

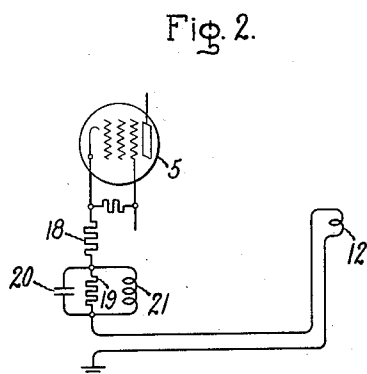
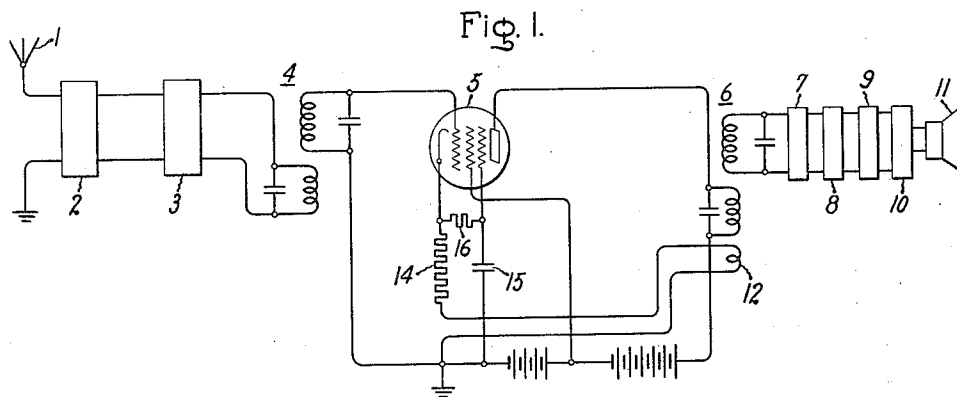
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APPARATUS FOR CONTROLLING THE APPARENT RESISTANCE OF AMPLIFIER ANODES

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APPARATUS FOR CONTROLLING THE APPARENT RESISTANCE OF AMPLIFIER ANODES

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Original application January 30, 1937, Serial No. 123,213. Divided and this application February 2, 1940, Serial No. 316,953

1 Claim. (Cl. 179—171)

My invention relates to amplifier circuits which include an electron discharge amplifier. In certain uses of such amplifier circuits it is desirable that the anode of the amplifier have a resistance which is materially different from its natural resistance; for example, in a radio receiver having an audio amplifier feeding a loud-speaker it is desirable that the resistance of the amplifier anode be low in order to provide the proper damping for the loud-speaker. In other cases it is desirable that the anode resistance shall be high, for example, in tuned high gain amplifiers where a low anode resistance is undesirable because it decreases the gain and the selectivity. Amplifiers with anodes having the desired low and high resistances are difficult and expensive to construct if, indeed, they can be produced.

It is the object of my present invention to provide improved apparatus which is connected with the amplifier circuit for causing the amplifier anode, while the circuit is in use, to have an apparent resistance which is greater than its actual resistance, my present application being a division of my copending application Serial No. 123,213, filed January 30, 1937, now Patent No. 2,220,770, November 5, 1940, for Apparatus for controlling apparent resistance of an amplifier anode.

In accordance with my invention I cause the amplifier anode to have an apparent high resistance by providing circuit apparatus which functions to supply feed-back voltages from the output circuit of the amplifier to the input circuit thereof, the value of one voltage being controlled by the output current and the value of the other voltage being controlled by the output voltage. To give the amplifier anode a high apparent resistance I make the current-controlled feed-back voltage degenerative and the voltage-controlled feed-back voltage regenerative.

Referring to the drawing, Fig. 1 is a circuit diagram illustrating an embodiment of my invention and Fig. 2 shows a modified detail thereof. In Fig. 1, where I have chosen to show my invention as forming a part of a radio receiving system of well known form, 1 is the receiving antenna; 2 is the radio frequency amplifier stage; 3 is the converter stage; 4 is the intermediate frequency transformer connecting the stage 3 with the amplifier 5; 6 is the intermediate frequency transformer in the output circuit of the amplifier 5; 7 is the second intermediate frequency amplifier stage; 8 is the second detector stage; 9 is the first audio amplifier stage; 10 is the second audio amplifier stage; and 11 is the

loud-speaker. The transformer 6 is provided with the auxiliary or tertiary winding 12 which is wound in the same direction as, coaxially with, and close to the primary winding of this transformer. Winding 12 connects in series with the cathode resistor 14 between ground and the cathode of the amplifier 5. The suppressor grid connects with the ground through the by-pass capacitor 15 and with the cathode through the high resistor 16. By this means a degenerative voltage, which is the voltage drop across the resistor 14, is supplied to the input circuit of the amplifier 5 which voltage is proportional to the current in the output circuit of the amplifier. Also, a regenerative voltage is induced in the winding 12 and which is proportional to the alternating voltage applied to the primary of the transformer 6. The anode of the amplifier therefore is caused to have an apparent high resistance as it is seen from the load by supplying to the input circuit of the amplifier a degenerative feed-back voltage which is proportional to the current in the output circuit of the amplifier and a regenerative voltage which is proportional to the voltage of the output circuit thereof.

In certain cases it may be desirable to reduce the amount of direct current cathode bias produced by the resistor 14. This may be done in the manner shown by Fig. 2 where the resistor is replaced by two separate resistors 18 and 19 and the latter is connected across a resonant circuit comprising the capacitor 20 and the reactor 21. This circuit being resonant at signal frequency offers a high impedance to the signal frequency in the cathode circuit but the reactor element 21 thereof readily passes direct current.

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

In combination with an amplifier circuit including an electron discharge amplifier having an anode in the output circuit thereof, apparatus for causing said anode to have a higher apparent resistance comprising a resistor in that part of the cathode circuit which is common to the input and the output circuits of the amplifier whereby a degenerative voltage responsive to the current in said output circuit is applied to said input circuit, a load circuit and a transformer having a primary winding in said output circuit, a secondary winding connected to supply said load circuit and a tertiary winding in said common part of the cathode circuit in series with said resistor whereby a regenerative voltage is applied to said input circuit responsive to the voltage across the output circuit.

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