March 26, 1935. J. V. CAPICOTTO 1,995,702

THERMIONIC TUBE

Filed June 7, 1932

Fig:1.

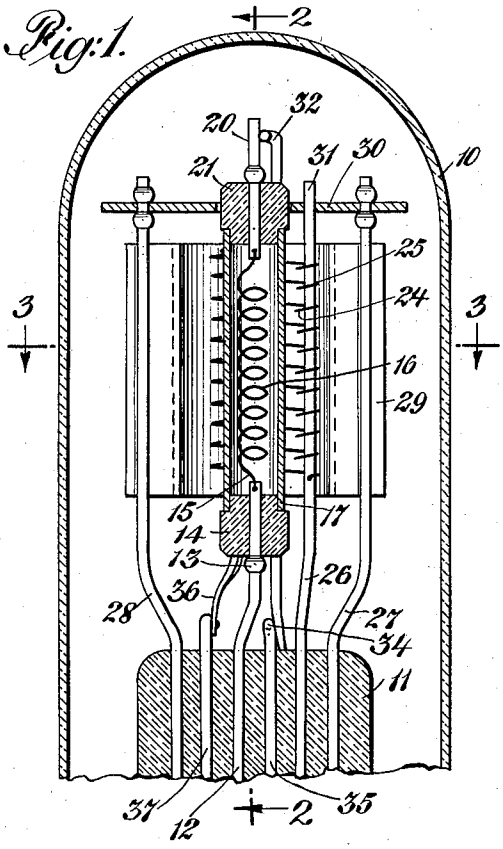


Fig:2.

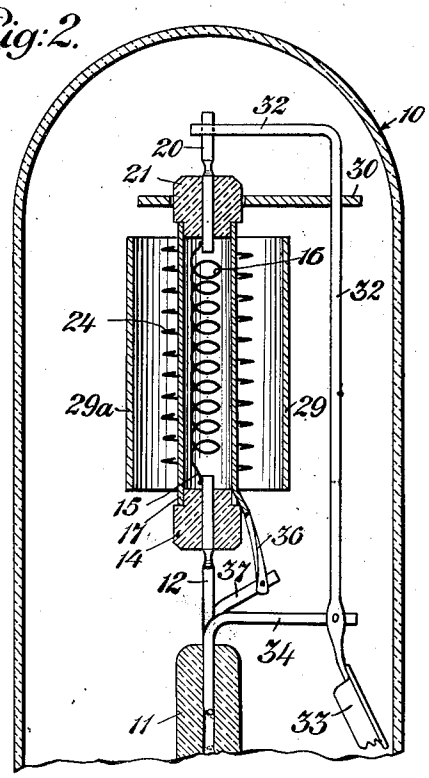


Fig:3.

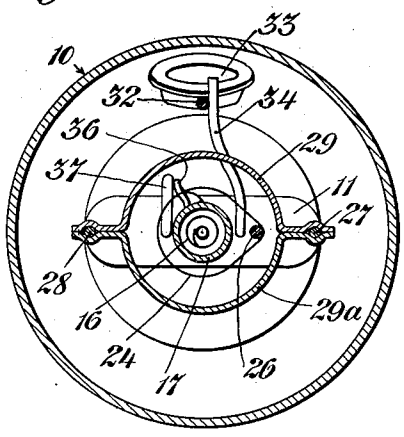


Fig:4.

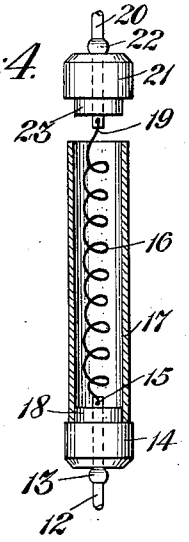
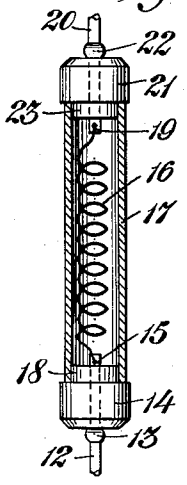


Fig:5.



