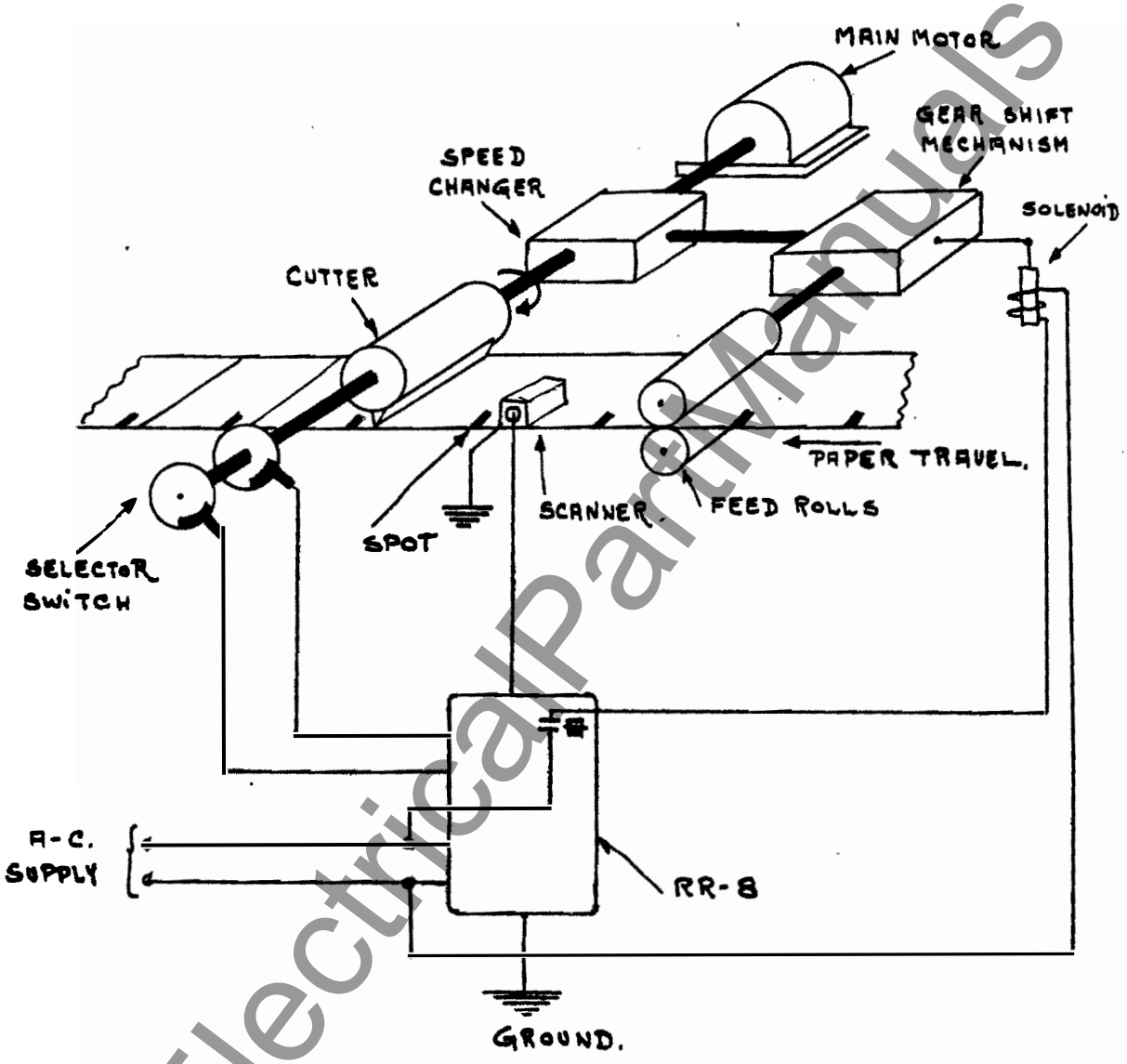


Fig. 2 - Schematic Arrangement of Mechanical Equipment
Dwg. T-78878

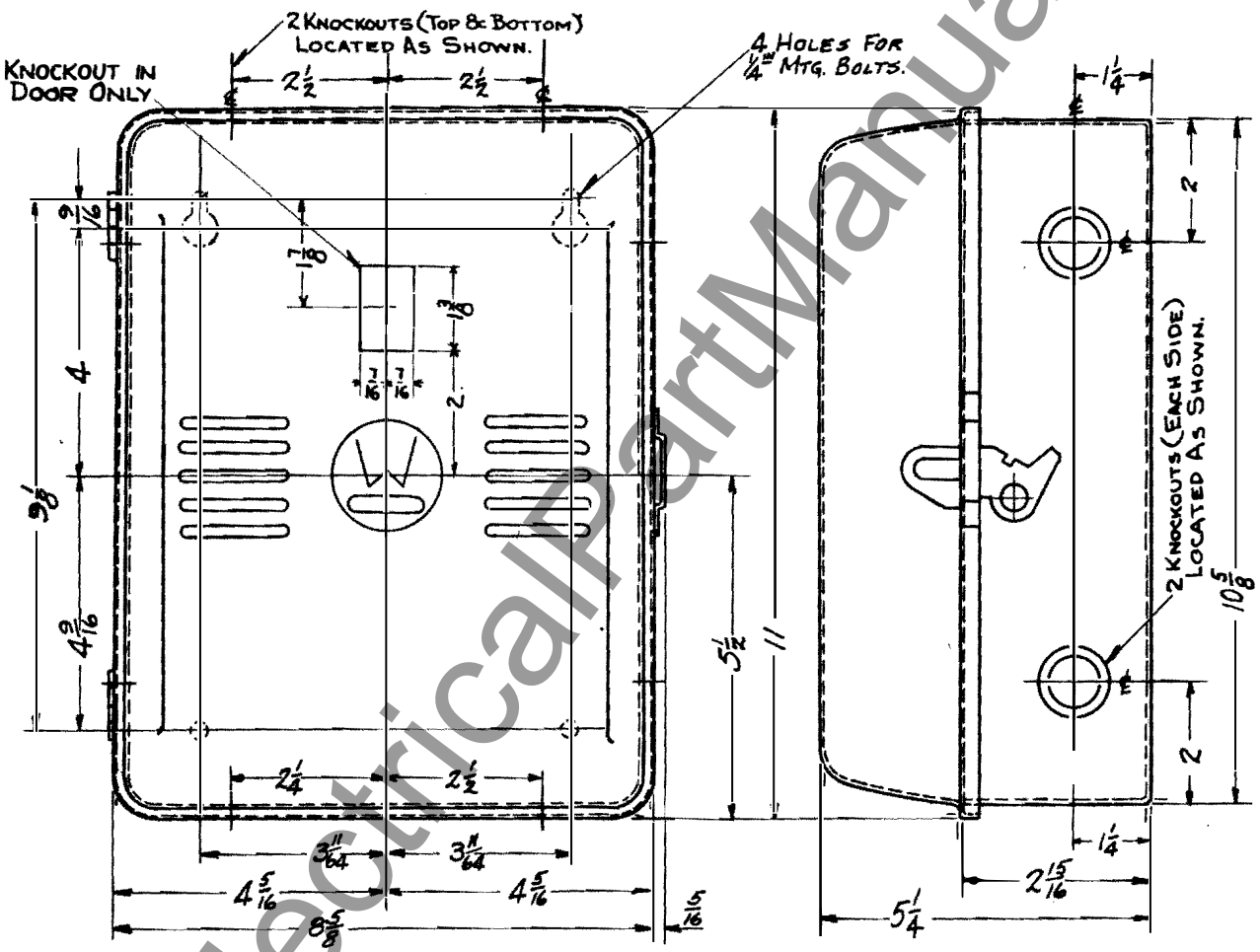
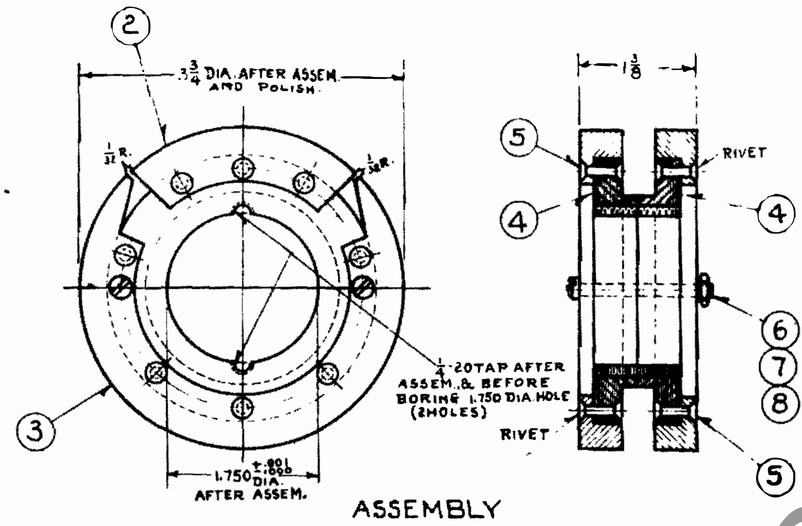


Fig. 3 - Type RR-8 Register Regulator Control Cabinet
Dwg. 81-D-194-4



Item	Description-Material-Ref. Dwg.		Style No.	Pgt. No.	Req.
1	CONTACT RING FROM 1/2" OF 4" DIA. ALLOY				2
* 2	SEGMENT, MAKE FROM ITEM 1				2
* 3	SEGMENT, MAKE FROM ITEM 1				2
4	RING, 3 1/4" X 3 1/4" X 1/2" TK MICARTA PLATE #431				2
5	1/8" X 5/8" CSK. HD. C. RIVET				16
6	1" .164-32 X 1 1/2 FIL. HD. B.M. SC.				2
7	1" .164 LOCK WASHER				2
8	1" .164-32 HEX. B.M. SC. NUT				2

* ONE OF ITEM #1 WILL MAKE ONE OF ITEM #2 AND ONE OF ITEM #3
CAM ASSEMBLY COMPLETE: S#856361 = 1 OF ITEMS 1 TO 8 THIS DWG.

