Oct. 15, 1935. W. WEHNERT 2,017,112

AMPLIFIER

Filed Aug. 6, 1931

Fig. 1

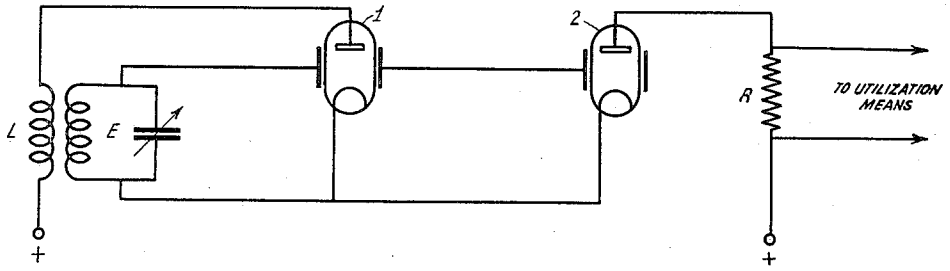


Fig. 2

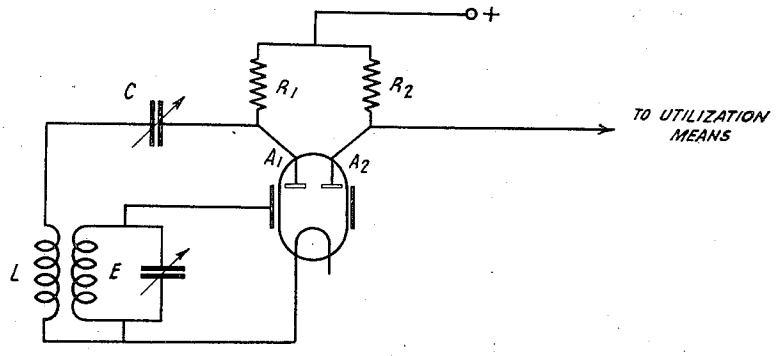
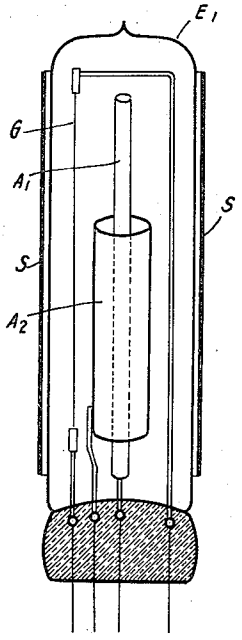


Fig. 3



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2,017,112

AMPLIFIER

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9 Claims. (Cl. 179—171)

The present invention relates to arrangements comprising resistance coupled, external control electrode tubes.

In resistance coupled circuit schemes the two chief objects are optimum regeneration, and optimum amplification of the modulated radio frequency waves. These two objects are incompatible, or militate against each other, inasmuch as good back-feed is predicated upon a maximum of slope of the plate current characteristic of the tubes, a requirement that militates against the desirability of insuring high audio amplification with the use of high ohm resistances. Hence, a compromise has heretofore been sought in that maximum gain was often abandoned to a point where just satisfactory regeneration could be obtained.

According to this invention independent tubes are employed for regeneration and amplification, whereby these tubes may be designed, and adapted respectively, to insure optimum conditions in their uses and purposes looked at from the viewpoint of slope and conductance.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically several circuit arrangements whereby my invention may be carried into effect, Fig. 1 illustrating the circuit diagram embodying my invention, Fig. 2 illustrating a modification of the diagram illustrated in Fig. 1, and Fig. 3 illustrating details of a vacuum tube particularly suited for circuit arrangements embodying my invention.

Fig. 1 shows two external control electrode amplifier tubes 1 and 2 which, for instance, for the object of suppressing troublesome noise in the case of supply line heating may be filled with a gas atmosphere. The cathodes, as well as the control electrodes thereof are united with one and the same tunable input oscillation circuit E, whereas the anodes are connected with circuit elements independent of each other.

For example, the anode circuit of tube 2 is connected with the rest of the cascade through a coupling resistance R, whereas the anode circuit of tube 1 is connected through a feedback coupling coil L with the positive pole of the anode potential source. However, it is also feasible to provide in the anode circuit of the tube 1 a suitably proportioned resistance whence energy for back-feed is derived in a convenient manner.

