

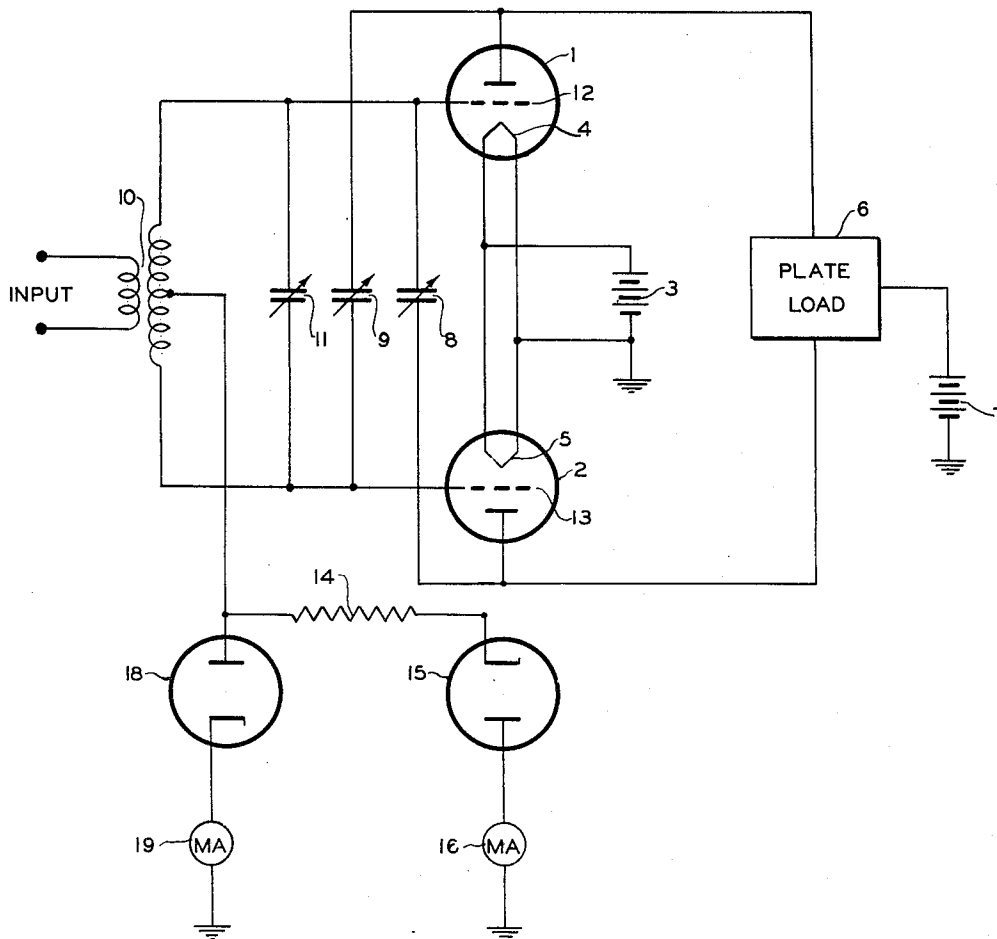
July 18, 1950

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2,515,224

PROTECTIVE DEVICE FOR VACUUM TUBES

Filed Sept. 24, 1945



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2,515,224

PROTECTIVE DEVICE FOR VACUUM TUBES

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Application September 24, 1945, Serial No. 618,388

1 Claim. (Cl. 250—27)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to protective devices for vacuum tubes and relates more particularly to apparatus adapted to protect transmitter tubes from the deleterious effects of grid emission attendant upon the use of such tubes at high operating temperatures over considerable periods of time.

In many applications it is necessary to operate vacuum tubes at relatively high temperatures, particularly in transmitters delivering large amounts of power. Although such tubes are usually liquid or air cooled, the power dissipation is so great that the tube elements must be capable of withstanding high temperatures. It has often been observed that the grids of such tubes become contaminated with the emissive oxides originally deposited upon the cathode to lower its work function. Under such conditions the grids themselves become elements which emit electrons. Since the resulting grid emission current flows in an opposite direction to the normal grid current through the grid resistor, the proper operating conditions for such tubes are upset. The grid emission current tends to make the grid more positive, a self aggravating condition which may ultimately result in serious damage to the tube.

