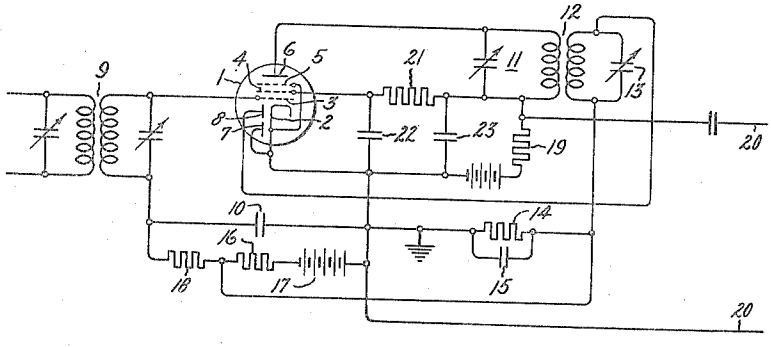
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ELECTRON DISCHARGE CIRCUIT

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ELECTRON DISCHARGE CIRCUIT

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2 Claims. (Cl. 179—171)

My invention relates to electron discharge circuits, and more particularly to circuits including electron discharge devices of the screen grid type. Its principal utility lies in circuits arranged for amplification of both low and high frequency currents, as for example, circuits employing the reflex principle, and especially such circuits which employ automatic volume control means.

One of its objects is to provide certain improvements in such circuits particularly with reference to means for regulating the screen grid operating potential.

In electron discharge circuits arranged for amplification of both radio frequency and audio frequency currents, where the grid bias on the amplifier is automatically controlled by the intensity of the amplified radio frequency currents, certain problems arise with respect to the application of the screen grid and anode operating potentials. Variations in intensity of amplified currents of course cause considerable variations in unidirection current flowing in the anode circuit of the discharge device and hence cause considerable variations in the anode potential. One of the objects of my invention is to provide means for reducing the distortion likely to result from such variations of potential.

Another object of my invention is to provide means in such circuits whereby the screen grid potential is automatically regulated in accordance with the magnitude of the anode current, and is maintained at a suitable value for all values of anode potential, thereby to reduce distortion likely to result from an improper relation between the screen grid and anode potentials.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which the single figure represents an embodiment of my invention.

Referring to the drawing I have illustrated therein an electron discharge device 1 having a cathode 2, a control grid 3, a screen grid 4, a suppressor grid 5 and an anode 6, the suppressor grid 5 being connected directly to the cathode 2 of the discharge device. This discharge device also has a pair of anodes 7 and 8 which are positioned to receive electrons from the cathode 2. As shown in the drawing however, the anode 7 is connected directly to the cathode.

Radio frequency currents to be amplified by the discharge device are supplied thereto by means of the transformer 9 the secondary of which is connected between the control grid 3 and the cathode 2, through a condenser 10. The amplified radio frequency currents appear in the tuned circuit 11, which is connected in the circuit of anode 6 of the discharge device, and are supplied through coupling transformer 12 to the anode 8 of the discharge device. The circuit of this anode 8 includes the secondary winding of transformer 12, which is tuned to the carrier frequency by means of a condenser 13, and resistance 14, the latter of which is shunted by a condenser 15. This circuit is the usual diode detector circuit for rectifying the amplified radio frequency carrier wave and for producing upon the resistance 14 and condenser 15, audio frequency potentials which are also to be amplified by discharge device 1.

