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AMPLIFIER CIRCUITS

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Fig. 1.

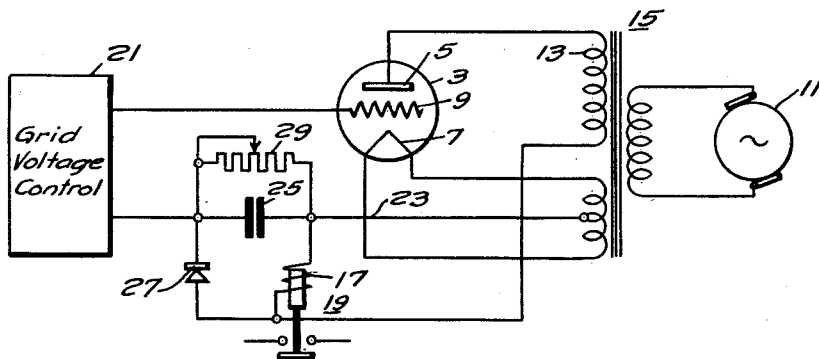
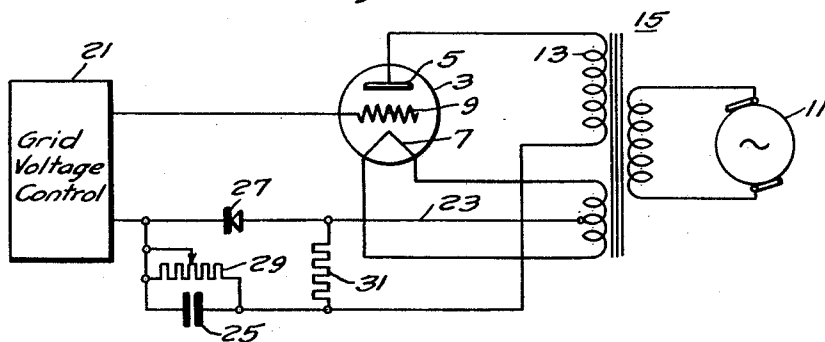


Fig. 2.



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AMPLIFIER CIRCUIT

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5 Claims. (Cl. 250-27)

My invention relates to electric discharge apparatus and has particular relation to highly sensitive amplifying systems.

In accordance with the teachings of the prior art of which I am aware, the sensitivity of the amplifier is increased by impressing in its grid-cathode circuit a boosting potential derived from an impedance in the anode-cathode circuit. The impedance is connected directly to the anode conductor and for this reason, a transformer must necessarily be interposed between the impedance and the control circuit. The transformer not only adds to the cost of the equipment but it increases its complexity and introduces servicing and maintenance problems.

It is an object of my invention to provide a highly sensitive amplifying system of simple structure.

Another object of my invention is to provide an amplifying system of simple structure with which a prolonged response to an exciting impulse of short duration shall be obtainable.

More specifically stated, it is an object of my invention to provide a highly sensitive relay that shall respond to an impulse of short duration.

In accordance with my invention, the impedance from which the boosting potential is derived is connected in the conductor extending from the principal electrode of the discharge valve which is in the control circuit. Since this electrode need not be insulated from the control electrode the interconnection between the impedance and the control circuit is not through a transformer but directly by metallic conduction. According to the preferred practice of my invention, the boosting potential is derived from the load per se and thus the apparatus is simplified. Of course, in its broader aspects, my invention may be practiced with the boosting potential derived from a separate impedance.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention, itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing in which:

Figure 1 is a diagrammatic view showing a preferred embodiment of my invention, and

Fig. 2 is a diagrammatic view showing a modification of my invention.

The apparatus shown in Figure 1 comprises an electric discharge valve 3 having an anode 5, a

cathode 7, and a control electrode 9. The valve 3 may be of the arc-like or high-vacuum type and while its cathode 7 is usually a heated filament, my invention may be practiced with a discharge device in which the cathode is a pool or a plate.

The discharge valve 3 is energized from an alternating current source 11 which may be of the usual commercial 60-cycle type through a secondary section 13 of a suitable transformer 15. The anode 5 is connected directly to one terminal of the section and the cathode 7 is connected to the other terminal through the exciting coil 17 of a relay 19 which constitutes the load supplied. To control the valve, any suitable system 21 such as a photo-electric cell or contacts of any general type may be provided. The control system 21 is interposed between the control electrode and the cathode.

In the conductor 23 from the control system 21 to the cathode 7, a capacitor 25 is interposed. A rectifier 27 is directly connected between the terminal of the relay coil 17 that is remote from its junction with the cathode 7 and the terminal of the capacitor 25 that is remote from its junction with the cathode. The rectifier conducts positive charges in the direction indicated by the arrow head.

