

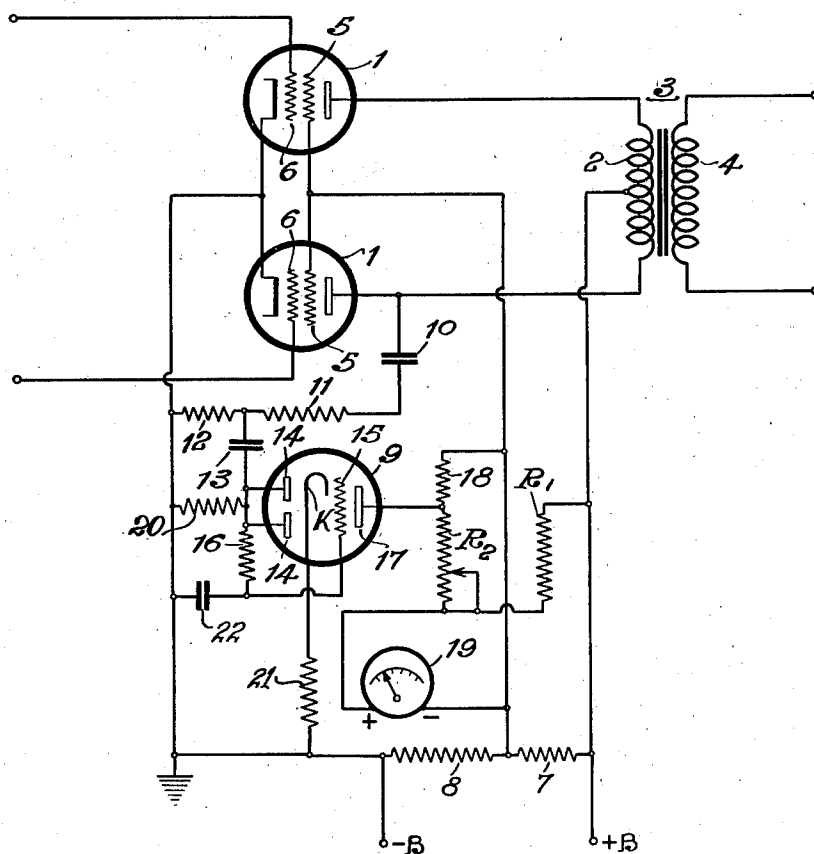
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J. L. HATHAWAY

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AUTOMATIC VOLTAGE REGULATOR

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INVENTOR
Jarrett L. Hathaway
BY *H. S. Snover*
ATTORNEY

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AUTOMATIC VOLTAGE REGULATOR

Jarrett L. Hathaway, Manhasset, N. Y., assignor
to Radio Corporation of America, a corporation
of Delaware

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8 Claims. (Cl. 179-171)

This invention relates to automatic voltage regulators and has particularly to do with voltage regulators such as are used in speech amplifier equipment.

In many amplifiers, it is necessary to control certain voltages so that when the signals are applied, there will be no appreciable drop in the positive potentials applied to different electrodes of the amplifier tube. In power amplifiers, it has been found desirable to take special precautions tending to hold up the screen voltage. This is particularly true when amplifier tubes of the "beam power" type are used.

It is an object of my invention to provide a system for automatically regulating the voltage applied to different electrodes of an amplifier tube. It is another object of my invention to provide a voltage regulator in association with the screen grid circuit of a signal amplifier. It is still another object of my invention to provide a convenient volume indicator acting in association with a voltage regulator circuit for a power amplifier.

A combination diode rectifier and triode amplifier tube is preferably used in the means for voltage regulation and volume indication. As shown in the diagram, a portion of the signal is diverted from the main amplifier and applied to the rectifier section of the regulator tube. The rectified and filtered potential is then applied to the grid of the amplifier section of this regulator tube, causing its plate current to decrease with an increase in the amplitude of the signal. If this plate current decrease exactly compensates for the increased current drawn by the screen grids of the main amplifier, then the screen voltage remains constant. If desirable, the screen voltage may actually be made to rise with increase in signal amplitude by this means.

My invention will now be described in more detail, reference being made to the accompanying drawing, the sole figure of which represents a circuit diagram of a preferred embodiment.

Referring to the drawing, I show therein a push-pull stage of an amplifier having a pair of discharge tubes 1, each of which is of the tetrode type. The anodes of these tubes are connected to the two ends of a primary winding 2 in an output transformer 3, the secondary 4 of this transformer may be connected to any utilization circuit.

For the sake of illustration, it is assumed that the screen grids 5 in the tube 1 are to be maintained at a constant voltage, irrespective of the amplitude of the signals applied to the grids 6

in the input circuit. Normally, the screen grid potential will be that which is obtained by a voltage divider consisting of resistors 7 and 8 across the direct current source indicated as +B and grounded -B.

The circuit diagram shows also a voltage regulator tube 9 which, in the case illustrated, may be of the type having a common cathode, a diode rectifier section and a triode amplifier section. A portion of the output energy derived from one side of the push-pull amplifier is impressed across a capacitor 10, a voltage divider consisting of resistive elements 11 and 12, and thence to ground. Between the resistors 11 and 12 is a connection to one side of a capacitor 13. This capacitor couples the diverted output from the push-pull amplifier to the diode anodes 14 in the tube 9.