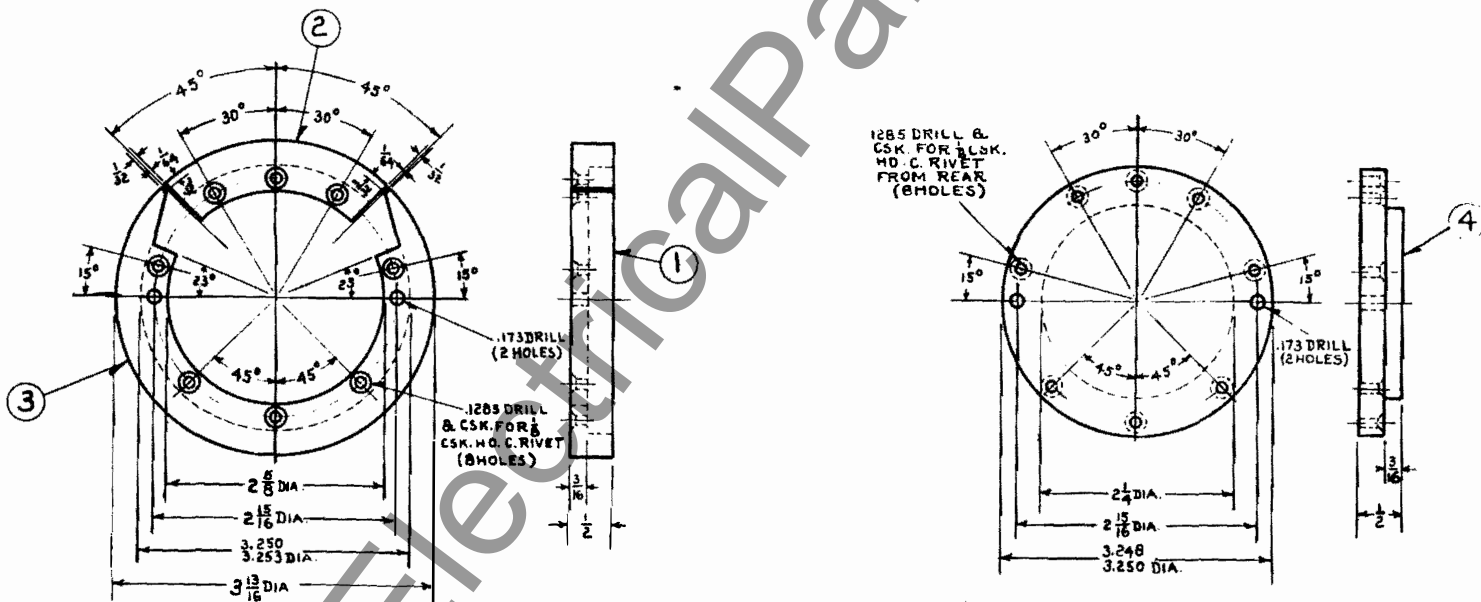
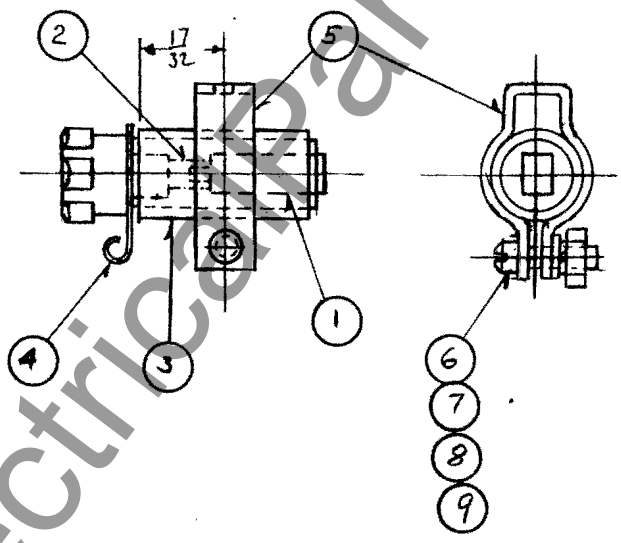


Fig. 4 - Selector Switch for Register Regulator
Dwg. 48-B-503-2

Item	Description-Material-Ref. Dwg.	FIN. CHART LINE NO.	Style No.	Pat. No.	Req.
1	BRUSH		832403		1
2	SPRING		170509		1
3	BRUSHOLDER		374187		1
X 4	TERMINAL		11040-A		1
5	CLAMP (IT.5 DWG. 12-C-544.)				1
6	.138-32 X 3/4 FIL.HD. I.M.SC.				1
7	WASHER		3408		1
8	.138 LOCK WASHER				1
9	.138-32 HEX. I.M SC.				1

X EXCEPT DRILL HOLE 11/32 DIA



S# 856464A = ITS 1 TO 9 OF THIS DWG REQ 2.