The discharge valve 3 may be assumed to be originally non-conductive and the relay 19 de-energized. When a small impulse is impressed from the control system 21 during half-periods of the source 11 during which the anode-cathode potential is positive, current flows between the anode 5 and the cathode 7 of the discharge valve and through the relay coil 17. Since the coil is inductive, a back potential appears across its terminals during the negative half-periods of the source. The latter potential is in a direction such that current is conducted through the rectifier 27 and the capacitor 25 is charged to a higher potential during each negative half-period. The potential between the plates of the capacitor which is produced by the charge is of such polarity as to increase the conductivity of the valve 3. The conductivity continues to increase as the capacitor is charged and the capacitor is charged to a higher and higher potential as the conductivity increases because the charging potential is increasing. The supply of current through the valve 3 thus becomes dependent on the charging of the capacitor 25 and independent of the control system 21 after the first positive half-period. The maximum current conducted by the valve 3 when an impulse

is impressed may be predetermined by properly setting the magnitude of a resistor 29 connected in parallel with the capacitor 25 which functions to discharge the capacitor at a predetermined rate.

In Fig. 2, my invention is shown as applied in apparatus in which the load 31 or the impedance from which the boosting potential is derived is non-inductive. In this case, the rectifier 27 is interposed in the conductor 23 between the cathode 7 and the control system 21 and the capacitor 25 is directly connected between the terminals of the load 31 and rectifier 27 that are remote from the cathode terminals.

In response to a small control impulse, current is conducted between the anode 5 and the cathode 7 of the electric discharge valve 3 and through the load 31. The potential drop which exists across the load by reason of the current flow is, in such a sense, that the capacitor 25 is charged. The polarity of the capacitor potential is such as to maintain the conductivity of the valve when current flow through the load tends to decrease since in such a case it would not be counteracted by the potential drop across the load. Accordingly, in spite of the fact that the energizing control impulse is only of short duration, the valve continues to conduct indefinitely.

While there are certain advantages in the use of alternating current in the anode circuit of the valve 3 in the practice of my invention, direct current may be used under the proper circumstances. Moreover, the charging potential for the capacitor may be derived by tapping off a portion of the load rather than directly connecting the whole load across the capacitor. On occasions the control system 21 may be interposed between the anode 5 and the control electrode 9. In such a case the impedance from which the boosting potential is derived should be in the anode conductor and not in the cathode conductor. Where it is desirable that the valve 3 be normally conductive and be rendered non-conductive in response to an impulse, the rectifier polarity in the Figs. 1 and 2 circuits is reversed.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In combination an electric discharge valve having a plurality of principal electrodes and a control electrode, conductors extending from said principal electrodes to which an energizing potential is to be connected, a control circuit for said valve including said control electrode and one of said principal electrodes, said control circuit including means for impressing a control potential therein, charge storing means in said control circuit, interposed between said one principal electrode and said impressing means, inductive load means in the conductor extending from said one principal electrode and conductive means connecting the terminal of said load means remote from said one principal electrode to the terminal of said storing means remote from said one principal electrode, said conductive means including means permitting flow of current therethrough only toward said charge storing means.

2. In combination an electric discharge valve

having a plurality of principal electrodes and a control electrode, conductors extending from said principal electrodes to which an energizing potential is to be connected, a control circuit for said valve including said control electrode and one of said principal electrodes, said control circuit including means for impressing a control potential therein, charge storing means in said control circuit, interposed between said one principal electrode and said impressing means, inductive load means in the conductor extending from said one principal electrode and conductive means connecting the terminal of said load means remote from said one principal electrode to the terminal of said storing means remote from said one principal electrode, said conductive means including an asymmetric conductor offering its lower resistance to current flow toward said charge storing means, and means for discharging said storing means at a predetermined rate.

3. In combination an electric discharge valve having a plurality of principal electrodes and a control electrode, conductors extending from said principal electrodes to which an energizing potential is to be connected, a control circuit for said valve including said control electrode and one of said principal electrodes, said control circuit including means for impressing a control potential therein and asymmetric conductive means interposed between said one principal electrode and said impressing means, load means in the conductor extending from said one principal electrode, charging storing means, and continuous metallic connections for connecting said storing means between a terminal of said load means that is remote from the terminal connected to said one electrode and the terminal of said asymmetric conductive means that is remote from the terminal connected to said one electrode.

4. In combination an electric discharge valve comprising an anode, a cathode and control electrode, conductors extending from said anode and cathode to which an energizing potential is to be connected, an electromagnetic device having a winding in the conductor extending from said cathode, a control circuit including said cathode and said control electrode and charge storing means connected to said cathode and conductive connections between terminals of said charge storing means and winding that are remote from those to which the cathode is connected, said connections including a rectifier permitting current flow only toward said charge storing means.

5. In combination, a source of energizing potential, an electric discharge valve having a plurality of principal electrodes in circuit with said source and a control electrode, load means connected between one of said principal electrodes and said source, a control circuit for said valve including control means for impressing a potential impulse between said control electrode and said one principal electrode to render said valve conductive, conductive means connected between one terminal of said load means and said control means permitting current flow therethrough away from said one terminal only, and a capacitor in said control circuit connected in parallel with said conductive means and load means, whereby said capacitor is charged in response to a potential appearing across said load means with a polarity tending to maintain said valve conditioned to conduct current.

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