H. C. EGERTON.

ELECTRON DISCHARGE DEVICE CIRCUITS.

APPLICATION FILED JULY 19, 1917.

1,426,826. Patented Aug. 22, 1922.

Fig. 1.

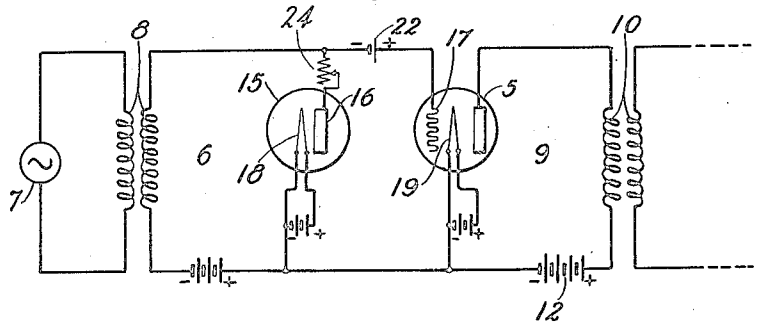


Fig. 2.

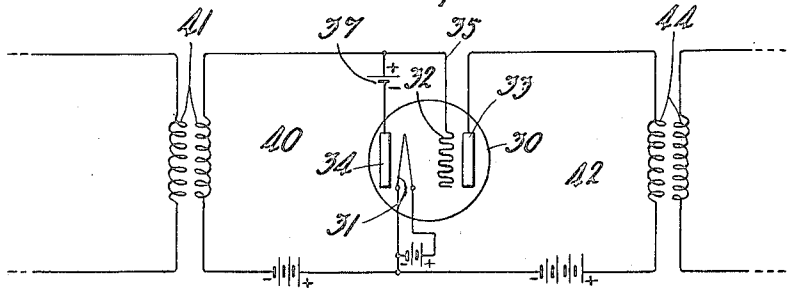
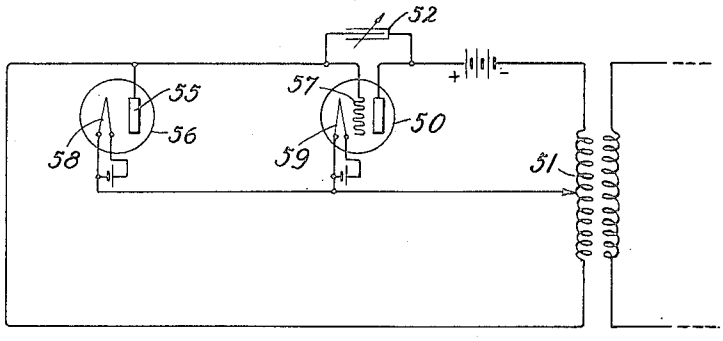


Fig. 3.



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UNITED STATES PATENT OFFICE.

HENRY C. EGERTON, OF PASSAIC, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRON-DISCHARGE-DEVICE CIRCUITS.

1,426,826. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed July 19, 1917. Serial No. 181,645.

To all whom it may concern:

Be it known that I, HENRY C. EGERTON, a citizen of the United States, residing at Passaic, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Electron-Discharge-Device Circuits, of which the following is a full, clear, concise, and exact description.

This invention relates to circuits for electron discharge devices and pertains more especially to audion circuits. Its object is to improve the operation of vacuum tubes, such as the audion.

The principal parts of an audion structure are a heated filament or other source of electrons, an anode and an electrode, preferably located intermediate the filament and the anode, said electrode being usually called the grid. These are preferably enclosed in an evacuated glass vessel. The main characteristic feature of the audion is that the amount of the space current flowing between the filament and the anode is dependent upon the potential of the grid electrode. An audion, accordingly, repeats with amplification, alternating currents that are impressed upon its input circuit.