In the amplifier section of the tube 9, I show a control grid 15 connected through a resistor 16 to the diode anodes 14. The conductive path between the anodes 14 and the cathode K is conventional, being inclusive of resistors 20 and 21. The junction between these resistors is preferably grounded, as is the negative terminal -B of the direct current source. The positive terminal of this source is indicated at +B. A by-pass condenser 22 is used to couple the grid 15 to ground. The anode 17 in the tube 9 is connected through a resistor 18 to the screen grid lead for the push-pull tubes 1. In shunt with the resistor 18 is a D. C. meter 19 acting as a volume indicator and connected through a potentiometer R₂. In order to make this volume indicator read "up scale" in reference to the actual volume of the signal, it is connected to a "bucking" potential through resistor R₁. If desired, the relation between the total impedance of resistors 7 and 8 the total impedance of resistors R₁, R₂ and the space path in the triode section of the tube 9 may be adjusted so that the indicator 19 will give a reading in terms of decibels of output from the amplifier tubes 1. The potentiometer R₂, however, is used to adjust the zero reading of the indicator when no signal is present.

In the operation of my invention, an output component of signal energy derived from the anode of one of the amplifier tubes 1 traverses capacitor 10 and resistors 11 and 12 to ground. Resistors 11 and 12 constitute a voltage divider, and the junction between these resistors is coupled through capacitor 13 to the anodes 14. Hence, a portion of this diverted signal energy is rectified in the diode section of tube 9 and the bias on the grid 15 is thereby controlled in such a manner that with an increase in the signal amplitude, the

grid 15 becomes more negative; consequently the triode section of tube 9 draws less current through resistor 18. The voltage on the screen grid circuit from the junction between resistors 7 and 8 on the screen grids 5 is therefore maintained at a substantially constant level, as is desired. However, the current drain in the triode section of the tube 9 may be normally maintained at a greater value than the current drain through the screen grids 5. In this case, the swing of current variations in the tube 9 may exceed that of the screen grids 5, and, in consequence, it is possible to actually increase the screen grid potential with increase in volume of the signal.

I am well aware that voltage regulators of different types have been applied to the screen grid circuit of an amplifier but, so far as I know, such voltage regulators of the prior art do not possess all of the advantages which are to be derived from the system herein disclosed. Among these advantages may be mentioned the simplicity of the circuit arrangement, and its two-fold function. One of these functions is to provide voltage regulation on the screen grids; the other function is to provide a convenient volume indicator.

It is well within the scope of my invention to provide a voltage regulator of the type indicated which would control the D. C. potentials on any of the electrodes of an amplifier tube or tubes. Furthermore, it will be seen that such voltage regulation may be adjusted to obtain a steady potential or to increase or decrease the potential as a function of the signal volume. Such alternative adjustments may be readily obtained by those skilled in the art in view of the foregoing disclosure.

I claim:

1. A voltage regulator for a main amplifier circuit, comprising an electron discharge device having a diode rectifier section and a triode amplifier section, a circuit for diverting a portion of the signal energy from the output side of said main amplifier circuit to be fed to said rectifier section for rectification therein, means responsive to variations in the amplitude of said signal energy so rectified for varying the control bias on the amplifier section of said discharge device, a direct current power source having connections arranged and adapted to deliver operating potentials to said main amplifier circuit and to the amplifier section of said discharge device, said connections being such that the space path of said discharge device is in shunt with a space path portion of said main amplifier circuit across which voltage regulation is to be applied, and means controlled by the space path current in said amplifier section for effecting said voltage regulation.

2. A voltage regulator according to claim 1, and including a volume indicator in parallel with an impedance, both being in circuit with the amplifier section of said discharge device and means for applying to said volume indicator a potential which varies in direct proportion to the output power from said main amplifier.

3. A voltage regulator according to claim 1 and including a volume indicator so connected in series with the space path in the amplifier section of said discharge device, so influenced thereby, and

so calibrated that it is readable in terms of decibels of amplitude of said signal energy, and is directly proportional thereto.

4. A voltage regulator according to claim 1 in which said voltage regulation is applied to a screen grid in said main amplifier circuit.

5. The method of regulating the voltage applied to a screer grid with respect to the cathode of a signal-energy amplifier stage, which method comprises rectifying an output component of signal energy from said stage, producing a current drain in a conductive path which shunts the space path from the cathode to the screen grid in said amplifier, causing said current drain to be controlled in amplitude in inverse proportion to the amplitude of said rectified component of signal energy, and utilizing the variations in said current drain to maintain substantially constant the potential difference between said cathode and screen grid.

6. The method of over-compensating for voltage variations in a screen grid potential with respect to the cathode of a signal energy amplifier stage, which method comprises rectifying an output component of signal energy from said stage, producing a current drain in a conductive path which shunts the space path from the cathode to the screen grid in said amplifier, causing said current drain to be controlled in amplitude as an inverse function of the amplitude of said rectified component of signal energy, causing said current drain to exceed the screen grid current in said amplifier stage when no signal is present, and utilizing the variations in said current drain to increase the screen grid potential as a direct function of the amplitude of said signal energy.

7. The method of under-compensating for voltage variations in a screen grid potential with respect to the cathode of a signal energy amplifier stage, which method comprises rectifying an output component of signal energy from said stage, producing a current drain in a conductive path which shunts the space path from the cathode to the screen grid in said amplifier, causing said current drain to be controlled in amplitude as an inverse function of the amplitude of said rectified component of signal energy, limiting the amplitude of said current drain to a value less than the screen grid current in said amplifier stage when no signal is present, and utilizing the variations in said current drain to maintain the screen grid potential within predetermined limits of variation.

8. In a device for regulating the screen grid potential of an amplifier in compensation for variations in the amplitude of signal input energy applied to said amplifier, a rectifier so coupled to the output side of said amplifier as to receive a portion of the output energy therefrom, impedance means including a controllable electron discharge device, a source of direct current for applying operating potentials to the electrodes of said amplifier and of said device, and means for causing said screen grid potential to be upheld by a reduction of current flow through the discharge path of said device in response to an increase in the amplitude of energy delivered by said rectifier.

JARRETT L. HATHAWAY.