It is, therefore, an object of the present invention to provide protective apparatus for vacuum tubes.

It is a further object of the present invention to provide means whereby the operating bias of a transmitter tube is maintained at a proper value.

It is another object of the present invention to provide means for curing vacuum tubes having grids which have become emissive elements.

These and other objects and advantages of the present invention are attained by the use of diodes or other unidirectional current elements placed in the grid circuits of the tube. A better understanding of the invention, however, may be obtained from the following description of a preferred embodiment of the invention, read in connection with the accompanying drawing in which the preferred embodiment is shown applied to a conventional radio frequency power amplifier.

Referring now to the drawing, a push-pull radio frequency power amplifier stage is shown, comprising essentially the two triodes 1 and 2 which

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are to be protected. A suitable source 3 provides the necessary energy to produce thermionic emission from the two filaments 4 and 5. The plate load 6 and the voltage supply 7 form the plate circuit for the triodes 1 and 2. Cross neutralization is provided in the convention manner by capacitors 8 and 9.

The grid circuit includes an input transformer 10 and a tuning capacitor 11. The secondary of transformer 10 is center tapped, and the ground return for normal grid current through the grids 12 and 13 is made through a bias resistor 14, a diode 15 and a milliammeter 16, the ground side of the circuit being connected to the plate of diode 15 as shown. The plate of a second diode 18 is connected to the grid side of resistor 14, and its cathode is connected through a milliammeter 19 to ground.

Under normal operating conditions, the electron flow in the grid circuits of triodes 1 and 2 is through resistor 14, diode 15 and milliammeter 16 to ground. No normal grid current will pass through the diode 18 since it is conductive only to current flow in a direction opposite to the direction of the normal grid current. The resulting voltage developed across resistor 14 provides the proper operating bias for the grids 12 and 13.

If the grids 12, 13 should become contaminated with emissive material from the cathodes and begin to emit electrons, the emission current, which heretofore would pass through the resistor 14 in a direction opposite to the normal grid current and thereby decrease the negative bias on grids 12 and 13, will be diverted over the low impedance unidirectional path provided by diode 18. This grid emissive current thus bypasses the resistor 14 and does not effect the operating characteristics of the triodes 1 and 2.

The diode 15 is included as an assurance that the impedance of the path for grid emission current through the resistor 14 and the diode 15 is high as compared to the impedance through the diode 18. In applications where the resistor 14 is normally of a high value the diode 15 may be omitted from the circuit. The milliammeters 16 and 19 are included to enable the operator to observe the normal grid current and any emissive current that may develop.

Not only does the invention protect tubes from failure due to grid emission, but it has also been found that the invention has a curative effect upon tubes which have developed emissive grids.

There has thus been disclosed a device whereby an electron discharge device may be protected

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from the effects of a grid emission current. It will be obvious that many modifications and changes are possible and within the spirit of the invention. The invention, therefore, is fully defined in the appended claim.

I claim:

In a circuit including an electron discharge device having at least a control grid and a cathode and a grid bias resistor between said grid and said cathode, means to eliminate grid emission current effects comprising a first unidirectional current element conductive to normal grid currents in series with said grid bias resistor, and a second unidirectional current element in parallel with said series combination, said second unidirectional current element being conductive to grid emission current, whereby grid emission currents will completely bypass said grid bias resistor and an operative bias will be maintained on said grid.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

	Number	Name	Date
5	1,426,826	Egerton -----	Aug. 22, 1922
	1,857,128	Acheson -----	May 10, 1932
	2,066,943	Philpott -----	Jan. 5, 1937
10	2,113,011	White -----	Apr. 5, 1938
	2,114,828	Bedford -----	Apr. 19, 1938
	2,144,995	Pulvermacher -----	Jan. 24, 1939
	2,153,172	Buschbeck -----	Apr. 4, 1939
	2,228,367	Sanders -----	Jan. 14, 1941
15	2,364,687	Banker -----	Dec. 12, 1944
	2,392,416	Sorensen -----	Jan. 8, 1946

OTHER REFERENCES

Terman, Radio Engineering, 1937 ed., pp. 355-6.

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