It has been found, however, that, when the grid is made considerably more positive than the filament, the tube operates less efficiently and an excessive positive charge may even cause the tube to "blue-haze" or to be destroyed. This is due to the fact that the grid, on becoming appreciably more positive than the filament, tends to become even more so through secondary electron emission by the grid, said secondary electron emission being caused by the bombardment of the grid by electrons. However, even if the grid does not acquire a charge sufficient to injure the vessel, the charge may hinder the action of the tube in the case of a repeater or amplifier by starting free oscillations in the tube circuits. Such free oscillations would also be undesirable where the tube was employed as an oscillation generator, for generating oscillations of a particular type.

In order to overcome these difficulties, it is proposed to afford a leakage path to the filament for the positive charge on the grid by connecting a unilateral impedance between these two electrodes in such manner as to allow current to flow from the grid to the filament, but not in the opposite direction. This invention will be better understood by reference to the following description, taken in connection with the accompanying drawings, in which Fig. 1 represents one embodiment of this invention; Fig. 2 shows how the internal structure of an audion may be modified to conform with the purpose of this invention; and Fig. 3 illustrates the invention in connection with an oscillation generator.

In Fig. 1, 5 represents a vacuum tube of the audion type having its input circuit 6 connected to the source of oscillations 7 by the transformer 8 and having its output circuit 9 connected by the transformer 10 to a suitable outgoing line or consumption circuit. 12 is a source of current for the output circuit 9. With such an arrangement the transformer 10 will impress upon the outgoing line amplified oscillations of the form impressed on the input circuit 6 from the source 7.

In order to prevent the grid from becoming a secondary source of electrons, an evacuated vessel 15 is shown having its electrode 16 connected to the grid 17 and its filament 18 connected to the filament 19. As is well known in the art, such a vessel will allow current to flow in one direction only, that is, from the electrode 16 to the filament 18. The tube should preferably be one of small impedance so that it affords a path of low resistance for the positive charges on the grid. With such an arrangement, the grid 17 cannot become excessively positive with respect to the filament 19, since the charge will leak off through the tube 15. The potential at which this leakage takes place may be regulated, if desired, by inserting a battery 22 of the proper value and polarity between the anode 16 and the grid 17, and herein shown to have its positive terminal connected to the grid, but the inclusion of such a battery is not essential to the successful operation of the invention, and it may be omitted if desired. A variable resistance 24 may also be inserted in series with the tube 15 to determine the rate at which the leakage takes place.

Fig. 2 ilustrates how an audion of the well known type may be modified to function both as a low impedance tube and as a repeater connected between suitable incoming and outgoing lines. The evacuated

vessel 30 contains a filament 31, a grid 32, and an anode 33, as in a repeater of the audion type, but in addition thereto is provided a fourth electrode 34, connected to the grid 32 by the wire 35 and placed in the tube at the proper distance from the filament 31, that there may be the desired impedance between the plate 34 and the filament 31 to afford a leakage path for the positive charges on the grid. A battery 37 is shown inserted between the fourth electrode 34 and the grid 32, the value of which determines at what potential of the incoming waves current flow will take place between the fourth electrode 34 and the filament. With such an arrangement the oscillations impressed on the input circuit 40 from the incoming line by the transformer 41 will not be distorted by any free oscillations of the tube 30, and may be impressed upon a suitable outgoing line by transformer 44. Furthermore, this arrangement is in the nature of a safety valve for the repeater and prevents an accumulation on the grid of the repeater of a positive charge large enough to set up secondary emission. As soon as the positive charge on the grid of the repeater tends to exceed a safe amount, the excess leaks off through the asymmetrical impedance to the cathode.

Referring to Fig. 3, the evacuated vessel 50 taken in connection with inductance 51 and capacity 52 constitutes a generator of oscillations. In order to prevent the grid from becoming sufficiently positive to cause the tube to "blue haze" or generate oscillations of an undesirable complexity, the electrode 55 of the unilateral device 56 is connected to the grid 57 and the filament 58 to the filament 59. By choosing the proper value of its impedance, the device 56, on account of its unilateral conductivity, will prevent the grid 57 from becoming excessively positive with respect to the filament 59, thereby increasing to a considerable degree the pureness of the oscillations generated by the tube 50.

