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THERMIONIC TUBE

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Fig. 1.

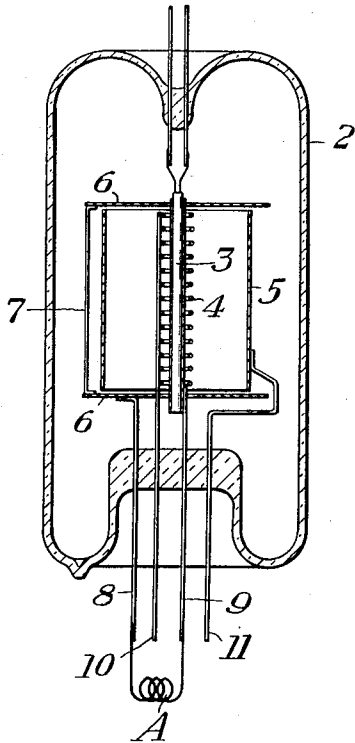


Fig. 2.

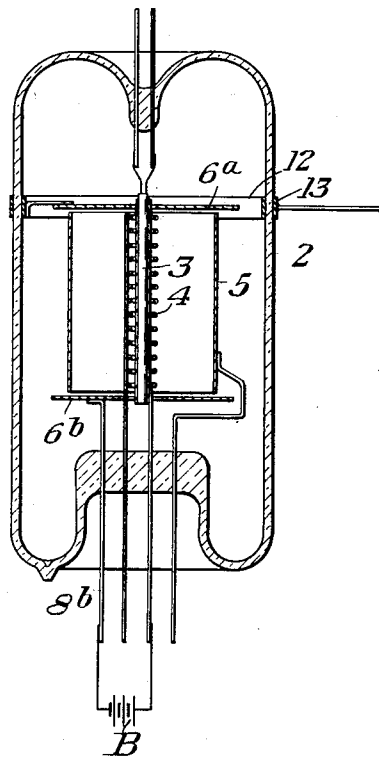


Fig. 3.

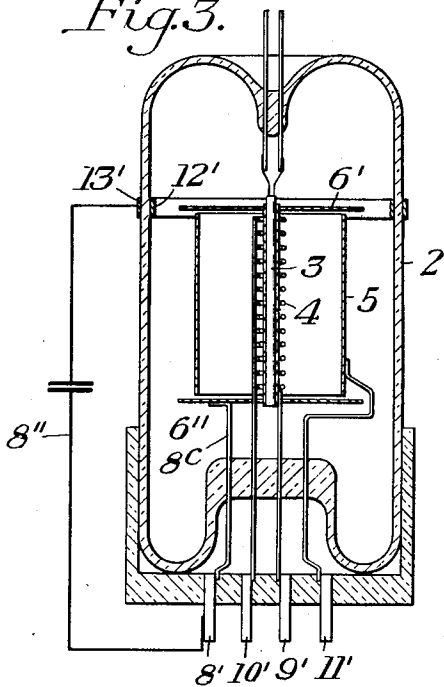
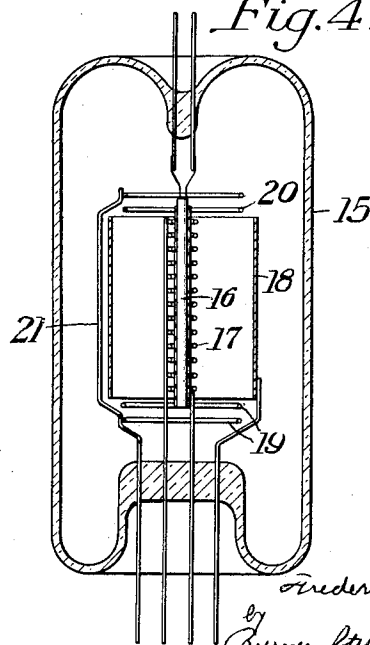


Fig. 4.



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THERMIONIC TUBE

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6 Claims. (Cl. 250—27.5)

This invention relates to thermionic tubes, and particularly to tubes for use in radio and similar circuits.