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THERMIONIC TUBE

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5 Claims. (Cl. 250—27.5)

This invention relates to improvements in thermionic tubes of the indirect heated cathode type and has for an object the production of such a tube of comparatively small size suitable for use in small radio receivers of the "midget" type. The bulb need not exceed 2" in length and ¾" in diameter, the tube having practically the same output and other electrical characteristics as a tube of standard size.

Another object of the invention is to provide a special form of cathode, generally applicable to thermionic tubes of this type. This cathode arrangement and assembly secure ample emission, yet the assembly may be relatively small in size, thus enabling a miniature amplifier or detector tube to be produced of similar characteristics to tubes of standard size.

A further object of the invention is to provide an inexpensive, compact and efficient construction and arrangement of the electrodes or elements in a thermionic tube that will withstand rough handling in assembly and use.

Although the invention will be disclosed in connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

In the accompanying drawing where by way of illustration is shown a miniature thermionic tube corresponding to the well known 227 type, embodying the objects of the invention as above set forth:

Figure 1 is a vertical sectional view through the tube;

Figure 2 is a vertical sectional view on the line 2—2, Figure 1;

Figure 3 is a horizontal sectional view on the line 3—3, Figure 1; and

Figures 4 and 5 are views partly in section of the cathode assembly of the tube.

The numeral 10 denotes the usual glass bulb having the usual reentrant stem 11 sealed therein containing the usual "press" in which the circuit connections and supports for the elements of the tube are sealed. The base (not shown) of the tube may be of any suitable construction provided with circuit terminals for the tube electrodes and is secured to the bulb in the usual manner.

The support 12 (which may form one circuit connection of the heater element) is sealed into the stem and has an enlarged portion 13 which supports an insulating bushing 14, the support passing through the bushing (which may be a tight fit thereon) and having attached to its inner end the lower end 15 of the heating element 16.

The heating element or filament 16 may be of any desired form, but preferably is wound in a comparatively tight helix and, after its lower end 15 is attached to the support 12, the tube 17 (preferably of nickel) constituting the cathode of the thermionic tube is placed over the filament, the lower end of said cathode tube being positioned on and preferably fitting tightly on the shoulder 18 of lower bushing 14. The outer surface of 17 can be treated or coated in any known manner if necessary to increase the electron emission.

The filament 16 is now extended by pulling it upwards and the upper end 19 of same is connected to member 20. The upper insulating bushing 21 is slipped over the member 20 and an enlargement 22 is formed on 20 which prevents the parts from falling apart during assembly.

It will be observed from Figure 4 that the filament 16 may be extended and has a springlike action and accordingly the shoulder 23 of the upper bushing 21 can be brought down and into the bore of the tube 17 and the entire cathode assembly will be held together by reason of the shoulders 18 and 23 on the bushings which can be made to fit tightly within the bore of the tube 17.

The cathode assembly made in the manner just described is shown partly in section in Figure 5 from which it will be observed that the filament 16 is held in tension between the support 12 and the member 20 adjacent to, but out of contact with, the inner walls of the cathode tube 17, and adapted to heat the cathode. It is not therefore necessary to coat the interior of this tube with an insulating material or to spray the filament helix with insulating material or to mount the filament helix on a center tube of insulating material in order to keep the filament 16 from electrical contact with the tube as is the case with known constructions.

The cathode assembly being made up and mounted in the center of the tube, the grid is now placed in position about the cathode tube 17 of the heater assembly. This grid structure comprises a coil 24 of wire constituting the grid element or electrode, each turn of the coil being welded as indicated at 25 to a support 26 which is sealed in the stem 11 and also forms the grid circuit connection. By welding each turn of the grid coil to its support, it is possible to secure a rigid grid assembly, the coils of which will be properly spaced from and concentric with the cathode tube 17, and which cannot contact therewith in case the entire tube is roughly handled in shipment or use.

