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1,844,977

VOLTAGE REGULATOR

Original Filed March 20, 1928

Fig. 1.

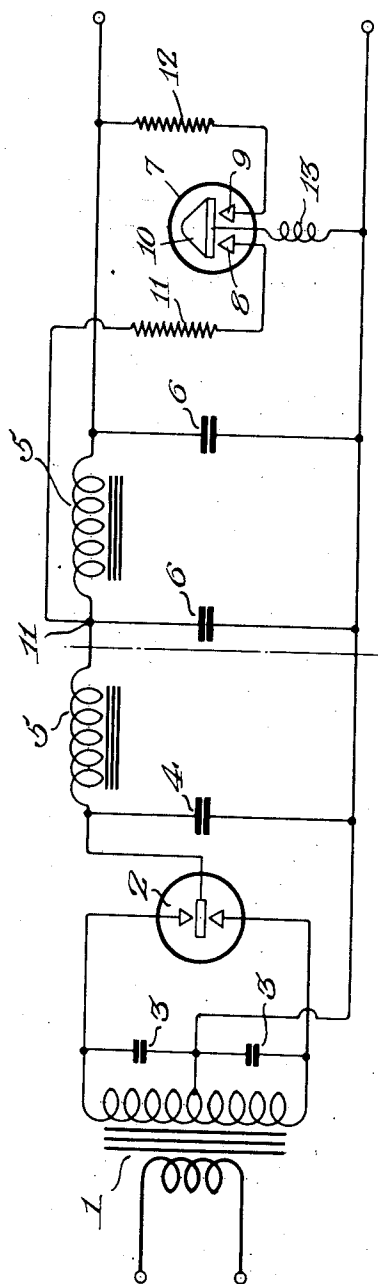
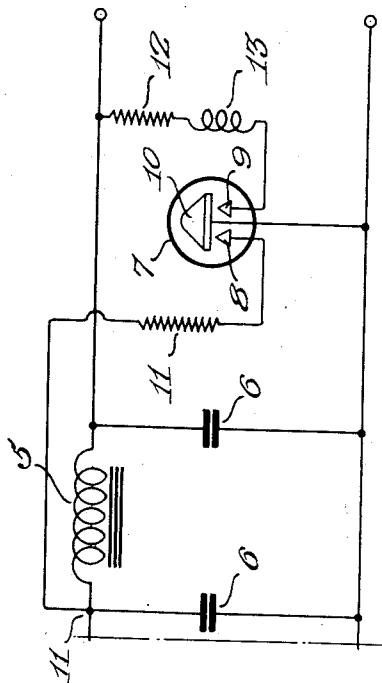


Fig. 2.



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VOLTAGE REGULATOR

Application filed March 20, 1928, Serial No. 263,179. Renewed December 17, 1930.

My invention relates generally to net works for deriving substantially constant potential from a variable or pulsatory source and in particular to a circuit employing a current by-pass of the tube type.

When a tube which depends upon gas ionization for conduction is connected across the line, there may appear disturbances in the region of the electrodes which give rise to voltage fluctuations and hence noise when the load comprises a radio set. While the disturbances appear to be the result of oscillations set up within the tube due to unsteadiness of discharge or other instability, the phenomenon is not thoroughly understood but its effect is distinctly discernible in the radio or audio frequency pickup e. g. a loud speaker. I have discovered that by modifying the circuit of the current by-pass, the disturbances may be eliminated or reduced to such an extent that the output is practically devoid of the voltage variations which ordinarily accompany the undesired phenomenon.

An object of the present invention is to reduce to a minimum or entirely eliminate the effect of disturbances produced in a gaseous current by-pass. Other objects and features will be apparent as the specification is perused.

In the drawings, which illustrate preferred embodiments of the invention,

Figure 1 is a schematic view of a source of pulsatory current, depicted as a combined rectifier and filter network and employing the improved voltage regulating accessory.

Figure 2 shows a modified arrangement.

In Figure 1, numeral 1 indicates a supply transformer feeding energy to rectifier 2, preferably double wave. In the event, the rectifier is of the gaseous type, for example, as described and claimed in the applications of Smith, Serial No. 526,095, which became Patent 1,617,179, issued February 8, 1927, and Bush, Serial No. 22,988, Raytheon B-H so-called, the usual buffer condensers 3 may be employed to advantage. These condensers are connected between the mid-tap of the transformer secondary and its extreme terminals as shown, said tap being extended

to form one of the outgoing mains; a lead from the common electrode of rectifier furnishes the other side of the circuit. Directly across the rectifier terminals is connected the usual condenser 4 of relatively large capacity.