By reason of the lack of flexibility in the control of the characteristics of thermionic tubes of the usual three-element type, it is necessary to introduce into various circuits employing the same various neutralizing devices and various auxiliary devices or auxiliary circuits, according to the results which one is endeavoring to obtain and the type of circuit employed.

The present invention has for its object to provide a tube wherein there is a considerable flexibility of control and wherein the characteristics of a given tube may be widely varied.

The invention may be readily understood by reference to the accompanying drawing illustrating diagrammatically preferred embodiments of my invention.

In the drawing:

Figure 1 represents a vertical section through an electron discharge tube embodying one form of my invention.

Figure 2 is a view similar to Figure 1, showing a slightly modified form.

Figure 3 is a view similar to Figures 1 and 2, showing a still further modification.

Figure 4 is a view similar to Figure 1 showing an additional modification.

Referring to Figure 1, 2 designates an envelope of the kind generally employed in devices of this kind. Within the tube is a cathode 3 which may be of any suitable type, either of the direct heated type or the indirectly heated type. I have illustrated the cathode as being of a well known indirectly heated type, having heater wires connected thereto, which pass out of the top of the tube. Outside the cathode is a grid or control electrode 4, and outside of this is the plate or anode 5. The anode 5 is preferably in the form of a cylinder and is preferably made of a magnetic material, such as nickel. In the preferred embodiment of my invention, the grid encircles the cathode, and is relatively close thereto as compared with the distance between the cathode and the plate 5.

At one, and preferably both ends of the cylindrical anode 5, are compensating or deflector elements 6. These are preferably in the form of metal disks having a central opening sufficiently large for the cathode and grid to be passed therethrough without contacting therewith, but which is otherwise as close to the cathode as possible. These compensating elements are out

of contact with the ends of the anode or plate electrode 5, but in close proximity thereto.

In the form of the invention shown in Figure 1, the compensating elements at the opposite ends of the anode are directly connected by a conductor 7. Leading through the envelope 2 and attached to one of the two deflector plates is a lead wire 8. Lead wires 9, 10 and 11 are also provided in the usual manner for connection with the cathode, grid, and plate, respectively.

I have found that by connecting the wire 8 into various circuits in different ways, that the characteristics of the tube can be widely varied, independently or in conjunction with the potentials applied to the grid. By varying the potential on the compensating elements, or by suitably including it in various circuits, a new element of control is provided, and the characteristic curve of the tube can be shifted and changed, and the oscillations of the tube can be readily controlled.

In Figure 1, I have shown an inductance, such as a periodic transformer A connected between the wire 8 and the cathode connector 9. This arrangement is illustrative of one circuit where the inductance A to secure proper tuning of a circuit in place, for instance, of a vernier condenser. This arrangement is especially applicable to a circuit using untuned radio-frequency amplification in circuits having both tuned and untuned radio frequency amplification, such as circuits using single dial tuning.

In the form of invention shown in Figure 2, the tube is of the same general construction and for the sake of brevity I have designated the corresponding parts with corresponding reference numerals. In this form of the invention, however, I have designated the compensating member remote from the base of the tube as 6^a and have designated the compensating member nearest the base as 6^b. The members 6^a and 6^b are not connected, as are the members 6 in Figure 1. The member 6^b has a lead wire 8^b attached thereto, corresponding to the wire 8 of Figure 1, while the member 6^a is statically or inductively coupled with an external circuit. For this purpose, I have shown a capacity member 12 on the inside wall of the vessel, which is connected with the member 6^a through a wire. Outside the vessel over the inner capacity 12 is a capacity 13. Potentials impressed on the capacity 13 from any preferred source will induce a corresponding potential change in the member 12 and the compensating element 6^a with which the member 12 is connected. It will be understood that the mem-

ber 13 may be included in any circuit, together with or independent from the circuit in which the wire 8^b is connected, the circuits forming no part of the present invention. I have illustrated a battery B in this circuit for applying a potential to element 6^b.

In the arrangement shown in Figure 3, the general construction of the tube is similar to that described in Figure 1 and corresponding reference numerals have been used to designate the corresponding parts. In this view, however, the compensating plates at the ends of the anode have been designated 6' and 6'', respectively. In this view, the arrangement is generally similar to that shown in Figure 2, but I have shown the member 6' inductively connected with the member 6'' through internal and external capacity members 12' and 13' respectively, and the capacity 13' is connected with the wire 8'' that is coupled to the compensating plate 6'' through wire 8c.

