Convotrol

BULLETIN 460

AUTOMATIC ELECTRIC

MAKERS OF TELEPHONE, SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

1033 W. Van Buren St., Chicago, U. S. A.

TABLE OF CONTENTS

Convotrol

GENERAL

The CONVOTROL, as shown in Figure 1, is fundamentally a constant voltage full wave noiseless type power unit, using selenium dry-disc type rectifying elements. It is self contained, self regulating, without moving parts and especially designed to supply constant D.C. voltage for the operation of telephone exchange equipment, in parallel with a storage battery. The CONVOTROL functions primarily as a power unit to supply direct current at a constant voltage for the operation of the exchange equipment, and secondarily, to keep the battery fully charged so that its maximum capacity will be available in an emergency. This method of battery operation insures maximum battery life, minimum maintenance attention and uniform operating voltage.

CONVOTROL units can be furnished in 3, 6, and 12 ampere sizes at a nominal potential of 50 volts. All three sizes operate on either 115 or 230 volts ± 10%, 50 to 60 cycles, single phase alternating current. The power consumption is especially low, the input power being approximately 25 watts for the 3 ampere and 60 watts for the 12 ampere size at no load.

The essential parts of a CONVOTROL are a transformer, the selenium rectifier elements, a filter choke, an automatic control unit, a control panel, and input and output circuit fuses, all mounted and completely wired on a metal frame work, as shown in Figure 2. The control panel is equipped with an ammeter, voltage control dial and an on-off toggle switch.

The gray baked enameled cover is designed so that the ammeter is visible and the voltage control dial, on-off switch and fuses are accessible with the cover in place. A hinged door equipped with a locking screw is provided for covering the fuse cutouts. The rating of the fuses is indicated on the inside of this cover.

Fig. 1 Convotrol.

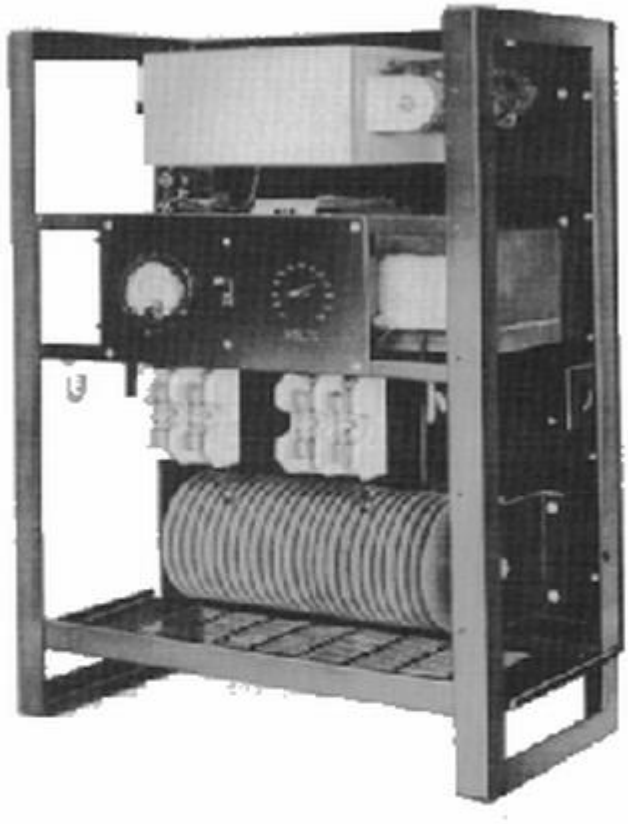

Fig. 2 Convotrol With Cover Removed.

The circulation of air for cooling is provided for by means of screening in the bottom of the mounting frame and in the upper part of the cover, thus producing a chimney effect. The top of the cover is closed to prevent dust falling inside the unit.

The approximate dimensions and weights of the various sizes are as follows:

	3 Ampere	6 Ampere	12 Ampere
Height	1'-11"	2'-4"	2'-7"
Width	1'-4"	1'-6"	1'-2"
Depth	9"	1'-0"	1'-2"
Weight	125 lbs.	200 lbs.	300 lbs.