Fig. 5 - Brush Assembly for Selector Switch
Dwg. 97-D-106-1

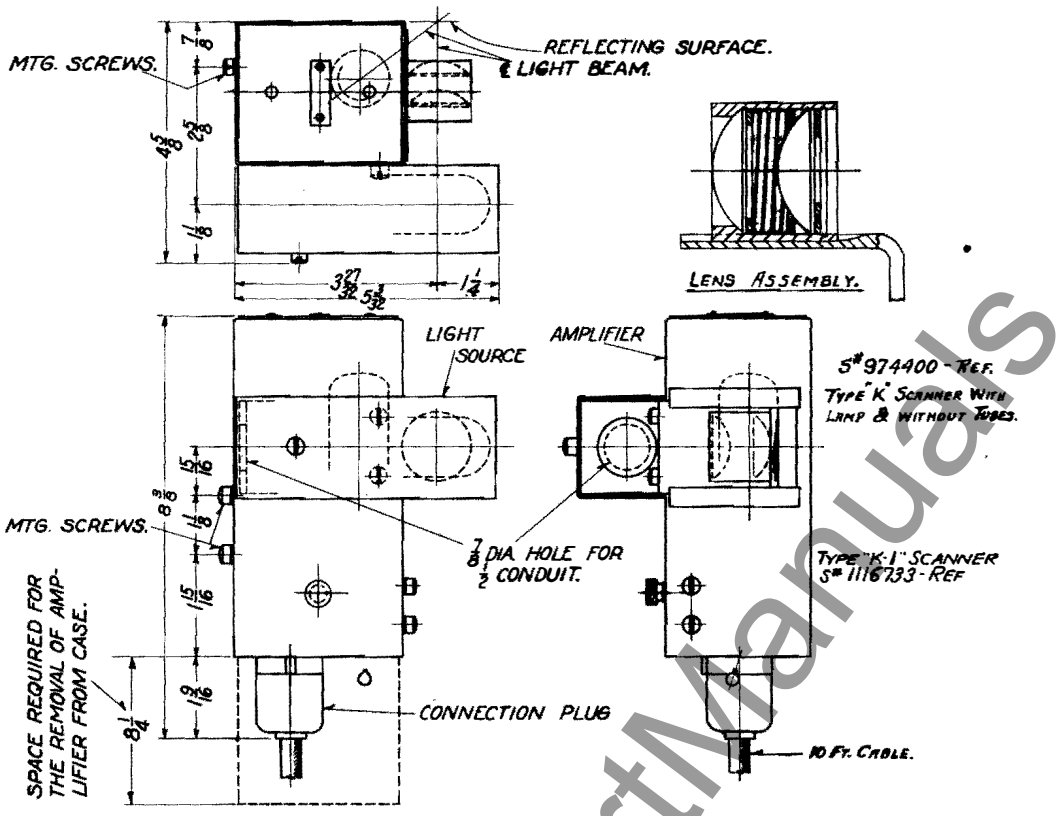


Fig. 6 - Scanner for Reflected Light
Dwg. 59-D-235-4

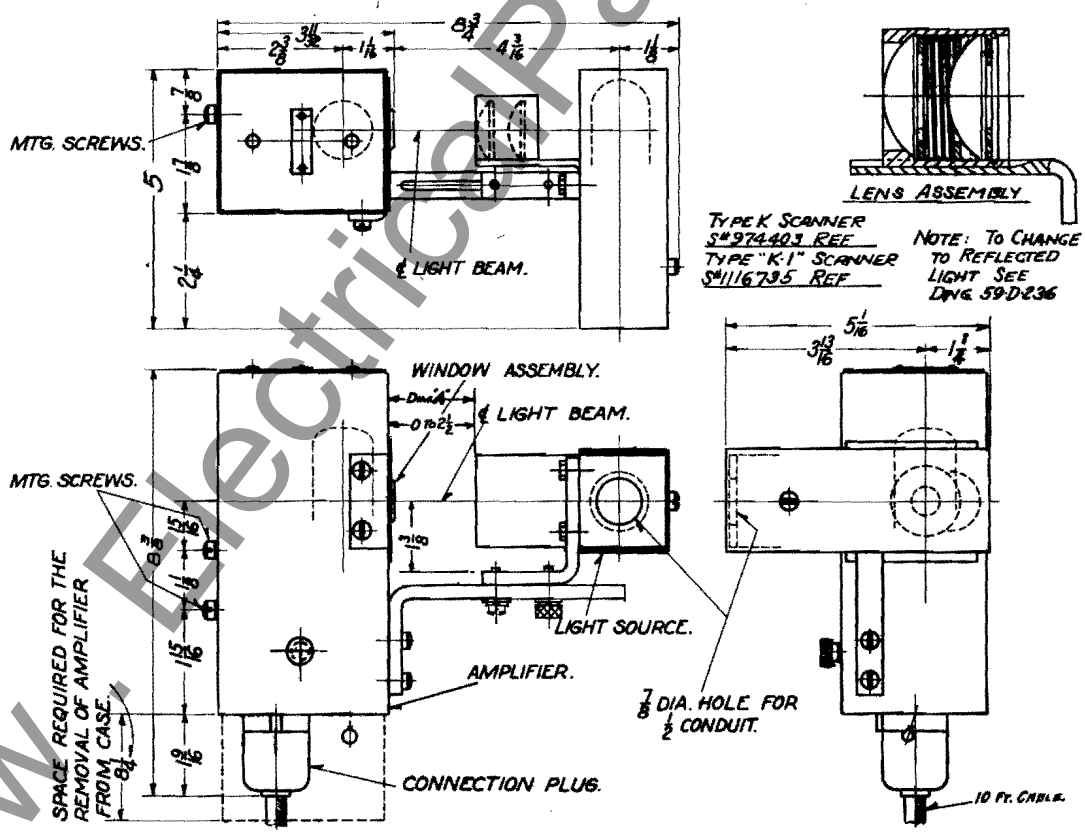


Fig. 7 - Scanner for Transmitted Light
Dwg. 59-D-236-4

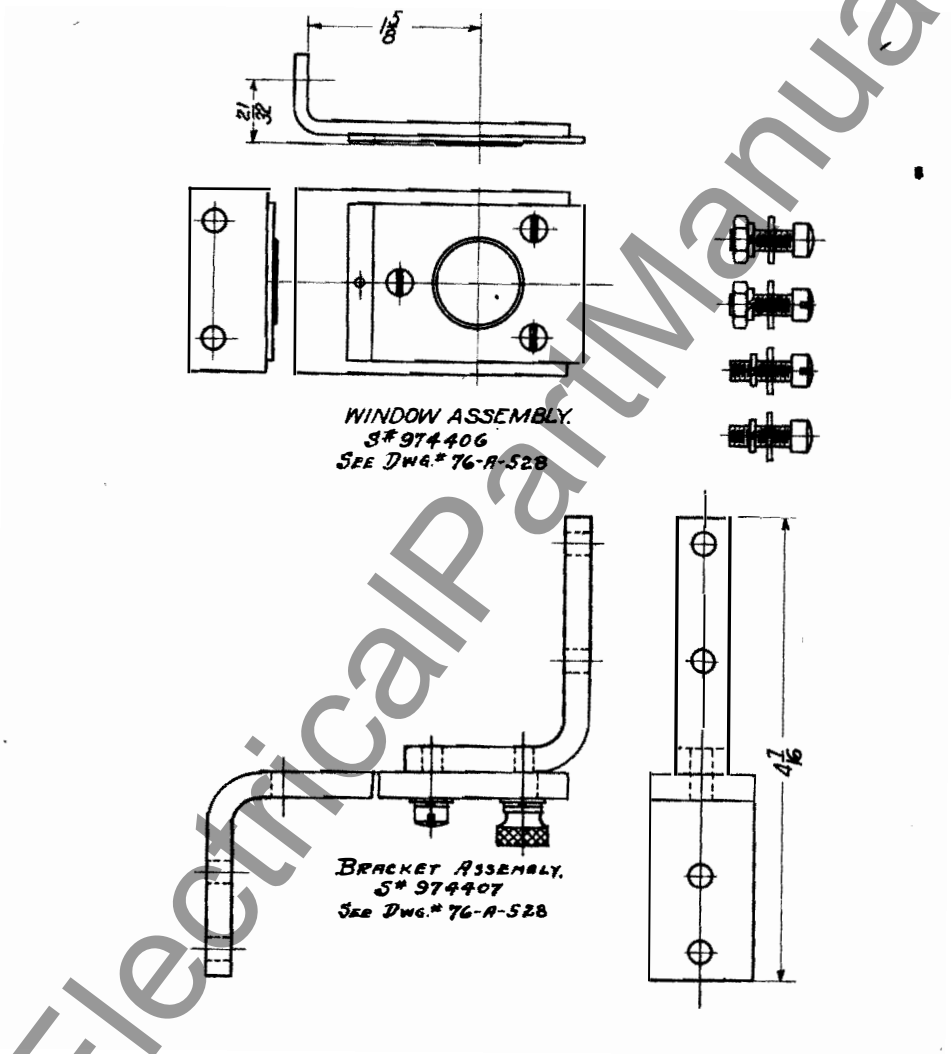


Fig. 8 - Additional Parts to Change from Reflected Light to Transmitted Light Scanner
Dwg. 68-D-918-1

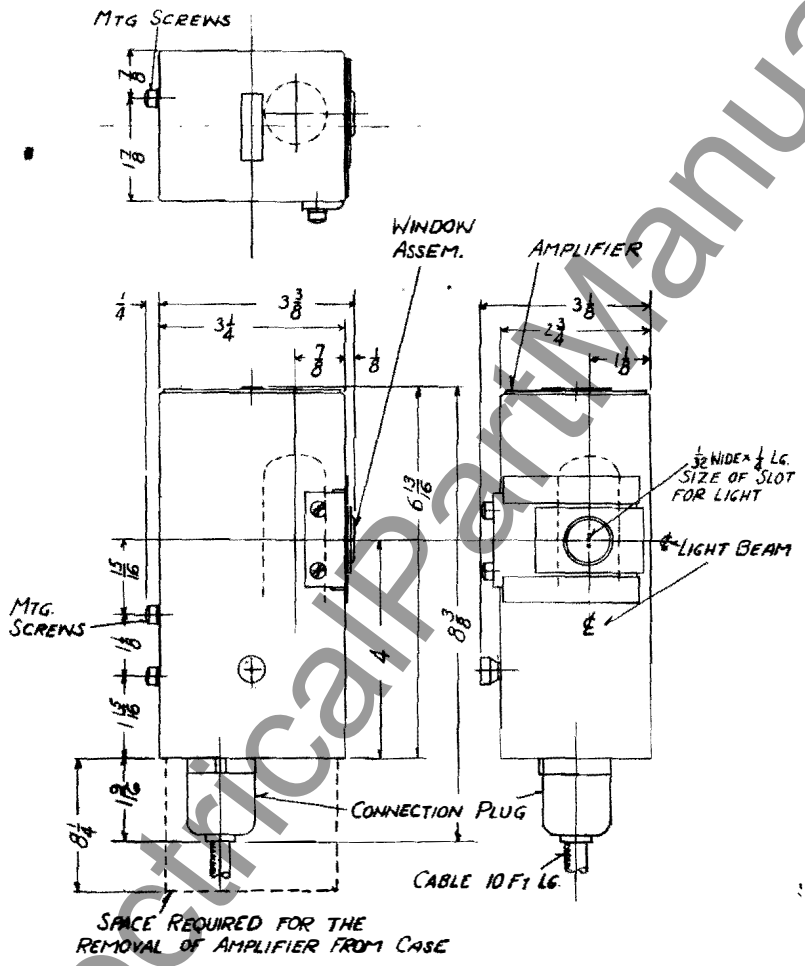


Fig. 9 - Scanner for Transmitted Light Without Light Source
Dwg. 1-D-1001-1

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES

(See Descriptive Data 18-310) (For Other Photo-Trollers See Price List 18-312)

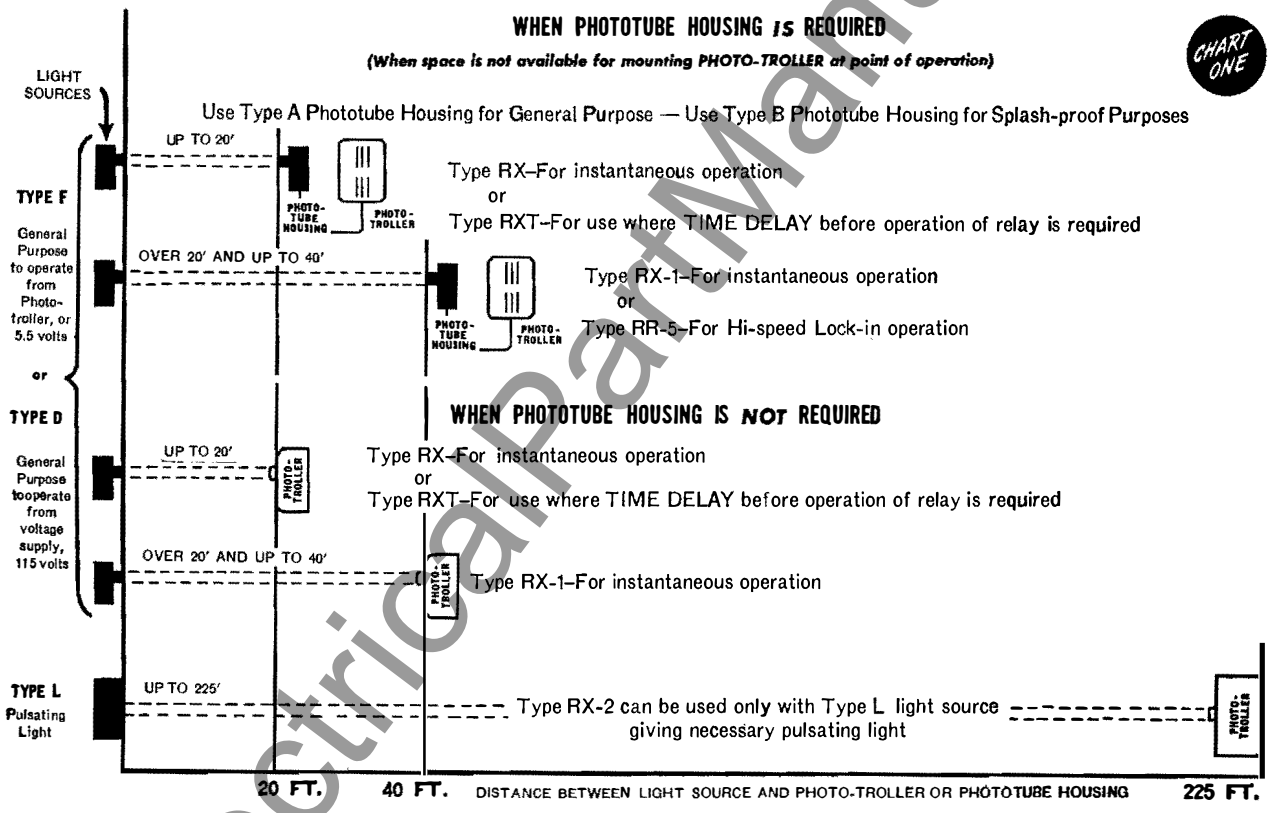
SELECTION OF EQUIPMENT

Before recommending equipment for any application, the customer's problem should be thoroughly understood and the following information should be obtained:

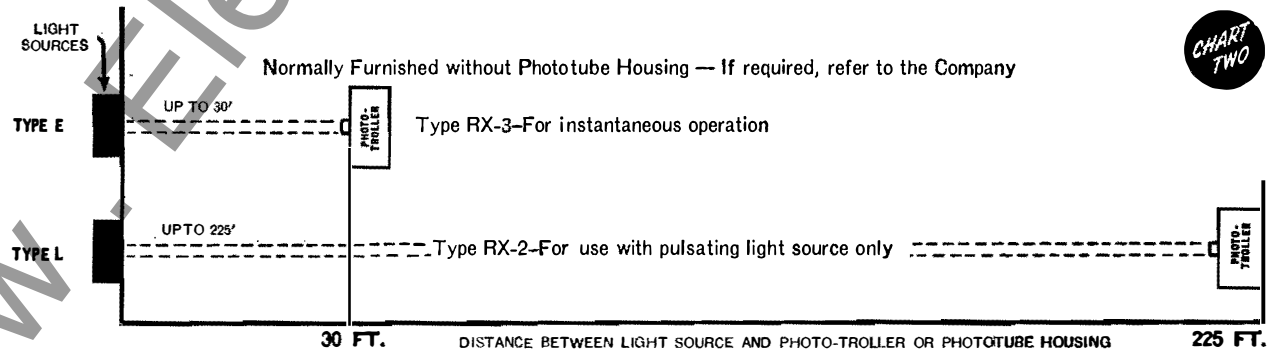
1. Distance between light source and phototube.
2. Interruption of 50% of light beam, based on a 1¼" diameter beam, necessary for maximum operating distance.
3. Operating conditions such as temperature, dust and weather conditions (indoor or outdoor).
4. Speed of operation. { a. Number of operations per minute. b. Time of single operation.
5. Space available for mounting the light source, phototube housing and/or Photo-Troller.

Having obtained above information, consult the charts below to select the proper equipment. For register regulator applications see Price Lists 18-311 and 18-513.

FOR INDOOR USE ONLY



FOR OUTDOOR USE ONLY



PRICES: See tables on page 2 for prices and ordering information.

Prices are subject to change without notice.

PHOTO-TROLLERS, PHOTOTUBE HOUSINGS AND LIGHT SOURCES—Continued

PHOTO-TROLLER CONTACTOR RATINGS

Contacts Provided	Rating Per Contact A-C.	
	Amps.	Volts
One Normally Open	20.	110 A-C.
	12.	220 A-C.
	7.	440 A-C.
	2.	125 D-C.
	0.7	250 D-C.
One Normally Closed	10.	110 A-C.
	6.	220 A-C.
	3.	440 A-C.
	1.	125 D-C.
	0.4	250 D-C.
Two Normally Open in Series	30.	110 A-C.
	20.	220 A-C.
	10.	440 A-C.
	3.	125 D-C.
	1.	250 D-C.

Max. Continuous Carrying Capacity

Normally Open—12 Amps.
Normally Closed—6 Amps.

POWER CONSUMPTION, DIMENSIONS AND WEIGHTS

Type	Approximate Power Consumption Watts		Approximate Overall Dimensions In Inches 60 Cycles Only			Approximate Shipping Weight, Lbs.
	Without Light Source	With Light Source	Width	Height	Depth	
RX Indoor	30	48	9	11	5¼	22
RX-1 Indoor	35	53	9	11	5¼	22
RX-2 Indoor			9	11	5¼	22
RX-2 Outdoor	35	53	13	17	9½	45
RX-3	30	48	13	17	9½	46
RX-T	35	53	9	11	5¼	22
RR-5	100	125	15	20	12	60

TYPE SC-2 REGISTER REGULATOR

for

WINDER CONTROL

Instruction Book 5670-88-A

* * *

Rep. 10-41

Westinghouse Electric & Manufacturing Company

East Pittsburgh, Pa.

INDEX

INDEX

DRAWING LIST

C A U T I O N

(1) NEVER OPERATE "RIGHT", "LEFT" OR "SELECTOR" SWITCH UNTIL A-C. VOLTAGE HAS BEEN APPLIED FOR AT LEAST TWO MINUTES.

(2) IF A-C. SUPPLY SOURCE IS GROUNDED THE GROUNDED TERMINAL SHOULD BE CONNECTED TO TERMINAL 2.

(3) NEVER OPERATE THE TRANSFER SWITCH OR THE TOGGLE SWITCH #1 WITHOUT FIRST DISCONNECTING THE A-C. SUPPLY VOLTAGE.

(4) IN OPERATING, CARE SHOULD BE TAKEN THAT THE SCANNER CABLE DOES NOT RUB AGAINST THE RUNNING WEB OR ANY OF THE ROTATING PARTS OF THE MACHINE.

I-DESCRIPTION

1- The type SC-2 Register Regulator consists of a control cabinet, scanner, push buttons, d-c. reversing motor, two limit switches, and a transfer switch as shown in diagram 6-A-9584.

2- Control Cabinet

The main parts of the control cabinet are a power transformer, five tubes, one impulse transformer, and various Rectox rectifiers, resistors and capacitors. The purpose of the RCA-83 rectifier tube is to supply d-c. current to the d-c. reversing motor field. The two WL-632 thyratron tubes are used to supply and reverse the armature voltage of the reversing motor, and the two KU-627 thyratron tubes operate to control the WL-632 tubes in accordance with the position of the paper as described later in this instruction book.

3- Scanner

The scanner consists of a synchronous motor with a lens assembly, lamp, WL-735 phototube and RCA-57 amplifier tube.

4- Selectors, Push Buttons and Transfer Switch

The Selectors are used to switch from "Automatic Control" to "Manual" Control. "Manual" Control is obtained from the push buttons. These operations may be controlled from either of two push button stations which are conveniently located on the winding machine.

The transfer switch, which reverses the grid polarity, of tubes No. I and IV is used to change the direction of rotation of the d-c. motor armature when toggle switch No. I is operated from "UP" to "DOWN" position or vice versa.

5- Limit Switches

The purpose of the limit switches is to disconnect the motor if the reel carriage reaches the mechanical limit position of its travel.

II-OPERATION

Referring to diagram 6-A-9584, it will be seen that the synchronous motor in the scanner is connected to terminals 12, 13, 14 and the lenses, therefore, have a definite position in relation to the a-c. voltage wave, and also the position of the light beam from any particular lens has a definite phase relation to the supply voltage wave. When a light beam intercepts the edge of the paper or the line printed on the paper, the illumination on the phototube is changed and through the RCA-57 amplifier tube an impulse is therefore produced in the secondary winding of the impulse transformer. Consequently, the point on the a-c. voltage wave where this impulse occurs depends upon the position of the printed line or paper edge relative to the center of the light circle on the paper produced by the rotating lenses.

7- This impulse is applied to the grid circuit of tube III, and this tube, therefore, will break down and conduct current earlier or later in the a-c. voltage wave, dependent upon the position of the paper. By means of a phase-shifted, rectified a-c. grid control circuit consisting of capacitor 41-42, resistor 42-45 and a Rectox rectifier 39-42, tube II is caused to break down at a definite point on the a-c. voltage wave, corresponding to approximately 90 degrees delayed phase angle. Resistor 43-49 is connected in the grid circuit of tube II, so that tube II cannot break down if during that particular half cycle tube III is already conducting current. By means of this circuit, selective operation of tube II is obtained as a function of the position of the paper, i.e., tube II will conduct current or will not conduct current dependent upon the position of the paper relative to the light circle.

8- Tube II applies voltage to resistor 22-A-49 so that 22 is negative in relation to 40, with the toggle switch thrown to the "UP" position, if current flows through tube II. If no current flows through tube II the voltage from 49-40A is applied across 22-40 and lead 22 is positive in relation to lead 40. The voltage across 22-40 is applied to the grid of tubes I and IV so that tube IV conducts current when 22 is positive and tube I conducts current when 22 is negative.

9- From the diagram will be seen that reversal of voltage across armature A1-A2 will result when current is transferred from tube I to tube IV, and consequently the direction of motor operation is reversed. The motor armature rotation should be clockwise, as the motor is viewed from the end opposite the shaft extension when tube IV conducts.

III-INSTALLATION

10-Mounting of Cabinet

Mount the cabinet (when not already built into the winder) at least 2 inches from a wall so that sufficient ventilation is obtained. Do not cover up the large hole in the bottom of the cabinet. This hole is used to ventilate the cabinet. Mount the scanner according to information given in drawing 2-A-4278.

11-Mounting and Location of Scanner

As shown in drawing 2-A-4278 the scanner mounting and location depends upon the type and color of the material being controlled, as well as the arrangement of the printing on the material. One of combinations No. 1 to No. 30, as shown in table I of Drawing 2-A-4278 should be used. To facilitate the selection of the correct combination, a summary is shown in table II of Drawing 2-A-4278. From this table will be seen that the equipment can be used to register according to a dark colored line printed on light colored paper or light colored printed foil or cellophane. The equipment may also be arranged to control the position of the edge of paper, foil or cellophane of either dark or light colors. Before using Table No. 2 of Drawing 2-A-4278 the following facts must be known:

1 - Whether line control or edge control is to be used.

2 - Type of material (foil, paper or cellophane).

3 - Color of material (Dark or light).

4 - Arrangement of printing on either side of the line or near the edge if edge control is used.