For some purposes it has proved advantageous to use tubes containing two discharge systems in cooperation with a hot filament, and a control electrode, as diagrammatically illustrated in Fig. 2. In this arrangement, E is the input circuit, L the back-feed, or tickler, coil to which energy is supplied from the anode A_1 through a variable condenser C. The anode circuit of electrode A_1 contains a high ohm resistance R_1, while a resistance R_2 contained in the circuit of anode A_2 serves for establishing coupling relations with the rest of the amplifier cascade. It has proved advantageous to give the system serving for rectification and audio amplification an anode conductance of less than five per cent, and to make the anode conductance of the other system more than five per cent. This latter system most suitably has a slope of over 0.1 milliamperes per V.

A tube particularly suited for circuit schemes of this kind is illustrated in its constructional details in Fig. 3, where A_1, A_2 are the anodes, and G the cathode. This tube is of the external control electrode type having a flattened cross-sectional shape. The two anodes A_1 and A_2 being electrically separated present dissimilar distances from the heated cathode, and as a result, also, the control electrode S surrounding the discharge vessel E_1 on the outside produces a conductance of different value upon the discharge systems.

While I have indicated and described several systems for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organizations shown and described, but that many modifications may be made without departing from the scope of my invention as set forth in the appended claims.

What I claim is:

1. In a high frequency system, a space discharge device including a cathode, an external control electrode, and two anodes arranged so that the conductance of the two anode-cathode paths are different, a high frequency input circuit connected between said control electrode and said cathode, an impedance connected to one of said anodes for coupling it to a load circuit, and a high frequency path connecting the other anode to said cathode.

2. In a high frequency system, a space discharge device including a cathode, a control electrode surrounding the tube, and two anodes arranged so that the conductance of the two anode-cathode paths are different, a high frequency input circuit connected between said control electrode and said cathode, an impedance

connected to one of said anodes for coupling it to a load circuit, and a high frequency path connecting the other anode to said cathode.

3. In a high frequency system, a space discharge device including a cathode, an external control electrode, and two anodes arranged so that the conductance of the two anode-cathode paths are different, a tunable high frequency input circuit connected between said control electrode and said cathode, an ohmic impedance connected to one of said anodes for coupling it to a load circuit, and a high frequency path connecting the other anode to said cathode.

4. In a high frequency system, a space discharge device including a cathode, an external control electrode, and two anodes arranged so that the conductance of the two anode-cathode paths are different, a high frequency input circuit connected between said control electrode and said cathode, an impedance connected to one of said anodes for coupling it to a load circuit, and a high frequency path coupled to said input circuit connecting the other anode to said cathode.

5. In a high frequency system, a space discharge device including a cathode, an external control electrode, and two anodes, said anodes being positioned so that said cathode is nearer one of said anodes than the other, a high frequency input circuit connected between said control electrode and said cathode, an impedance connected to one of said anodes for coupling it to a load circuit, and a high frequency path including a variable reactance element connecting the other anode to said cathode.

6. In combination, a space discharge device including a cathode, a cold electrode external to said device, an alternating current circuit connected between the cathode and cold electrode, a pair of auxiliary cold electrodes disposed within said device, said auxiliary cold electrodes being positioned so that said cathode is nearer one of said auxiliary cold electrodes than the other, a high frequency circuit connected between one of said auxiliary electrodes and said cathode, and an impedance connected to the other auxiliary electrode for coupling it to a load circuit.

7. In combination, a space discharge device including a cathode, a cold electrode surrounding said device, an alternating current circuit connected between the cathode and cold electrode, a pair of auxiliary cold electrodes disposed within said device, said auxiliary cold electrodes being positioned so that said cathode is nearer one of said auxiliary cold electrodes than the other, a high frequency circuit connected between one of said auxiliary electrodes and said cathode, and an impedance connected to the other auxiliary electrode for coupling it to a load circuit.

8. In combination, a space discharge device including a cathode, a cold electrode external to said device, an alternating current input circuit connected between the cathode and cold electrode, a pair of auxiliary cold electrodes disposed within said device, said auxiliary cold electrodes being positioned so that said cathode is nearer one of said auxiliary cold electrodes than the other, a high frequency regeneration circuit connected between one of said auxiliary electrodes and said cathode, and an impedance connected to the other auxiliary electrode for coupling it to a load circuit.

9. A wave repeating system comprising a space discharge device, means in said space discharge device providing a plurality of electron paths of different conductance, an external control electrode for said space discharge device for controlling at least one of said electron paths, an input circuit for the wave repeating system connected to energize said control electrode to vary the instantaneous potential thereof, an external circuit connected to be completed in said space discharge device through one of said electron paths, an impedance in said external circuit for coupling said circuit to a load circuit, and means comprising a high frequency path connected external of said space discharge device and completed through another of said electron paths.

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