It will be understood that each of the forms of tubes herein described may have a base provided thereon as is customary with devices of this kind. In Figure 3, I have shown such a base in sections. The base is of the type designed to fit standard sockets, and has four pins therein at the terminals of the several wires 8', 9', 10' and 11', respectively. In view of the fact that the tube is of the indirectly heated method type, there need be only one pin in the base leading to the cathode. Consequently, the fourth pin can connect to the wire 8c so that when the tube is fitted in a standard socket, the deflector or compensating elements can be readily included in the circuit. It will be understood that this arrangement may be duplicated in any of the forms of tubes herein illustrated.

In Figure 4, I have shown a tube 15 having a cathode 16 of the indirectly heated type, a grid 17, and a plate 18. Adjacent the ends of the plate and grid, preferably at both ends thereof, are compensating elements 19 and 20 at the bottom and top of the tube respectively. Instead of being in the form of a plate, these are in the form of a plurality of turns of wire. These turns of wire are connected in any suitable way. I have shown them connected by a wire 21 corresponding to the wire 7 of Figure 1.

The foregoing embodiments of the invention are to be considered as merely illustrative of various arrangements which may be employed within the contemplation of my invention.

The compensating elements at the opposite ends of the cylindrical anode may be separately or jointly used to control the characteristics and operation of the tube, and by means of these deflector or compensating elements, very fine increments of control can be obtained and characteristics of the tube varied within a very wide range. Not only do the compensating elements serve to provide an adjustable means for governing the action of the tube, but they effectively enclose the ends of the space within the cylindrical anode to confine the electron flow within this space and confine the stray discharge through the ends of the anode.

The invention is especially applicable to radio circuits wherein the action of the tube must be accurately controlled, and can be used to advance

tage in certain types of power tubes, particularly those used in power and amplification circuits, where the signal distortion due to undesirable oscillation must be most effectively eliminated.

While I have illustrated some embodiments of my invention, various changes may be made in the construction and arrangement of parts and in the disposition of the elements within the spirit of my invention and under the scope of the following claims.

I claim as my invention:

1. An electron tube comprising an evacuated envelope having grid, plate and cathode electrodes and having a compensating electrode therein at one end of the grid and plate electrodes and out of electrical contact with each and located out of the space between the grid and the plate but in cooperative relation thereto, said electrode being electrically separate from the grid and from the plate and cathode, and electrostatic means for connecting said compensating electrode into an external circuit with other elements of the tube.

2. An electron tube having a grid, plate and cathode electrodes and having a compensating electrode at one end of the grid and plate electrodes and out of direct electrical contact with each other and located out of the space between the grid and the plate but in cooperative relation thereto, said electrode being also electrically separate from the grid having an electrostatic coupling with the exterior of the tube, and comprising a plate-like element located in a plane substantially perpendicular to the plane of the other electrodes within the tube.

3. A thermionic tube comprising an evacuated chamber having an anode and a cathode with a grid interposed therebetween, all of which are co-axially arranged within the tube, a compensating element adjacent one end of the anode and in close proximity thereto, and means for inductively impressing a potential on the compensating element.

4. A thermionic tube having an anode and a cathode with a grid interposed therebetween, said elements being arranged within an envelope, a compensating element within the envelope adjacent one end of the anode and in cooperative relation thereto, and means for establishing an electrostatic coupling between said compensating element and an external circuit.

5. A thermionic device comprising a plate, a cathode, and a single control electrode therebetween, said electrodes being arranged substantially co-axially, and a compensating electrode at one end of the plate, said compensating electrode being electrically coupled to the cathode and having an electrostatic coupling with the exterior of the device, for controlling the characteristics thereof.

6. A thermionic device comprising a plate, a cathode and a grid therebetween, said electrodes being arranged substantially parallel, and a compensating electrode at one end of the plate having an electrical coupling to the cathode, the compensating electrode being in the form of a flat plate and having an electrostatic connection with the exterior of the device.

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