To illustrate the use of table No. 2 examples are shown as follows:

A - Conditions: (1) Line Control.
(2) Foil printed light colors.
(3) Dark line color.
(4) Light-colored printing on either side of line but no dark-colored printing within 3/4" on left side of line.

Selected Combination: 4

B - Conditions: (1) Edge control.
(2) Dark-colored paper.
(3) No light-colored printing within 1/8" of right edge.

Selected Combination: 16

In selecting the various combinations for edge control it should be noted that best results are obtained if the combination with the lowest number is used.

12- When the correct combination is selected according to table No. 2 of Drawing 2-A-4278, proceed to arrange the scanner as shown in 2-A-4278 as follows:

(1) Operate scanner switch to "Dark" or "light" position as specified in table No. 1.

(2) Mount as per position A or B.

(3) Operate toggle switch No. 1 on control panel to "UP" or "DOWN" position.

(4) Locate scanner in locations 1, 2 or 3.

(5) Cover roll with material as specified.

13-Connections

Make external connections using wire with 1500 volts insulation as shown in diagram 6-A-9584. Make sure that the a-c. frequency is within 3 per cent of rated frequency. Measure the a-c. voltage and connect the link between terminal 62 and either of terminals 58, 59, 60, 61 as outlined in the table in diagram 6-A-9584 so that the a-c. line voltage does not exceed the terminal rating. If the a-c. supply source is grounded, the grounded side must be connected to terminal 2. Do not use the series field on the d-c. reversing motor. Connect terminal 15 to a water pipe by means of a No. 10 copper wire, and connect terminal 15 to the mounting strap on the machine to which the scanner is assembled. Make preliminary connection of jumper 11 attached to the right hand side of the 10-inch resistor tubes mounted at top rear of the panel so that no sections of the resistor tubes are short circuited, and change later if necessary as outlined in paragraph 20 of these instructions. A 2-pole fusible line disconnecting switch or safety switch should be provided which is readily accessible to the machine operator. Line fuses of 15-ampere capacity should be installed.

IV-PLACING INTO SERVICE

14- Preliminary Tests

Place the tubes in their sockets. Turn selector switch to "MANUAL" position. Operate toggle switch No. 1 on the control panel to the position as outlined in paragraph 12 and operate the transfer switch to the corresponding position. Inspect the scanner to see that the lenses are clean and that the motor shaft is turning freely. Remove the shipping wedge from the cathode protection relay. Close the a-c. supply switch and after 5 minutes, check to see that voltage is applied to the anodes of the WL-632 tubes by operating either the right hand or left hand push buttons and noting the presence of a glow in one of the WL-632 tubes. While the synchronous motor is running disconnect the a-c. supply voltage and measure the time required for the motor to reach standstill. If this time is less than 8 seconds, there is too much friction in the motor bearings and the motor bearings should be cleaned or replaced. Inspect the tubes to see that the filaments are glowing with a red glow, and observe that the lenses are rotating in direction as specified in table I of Drawing 2-A-4278, viewing it from inside the scanner case when the door is open. Check to see that the d-c. reversing motor field is supplied with voltage by observing that there is a bluish glow in the RCA-83 rectifier tube.

Throw the "ON-OFF" toggle switch on the scanner to the "OFF" position.

Place a representative piece of the material, free of printing or dirt, on the roll below the scanner and turn the potentiometer dial to position 100. The sample material used for this test must be kept as clean as possible. There should be a bluish glow in tube II and no glow in tube III. If there is a glow in tube III, the scanner is not properly aligned in relation to the roll, the ground connections are not properly made, the material is dirty, or it is loose on the roll.

It is important that tube III does not glow with plain material placed on the roll, although it will be necessary in some cases (if the material does not have a plain appearance) to reduce the potentiometer dial setting. In cases where this is necessary, note the potentiometer dial setting and do not exceed this value when operating the equipment.

15- Operation of Tubes

To test the operation of the scanner and tubes II and III, place the material in its normal position beneath the scanner. Turn potentiometer to position 100. Place the line or edge in the approximate diametrical center of the light circle and move to left and right. Observe tube II which should be "ON" as indicated by a bluish glow or "OFF" approximately within the regions as indicated by Fig. 1 and 2 of Drawing 2-A-4278. It

will be noted that tube II will be on or off if the line or edge is moved slightly away from the diametrical position. If this "ON-OFF" position is not approximately in the diametrical position, the location can be changed by turning the lens holder slightly in relation to the motor shaft, although this should not be necessary because adjustment of the lens holder has been made at the factory, and the correct position of the lens holder is indicated by a mark on the motor shaft opposite a mark on the lens holder bushing.

It may be found in some cases that more points of control exist than are shown in Fig. 1 and Fig. 2 of Drawing 2-A-4278. By turning the potentiometer towards zero this condition can be eliminated.

By observing tube III it will be seen that when the line is moved in the direction of travel of the light beam or rotation of the scanner lenses nearest the phototube the glow in the tube will decrease, and when the line is moved away from the diametrical position opposite to the travel of light beam or rotation of the scanner lenses the glow will increase.

In Fig. 1 and Fig. 2 of Drawing 2-A-4278 is shown the range of the control zone. If the line is located outside this zone the equipment will not operate to bring the line back to the normal control position.

16- Adjustment of Toggle Switch No. 1

The position of Toggle Switch No. 1 determines the direction of rotation of the synchronous motor in the scanner. Viewing the lens assembly from inside the case with the door open the lenses will rotate counter-clockwise with switch No. 1 up, and will rotate clockwise with switch No. 1 down. Switch No. 1 should be in a position as shown in table No. 1 of Drawing 2-A-4278.

It should be noted that the a-c. supply voltage must be disconnected and the motor must come to standstill before switch No. 1 is operated. If switch No. 1 is operated while the synchronous motor is running, the direction of rotation of the motor will not reverse.

When this equipment is installed on a winder prior to shipment all external interconnections have been properly made and the machine has been tested, therefore no changes in external wiring should be made unless proper operation cannot be obtained. Paragraphs 17, 18 and 19 are included for this purpose.

17- Connection of Motor Field Leads 5-6

The equipment has been tested after having been mounted on the winder machine and the connection of the motor field leads should be correct. In order to make sure that this is the case proceed as follows:

Open the a-c. switch, operate selector switch to "MANUAL" position and operate the transfer switch to same position as toggle switch No. 1. Close the a-c. switch and place the material with the line or edge within 1/8 inch of the diametrical center of the light circle. After the cathode protection relay closes, operate the selector switch to the "AUTOMATIC" position. If, in doing the above, the control equipment operates to shift the line or edge to another point not at the approximate diametrical position, the leads 5 and 6 should be reversed. Operate the selector switch to "MANUAL", close the line switch, wait for the cathode protective relay to close. Then close selector switch to "AUTOMATIC", and repeat the above test. The position of the paper should now be maintained within a 1/32-inch range, and the mill roll control motor will rapidly oscillate back and forth.

18- Adjustment of Limit Switches

With the transfer switch in the same position as toggle switch No. 1, "inch" motor along under manual control by operating the "LEFT or "RIGHT" push button until one limit switch is opened. If opening the limit switch does not stop motor travel, interchange connections to the limit switches.

19- Left, Right, Push Buttons and Automatic-Manual Selectors

Two push button stations are provided which give full control of the equipment from two conveniently located points on the Winder.

The selector switch places the equipment under either "AUTOMATIC" or "MANUAL" control, depending upon the relative position of the selectors. If the selectors are set for "AUTOMATIC" the equipment is placed under automatic control, with the "LEFT" and "RIGHT" push buttons permitting manual control to bring the line or edge to the normal operating position. If the selectors are set to the manual position, only manual control can be obtained. If manual control only is desired for any continued run, the scanner should be moved so that the light circle falls entirely on the rubber roll.

The equipment can be placed under "AUTOMATIC" control or "MANUAL" control from either push button station.

With the selector switches set for "MANUAL" control, operate the push buttons and observe the operation of the motor. If necessary, interchange connections between right and left push buttons, to make the paper move to the right or left when viewing it from the finishing end of the winder.

20- Connections of Jumper 11 to Resistor Terminals

The two 10-inch resistor tubes mounted at the top of the panel are connected in series with the motor armature. By short-circuiting part of these resistors it is possible to increase the response of the reversing motor. It should be noted

that under no circumstances should more than two sections of the resistors be short-circuited as this would damage the WL-632 tubes. The machine has been previously operated and the connection giving satisfactory torque has been indicated and left thus connected. However, if different response or rate of connection is needed jumper 11 may be connected to a different resistor terminal.

21- Reconnection of Scanner for Light or Dark Operation

As shown in drawing 2-A-4278 the scanner switch should be operated to "DARK" or "LIGHT" position as indicated in table I.

V-ARRANGEMENT OF PRINTING AND COLOR OF MATERIAL

22 - Arrangement of Printing

In Table I of Drawing 2-A-4278 are shown different arrangements of the printing. The following general rules apply:

A- Line Control

(1) The color of the line must be considerably darker than the color of the material.

(2) The width of the line must not be less than 1/16 inch.

(3) The width of the line may be more than 1/16 inch, for example a printed border 1 inch wide may be used for register, since operation is obtained from the nearest edge of printing.

(4) There must be a 3/4-inch space on one side of the line within which space there is no dark printing.

(5) The line may be located 1/8 inch distant from the edge of the material provided the roll is covered with the material.

B- Edge Control

(1) The color of the material may be either dark or light.

(2) If the color is dark and dark edge control is used there must be no light printing within 1/8 inch of the edge.

(3) If the color is light, and light edge control is used, there must be no dark printing within 1/8 inch of the edge.

23 - Color of Material

A - Line Control

When dark line control is used, the color of the material must be either white, yellow, red, pink, light green or light blue, or any combination of light colors. The line or printed border should be either black, dark blue, dark green, brown or any combination of dark colors. It should be noted that foil appears dark to the phototube.

B-Edge Control

The material may be either dark or light-colored provided the roll is covered with a contrasting color as outlined in table I of Drawing 2-A-4278.

