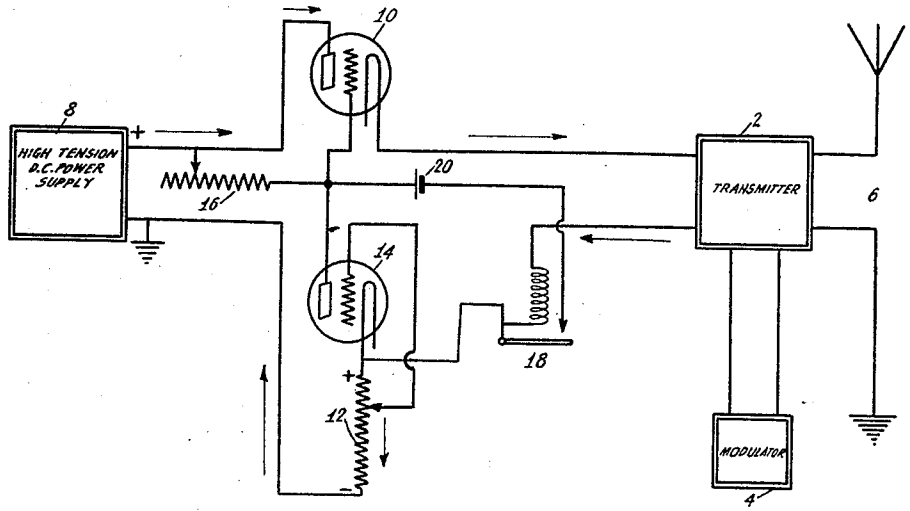
Aug. 30, 1932. C. W. HANSELL 1,874,981

VOLTAGE REGULATOR

Filed Oct. 2, 1928



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Patented Aug. 30, 1932 1,874,981

UNITED STATES PATENT OFFICE

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VOLTAGE REGULATOR

Application filed October 2, 1928. Serial No. 309,876.

This invention relates to voltage regulators, and more particularly to a voltage regulator for high tension direct current.

The direct current which is used for the excitation of electron emission tubes, as in tube transmitters, is relatively small in magnitude, and is supplied at a high potential. The load is varied over an extreme range with exceedingly great rapidity by the modulation applied to the transmission energy, whether it be code or speech. Under these circumstances it becomes difficult to keep the direct voltage constant, and to provide the usual types of voltage regulator is not feasible because of the rapidity of the load variation.

To provide a voltage regulator which is suitable for the purposes already outlined is the primary object of my invention, and to this end I employ a voltage regulating triode the cathode to anode circuit of which is connected in series with the supply circuit, the triode constituting an inertialess variable impedance. A resistance is connected in series with the supply circuit, and this is so coupled to the control electrode of the voltage regulating triode that the potential applied to the control electrode is varied inversely in response to variations of the potential drop across the resistance. More specifically, the desired effect is transferred through a second triode, the series resistance being used to determine the potential on the control electrode of the second triode, while another resistance in the anode of the second triode determines the potential applied to the control electrode of the voltage regulating triode.

Circuit breakers have been designed for operation up to three thousand volts, but their operation on the higher voltages is not very satisfactory, and the voltage mentioned does not approach that commonly used on the anodes of large sized transmitter tubes. A further object of my invention is to provide a high tension circuit breaker, and for this purpose I employ any suitable over load relay in series with the direct current circuit, and use the relay to apply a blocking potential to the voltage regulating triode so as to make its impedance infinite, thereby acting as a high tension circuit breaker.

The invention is described more in detail in the following specification, which is accompanied by a drawing the single figure of which is a schematic representation of my invention.

Referring to the drawing, there is a vacuum tube transmitter 2, the output of which is modulated by a suitable key or speech modulator 4, and thereafter is transmitted from any appropriate antenna or other utilization circuit 6. The direct current excitation for the transmitter 2 is provided from a high tension direct current power supply 8, which, in practice, may be a tube rectifier, motor generator, or any desired arrangement for converting alternating current power to direct current power at high voltage.

