April 11, 1939. I. E. MOUROMTSEFF 2,154,278

CARBON EXTERIOR ANODE

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Fig. 1.

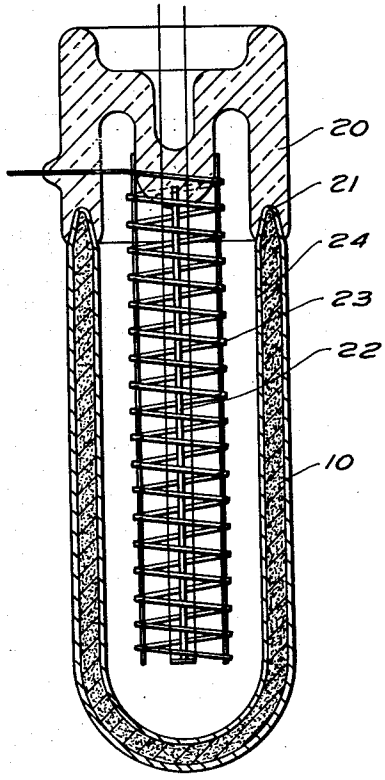
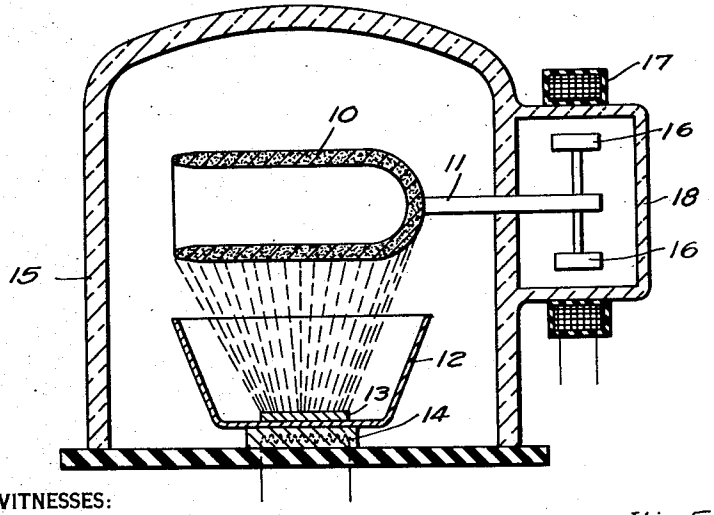


Fig. 2.



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UNITED STATES PATENT OFFICE

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CARBON EXTERIOR ANODE

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Application October 16, 1936, Serial No. 105,919

9 Claims. (Cl. 250—27.5)

My invention relates to anodes and especially to anodes for power tubes.

An object of my invention is to devise an anode for power tubes that will withstand high temperature.

Another object of my invention is to utilize anodes utilizing a material for an anode that will not cause secondary emission.

Another object of my invention is to provide a cheap and easily machined material for the main portion of the anode.

Other objects of my invention will be apparent from the following description in which:

Figure 1 is a cross-sectional view through a preferred embodiment of my invention; and,

Fig. 2 is a cross-sectional view of apparatus utilized in the process of preparing the anodes for its use in a discharge tube.

I desire to use carbon or graphite for the exterior anodes of high power tubes. This material has the specific advantages that it can stand very high temperature without collapsing or melting or evaporating. This advantage is particularly important with respect to the inner surface of the anode where local overheating of sharp points can occur during tube operation and thus cause flashovers. Another advantage of graphite is considerable freedom from secondary emission. Graphite also has the advantage that the anode can be easily machined from stock graphite

After a block of graphite is machined into the usual tubular shape closed off at one end, such as illustrated by the reference character 10 in Figs. 1 or 2, I desire to coat the edges and the outer surface with a metal, although the inner or both surfaces may be thus coated. My preference for this metal is copper, although other materials, such as nickel, silver, etc., may be used.