24 - Adjustment of Potentiometer

Check to see that the "ON-OFF" toggle switch on the scanner is thrown to the "OFF" position.

It will be found that if there is sufficient contrast between the paper color and the color of the line, the equipment may operate satisfactorily with any potentiometer adjustment between 0 and 100. However, if it is found that tube III glows with plain material beneath the scanner, as described in paragraph 14, the minimum potentiometer dial setting at which the glow occurs should be considered the maximum dial setting.

In order to determine approximately the best operating position, place the material in its normal position, when the web is not unwinding or the machine is not in operation. With the potentiometer set to the maximum dial position, the line or edge should be maintained in the approximate diametrical center location of the light circle. Turn the potentiometer dial slowly toward 0 until operation becomes erratic (minimum dial position), then turn the potentiometer dial to a position midway between the maximum dial position and the minimum dial position. If erratic operation is not obtained at 0 setting, use 0 as the minimum dial position.

On some applications where there is extremely large contrast between roll and/or line color and the color of the paper, for example on edge control, it will be necessary to throw the "ON-OFF" toggle switch on the scanner to the "ON" position and, with the switch in this position, determine the maximum dial setting and best operating position.

25 - Starting

A - Starting from Complete Shutdown

(1) Make sure that the transfer switch is in the same position as toggle switch No. 1.

(2) Close line switch.

(3) Wait for cathode protective relay to close.

(4) Operate "select" or switch to "AUTOMATIC" control.

B - Starting from "MANUAL" Operation

(1) Operate "Selector" switch to "AUTOMATIC" control.

26 - Stopping

A - Stopping for Prolonged Shutdown

(1) Open line switch.

(2) Operate "Selector" switch to "MANUAL" control.

B - Stopping Temporarily

(1) Operate "Selector" switch to "MANUAL" control.

27 - Transfer Switch

If toggle switch No. 1 is operated from "UP" to "DOWN" position the transfer switch should be operated correspondingly. Never operate these switches unless the line switch has been operated to disconnect power to the equipment.

VII-TUBES TESTS

TO TEST TUBES I AND IV THROW THE TRANSFER SWITCH TO THE "UP" POSITION.

28 - (A) Replace tube I if this tube fails to glow when tube II glows.

Replace tube I if this tube glows when tube II does not glow.

(B) Replace tube IV if the tube glows when tube II glows, or if tube IV fails to glow when tube II does not glow.

(C) If tube II glows continually regardless of the position of the line, first check potentiometer adjustment per paragraph 24, then replace tube III, the RCA-57 tube in the scanner and the WL-735 phototube, one at a time.

(D) Replace the RCA-83 tube if the voltage across 5-6 is less than 190 volts.

VIII-SPARE TUBES & LAMPS

29 - Keep the following spare tubes in stock:

1 - RCA-57

1 - RCA-83

2 - KU-627

2 - WL-632

1 - WL-735

2 - Lamp, S#1014663

IX-SENSITIVITY OF CONTROL

30 - As outlined in paragraph 16 the equipment will maintain the paper in an oscillatory condition within a 1/32-inch range when the web is stationary. If this condition is not obtained, the cause may be either in the scanner and electrical circuits or in the mechanical characteristic of the mill roll shifting mechanism.

31 - To check the scanner and the electrical equipment disconnect the chain to the reversing motor and make the motor reverse by moving the paper with the line slightly relative to the light circle about the diametrical control point. If 1/64-inch movement of the line causes reversal of the motor, the scanner and the electrical control is in good condition. If more than 1/64-inch movement is required check:

(a) Synchronous motor for friction per paragraph 14.

(b) Potentiometer adjustment per paragraph 24.

(c) Tubes per paragraph 28.

32 - If the equipment tests satisfactorily according to paragraph 31 but does not meet the requirements outlined in paragraph 30, mechanical adjustments are needed on the mill roll shifting mechanism to eliminate any lost motion between the reversing motor and the paper carrying roll and paper support roll. First check all chains to see that they are not too slack and take up all lost motion in linkages and worm screws. To test the mechanical equipment move motor shaft by hand until paper roll moves. Now turn the motor shaft 15 mechanical degrees in the reverse direction. This should cause the paper roll to move in the opposite direction. If this condition is not obtained there is too much lost motion in the mechanical connections, and this condition must be improved before successful register control will result.

33 - It is also important to check the operation of the motor over the entire operating range of the paper roll between the two limit switches to make sure that there is no excessive friction in the mechanical linkage at any point within the operating range.

34 - After the stationary tests in paragraphs 30 to 33 have been made the register control should operate satisfactorily at low paper speeds, for example 100 feet per minute. As the speed of the paper is increased eventually a point may be reached where the variation in the position of the paper expressed in inches per second exceeds the rate of correction, and obviously, under these conditions, satisfactory regulation will not result. Assuming that, for example, the rate of correction is 1/4 inch per second

and that the paper roll is wound so that a variation in paper position of 1/4 inch is obtained in 5 feet of paper, it is apparent that the maximum paper speed for which the regulator will maintain the position of the line is 300 feet per minute. If the rate of correction is increased or if the variation of paper position for 5 feet of paper is decreased the maximum operating speed will increase in proportion.

X-WHAT TO DO IF EQUIPMENT DOES NOT OPERATE PROPERLY

35 - General Tests

(a) Remove ground connection to terminal 15 and remove cable plug from scanner. Test resistance between terminal 15 and ground. This resistance should be 5 megohms or more.

(b) Measure the voltage across terminals 5-6. This voltage should be 190 volts or more.

(c) Check to see that all tube filaments are heated when the a-c. voltage is supplied, and that the cathode protective relay is closed.

(d) Test to see if the a-c. supply source is grounded. If grounded connect the grounded side to terminal 2.

36 - A - D-C MOTOR DOES NOT OPERATE

Tests (1) Measure voltage between 7 and 8. This voltage should be 110 volts a-c. or more. If no voltage check circuit from 1 to 8.

(2) Measure d-c. voltage across 5-6 (190 volts or higher) and make sure that motor field is magnetized.

B - TUBE I DOES NOT CONDUCT CURRENT WHEN TUBE II CONDUCTS CURRENT WITH TRANSFER SWITCH IN "UP" POSITION.

Tests (1) Make sure that the push buttons and limit switches are closed.

(2) Measure with d-c. voltmeter with resistance 1000 ohms per volt, the d-c voltage between 40 and 22. This voltage should be at least 80 volts. 22 should be negative.

(3) Replace tube I.

C - TUBE IV DOES NOT CONDUCT CURRENT WHEN TUBE II DOES NOT CONDUCT CURRENT WITH TRANSFER SWITCH IN "UP" POSITION

Tests (1) Make sure that the push buttons and limit switches are closed.

(2) Measure, using d-c. voltmeter with resistance 1000 ohms per volt, the d-c. voltage between 40 and 22. This voltage should be at least 80 volts.

(3) Replace tube IV.

D - TUBE II DOES NOT CONDUCT CURRENT WHEN TUBE III DOES NOT CONDUCT CURRENT

Tests (1) Replace tube II.

(2) Check voltage between top connection of tube II and the filament terminal 49. This voltage should be approximately 220 volts a-c.

E - TUBE II BREAKS DOWN CONTINUALLY

Tests (1) Replace tube II.

(2) Check continuity of grid circuit 49-43-44-GRID.

(3) Measure d-c. voltage across 43-44 which should be approximately 40 volts.

(4) Measure the d-c. voltage across 15-17 which should be approximately 130 volts.

F - TUBE III DOES NOT BREAK DOWN

Tests (1) Replace tube III.

(2) Measure the a-c. voltage between 51-and 49, which should be approximately 220 volts.

(3) Replace the RCA-57 amplifier tube and the WL-735 phototube.

G - REGULATION IS UNSTABLE

Tests (1) While the synchronous motor is running disconnect the a-c. supply voltage and measure the time required for the motor to reach standstill. If this time is less than 8 seconds there is too much friction in the motor bearings and the motor bearings should be cleaned or replaced.

(2) Adjust the potentiometer as outlined in paragraph 24.

(3) Replace the phototube and the RCA-57 amplifier tube.

(4) While the winder is operating, adjust the anti-hunting potentiometer to reduce hunting. Once this adjustment is made, it should not be changed.

37 - Type SC-2 Slitter Regulator without tubes, S# 1186447

Description	Style No.
Large, 4 prong socket	793 202
Small, 4 prong socket	1 040 576
Capacitor 2-2-2-1 m.f.d.	948 995
Capacitor 2 x 4 m.f.d.	1 014 388
Capacitor2 x 0.1 m.f.d.	1 186 472
Resistor 23 ohms	943 775
500 ohms	943 634
5000 ohms	860 382
10000 ohms	799 952
20000 ohms	943 633
30000 ohms	1 115 117
50000 ohms	846 669
1/4 Megohms.	861 041
1/2 Megohms.	846 667
5 Megohms.	1 018 949
Potentiometer, 1/2 Megohms.	966 591
Potentiometer, 20000 ohms	846 696
Potentiometer Dial	869 654
D.P.D.T. Switch	966 576
Rectox Rectifier	971 580
Cathode Protective Relay	1 106 007
Impulse Transformer	1 070 388
Power Transformer 115 Volt 60 Cycles.	1 091 021
23 ohm resistor	943 775
3 Unit Type HD pushbutton station	1 169 420
Selector switch assembly.	1 032 940
Pushbutton unit	1 169 592
Limit Switch (See I.L. 1865)	850 689
Type SK Motor	1 034 615
Front bearing	782 872
Rear bearing	637 440
2 brushes in one set	761 508
Commutator Similar to	770 248
except slot for wire	2#20
(1) One set coils	771 267
(2) One set compound coils	771 283

