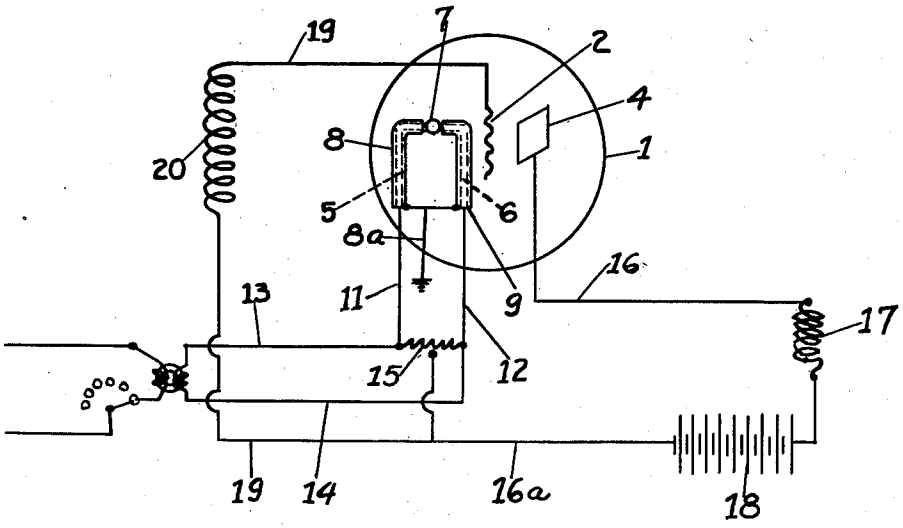
Jan. 27, 1931. G. SPERTI ET AL 1,790,286

ELECTRONIC TUBE

Filed June 12, 1925

Fig 1



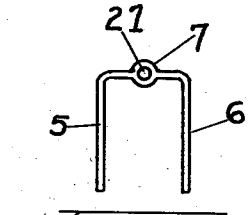


Fig 2

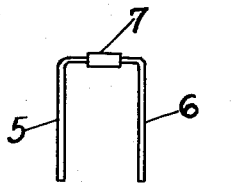


Fig 3

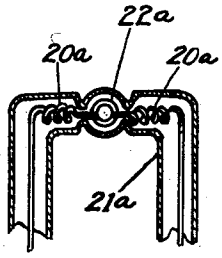


Fig 5

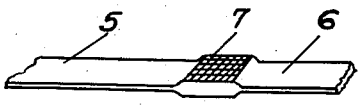


Fig 4

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UNITED STATES PATENT OFFICE

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ELECTRONIC TUBE

Application filed June 12, 1925. Serial No. 36,706.

It is our object to provide electronic tubes suitable for use with an energizing current from the usual domestic light circuits, whether alternating or direct, and also to provide an electronic bulb which is valuable for use with the usual electrolytic cells, now generally employed in radio work.

One of our objects is to provide a tube in which oscillatory variations due to difference in potential of portions of the electron emitting and controlling elements are largely eliminated.

Our object is also to provide a bulb in which disturbances due to alternating current as a generating source, and arising chiefly when the thermionic effect of the electron discharge element is reduced due to moments of zero current, are so eliminated as to do away with distortions within the audible range.

Thus we preferably employ as a generating electrode, an element having branches of high resistance connected to an intermediate portion of a material of comparatively low resistance and high thermionic effect, which intermediate portion serves as the generating body for the electrons on which the tube operates.

We are enabled to require a very low watt consumption by this means, because we obtain a large portion of our heating effect by passing the energizing current through the said intermediate portion, whereas in the prior art with which we are familiar, the thermal effects of the current have been applied uniformly to a filament portion which imparts its heating to a thermionic member by heat conduction alone.

Also we may shield the high resistance portions of our filament, or else form these portions of non-thermionic material and do not have to provide extra leads within our tube, in order to connect up the generating electrode in the out-put circuit of the tube.

Furthermore, we preferably make our electron generating element a spot, and thus can use small grids and plates, and the tube elements thus have fairly equipotential surfaces, and the range of effectiveness of small potentials as impressed on the grid makes our tubes of high effectiveness in both rectifying and amplifying. Furthermore internal tube capacity effects will be reduced to a minimum between the electrodes of the tube due to the small dimensions of the electron source.

We accomplish our objects by that certain construction and arrangement of parts to be hereinafter more specifically pointed out and claimed.

In the drawings:

Figure 1 is a diagram of a typical tube involving our invention.

Figure 2 is an elevation of a generating electrode of another pattern.

Figure 3 is an elevation of another type of electrode.

Figure 4 is a perspective diagram of still another type of electrode.

Figure 5 is a perspective diagram of a form to give increased heat effect, and showing a single tube with a hole in it, to serve as a shield.

