

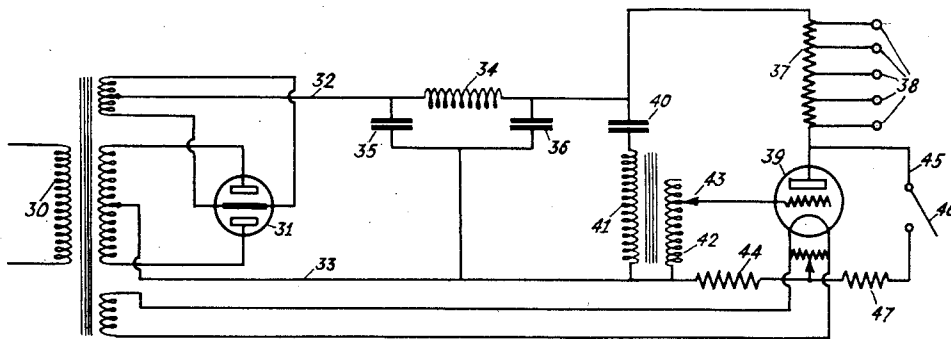
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POWER SUPPLY CIRCUIT

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POWER SUPPLY CIRCUIT

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7 Claims. (Cl. 250—27)

This invention relates, broadly to a means for maintaining a constant current in a circuit that is subject to current and voltage pulsations. More particularly, this invention relates to circuits such as a power supply circuit for a radio receiving set, and to means for maintaining a constant current in such a circuit.

It is well known to form a power supply circuit from a means for rectifying alternating current and a filter circuit comprising condensers and choke coils for smoothing out the rectified current. Good results and a practically constant current can be obtained in the output of such power supply circuits when large and relatively expensive choke coils and condensers are used in the filter circuit. In many instances, however, it is desirable to use small and inexpensive choke coils and condensers and in such instances, a slightly pulsating current is obtained in the output. My invention relates to a means for eliminating such pulsations.

It is the object of my invention to provide means for maintaining a constant current in any circuit that is subject to current and voltage pulsations.

It is a further object of my invention to place the equivalent of a balancing voltage in a circuit and to vary this voltage by means of the pulsations which it is desired to eliminate.

It is a further object of my invention to connect a space discharge device in series in a circuit which is subject to current and voltage pulsations and to vary the effective resistance of the space discharge path of said space discharge device in order to eliminate or reduce said pulsations to a minimum.

It is a still further object of my invention to provide means in place of or in addition to the choke coils and condensers of the filter circuit, for obtaining a relatively smooth current output in a power supply circuit.

Other objects of my invention will become apparent upon reading the specification and appended claims of this application which is a division of my copending application filed October 26, 1928, Serial No. 315,142, Patent No. 1,925,569 Sept. 5, 1933.

These objects of my invention are attained by including a space discharge device in the circuit to be controlled, and by providing means for instantaneously varying the effective impedance of the space discharge device in accordance with the pulsations to be controlled. That is, means are provided for varying the apparent or effective resistance of the space discharge path of the de-

vice with respect to the current pulsations passing or tending to pass therethrough.

In the case of the power supply circuit, a space discharge device such as an ordinary three-electrode thermionic valve is connected in series in said circuit so that the circuit is completed by the space discharge path of the space discharge device. It is to be understood that the valve will pass sufficient current for the proper operation of the radio receiving set. Means are provided and associated with said space discharge device for impressing upon the control grid thereof a potential which is 180° out of phase with the voltage pulsations in the power supply circuit.

The means which may comprise a transformer connected across the output of the filter section of the power supply circuit, is such that the reverse potential applied to the control grid of the space discharge device, has a value substantially equal to

$$\frac{1}{\mu}$$

times the value of the voltage pulsations in the power supply circuit where μ is the amplification constant of the valve. As a result the equivalent of a balancing voltage is introduced into the circuit, or looked at from a slightly different point of view, the effective resistance of the space discharge path is changed in such a manner that the current through the space discharge device which is incidentally the current in the output of the power supply circuit, remains constant regardless of the potential variations tending to pass more current through the circuit.

The details of an approved form of my invention will be more readily understood by referring to the following specification which should be read in connection with the accompanying drawing in which the single figure illustrates diagrammatically a power supply circuit which has been modified according to my invention.

The accompanying drawing illustrates an application of my invention to a power supply circuit such as is used for supplying power to operate a radio receiving circuit. In this power supply circuit a transformer 30 whose primary winding is adapted to be connected to the local alternating current mains, has its secondary winding connected to a rectifying means 31. The member 31 is shown as a whole wave rectifier of the heated cathode type but it is to be understood that any other type of rectifying means can be used equally well. The cathode of the rectifier is preferably heated from a separate winding on the

transformer 30. A connection 32 to the cathode of the rectifier, and a second connection 33 to the midpoint of the secondary winding of the transformer 30, form respectively the positive and negative side of the circuit.

A choke coil 34 is inserted in the circuit, and two condensers 35 and 36 are shunted across the circuit on each side of the choke coil to smooth out the current and voltage pulsations. A resistance member 37 is shunted across the circuit and various taps 38 are provided on the resistance member for obtaining the desired potential drop for the various operating needs of the receiving circuit. All of this structure so far described is well known in the art and various substitutions can be made for parts of this structure without changing the general nature of the power supply circuit. A power supply circuit, as described, provides a relatively smooth current only when large and expensive choke coils and capacities are employed. Otherwise objectionable current and voltage pulsations are present in the output of the power supply circuit.