Resistance 14 is connected in shunt with an additional path comprising resistance 16 and source of potential 17. Of course, calculations of the time constant for proper reproduction of audio frequency currents must take into consideration the effect of resistance 14 in shunt with the resistance 16 and condenser 15. The source of unidirectional potential 17 is connected through resistances 15 and 18 between the cathode 2 and control grid 3 of the discharge device. This source is also connected through resistance 16 and the secondary winding of transformer 12 to the anode 8 of the discharge device and operates to bias the anode 8 negative normally with respect to the cathode, thereby preventing any detection of the received carrier wave until the carrier is of more than a predetermined amplitude. When the received carrier wave exceeds such predetermined amplitude it is of course rectified by the diode 8 and a unidirectional potential appears upon resistances 14 and 16 in parallel due to this rectification, and this unidirectional potential is supplied through resistance 18 to the grid of the discharge device. It of course varies in amplitude in accordance with the average intensity of the carrier and thus automatically controls the amplification of the discharge device, the potential on control grid 3 being driven more negative as the currents to be amplified increase in intensity.

Audio frequency potentials which appear upon resistances 14 and 16 are likewise supplied through resistance 18 to the grid of the discharge device where they are amplified and the amplified potentials appear upon resistance 19 in the

anode circuit of the discharge device. These potentials may of course be supplied through conductors 20 to any suitable output apparatus, such as a power amplifier or a loud speaker.

Since the unidirectional potential across resistances 14 and 16 is supplied to the control grid of the discharge device and since this potential varies in accordance with the variations in intensity of the received carrier wave, it will be observed that the anode current of the discharge device varies widely in accordance with variations in the current supplied thereto for amplification. This is true particularly when the system is used in radio receivers, for example, in which the variations in intensity of the radio frequency currents to be amplified varies over a wide range due to fading and the like. Accordingly means must be provided to maintain a proper relationship between the anode potential and the screen grid potential of the discharge device or distortion is likely to result. In accordance with my invention, this is effected by connecting the sccreen grid through resistance 21 to the end of resistance 19 nearer the anode and by inclusion of condenser 22 substantially to prevent audio frequency potentials which appear on resistance 19 from being impressed upon the screen grid 4. Condenser 23 serves as a radio frequency by-pass condenser. Resistance 21 thus serves the dual function of maintaining the screen grid potential at a potential lower than the anode potential, irrespective of the magnitude of the anode potential, and at the same time it operates in conjunction with condenser 22 to filter out the audio frequency electromotive forces and prevent their application to the screen grid 4.

I have found that this method of application of the screen grid potential to the discharge device is far superior to that commonly employed in such circuits in that the system is capable of operation over a considerably wider range of received signal intensities without producing distortion. Were the screen grid potential maintained fixed, for example, it would be necessary to apply a potential thereto which is too high for the condition when the anode potential is low, as during reception of weak signals, and which is too low when the anode potential is high, as during reception of strong signals. This compromise, however, results in distortion upon both extremes of variation of the received signal intensity, the anode potential, at one time, being too high with respect to the screen grid potential, and at another time the anode potential being too low, or even below, the screen grid potential. In accordance with my invention, as above described, the screen grid potential is always maintained below the anode potential and in proper relation thereto.

While I have shown a particular embodiment of my invention, it will of course, be understood that I do not wish to be limited thereto since many modifications both in the circuit arrangement and in the instrumentalities employed may be made and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, an electron discharge amplifier having a control grid, a screen grid and an anode circuit, means to supply to said discharge device both high frequency currents and low frequency currents to be amplified thereby, output circuits for said high and low frequency currents coupled to said anode circuit, said low frequency output circuit being coupled to said anode circuit by a resistance, means to supply operating potential to said screen grid through said resistance, and means to supply unidirectional bias potential to said control grid varying in magnitude in accordance with the intensity of currents in said high frequency output circuit.

2. In combination, an electron discharge amplifier having a control grid, a screen grid, and an anode circuit, means to supply to said discharge device both high frequency currents and low frequency currents to be amplified thereby, said anode circuit including both high frequency and low frequency output coupling means, means to supply biasing potential to said control grid having magnitude varying in intensity in accordance with the intensity of current in said high frequency coupling means, means to supply operating potential to said anode and screen grid through said low frequency coupling means, and means substantially to prevent low frequency potentials from appearing on said screen grid.

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