38 - Scanner without Lamp and tubes S# 1186448

Description	Style No.
Synchronous Motor	954 512
Lens Mounting	1 190 217
Lens	1 091 260
D.P.D.T. Switch	966 576
S.P.S.T. Switch	919 068
6 prong socket	1 040 566
4 prong socket	1 040 567
Resistor, 5 Megohm	1 018 949
Resistor, 3,5 Megohm	860 873
Cable Connector	1 091 132
Transformer	1 070 391
Lamp Socket	895 958
Tube shield	967 332
Capacitor, 0.0005 m.f.d.	1 115 744

TYPE SK MOTORS AND GENERATORS

Frames F-20, W-204, W-224, W-225 and F-225

(Direct Current, Shunt, Compound and Series Wound)

RENEWAL PARTS DATA

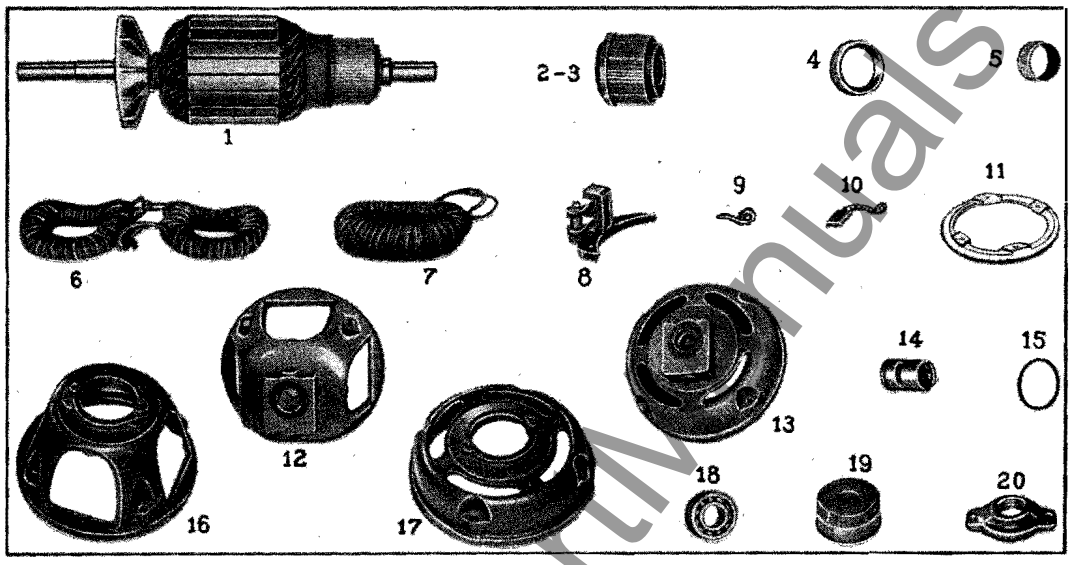


FIG. 2—RENEWAL PARTS OF TYPE SK SMALL MOTORS AND GENERATORS

RECOMMENDED STOCK OF RENEWAL PARTS

Motors or Generators in use			1	5
Ref. No.	Description of Part	No. Per Motor or Generator	Recommended For Stock	
1	Armature Complete	1	0	1
2	Commutator	1	0	0
3	Assembled Segments	1	0	0
4	Mica V Ring	2	0	0
5	Micarta Commutator Bushing	1	0	0
6	Field Coil—Main—(Set)	1	0	1
7	Field Coil—Commutating	1	0	0
8	Brushholder	2	0	1
9	Brushholder Spring	△	1	1
10	Brush	△	4	8
11	Rocker Ring	1	0	0
12	Bracket—Front with Sleeve Bearing	1	0	0
13	Bracket—Rear with Sleeve Bearing	1	0	0
14	Sleeve Bearing—Front or Rear	2	1	1
15	Oil Ring	2	1	1
16	Bracket—Front—Ball Bearing	1	0	0
17	Bracket—Rear—Ball Bearing	1	0	0
18	Ball Bearing—Front or Rear	2	2	2
19	Cartridge	2	0	0
20	Cartridge Cap	2	0	0

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

△ Frames F-20 and 204 use two per motor. Frames 224 and 225 use four per motor.

This is a list of the Renewal Parts and the quantities of each that we recommend should be stocked by the user of this apparatus to minimize service interruptions caused by breakdowns. The parts recommended are those most subject to wear in normal operation, or to damage or breakage due to possible abnormal conditions.

This list of Renewal Parts is given only as a guide. When continuous operation is a primary consideration, additional insurance against shutdowns is desirable, Under such conditions more renewal parts stock should be carried, considering the severity of the service and the time required to secure replacements.

ORDERING INSTRUCTIONS

Name the part and give its style number. Give the complete name plate reading. State whether shipment is desired by express, freight or by parcel post. Send all orders or correspondence to nearest Sales Office of the Company. Small orders should be combined so as to amount to a value of at least $1.00 net; where the total of the sale is less than this, the material will be invoiced at $1.00.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Printed in U.S.A. (Reprint 11-40)

TYPE SK MOTORS AND GENERATORS—FRAMES F-20, W-204, W-224, W-225 AND F-225
(Direct-Current—Shunt, Compound and Series Wound)
INSTRUCTIONS

Initial Inspection—After unpacking the motor or generator, examine it carefully to see that no damage has occurred during shipment. Turn the shaft by hand to see that it turns freely. Check the name plate data to make certain that the rating is correct for the power supply and load.

Mounting—The location for motors and generators not especially constructed for unusual operating conditions should be clean, dry and well-ventilated. If protecting shields or guards are used, they must permit a free flow of air over the machine.

Sleeve bearing machines are ordinarily designed for operation with the shaft horizontal. Unless otherwise specified when ordering, they are assembled for floor mounting. If it is desirable to mount on a wall or ceiling, the end brackets of the machine should be loosened and rotated 90° or 180° so that the main portion of the oil reservoir will be below the shaft. When the front bracket is rotated, the rocker ring in the bracket must be shifted so the brush holders will be in their original position relative to the frame and poles, and locked in place. If the adjusting plate has more than one locking hole, the screw should always be replaced in the same hole.

Ball bearing machines (grease lubricated) will operate in any position. For convenience in lubricating, it may be desirable to shift the brackets or bearing cartridges to obtain a more accessible location of the openings.

If desired, the leads may be brought out on the opposite side of the machine by bringing the leads out the other lead hole. The lead holes are the proper size for threading with a ¾" pipe tap.

Direction of Rotation—The direction of rotation as referred to in this leaflet is that when viewing the machine from the end opposite the shaft extension. The direction of rotation of these motors is determined by the connections. Motors and generators with only one locking hole in the rocker ring adjusting plate may be operated in either direction of rotation without shifting the brushes. Generators with three locking holes in the adjusting plate are shipped with the brushes set for clockwise rotation unless ordered otherwise. If the generator is to be operated in the opposite direction of rotation, the brushes should be shifted so the locking screw will be in the hole on the opposite end of the adjusting plate.

MOTOR CONNECTIONS
Shunt and Compound Wound

Counterclockwise Rotation—Connect the two line wires to terminals on starter marked "Line +" and "Line —". Connect "A-1" to terminal on starter marked "Arm"; connect "F-1" to terminal on starter marked "FLD"; connect "A-2" to "S-1"; connect "S-2" and "F-2" to terminal on starter marked "Line—".

Clockwise Rotation—Connect the two line wires to terminals on starter marked "Line +" and "Line —". Connect "A-2" to terminal on starter marked "Arm"; connect **"F-1" to terminal on** starter marked "FLD"; connect "A-1" to "S-1"; connect "S-2" and "F-2" to terminal on starter marked "Line—".

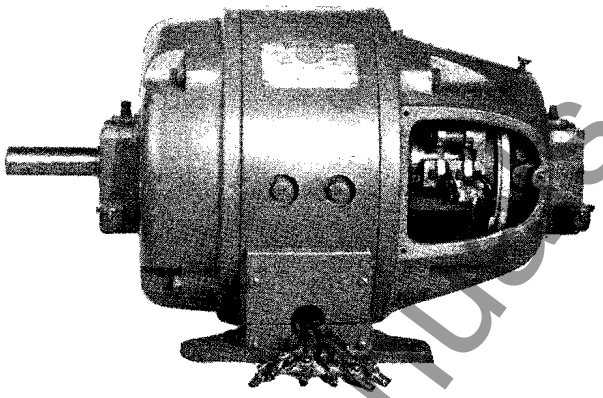


FIG. 1—TYPE SK MOTOR OR GENERATOR

MOTOR CONNECTIONS
Series Wound

Counterclockwise Rotation—Connect the two line wires to terminals on starter marked "Line+" and "Line—". Connect "A-1" to terminal on starter marked "Arm", connect "A-2" to "S-1"; connect "S-2" to terminal on starter marked "Line—". When used without a starter connect "A-1" to one line wire; connect "A-2" to "S-1"; and connect "S-2" to the other line wire.

Clockwise Rotation—Connect the two line wires to terminals on starter marked "Line +" and "Line —". Connect "A-2" to terminal on starter marked "Arm"; connect "A-1" to "S-1"; connect "S-2" to terminal on starter marked "Line—". When used without a starter connect "A-2" to one line wire; connect "A-1" to "S-1"; and connect "S-2" to the other line wire.

GENERATOR CONNECTIONS
Shunt Wound

Clockwise Rotation—Connect "A-2" to + line wire; connect "A-1" and "F-2" to the — line wire; connect "F-1" to one terminal on the field rheostat and the other terminal on the field rheostat to "A-2". If a field rheostat is not used connect "F-1" to "A-2".

Counterclockwise Rotation—Connect "A-1" to the + line wire; connect "A-2" and "F-2" to the — line wire; connect "F-1" to one terminal on the field rheostat and the other terminal on the field rheostat to "A-1". If a field rheostat is not used connect "F-1" to "A-1".

GENERATOR CONNECTIONS
Compound Wound

Clockwise Rotation—Connect "A-2" to the + line wire; connect "S-1" to the — line wire; connect "A-1" and "F-2" to "S-2"; connect "F-1" to one terminal on the field rheostat and the other terminal on the field rheostat to "A-2". If a field rheostat is not used connect "F-1" to "A-2".