SELECTING THE CONVOTROL

The ratings of these CONVOTROL units are conservative. They are self protecting on over loads and therefore it is not necessary to add a safety factor when making calculations for their application. To select the correct size to meet an average requirement the following general rule may be applied.

Estimate the total ampere hours required to operate the equipment over a 24-hour day. Multiply this by five-fourths and divide by 24.

Example:

Total 24 hour requirements = 60 A.H.
5/4 x 60 = 75
75 ÷ 24 = 3+
Specify a 3 ampere Convotrol

The extra 25% capacity is provided for rapid recovery of battery capacity after a period of discharge i.e. when the load has exceeded the Convotrol capacity for a period. It also limits battery drain during high peak loads.

OPERATION OF CONVOTROL

The Convotrol is designed to operate continuously in parallel with the battery and the load. It maintains a constant voltage across the battery terminals regardless of the load fluctuations i.e. it follows the load by increasing or decreasing its output current as dictated by the variations in the demand for current to operate the equipment. After a period of peak load in excess of the rating of the Convotrol, it will operate at a rate in excess of the load current for sufficient time to restore the battery to a fully charged state. During no load periods, the Convotrol will function at the trickle rate necessary to take care of the internal battery losses, thus maintaining it fully charged.

The battery manufacturers advise that if a voltage of 2.15 per cell (± .01) is maintained across the battery constantly it will be maintained at approximately full capacity.

The following table shows theoretical values of floating and equalizing charge voltages for 21 to 26 cell batteries.

Cells	Floating 2.15V Per Cell	Equalizing 2.33V Per Cell
21	45.2	48.9
22	47.3	51.3
23	49.5	53.6
24	51.6	55.9
25	53.8	
26	54.9	

If the voltage is continually below this value, the input to the battery will be insufficient, causing a gradual drop in gravity and loss of capacity. If the voltage is continually above this value, the input to the battery will be excessive, causing injury incident to overcharging of the battery and thus shorting its life. Slight voltage variations above and below this value are not harmful as long as the 2.15 volts per cell average is maintained. Under normal operating conditions, the load is carried by the Convotrol to its rated capacity. Any load beyond that point is carried by the battery. If the battery becomes discharged due to power failure it will recharge as soon as the A.C. is restored; the time it takes depending upon the differences between the load demand and the output capacity of the Convotrol.

Under this method of maintenance the battery discharges only when the load exceeds the capacity of the Convotrol during peak demand periods, or during periods of commercial power failures.

EQUALIZING CHARGE

An equalizing charge, as recommended by manufacturers at occasional intervals, is given by raising the output potential of the Convotrol to approximately 2.33 volts per cell and maintaining this voltage until the gravity has reached its proper level. After the battery is fully equalized, the voltage of the Convotrol should be reduced to the floating value.

REGULATION CONTROL

The regulation of the output of the Convotrol is controlled entirely by the battery voltage and therefore anything that affects this voltage, such as load variations, reduction in Convotrol capacity due to ageing, battery temperature and A.C. voltage or frequency variation is inherently compensated for.

Only one manual adjustment, a small dial calibrated from 44 to 56 volts is provided to select the desired voltage that is to be maintained across the battery. No other adjustment is required. The output voltage selected holds to within ± 1 volt of the dial setting at any load up to 100% of its rated capacity and then drops sharply, thus providing self protection against dangerous overloads.

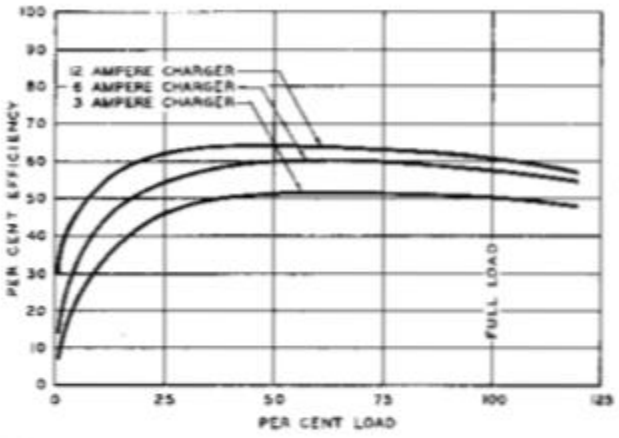

Fig. 3 Voltage Characteristic Curve.