The rectifier transmits pulsatory energy through a multi-sectioned filter network of series inductances 5 and shunt condensers 6 to be smoothed and then, to a direct current load which may comprise the "A" "B" "C" circuits, any or all, of a radio set. Across the last section of the filter, I connect a voltage regulating tube 7 having for one of its purposes, the by-passing of excess current so that the potential derived from its terminals will be substantially constant i. e. a uniform voltage level and devoid of ripples, irrespective of the amount of current flowing therethrough. The by-pass may take any form of current discharge which has an invariable voltage drop or voltage variations which are immaterial although I prefer the type which depends upon gas ionization for conduction and in particular, a tube filled with inert gas e. g. helium at a pressure approximating 15 mm. Hg. containing a starting anode 8 and an operating or running anode 9, each presented to the interior of a common cathode 10 of conical, hemi-spherical or other partially closed hollow shape.

In order to supply a higher operating potential to the starting anode, I provide a resistor 11, of relatively large magnitude and tap back to a connection in the filter or other element which precedes the by-pass at which the necessary potential is available. As will be evident, when a high potential charge is applied to electrode 8 to initiate ionization and upon the passage of the charging current to the cathode within member 7, the potential drop in resistor 11 precludes the further functioning of the starting anode, although if desired, the magnitude of the resistance and the position of the high potential tap may be so regulated as to enable the electrode to operate continuously. The potential for operating anode 9 is derived from the mains subsequent to the filter and may be supplied through a resistance 12 of smaller magnitude

than the companion element. As is well known, the impedance of this form of gaseous discharge appears to be a function of the current flowing and hence, provides a relatively constant voltage drop irrespective of the amount of current by-pass.

When employing a discharge gap in shunt, an example of which has been described in detail, disturbances usually accompany the discharge making themselves manifest by way of voltage variation or ripple in the output and hence, noise in the radio set load. I have discovered that by inserting an inductive reactance element 13 or resistance of proper value or both in series either with the cathode 10 or with the anode 9, these disturbances are eliminated or at least their effects are reduced to a negligible factor. Inductance is preferable since the direct current drop across it is lower than in the case of resistance.

In Figure 1, the inductance 13 is illustrated in series with the cathode lead and in Figure 2 in series with the operating or running anode, although as stated, under certain conditions, it may be desirable to insert a portion of the inductance in each of the cathode and anode leads. It will be understood that the embodiment shown in Figure 2 may bodily replace the entire network to the right of the dot-dash line in Figure 1. In the case of Figure 1, I have found that a resistance may be substituted for inductance member 13, although I prefer the latter. It will be further evident that the magnitude of inductance or resistance is dependent upon the characteristics of the tube by-pass and associated circuits.

In the foregoing, I have disclosed a combination of circuits and elements which cooperate remarkably well to render rectified or other voltage containing pulsations, substantially uniform and entirely devoid or reduced to a negligible amount those oscillations which have their inception within the circuits themselves.

I claim:

1. In combination a source of rectified current, a load and means interposed therebetween for by-passing excess current across the load, said means including a glow discharge device having a cathode and two anodes, said cathode being connected to one side of the line through an inductance and said anodes being connected to the other side of said line in such a manner that there is a difference of potential between the anodes.

2. In a voltage regulating system a source of pulsating direct current, a filter comprising a plurality of inductances connected in series on one side of the line, condensers connected on each side of the inductances to the other side of the line, a glow discharge device having a cathode and two anodes connected across the output side of the line, said cathode being connected through an in-

ductance to one side of the line and said anodes being connected to the other side of the line through resistances, the two anodes being connected across an inductance.

3. In combination a source of direct current, a load supplied from said source, and means interposed therebetween across said load for by-passing excess current, said means including a glow discharge device in series with an impedance.

4. In combination a source of direct current having an alternating current component, a load supplied from said source, a gaseous discharge device, said device containing a plurality of anodes and a common cathode, and means for applying to one of said anodes a higher potential than to the other anode, and an impedance in series with said common cathode said impedance and gaseous discharge device being connected across said load.

5. In a voltage regulating system a source of direct current, a load fed by said source, a glow discharge tube, and an inductance in series therewith across said load.

In testimony whereof, I have signed my name to this specification this 15th day of March, 1928.

DELBERT E. REPLOGLE.