In Fig. 2, I have shown one preferred method of coating the carbon tube. The carbon tube is placed on the shaft 11 above a container 12 having a piece of the desired coating material 13 within it. The heater, such as an electric coil 14, raises the metal to a very high temperature. These devices are preferably enclosed within a substantially vacuum-tight container 15 from which air is exhausted. The metal 13 is then evaporated or sputtered in this vacuum by means of the heater arrangement and deposited on the outer surface and edge of the carbon tube 10.

The tube 10 is revolved during this treatment, and I prefer to have this movement performed by having magnets 16 connected to the shaft 11 and revolved by a stator winding 17 on the exterior portion 18 of the container 15.

Other methods, such as spraying in open air or electro-plating, could be used for depositing the material on the carbon. I also contemplate putting a plurality of different materials on the carbon, such as nickel with copper over the nickel.

The tubular anode is then sealed to the insulating portion of the tube wall, such as the portion 20 in Fig. 1. This portion preferably is of boro-silicate glass, such as that sold under various trade names as "707–DG" and "705–AJ." This is feasible because the coefficients of thermal expansion of the graphite and the boro-silicate glass are nearly equal and the copper edges 21 on the carbon will provide a good seal between the carbon and the insulating material.

In Fig. 1 a cathode 22 and grid 23 are illustrated which may be of any desired construction to cooperate with the exterior anode 10

If it is desired to prevent or cut down secondary emission from the anode, the interior surface 24 or a major portion thereof may be left free from coating material instead of coated as shown in Fig. 1.

While I have referred to copper and nickel as materials to be used, I contemplate using other metals or their oxides or any combination of them.

Cooling means, such as water or forced air, can be applied to my anode by means of a water jacket or fan in substantially the same manner as these means are applied to the exterior solid copper anodes of the prior art.

Although I have described a specific embodiment of my invention, I am aware that many modifications thereof are possible. Accordingly, I do not desire the following claims to be limited except as is necessitated by the prior art.

I claim as my invention:

1. A container for a discharge device having a wall portion of graphite coated on at least one side with copper.

2. A discharge device comprising a container having a cathode and an anode forming a portion of the wall thereof, said anode being of graphite coated with copper, and being insulated from said cathode by glass which is sealed vacuum-tight to said copper.

3. The steps in forming a container for a discharge device which comprises forming carbon material as a wall of the container, coating the carbon with copper and sealing an insulating

wall portion to said copper, said copper forming an intervening layer sandwiched between said insulating wall-portion and said carbon material to form the seal.

4. A discharge device comprising a container having a wall portion of glass, at least one conductor sealed through said glass, a main electrode within the container connected to said conductor and another wall portion of said container being of carbon material having a layer of metal thereon and a seal between said two wall portions in which said metal forms a layer sandwiched between said glass and said carbon material.

5. A discharge device comprising a container having a wall portion of glass, at least one conductor sealed through said glass, a main electrode within the container connected to said conductor and another wall portion of said container being of carbon material having a layer of copper thereon and a seal between said two wall portions in which said copper forms a layer sandwiched between said glass and said carbon material.

6. A discharge device comprising a container having a wall portion of glass, at least one conductor sealed through said glass, a main electrode within the container connected to said conductor and another wall portion of said container being of carbon material having a layer of metal thereon and a seal between said two wall portions, said layer of metal being on the exterior wall of said carbon material and at the seal forming a layer sandwiched between said glass and said carbon material.

7. A discharge device comprising a container having a wall portion of glass, at least one conductor sealed through said glass, a main electrode within the container connected to said conductor and another wall portion of said container being of carbon material having a layer of copper thereon and a seal between said two wall portions, said layer of copper being on the exterior wall of said carbon material and at the seal forming a layer sandwiched between said glass and said carbon material.

8. A gas-tight enclosure comprising a chamber having walls of graphite coated on at least one side with copper, said walls having an aperture sealed gas-tight to a glass wall-portion, said copper layer covering the inner face between said graphite and said glass.

9. A gas-tight container comprising a hollow cylinder of graphite closed at one end and coated with a thin layer of copper, the other end of said cylinder being sealed to a glass wall-portion, said copper layer covering the inner face between said graphite and said glass.

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