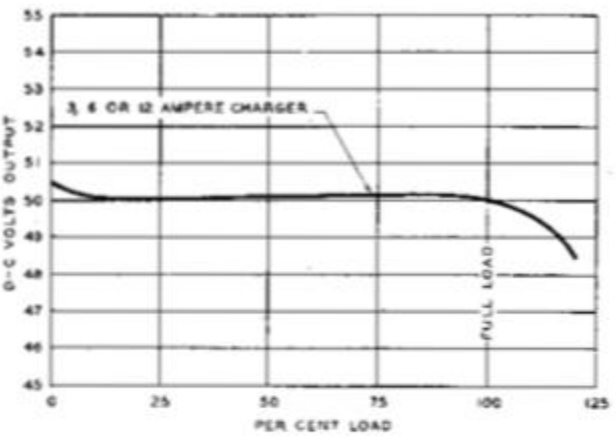

Fig. 4 Efficiency Characteristic Curve.

CALIBRATION

Convotrol units are calibrated in the factory to float a battery at approximately the voltage indicated by the dial setting. No further adjustments should be required, since the regulator unit automatically compensates for ageing, normal line voltage variations and frequency variations.

The floating voltage of the battery should be within ± 1 volt of the dial setting except during a few minutes warm-up time when first connected; or while the battery is being brought up from a discharged condition; or when the load and charge required by the battery exceeds the rating of the Convotrol unit.

If it is found necessary to consistantly keep the dial setting at higher or lower values than the proper battery floating voltage indicates, the dial can be recalibrated by changing the adjustment of resistors R1 and R3. Recalibration should be checked at two points on the dial, preferable at 45.2 volts which is the floating voltage of 21 cells and 55.9 volts which is the floating voltage of 26 cells. Moving the sliders on the adjusting resistors to the right raises the voltage and to the left lowers the voltage. Resistor R1 (bottom) affects the lower dial settings and R3 (top) the higher dial settings.

Calibrations should always be made when the battery is in a fully charged condition and with the Convotrol delivering approximately two thirds of its rated capacity.

The average efficiencies of these Convotrol units operating at from 10% to 100% of their ratings, are 50%, 53% and 62% for the 3, 6 and 12 ampere sizes, respectively.

PARALLEL OPERATION

A Convotrol may be operated in parallel with a rectifier of any type; i.e. another Convotrol, an A.E.Co. Type 46 constant current rectifier or a constant current unit of other manufacture.

When two Convotrol units are operated in parallel no auxiliary control equipment is required. Under this condition they may not always divide the load exactly proportionally, due to slight differences in their individual characteristics. Since they operate at equally high efficiency over their entire operating range the overall results are the same regardless of how the load is divided.

When an A.E.Co. Type 46 unit or any other constant current rectifier is used in combination with a Convotrol, (see Fig. 5) all the advantages of constant voltage (full float) operation will be retained, providing the constant current unit is adjusted so that its capacity will be less than that of the Convotrol.

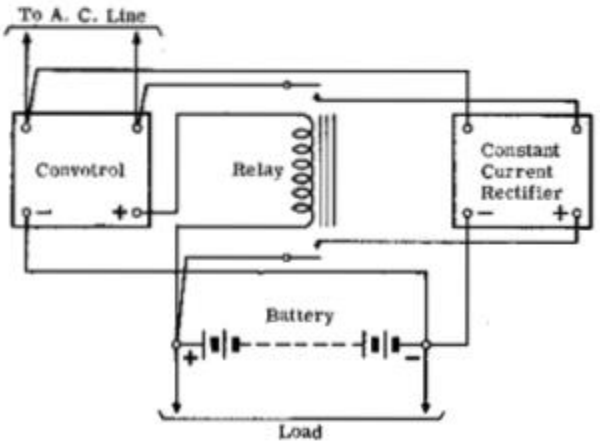

Fig. 5 Schematic of a Typical Combination.