Although this invention has been described herein in connection with an amplifier and an oscillation generator, it is evident that the invention may be employed in connection with vacuum tubes serving as detectors, or for other uses known in the art.

What is claimed is:

1. An electric system comprising an evacuated vessel having an anode, a cathode, and an auxiliary electrode, and a leakage path for positive charges from said auxiliary electrode comprising a unilateral impedance connected between said auxiliary electrode and said cathode.

2. An electron discharge device comprising two electrodes, means for establishing an electron current between said electrodes, a third electrode for controlling the flow of said current, and an asymmetric-impedance leakage path for said control electrode, said path being traversed by current which varies in intensity according to the value of the impulses to be transmitted.

3. The combination with separated electric circuit terminals, of means for causing passage of electricity across the gap between the terminals, auxiliary means for impressing a charge upon one of said terminals, and means for preventing an accumulation of charge of one kind upon said terminal while permitting an accumulation of charge of another kind thereon.

4. An electric system comprising an evacuated vessel having an anode, a cathode and an auxiliary electrode, and a second evacuated vessel having an anode and a cathode, the anode and cathode of said second vessel being connected respectively to the auxiliary electrode and the cathode of said first vessel to provide a leakage path for positive charges from said auxiliary electrode.

5. An electric system comprising an evacuated vessel having an anode, a cathode and an auxiliary electrode, a second evacuated vessel having an anode and a cathode, the anode and cathode of said second vessel being connected respectively to the auxiliary electrode and cathode of said first vessel, a source of oscillations, means for impressing said oscillations upon said auxiliary electrode, and a source of voltage for controlling at what potential of said oscillations current will begin flowing through said second vessel.

6. A vacuum tube repeater comprising a container, a cathode, an anode and a control electrode within said container, means to supply space current between said anode and cathode, an input circuit between said grid and cathode, an output circuit between said anode and cathode and an asymmetrical leakage path between two of said electrodes, said path being traversed by current which varies in intensity depending upon the value of the impulses to the transmitted.

7. An electric system comprising a thermionic amplifier having a cathode, an anode and a grid, an incoming line connected to the input terminals of said amplifier, and an asymmetrical leakage path for positive charges shunted across said line at a point prior to its connection with the input terminals.

8. The combination with separated electric circuit terminals of means for causing passage of electricity across the gap between the terminals, auxiliary means for impressing a charge upon one of said terminals, and means for preventing an accumulation of charge of one kind upon said

terminal while permitting an accumulation of charge of another kind thereon, said means comprising an evacuated vessel having a cathode and an anode connected to certain of said terminals.

9. The combination with separated electric circuit terminals of means for causing passage of electricity across the gap between certain of the terminals, auxiliary means for impressing a charge upon another of said terminals, and means for preventing an accumulation of a positive charge upon said terminal while permitting an accumulation of negative charge thereon.

10. The combination with separated electric circuit terminals of means for causing passage of electricity across the gap between certain of said terminals, auxiliary means for impressing a charge upon another of said terminals, and means for preventing an accumulation of a positive charge upon said last-named terminal while permitting an accumulation of a negative charge thereon, said means comprising an evacuated vessel having a cathode and an anode interposed between said last-mentioned terminal and one of the other terminals.

11. The combination with a vacuum tube having a cathode, an anode and control electrodes, of means for causing passage of electricity across the gap between the anode and cathode, auxiliary means for impressing a charge upon the control electrode, and means for preventing an accumulation of a positive charge upon said control electrode while permitting an accumulation of a negative charge thereon, said means comprising a two-electrode vacuum tube interposed between said control electrode and said cathode.

In witness whereof, I hereunto subscribe my name this 13th day of July A. D., 1917.

HENRY C. EGERTON.