In accordance with my invention, in series with the source 8 there is inserted a voltage regulating triode 10. The cathode to anode circuit is connected in the main supply line, so that by varying the potential on the control electrode of the tube the impedance thereof may be varied, and since this action is instantaneous in response, the rapidity of the modulation from the modulation source 4 is of no consequence. In series with the source 8 there is provided a resistance 12, and the potential drop across this resistance is used to determine the bias potential of the triode 14, the anode circuit of which includes a resistance 16, the potential drop across which is in turn used to determine the bias potential of the voltage regulating triode 10. This arrangement results in the impedance of the voltage regulating triode 10 being varied in response to the load, but in inverse sense, and to a degree which is adjustable by varying the magnitude of the resistances 12 and 16. The use of resistances, rather than other impedances, tends to keep the arrangement inertialess, and therefore independent of the modulation frequency.

Also in series with the direct current power supply 8 there is provided an overload relay 18, and this is arranged, as shown, so that upon overloading the relay is closed, thereby short circuiting the tube 14, and permitting sufficiently large a current flow through the resistance 16 that the control electrode of the

voltage regulating triode 10 is biased to cut off, that is, the impedance of the triode becomes large, and can even be made infinite, especially if a bias battery such as 20 is added in the relay circuit, so that in effect a high tension circuit breaker has been provided in a very simple manner, and utilizing in combination with the voltage regulator only a low tension series relay.

To summarize the operation of the present invention, vacuum tube 10 acts as a variable resistance whose resistance increases as the load decreases, and whose resistance decreases as the load increases in such a manner that the voltage applied to the load circuit remains substantially constant. Tube 14 functions so as to control the grid of tube 10 in such a manner that the desired action takes place. For example, an increase in load increases the voltage drop in resistor 12 which makes the cathode of tube 14 more positive with respect to its grid, or, in other words, the grid becomes more negative with respect to the filament. This decreases the anode current through tube 14, and decreases the voltage drop in resistor 16. Consequently, the potential of the anode of tube 14 and the grid of tube 10 become more nearly the potential of the positive source 8, and in this manner the grid of tube 10 is made more positive with respect to its cathode thereby decreasing the resistance of tube 10 in such a manner as to tend to hold constant the load voltage. By making the action of tube 14 in controlling tube 10 great enough, the voltage on the load can be held constant over a large range of load currents.

If a single source 8 is used to energize a plurality of transmitters 2, 4, a separate voltage regulator is provided in series with each transmitter supply lead, so that each is regulated in accordance with its own modulation. At the same time the use of separate overload relays serves to protect the troubled circuits without interrupting the others, which is a feature of great value in the practical operation of a station.

I claim:

1. An inertialess voltage regulator for direct current comprising a voltage regulating electron discharge device the cathode to anode circuit of which is connected in series with the supply circuit, a second electron discharge device, a resistance in series with the supply circuit for determining the potential on the control electrode of the second electron discharge device, and a resistance in series with the anode of the second electron discharge device for determining the potential applied to the control electrode of the first electron discharge device so that the impedance of the first triode is varied in response to the load flowing therethrough but in inverse sense.

2. An inertialess high voltage regulator and high tension circuit breaker for a high tension direct current supply circuit comprising a voltage regulating electron discharge device the cathode to anode circuit of which is connected in series with the supply circuit, a resistance connected in series with the supply circuit, an overload relay arranged in series with the supply circuit, and means coupling the resistance and relay to the control electrode of the electron discharge device so that the impedance of the electron discharge device is varied inversely in response to the load flowing therethrough, but is made extremely great upon actuation of the overload relay.

3. A transmission system comprising an electron emission tube transmitter, means to modulate the output of the transmitter, a source of direct current for the anodes of the transmitter tubes, and means to keep the direct voltage constant during modulation comprising a voltage regulating electron discharge device the cathode to anode circuit of which is connected in series with the source, a resistance in series with the source, and means to so vary the potential on the control electrode of the electron discharge device in response to the potential across the resistance that the impedance of the electron discharge device is varied in inverse sense to the load flowing therethrough.

4. A transmission system comprising an electron emission tube transmitter, means to modulate the output of the transmitter, a source of high tension direct current for the anodes of the transmitter tubes, a voltage regulating electron discharge device the cathode to anode circuit of which is connected in series with the direct current source, a resistance and an overload relay also arranged in series with the direct current source, and means so coupling the resistance and relay to the control electrode of the electron discharge device that its impedance is varied inversely in response to the current flow therethrough, but is made extremely great upon actuation of the overload relay.

CLARENCE W. HANSELL.

CERTIFICATE OF CORRECTION.

Patent No. 1,874,981. August 30, 1932.

CLARENCE W. HANSELL.

It is hereby certified that erro appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 62, claim 1, for "triode" read "electron discharge device"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of January, A. D. 1933.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.