When so arranged the Convotrol will carry the load up to its rated capacity. At this point the control circuit will cause the constant current unit to start. The output of the constant current unit must be adjusted to deliver slightly less current than the rated output of the Convotrol. In order to assure that the current required by the load, in excess of the capacity of the constant current unit will stay within the regulating limits of the Convotrol. It will then carry the load up to its capacity, and the Convotrol will take up the difference up to the total output of the combination. The battery will carry the excess load beyond the combined capacity of the two units. When the current demand falls below the capacity of the Convotrol, the control circuit will allow the constant current unit to drop out, letting the Convotrol carry the load alone.

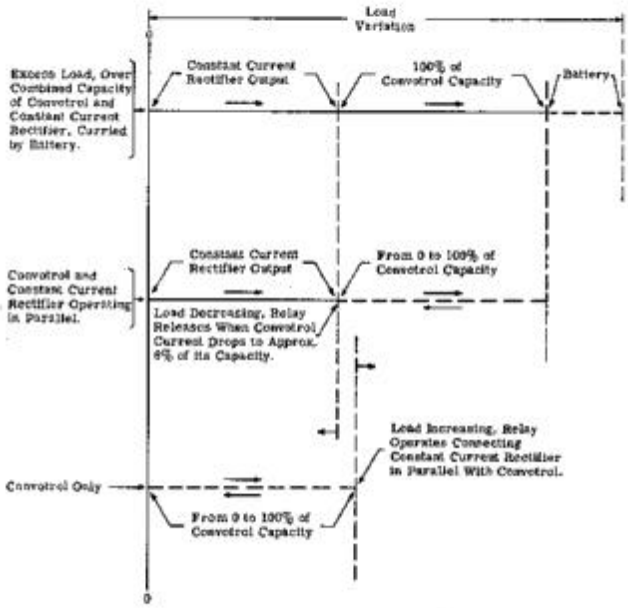

Fig. 6 Operation of Convotrol in Combination With a Constant Current Rectifier.

MOUNTING

Convotrol units should be mounted where the air circulates freely to promote cooling, and where the ambient temperature does not exceed 110 degrees F. They are designed for wall or rack mounting but can also be located on a table or shelf. The Convotrol, storage battery and switchboard should be located as close together as possible. This will eliminate the necessity for over size d.c. power leads to prevent excessive voltage drop.

WIRING AND CONNECTING

Openings are provided in the bottom, and sides of the frame work for both incoming a.c. power leads and outgoing d.c. and alarm leads which are the only connections required to place the Convotrol in operation. The commercial voltage should be checked before the Convotrol is placed in operation to make sure that it does not exceed the ± 10% voltage or the frequency limits.

The a.c. power supply leads shall then be connected to the a.c. line terminal block. The d.c storage battery charging leads shall be connected to the positive and negative bottom terminals of the d.c. fuse block as shown in Figures 8, 9 and 10.

Connections to the battery must be clean and securely made. The battery must also be in good condition. Noiseless charging should not be expected with a badly sulphated battery or one which is improperly maintained.

Where the distance between the Convotrol and the battery, or the switchboard and the battery does not exceed 25 feet #12 wire is recommended for the d.c. leads. If the distance is greater, the wire should be large enough to avoid excessive voltage drop (approximately 1 volt at full load) between the Convotrol and the switchboard and battery.

Convotrol units are deisgned for operation on either 115 or 230 volts 50 to 60 cycle current. Only two connections are affected by the voltage of the supply current. (See wiring diagrams Figures 8, 9, and 10). These connections should be checked before the unit is placed in service.

A. For operation on 115 volts a.c :

Both leads 21 & 23 should be connected to top terminal of left a.c. fuse.

Both leads 22 & 24 should be connected to top terminal of right a.c. fuse.

B. For operation on 230 volts a.c.:

Lead 21 should be connected to top terminal of left a.c. fuse.

Lead 24 should be connected to top terminal of right a.c. fuse.

Both leads 22 & 23 should be connected together, soldered and taped.

When lightning conditions are severe, especially when the power line is of the exposed open-wire type it is recommended that a Brach No. 391-1 or similar, lightning arrester be connected in the power circuit as shown in Figure 7.

