

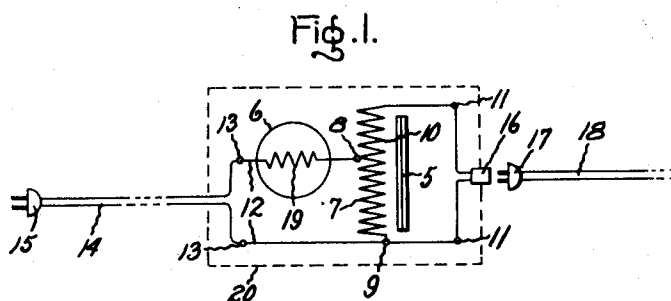
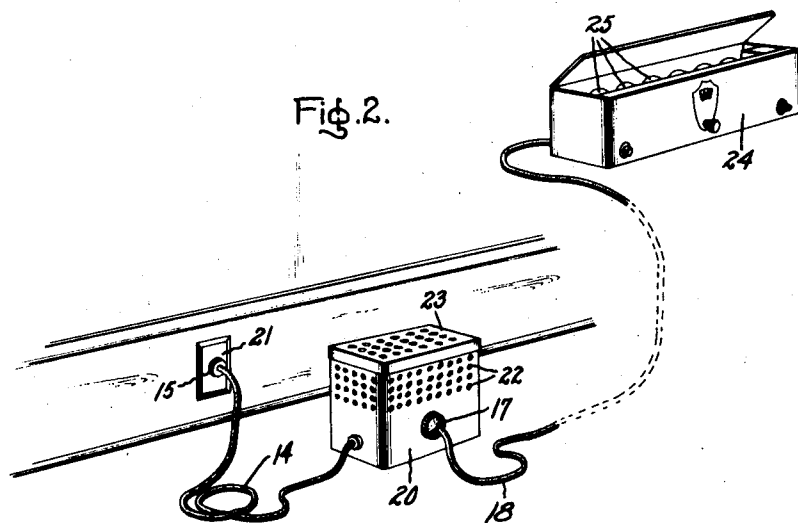
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VOLTAGE REGULATOR FOR ALTERNATING CURRENT APPARATUS

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UNITED STATES PATENT OFFICE

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VOLTAGE REGULATOR FOR ALTERNATING CURRENT APPARATUS

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The present invention relates to a voltage regulator for alternating current apparatus, and more particularly to a regulator for controlling the voltage applied to apparatus such as an alternating current operated radio receiving apparatus for example, which is sensitive to or liable to be injured by voltage variations above a certain normal value.

Radio receivers designed for alternating current operation or including tubes which have their heating current supplied from alternating current circuits are affected by the line voltage variations encountered on most distribution systems, such as the ordinary alternating current house lighting lines of commercial low voltage and frequency. Although the receiver or other apparatus connected to such lines may be designed for the normal voltage of the supply circuit, the effect of voltage variations in the case of radio receivers in particular, is to reduce the life of the tubes used therein and in certain cases to cause unstable operation of the whole receiver due to abnormal voltage fluctuations in the apparatus provided for supplying the anode and bias voltages. Thus a radio receiver employing a plurality of receiving tubes and suitable operating voltage supply apparatus designed for a rated normal supply voltage of 110 may receive voltages varying from 105 to 125, depending upon the voltage of the supply at the particular place in which the receiver is installed, and upon the regulation of the supply at that place.

Various types of rheostatic control devices have been proposed heretofore for insertion in the primary or supply side of an alternating current operated receiver or similar apparatus for adjusting the voltage applied to the receiver, but such devices are adjusted for the variation from normal at one particular time and do not provide for instantaneous fluctuations in voltage. Thus such devices may be used for reducing the supply voltage from an excessively high value to approximately normal value at any one instant and therefore approximately provide for protecting filaments of the receiving tubes or other apparatus sensitive from excessively high voltage.

Because of the relatively wide variation from the generally accepted standard of 110 volts in the usual commercial supply or house lighting systems and because of the great numbers of alternating current radio receiving sets and similar apparatus operating on such lines, which sets and apparatus are designed for this rated normal voltage, there has been and there still is a great need for a voltage regulating means which may easily be inserted between the standard alternating current outlet and such apparatus for effectively reducing and regulating the supply voltage to that for which the apparatus is designed.

Such a regulator is not, however, limited to use with radio receiving apparatus but may be utilized in connection with any electrical apparatus requiring a substantially constant, normal supply voltage, and it is the object of the present invention to provide a voltage regulator which not only reduces abnormally high supply voltages to a normal operating value but also automatically compensates for voltage variations above and below normal, and which is adapted to be readily and easily inserted between an alternating current outlet and an existing apparatus requiring substantially a constant voltage from such outlet, such as an alternately current operated radio receiving set, for example.

The invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the drawings Fig. 1 is a schematic wiring diagram of a voltage regulator embodying the invention; and Fig. 2 is a view in perspective of such a regulator connected and ready for use with a radio receiver.

Referring to Fig. 1, 5 is an auto-transformer and 6 is a constant current device which may be of the ballast lamp type. The auto-transformer is provided with a primary or primary section 7 having terminals 8 and 9 and a secondary or secondary section 10 having terminals 11. This is a usual auto-transformer arrangement. In the present

example the secondary is the entire winding while the primary is provided by tapping the winding as indicated by the location of terminal 8 which may be considered to be
5 the high potential terminal of the primary.

The voltage to be corrected or the supply voltage is applied to the primary terminals through the ballast lamp which is connected in series therewith through a primary circuit 12 having input terminals 13. A suitable supply connection with the latter is provided by a cord 14 and plug 15.

The ballast lamp or constant current device 6 is preferably, but not necessarily, located in the high potential side of the primary circuit. In the present example it is shown as connected in series with the primary high potential terminal 8.