Sealed into the stem 11 are the supports 27 and 28, either one of which may form the circuit connection to the anode or plate element of the tube. This is composed of two sections shown at 29, 29*a* in Figure 3 which surround and are welded to the supports 27, 28 in any suitable manner. Thus the plate elements form what is practically a cylinder surrounding and concentric with the grid and cathode, and this plate assembly is rigidly held against contact with the grid assembly.

An insulating member 30 which may be of mica or the like, has a central aperture adapted to surround the upper portion of the outer bushing 21 of the cathode assembly and is also apertured to receive the upper end 31 of the grid support 26. The member 30 is secured to the plate supports 27 and 28 in any suitable manner, and serves to space the cathode, plate and grid assemblies apart from each other and definitely position the outer ends of the supports 26, 27, 28.

Extending downwardly through 30 is the connecting rod 32 which is welded and thereby electrically connected to the member 20. This rod 32 carries as its lower extremity the button 33 for the "getter" commonly employed in thermionic tubes. The portion 34 of rod 32 extends laterally as shown in Figure 2 and connects to a circuit connection 35 which together with the support 12 may constitute the circuit connections to the heater filament 16.

As the filament 16 is under considerable tension, it may sag in service without coming in contact with the inner walls of the cathode tube 17 and the connecting rod 32 is resilient and so tensioned during assembly that it will pull outwardly against the filament and take up the slack therein when the filament coil expands when heated, thereby always keeping the filament out of contact with the inner wall of 17. The member 20 fits rather loosely in the hole in bushing 21 so that the spring action of rod 32 can act on the filament and keep it from sagging when hot, and the rod 32 may be free in member 30 or may flex this member sufficiently to act in the manner described. When the member 30 is made flexible it can act as a spring or tension member, and through rod 32 act to keep the filament taut.

The integral outwardly extending tab 36 on the cathode tube 17 is bent as shown in Figures 1 and 2 and is connected to the circuit connection 37.

The evacuation, sealing and other details of construction of this thermionic tube not herein described in detail may be carried out in the usual manner, and this tube may be employed for a large variety of purposes for which thermionic tubes are commonly used. As the operation of a tube of this character is well known it is not herein described in detail.

A miniature tube of this character can be used in many applications where standard size tubes cannot be used because of lack of room, for example, in mantel clock radio receivers where the cabinet contains a clock with a 5'' dial and there are 6 tubes in the radio receiver built into the cabinet and the latter is only 6 x 6 x 10''.

What is claimed is:

1. In a thermionic tube having a reentrant stem, a plurality of supports having their inner ends sealed into said stem and extending outwardly therefrom, a heater assembly having a tubular member and insulating caps thereon supported on one of said supports, a grid and anode carried by said supports, and an insulating member embracing one of said caps and the outer ends of said supports for the grid and anode.

2. In a thermionic tube, a cathode assembly comprising a tubular cathode and means within said cathode for heating the same, said tube having insulating heads and being supported in the center of said tube, a grid and plate surrounding said assembly, an insulating member adapted to prevent lateral movement of said cathode assembly in said thermionic tube and embracing one of the insulating heads thereon, and a spring tension member passing through said insulating member and adapted to hold said heating means in said cathode under tension during operation of the tube.

3. In a thermionic tube, a cylindrical plate assembly, supports therefor sealed into the press in said tube and extending above said plate assembly, a cathode assembly including an insulating cap on the cathode, said assembly being positioned within said plate assembly, and an insulating member extending across and laterally embracing the insulating cap of said cathode assembly and secured to said supports.

4. In a thermionic tube, a grid comprised of an open helix of wire having each turn thereof secured to a common support, a tubular cathode lying entirely within said helix, said cathode having insulating caps on its ends extending outside said helix, and means for positioning said cathode within said tube concentric to said grid and holding the same fixed relative thereto including a laterally extending insulating member embracing one of said caps and said grid support.

5. In a thermionic tube, a cathode assembly comprising a tubular cathode, a heat element therein, insulating heads for said tube, a support rigidly secured to one of said heads and connected to said heater element, spring means passing through one of said heads and connected to said heater element whereby the same is kept stretched while heated, said means forming a circuit connection to said heater, and a getter button supported on said spring means.

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