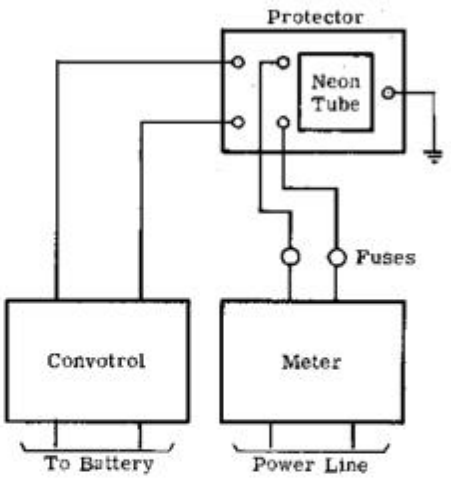

Fig. 7 A.C. Service Connection Showing Lighting Protection.

When this is done mount the arrester close to the electric light or power meter. Connect the wires from the meter to the inside terminals (nearest the neon tube) of the arrester, and the wires from the Convotrol to the outside terminals. Connect a No. 10 wire to ground the (single) terminal of the arrester, and run this wire as direct as possible to a permanent low-resistance ground. Do not enclose ground wire in conduit and avoid sharp bends and other leads.

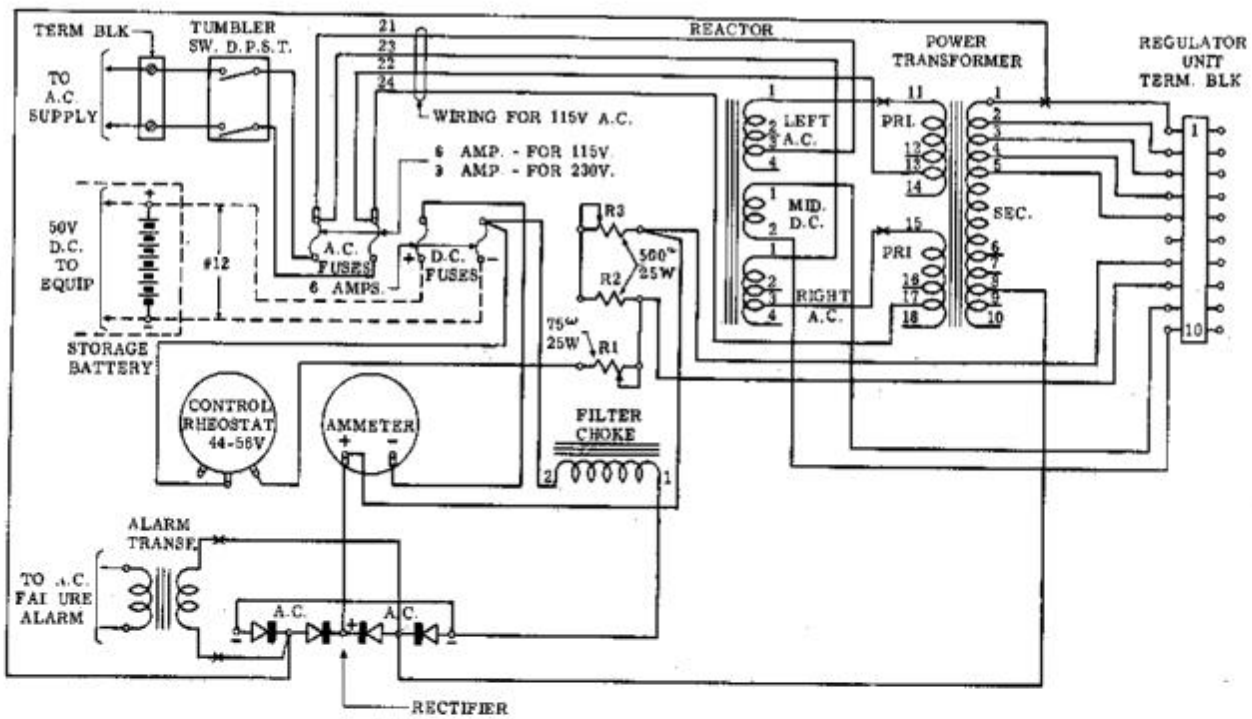

Fig. 8 Wiring Diagram 3 Ampere Convotrol.