Counterclockwise Rotation—Connect "A-1" to the + line wire; connect "S-1" to the — line wire; connect "A-2" and "F-2" to "S-2"; connect "F-1" to one terminal on the field rheostat and the other terminal on the field rheostat to "A-1". If a field rheostat is not used connect "F-1" to "A-1".

LUBRICATION

Ring Oiled Sleeve Bearings—Motors equipped with ring oiled sleeve bearings are drained before being shipped from the factory. Before operating the motor, fill each oil well through the overflow cup with a good grade of dynamo or machine oil until the level rises nearly to the top of the cup. In ordinary service the motor will run several months without refilling.

Ball Bearing—Standard ball bearing motors are properly lubricated when they leave the factory. In ordinary service, the motors will run for a year as received. It is recommended, however, that a small quantity of neutral medium consistency grease be added every four or six months to maintain an even lubricating condition.

Operation—These motors will operate satisfactorily on a 10% variation in voltage and the generators will operate satisfactorily on a 5% variation in speed, but not necessarily in accordance with the standards of performance established for operation at normal voltage or speed.

It is desirable to use a starting rheostat or controller with these motors. A circuit breaker or line switch with fuses should be installed in the circuit between the line and the starter.

With a controller, the motor should be started and stopped by using the controller handle. With a starting rheostat the motor should be started by using the rheostat handle, and stopped by opening the line switch.

Never start a series motor without load.

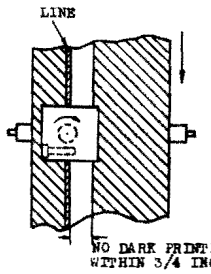
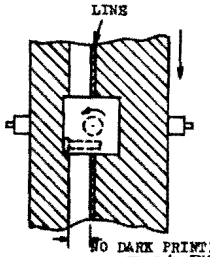
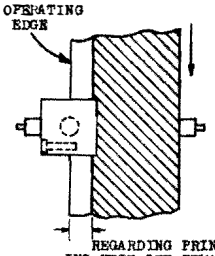
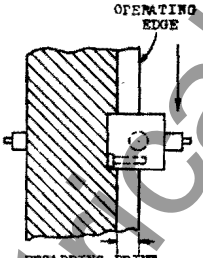
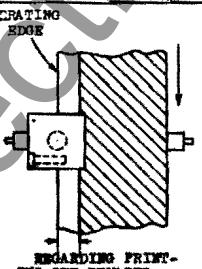
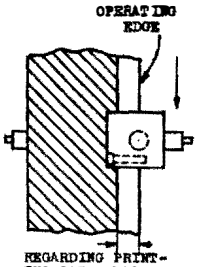
Care—Motors and generators should be inspected at regular intervals, noting particularly that all parts are tight and that the bearings are properly lubricated.

The commutator surfaces should be kept clean and smooth. Ordinarily this will require only occasional wiping with a piece of canvas. Do not use emery cloth. The carbon brushes supplied with these machines have been carefully selected for this particular service and, for best results, only this make and grade should be used.

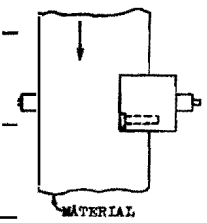
I. L. 3250

Westinghouse
Scanner Arrangement and Operating Combinations

TABLE II

GROUP	TYPE OF CONTROL	ARRANGEMENT OF PRINTED MESSION	MATERIAL	COLOR OF LINE	NO PRINTING OF COLOR INDICATED WITHIN RANGE AS SHOWN IN INCHES				COMBINATION NUMBER
					LEFT SIDE OF OPERATING POSITION		RIGHT SIDE OF OPERATING POSITION		
					LIGHT	DARK	LIGHT	DARK	
A	DARK LINE ON LIGHT MATERIAL		FOIL	DARK				3/4	1
				DARK				3/4	2
			PAPER	DARK				3/4	3
				DARK		3/4			4
				DARK		3/4			5
			CELLOPHANE	DARK		3/4			6
							1/8		8
					1/8				14
B	DARK LINE ON LIGHT MATERIAL (PREFERABLY USE GROUP A)		FOIL				3/4		20
					3/4				26
			PAPER					3/4	7
						3/4			13
								1/8	19
			CELLOPHANE			1/8			25
							1/8		10
					1/8				16
C	LEFT EDGE CONTROL		FOIL				3/4		22
				3/4					28
								3/4	9
			PAPER			3/4			15
								1/8	21
						1/8			27
			CELLOPHANE				1/8		18
				1/8					18
							3/4		24
D	RIGHT EDGE CONTROL (PREFERABLY USE GROUP C)		FOIL	3/4					30
								3/4	11
			PAPER			3/4			17
								1/8	23
						1/8			29
E	LEFT EDGE CONTROL (USE ONLY WHEN GROUP C CANNOT BE USED)		FOIL						
			PAPER						
			CELLOPHANE						
F	RIGHT EDGE CONTROL (USE ONLY WHEN GROUP E CANNOT BE USED)		FOIL						
			PAPER						
			CELLOPHANE						

NO. 3
RIGHT EDGE CONTROL

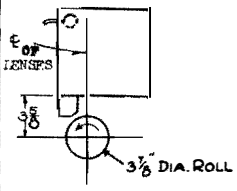


II

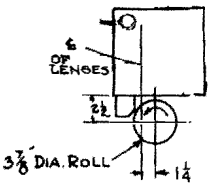
NS ROTATIONS AS SWED FROM INSIDE CASE WHEN DOOR OPEN.

SCANNER MOUNTING POSITIONS

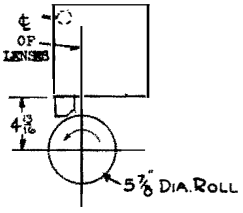
POSITION A_1



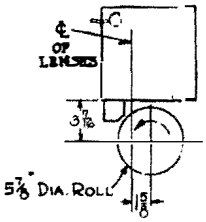
POSITION B_1



POSITION A_2



POSITION B_2



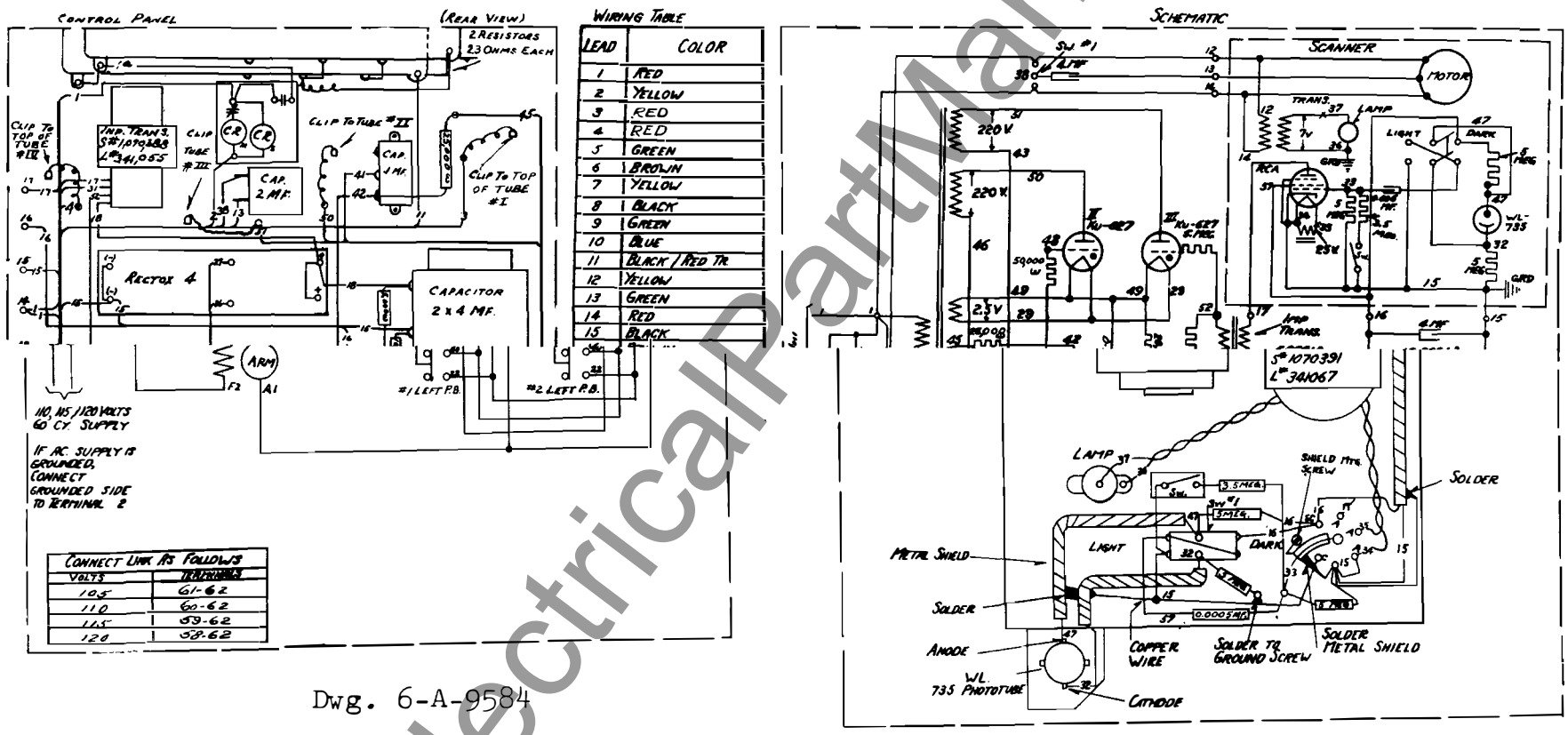
Dwg. 2-A-4278

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Type SC-2 Register Regulator

Wiring Diagram

For Further Information, See I. B. 5670-88 A



Dwg. 6-A-9584

Printed in U.S.A.

Westinghouse Electric & Manufacturing Company

East Pittsburgh, Pa.