The secondary terminals 11 are utilized to supply apparatus requiring substantially constant voltage, and in the present example, are connected with a suitable plug receptacle 16 for connection with an external plug 17 and cord 18 leading to the load apparatus.

25 The regulator is very simple in construction and is readily adapted to be manufactured in large quantities at low cost since it employs only a simple auto-transformer and a constant current device which may be of the well-known ballast lamp type having a filamentary resistor 19 surrounded by a suitable gas.

The line or supply voltage to be regulated is applied through the ballast lamp and auto-transformer primary in series and the output voltage for the receiver or other apparatus is applied through the terminals of the auto-transformer secondary. The ballast lamp functions as constant current device
40 for absorbing the supply voltage variations and reducing the supply voltage to a substantially constant subnormal value, the voltage across the lamp depending upon change in the resistance of filament 19. This resistance change is proportional to the line voltage and current variations. With a normal voltage at the supply or input terminals 13, the auto-transformer is so designed, that is, its ratio is made such that it operates to
50 step up the voltage, from that applied through the ballast lamp or constant current device to its primary terminals. Thus with a normal line voltage the ballast tube reduces the voltage and the auto-transformer restores it to the same normal value which is that required by the receiver or other apparatus to which it supplies current.

This device makes possible the use of a regulating means with a standard receiver or
60 other vacuum tube apparatus without requiring any changes in the receiver or apparatus. For use with existing equipment this type of regulator is readily adapted for mounting in a small portable container which is indicated
65 in Fig. 1 by the dotted enclosure 20.

Referring to Fig. 2 the regulator of Fig. 1 is shown in use in connection with a baseboard outlet 21 near which it is located, and with which it is connected by extension cord 14 and plug 15, this figure of the drawing
70 having the same reference numerals for like parts as Fig. 1. The casing 20 is perforated as indicated at 22 to provide ventilation for the ballast lamp or constant current device, and is also provided with a removable cover
75 23 for inspecting or changing the lamp. The plug 17 of the apparatus receiving its supply from the regulator is shown connected with the receptacle 16 in the side of the casing 20, 18 being a cord leading to the apparatus from the plug. In the present example a radio receiver 24 is connected with the regulator and is of the type having alternating current operated filament type of tubes 25.

In the foregoing it will be seen that this
85 voltage control apparatus is thus readily adapted to be inserted between a plug receptacle and an apparatus plug such as that of a radio receiver, making it necessary only to remove the apparatus plug from its wall receptacle and to insert it in the plug receptacle in the regulator, and to insert the regulator plug in the wall receptacle to complete the connection. The regulator may be placed in any suitable location, such as on the floor,
90 as indicated, adjacent the baseboard outlet.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A voltage regulator for alternating current operated apparatus including an auto-transformer having a secondary section provided with output terminals and a primary section, a constant current device, and circuit means for applying a supply voltage through said primary section and constant current device, said auto-transformer sections being so related that said auto-transformer operates to restore to normal a supply voltage reduced by said constant current device.

2. A voltage regulator adapted to be inserted between a source of alternating current energy of varying voltage and an electrical apparatus requiring current at substantially a constant voltage, comprising input terminals for receiving said energy, output terminals arranged for connection with said apparatus, a constant current device including a ballast resistor, and a transformer having a primary section connected with said input terminals in series with said constant current device and a secondary section connected with said output terminals, the ratio of said transformer being such that at normal load a normal voltage at said input terminals reduced to a lower value by said constant current device is restored to substantially the same normal value at the output terminals.

3. The combination with an electrical apparatus embodying electric discharge devices of the alternating current filament type, of
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a voltage regulator therefor comprising input terminals adapted to be connected with a source of alternating current energy at a certain rated normal voltage, an auto-transformer having output terminals adapted to be connected with said apparatus to supply operating and filament voltage thereto and a primary tap, and a constant current device connected in series with one of said input terminals and said primary tap and being adapted to reduce the input voltage to a sub-normal value, and said auto-transformer being adapted to restore said voltage to said normal value.

4. A voltage regulator for alternating current operated devices requiring a constant voltage, comprising input terminals for receiving energy at a varying voltage, output terminals, a constant current device, and an auto-transformer having a primary section connected with said input terminals in series with said constant current device and a secondary section connected with said output terminals, the ratio of said auto-transformer being such that a normal supply voltage at said input terminals reduced to a lower value by said constant current device is restored to a normal value at the output terminals.

5. As a new article of manufacture, a regulator including a transformer having primary and secondary terminals, a ballast resistor arranged to be connected in circuit with said primary terminals to control the primary current, the ratio of said transformer being such that the normal secondary voltage between said secondary terminals exceeds the normal primary voltage between said primary terminals by an amount equal to the voltage drop across the ballast resistor at normal load, a ventilated casing surrounding said transformer and ballast resistor, and means connected with said ballast resistor and transformer for making plug connections with external electrical circuits.

6. As a new article of manufacture, a voltage regulator including input terminals, output terminals, a constant current device including a ballast resistor, a transformer connected with said output terminals and having a primary circuit connected with said input terminals through said constant current device, the ratio of said transformer being such that the normal secondary voltage thereof exceeds the normal primary voltage by an amount equal to the voltage drop across the constant current device at normal load, a ventilated casing surrounding said transformer and constant current device, and means connected with said input and output terminals adapted to provide electrical plug connections with external electrical circuits.

7. In a voltage regulator, the combina-

tion of a constant current device and a transformer in circuit therewith, the output voltage of the transformer exceeding the input voltage thereof, at normal supply voltage, by an amount substantially equal to the fall of potential in said constant current device under normal load conditions.

In witness whereof, I have hereunto set my hand this 25th day of September, 1928.

JAMES I. CORNELL.