NEW: 6-46
ATS:VP

PRINTED IN U. S. A. BY JOHN S. SWIFT CO., INC. 1M—10-46

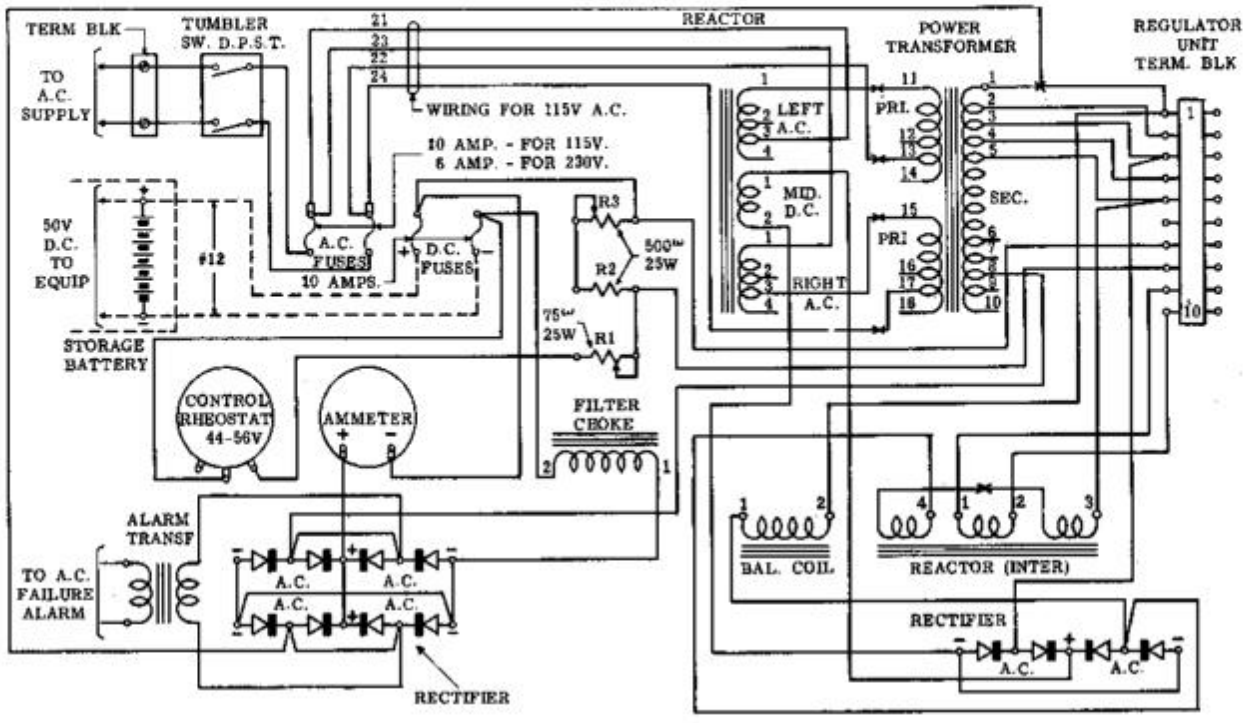

Fig. 9 Wiring Diagram 6 Ampere Convotrol.