According to my invention a space discharge device 39 of the three element type, is inserted in the power supply circuit, so that the circuit is completed by the space current of the device. According to the broad principle of my invention, the space current of the device 39 is kept constant and the objectionable pulsations are therefore prevented from passing through the resistance member or voltage divider 37.

The constant space current may be obtained by impressing upon the grid of the device 39 a potential which is 180° out of phase with the objectionable pulsations and which has a magnitude equal substantially to

$$\frac{1}{\mu}$$

times the magnitude of the pulsations. In the modification illustrated I accomplish this by connecting a series arrangement comprising a condenser 40 and a primary winding 41 across the power supply circuit and by coupling a secondary winding 42 to the winding 41. The condenser 40 is provided so that only the alternating component of the current in the power supply circuit will pass through the winding 41. The grid of valve 39 is connected to the winding 42, preferably by a slide member 43 so that the potential impressed upon the grid has the proper magnitude. The reverse potential is obtained by winding the coils 41 and 42 in opposite directions and the windings should be such that a tight coupling is obtained between these coils. A resistance 44 is provided to maintain the desired grid bias.

The cathode of the device 39 can be heated by alternating current from a winding on the transformer 30 or by any other means. Connections could also be made to obtain the cathode heating current from the resistance member 37 but in that case it would be necessary to provide a temporary circuit shunting the anode and cathode to complete the power supply circuit and cause a flow of current through resistance 37 until the cathode had heated sufficiently for the device to pass current. Such a shunting circuit 45 containing either an automatic or a manually operated switch 46 could also be used to complete the power supply circuit in the case of emergency such as the burning out of the device 39. The shunting circuit 45 contains a resistance 47 equal to the apparent resistance of the device 39.

In the operation of a power supply circuit mod-

ified in accordance with my invention, when there is an increase in the potential in the circuit tending to increase the space current of the device, a negative potential of the proper magnitude is impressed upon its grid to vary the effective impedance of the space discharge path and thus maintain a constant space current and consequently a constant current through the resistance 37.

Various other modifications of the circuits disclosed and various other applications of the broad principle of my invention have been contemplated by me and I do not intend to be limited by the modifications disclosed but only by the scope of the appended claims.

I claim:

1. In a power supply circuit, a source of fluctuating energy, a voltage dividing member and a variable impedance device forming a series circuit connected across said source, a control element for said variable impedance device, a second circuit connected across said source and means for causing said control element to function in response to fluctuations of energy flowing in said second circuit, and means controlled thereby for maintaining the voltage across said voltage dividing member substantially constant.

2. A power supply circuit comprising means for rectifying alternating current, a filter circuit for smoothing out the rectified current, a direct current path consisting of a voltage dividing resistance member and a space discharge device connected in series across the output of said filter circuit, a control electrode for said space discharge device, an alternating current path connected across the output of said filter circuit, and means including said alternating current path for impressing a potential upon said control electrode which has a predetermined relationship to the potential variations in said alternating current path.

3. A power supply circuit comprising means for rectifying alternating current, a filter circuit for smoothing out the rectified current, a voltage dividing resistance member and a triode connected in series across the output of said filter circuit, said triode containing an anode, a cathode, and a control electrode, said anode being connected through said resistance member to the positive side of said filter circuit and said cathode being connected to the negative side of said filter circuit, a transformer having primary and secondary windings, a condenser and said primary winding connected in series across the output of said filter circuit, said secondary winding being connected between said cathode and said control electrode, a resistance included in the connection between said cathode and said control electrode, and a switch for by-passing current around said triode.

4. A power supply circuit comprising means for rectifying alternating current, a filter circuit for smoothing out the rectified current, said filter circuit being adapted to have a pulsating current in its output, and a pair of paths connected in parallel across the output of said filter circuit, one of said paths including means for preventing the direct current component of said pulsating current from passing therethrough and the other of said paths including means for preventing the alternating current component of said pulsating current from passing therethrough.

5. A power supply circuit comprising means for rectifying alternating current, a filter circuit associated with said rectifying means, said filter

- circuit being adapted to have a pulsating current in its output, and a pair of paths connected in parallel across the output of said filter circuit, one of said paths including means for permitting only the alternating current component of said pulsating current to pass therethrough, and the other of said paths including means for permitting only the direct current component of said pulsating current to pass therethrough, said last mentioned means comprising a variable impedance member whose impedance is controlled by the alternating current component in said first mentioned path.
6. A power supply system comprising a source of fluctuating direct current, a pair of paths connected in parallel across the output of said source, one of said paths including means for permitting only the alternating current component of said fluctuating current to pass therethrough, the other of said paths including means for permitting the direct current component of said fluctuating current to pass therethrough, said last mentioned means comprising a space discharge device the output circuit of which is included in said direct current path and the input circuit of which is connected to said alternating current path.
7. A power supply system comprising a source of fluctuating current a pair of paths connected in parallel across said source, one of said paths including means for permitting only the alternating current component of said fluctuating current to pass therethrough, the other of said paths including means for permitting the direct current component of said fluctuating current to pass therethrough, said last mentioned means comprising a space discharge device the output circuit of which is included in said direct current path and the input circuit of which is connected to said alternating current path.

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