April 2, 1935. W. W. EITEL 1,996,506

MEANS AND METHOD OF PROCESSING THERMIONIC TUBES

Filed Sept. 12, 1932

Fig. 1.

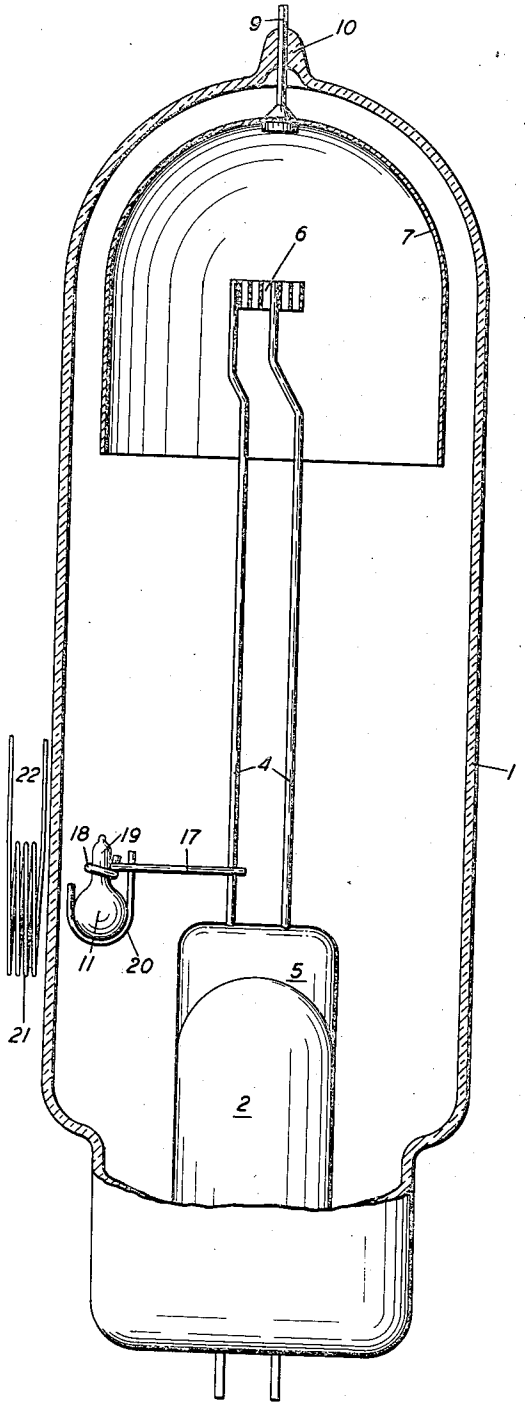


Fig. 2.

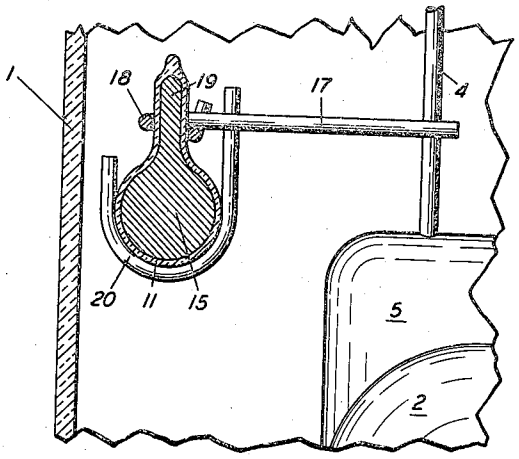
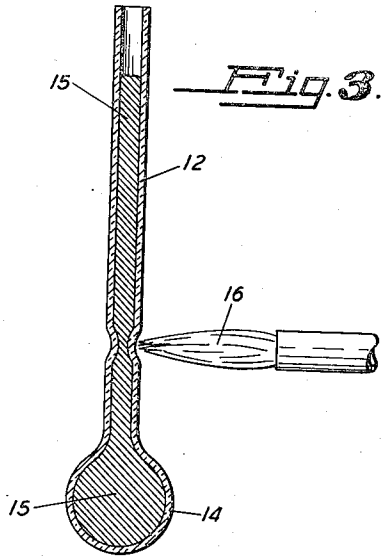


Fig. 3.



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Patented Apr. 2, 1935 1,996,506

UNITED STATES PATENT OFFICE

1,996,506

MEANS AND METHOD OF PROCESSING THERMIONIC TUBES

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Application September 12, 1932, Serial No. 632,786

3 Claims. (Cl. 250—27.5)

My invention relates to means and method of introducing a volatile metal into a thermionic tube, and more particularly to the processing of such tubes as use mercury vapor as a conducting medium.