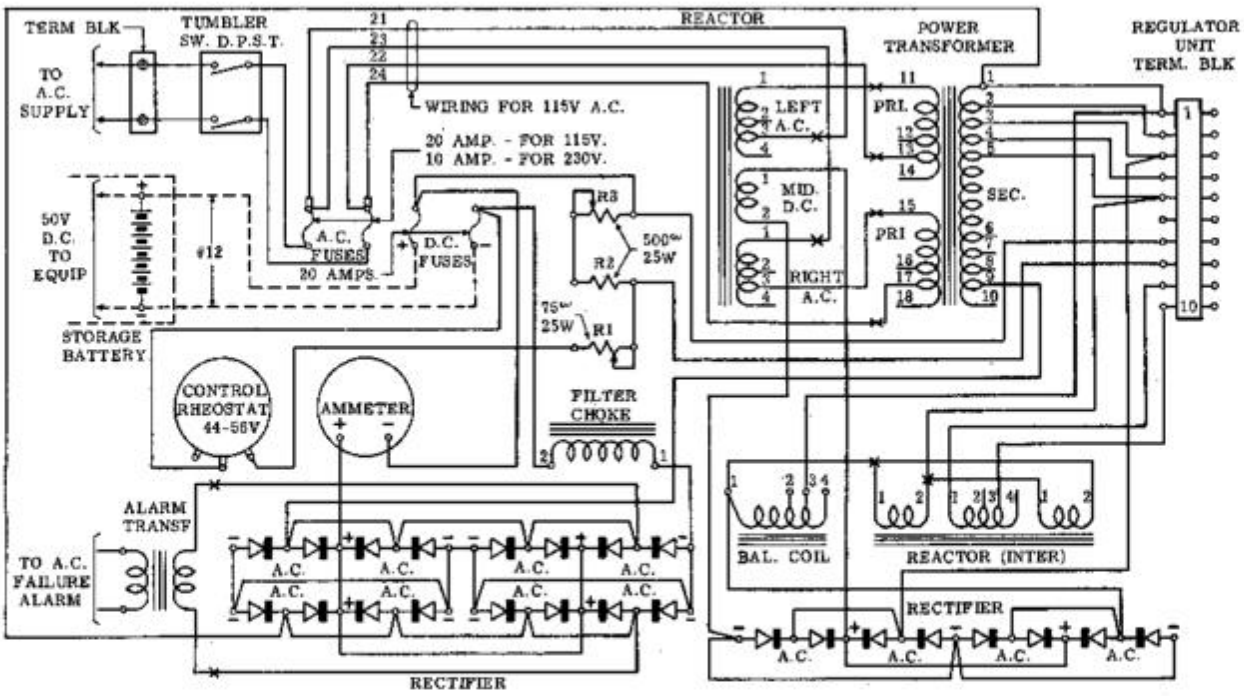

Fig. 10 Wiring Diagram 12 Ampere Convotrol.

AUTOMATIC ELECTRIC

MAKERS OF TELEPHONE, SIGNALING AND COMMUNICATION APPARATUS
ELECTRICAL ENGINEERS, DESIGNERS AND CONSULTANTS

●

DISTRIBUTORS IN U. S. AND POSSESSIONS

AUTOMATIC ELECTRIC SALES CORPORATION

1033 West Van Buren Street, Chicago 7, U.S.A.

Sales Offices in All Principal Cities

●

GENERAL EXPORT DISTRIBUTORS

INTERNATIONAL AUTOMATIC ELECTRIC CORPORATION

1027 West Van Buren Street, Chicago 7, U.S.A.

●

ASSOCIATED MANUFACTURERS

Phillips Electrical Works Limited	Brockville, Ont., Canada
Automatique Electrique, S. A.	Antwerp, Belgium
Automatic Telephone & Electric Co., Ltd.	Liverpool, England
Autelco Mediterranea S.A.T.A.P.	Milan, Italy

●

A PARTIAL LIST OF ASSOCIATED DISTRIBUTORS

Argentina
Luis Pitigliani, 25 de Mayo 489, Buenos Aires

Australia
Automatic Electric Telephones Limited, Sydney

Brazil
Automatic Telephones Limited of Brazil, Sao Paulo

Canada
Automatic Electric (Canada) Limited, Toronto.
Branches—Montreal, Winnipeg, Regina, Vancouver, Brockville, Edmonton, and Calgary

Colombia
Compañía Industrial de Teléfonos, Bogota

Egypt
Automatic Electric Sales Company, S. A., Cairo

India
Automatic Telephone & Electric Co., Ltd., Calcutta

Mexico
Henry S. Dabdoub,
Filomena Mata 13, Mexico, D.F.

South Africa
Automatic Telephones (South Africa) Ltd., Johannesburg

Other Sales Representatives and Agents Throughout the World