

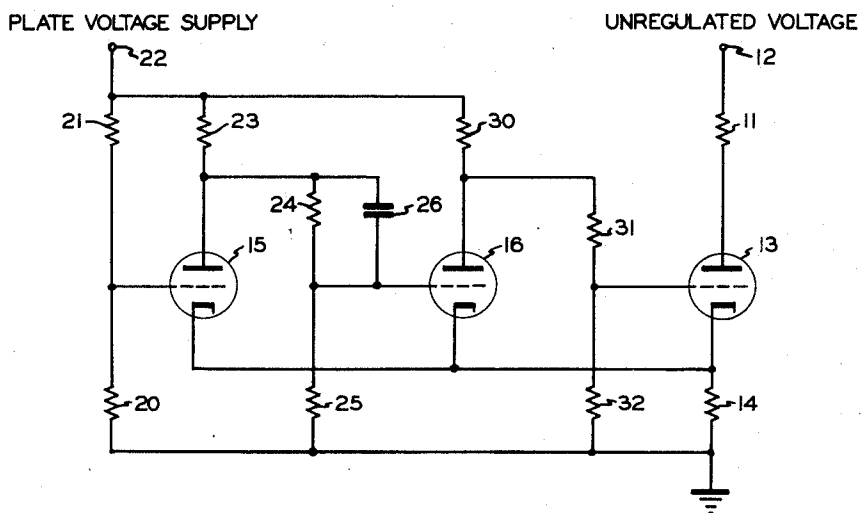
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CONSTANT CURRENT DEVICE

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CONSTANT CURRENT DEVICE

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1 Claim. (Cl. 323—4)

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This invention relates to current stabilizers and more particularly to D. C. constant current devices.

In many applications such as the field coils of tachometer-generators of the type used in many aircraft installations, it is essential that the field current be maintained very constant. As the temperature, and hence the resistance, of these field coils vary over a wide range in such an installation, and as the voltage for the field windings is generally obtained from an unregulated voltage supply, the current variations tend to be too large for the most satisfactory operation of the tachometer. It, therefore, becomes desirable to use a current stabilizing device to insure a constant current in the field coils and hence more satisfactory operation of the instrument.

This invention achieves the above required results with an economical use of parts and a small consumption of power. Another feature of this invention is that the current value at which stabilization occurs may be varied according to variations in a control voltage. The variations in the current may be made directly proportional to variations in this control voltage over a wide range of voltages. Although the application of this invention has been described with particular reference to its use with a tachometer-generator field, it is not to be considered as a limiting, but merely as an illustrative application.

A primary object of this invention is to generally improve constant current devices.

Another object of this invention is to provide a current stabilization device to maintain constant current through a resistance despite changes in that resistance and changes in the voltage of the current source.

A further object is to provide a constant current device suitable for use with direct currents.

A still further object is to provide a constant current device suitable for use in the field circuit of small generators.

A still further object is to provide a current stabilizing device in which the current may be varied according to variations in a control voltage.

These and other objects of the invention will be apparent from the following description when taken with the accompanying drawing which is a schematic diagram of one embodiment thereof.

Referring to the drawing, resistor 11, through which the current is to be maintained constant, is connected between the unregulated voltage source at terminal 12 and the plate of triode electron tube 13. The cathode of triode 13 is con-

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nected directly to the cathodes of triode electron tubes 15 and 16, and to ground through resistor 14. The grid of triode 15 connects to ground through resistor 20 and to the plate voltage supply at terminal 22 through resistor 21. The plate of triode 15 connects through plate load resistor 23 to the plate voltage supply at terminal 22 and also to ground through the series combination of resistor 24 and resistor 25. The grid of triode 16 connects to the junction point of resistors 24 and 25, and also to the plate of triode 15 through condenser 26. The plate of triode 16 connects through resistor 30 to the plate voltage supply at terminal 22 and also to ground through the series combination of resistor 31 and resistor 32. The grid of triode 13 connects to the junction of resistor 31 and resistor 32.

In the operation of this embodiment of the invention, it is desired to maintain a constant current flow through resistor 11 despite changes in its resistance and changes in the voltage at terminal 12. This current is the plate current of triode 13 and also flows through the constant resistance of resistor 14, across which is developed a voltage proportional to the current to be maintained constant. A variation in the current through resistor 11 causes a change in voltage across resistor 14 which is coupled directly into the cathode of triode 15. Triode 15 and 16, and related circuit elements, constitute a two stage D. C. voltage amplifier having positive voltage feedback due to common cathode resistor 14, resulting in a very large gain in the amplifier. The output of the amplifier is taken from the junction of resistors 31 and 32, and connected to the grid of triode 13. The phase of the signal output from the amplifier is such that triode 13, responding to its grid voltage variations, tends to compensate for the current change that originally caused the error voltage across cathode resistor 14. Condenser 26 is included in the circuit to prevent the positive voltage feedback in the amplifier circuit from causing high frequency oscillations.

Changes in the plate voltage supply at terminal 22 results in variations in the grid to cathode voltage of triode 15 which appears on the grid of triode 13 in such a phase as to cause the plate current, and hence the stabilized current in resistor 11, to follow in direct proportion to the changes in the plate supply voltage at terminal 22.

This invention need not be limited to the details shown in the foregoing specification which are considered to be illustrative of one embodi-

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ment thereof. The scope of the invention is defined by the appended claim.

What is claimed is:

A constant current device comprising a first resistance through which the current is to be maintained constant, a first electron tube having at least a cathode, an anode, and a control grid, said first resistance constituting the plate load resistance of said first electron tube, a second resistance in the cathode circuit of said first electron tube across which is developed a variable voltage depending upon variations in the current in said first resistance, a second and third electron tubes each having at least a cathode, an anode, and a control grid, said second and third electron tubes comprising a two stage amplifier, the cathode to grid circuits of said second and third electron tubes including a common cathode resistance to provide positive voltage feedback, a voltage divider to provide a fixed voltage to the cathode-control grid circuit of said second electron tube, means to apply said variable voltage to the cathode-control grid circuit of said second electron tube, variations in said variable voltage when compared with said fixed voltage producing an error voltage in the cathode-con-

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trol grid circuit of said second electron tube, said error voltage constituting the effective signal input to said amplifier, said error voltage being dependent upon the variations in the stabilized current, and means for applying the output of said amplifier to the control grid-cathode circuit of said first electron tube to maintain the current in said first resistance constant.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,120,884	Brown	June 14, 1938
2,197,934	Koch	Apr. 23, 1940
2,274,364	Gardiner	Feb. 24, 1942
2,394,891	Bowie	Feb. 12, 1946
2,447,507	Kenyon	Aug. 24, 1948
2,464,724	Paradise et al.	Oct. 11, 1949

OTHER REFERENCES

Current Stabilizers, by Van Scoyoc et al., published in Proceedings of the I. R. E. vol. 32 No. 7 July 1944, pages 415-418 inclusive, a copy may be found in Division 26 171-312-1729.