Among the objects of my invention are: To provide a simple and effective means of releasing volatile metal in a thermionic tube; to provide a method of releasing purified volatile metal in a thermionic tube after the tube has been evacuated; to provide a method of processing thermionic tubes in which mercury is to be used as a conducting medium; and to provide a simple and inexpensive method of processing a mercury arc rectifier.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of my invention herein described, as various forms may be adopted within the scope of the claims.

In the drawing, representing one preferred embodiment of my invention:

Figure 1 is a longitudinal sectional view of a mercury arc rectifier showing the positioning of a mercury capsule.

Figure 2 is an enlarged view of the capsule.

Figure 3 is a section showing a method of preparing a capsule.

In the processing of thermionic tubes, particularly in the degassing of elements and evacuation to a high degree, it often happens that the presence of volatile metals later to be used in the tube, prevents the proper evacuation, and almost always lengthens the time required for pumping. It is in many cases desirable to completely pump the tube, and then insert the volatile metal. Such insertions often require complicated apparatus and costly precautions.

Broadly speaking my invention comprises the insertion into a thermionic tube of such volatile metal sealed in a frangible capsule which will remain sealed and inert during the evacuation of the tube but which can be broken by heat locally applied to the metal. I prefer to generate this heat by the application of high frequency from without the tube to cause eddy currents in the metal. I also prefer to purify the metal contained in the capsule.

Referring to the figures which show only one specific form of my invention as applied to a mercury arc rectifier, an envelope 1 is provided with a reentrant stem 2 having cathode leads 4 sealed through a pinch 5. These cathode leads extend upwardly into the tube and carry a cathode filament 6 which in this instance is a coiled oxide-coated ribbon. An anode 7 is supported from the top of the envelope by an anode lead 9 passing through the envelope at a seal 10.

A frangible capsule 11 is prepared as shown in Figure 3. A length of glass tubing 12 is provided with a bulb portion 14 and is then filled with mercury 15. This mercury may be purified in any approved manner and the bulb portion is then sealed off from the tubing by a flame 16 to form the capsule. Almost any of the common glasses have a thermal expansion coefficient less than that of mercury and I have found that lead glass is satisfactory.

The capsule is then mounted in a frame comprising a strut 17 forming a ring 18 around a capsule seal 19. Capsule support 20 extends underneath the capsule and is welded to the strut 17. I prefer to make the entire frame from nickel wire.

The end of the strut 17 may then be welded to some portion of the tube elements, and in this case I have shown it attached to one of the cathode leads 4 near the pinch, with the capsule approaching the side wall of the tube.

I have found that the tube may be evacuated, baked out, degassed or otherwise heat treated without danger of the capsule liberating its contents. When desired, at or near the end of the processing, or after the tube has been sealed off the pumps, a bombarder coil 21 may be supplied with high frequency through leads 22 and eddy currents generated by induction into the mercury 15.

These eddy currents cause heating of the mercury inside the capsule and the capsule cracks. All of the contained metal is expelled by vapor pressure through the crack and the metal is thereby released into the tube where it can take up its prescribed duty.

If higher power in the bombarder coil is used and intense heat generated quickly in the mercury, the capsule will burst and the contained material expelled at once.

I therefore have provided a means of introducing mercury into an arc tube after all preliminary processing has been accomplished.

While the description above refers to a mercury arc, I have also been able to insert other metals such as sodium, potassium, and like materials, in the same manner. When these metals are used, which are solid at room temperatures, the eddy currents will first melt them, then the container will fracture and the metals will be expelled in liquid form.

I claim:

1. In combination with a thermionic tube envelope, a capsule containing a volatile material, said capsule being flask-shaped and having a main spherical portion and a restricted neck portion, a main support wire adapted to be attached at one end to an element within said envelope and having the other end shaped to encircle said neck portion, and a body supporting wire attached to said main support wire and passing below said spherical portion to provide support therefor.

2. In combination with a thermionic tube envelope, a capsule containing a volatile material, said capsule being flask-shaped and having a main spherical portion and a restricted neck portion, a main support wire adapted to be attached at one end to an element within said envelope and having the other end shaped to encircle said neck portion, and a body supporting wire attached to said main support wire and passing below said spherical portion to provide support therefor, said body supporting wire being open circuited.

3. In combination with a thermionic tube envelope, a capsule containing a volatile material, said capsule being flask-shaped and having a main spherical portion and a restricted neck portion, a main support wire adapted to be attached at one end to an element within said envelope and having the other end shaped to encircle said neck portion, and a body supporting wire attached to said main support wire and passing below said spherical portion to provide support therefor, the circle of said main support wire being substantially smaller in diameter than the diameter of said spherical portion, and said body supporting wire being open circuited.

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