The electronic bulb is shown mainly in diagram, as it does not differ as to grid and plate from the usual tube except in proportions, which will be a variable in any event.

We indicate by the outline 1 the glass tube, within which a desired vacuum has been set up. The usual grid is indicated at 2, and the plate at 4.

The novel electrode is shown in Figure 1, as composed of two relatively high resistance filament sections 5 and 6, preferably of equal length and balancing disposition, connected together by a comparatively low resistance element 7. The balancing or equality of the filaments is not of primary importance. The size of the filaments should not be so out of proportion, however, as to prevent a heat flow from each filament to the element 7. We have indicated bent tubes 8 and 9 of glass or other material, surrounding and shielding against electron flow the balanced filament sections, but leaving the connecting spot exposed. These tubes may be grounded as indicated at 8*a*, but being of large area will not distort the action of the electron stream due to impressed charges.

The connections from this electrode are indicated at 11 and 12, as passing out through

the bulb, where they join the incoming leads 13 and 14 from the source of current, which may be alternating or direct, such as is transmitted in the usual service lines of a light and power company.

The connections 11 and 12 are indicated as bridged by an impedance 15, to which the leads of the grid and plate circuits are connected, as closely to a full intermediate position as practical. The plate circuit in the drawing includes the leads 16 from the plate to the primary coil 17, to the B battery 18, and lead 16a to the impedance 15. The point of connection to the impedance 15, shown here as a resistance will be arranged to balance the potentials so as to bring the lead and hot spot to the same potential. The grid circuit in the drawing includes the lead 19 from the grid to the secondary 20 and from it to the same connection as the plate circuit, to the resistance 15. These are merely shown as an example of one kind of possible circuit for the tube elements.

In operation this bulb provides a steady electron flow from the generating electrode in which no audible variations appear. The current, assuming it to be alternating, causes the filament sections to glow most brightly at the two crests of the alternations, and to dim down at the neutral points between oscillations. The central spot because of its cross section or inherent composition, is not brought to a glow by the current alone, but the heat moving by conduction into the spot from both filaments keeps the spot glowing and discharging electrons right through the zero period of cycle of the current. The heat conducted by the two filament sections to the connecting spot moves in at both sides to the spot which retains its heat due to its nature, so that there is no appreciable drop in glow of the spot, or of electron flow therefrom, when the filament sections oscillate in brilliance.

In Figure 2 we have indicated a similar electron generating body to that in Figure 1, and having the filament sections 5 and 6, but the central hot spot has a nodule of oxide at the center as indicated at 21, whereas the filament sections are not thermionic. In Figure 3 is indicated an electrode having a pair of filaments of metal such as platinum (not thermionic) connected by a hot spot of another metal such as thoreiated tungsten, which is thermionic. In Figure 4 is indicated an electrode in which the filament sections are very thin ribbons, with a thicker central section or hot spot formed of a desired shape.

In each instance the heating effect of the current is not productive of a practical electron discharge on the connecting element or filaments, and it is from the hot spot that the electron stream on which the tube operates is discharged.

In the form shown in Figure 5 the filament sections are formed into coils at 20^a, 20^a, and the whole device is surrounded by a U tube 21^a, which has an aperture 22^a for the electron stream. The heating effect is increased by the coiling of the filaments with regard to the conducted heat to the thermionic spot. In use the form of tube shown will probably not collect a charge that will affect the electron stream, and if it does a simple grounding will eliminate this effect. In the forms of electrode in which no shields are shown, it will probably be best to use a shield in order to prevent the charges on the non-thermionic filament portions from having any control on the electron stream. In a balanced arrangement of filament sections, however, the opposed direction of the two sections would result in a cancellation of the charges to a certain extent.

In use with A batteries in radio, our tubes eliminate distortions due to bubbling in the battery, in the same manner as they eliminate the audible variations due to an alternating current energizing source. The tubes of our invention may be applied to a wide range of uses, wherever it is desired to control the flow of electrons from an emitting source, where a substantially equipotential source is required.

We have not described in detail all ways of accomplishing our objects, and do not wish to be limited to those shown. Structurally our invention involves the employment of a filament of which a portion only serves as an electron generating element, which portion is of large heat capacity, is maintained at proper thermionic stage between zero potentials of alternating current by the energizing current source, and is maintained at proper thermionic stage during periods of zero current by its own retained heat, and also by conduction from portions of the filament which in one way or anther are prevented from affecting the plate current.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

An electronic vacuum tube having a grid and a plate, an electron generating electrode to be connected to the grid and plate comprising branch elements of high heating effect due to electric current, and an intermediate electron emissive element in series electrically with the branches and of relatively low heating effect but high thermal capacity, said intermediate element being the sole electron discharging means of the tube.

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