July 7, 1925. 1,545,256

C. D. HOCKER

PROCESS OF MANUFACTURING ELECTRON EMITTING CATHODES

Filed Sept. 5, 1918

Fig. 1.

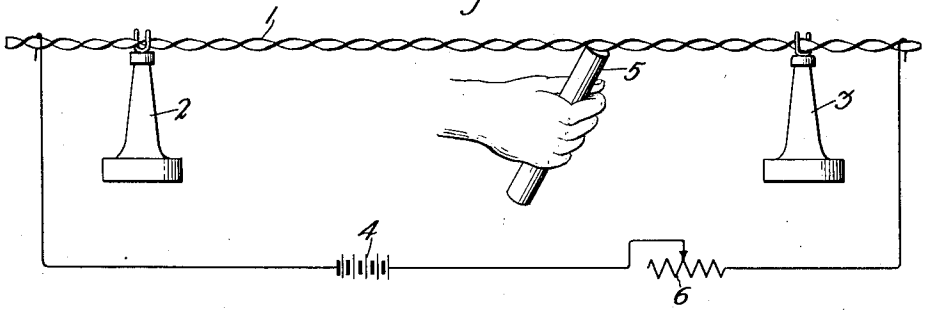
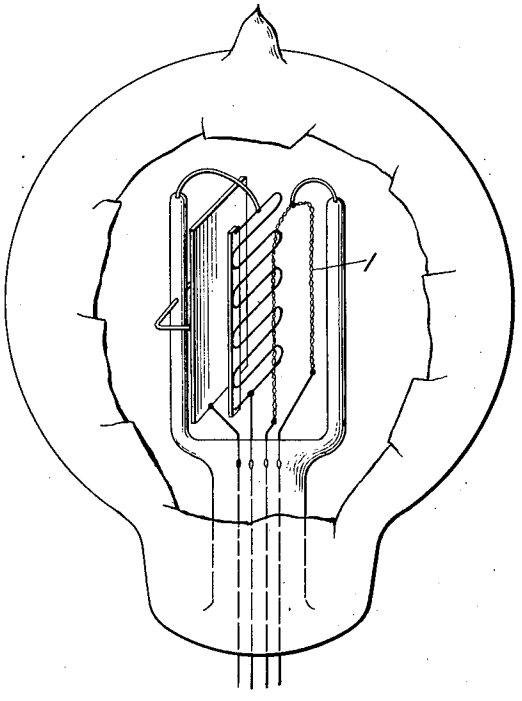


Fig. 2.



Inventor:
Carl De Witt Hocker.
by A. C. Stevens. Att'y.

Patented July 7, 1925. 1,545,256

UNITED STATES PATENT OFFICE.

CARL D. HOCKER, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROCESS OF MANUFACTURING ELECTRON-EMITTING CATHODES.

Application filed September 5, 1918. Serial No. 252,689.

To all whom it may concern:

Be it known that I, CARL DE WITT HOCKER, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in the Process of Manufacturing Electron-Emitting Cathodes, of which the following is a full, clear, concise, and exact description.

This invention relates to the process of manufacturing electron-emitting cathodes, such as are used in audions or vacuum tubes.

It has been known for some time that the thermionic activity of a metal, for example platinum, may be greatly increased by applying a coating of compounds of alkaline earth metals thereto.

An object of the present invention is to provide a convenient manner of applying the thermionically active coating material upon a filamentary cathode.

As disclosed in the patent to Nicolson and Hull, No. 1,209,324, December 19, 1916, Electron-emitting cathode and the process of manufacturing the same, the coating material may be applied to the filament by dipping a heated filament into troughs containing strontium hydroxide and barium resinate. In the then preferred process of carrying out the invention, the strontium hydroxide, which is only sparingly soluble, is made into a thin paste with water before being applied to the filament, and due to the tendency of this compound to settle out of suspension, it is necessary to stir the solution at frequent intervals.

This difficulty of keeping the material in suspension while coating the filament is avoided, according to the present invention, the coating material being embodied or suspended in a solid carrier which may be of waxy material such as paraffin.

Other advantages to be derived by the use of a solid or wax-like material as a carrier are:

1. Saving of material incorporated in the carrier since the wax-like carrier does not spill or run away as is characteristic of the water suspension.

2. Thorough protection of the material incorporated in the wax from the action of carbon dioxide, water, or other constituents of the air that might change its character. This makes it possible to employ the wax-like coating mixture, even after an indefinite length of standing.

3. Saving of time in application of coating.

According to the present invention, it is preferred to use the carbonates of barium and strontium, the desired quantity of each of which is stirred into separate batches of molten paraffin which is stirred until cool and then formed into the desired shape, for instance, in the shape of rods or other convenient form.

An advantage to be derived from using carbonates rather than oxides of alkaline earth metals is that the carbonates are more easily prepared pure and with more assurance of uniformity than the oxides or hydroxides. In the preparation of the latter, a troublesome calcining operation is necessary.

The filament core which is preferably of platinum is heated in the usual way to a sufficient temperature to melt the paraffin as it is moved along the hot wire. It is preferred that a total of sixteen coats of the carbonate should be applied in the following way: 4 coats of $SrCO_3$, 4 coats of $BaCO_3$, 4 coats of $SrCO_3$, 4 coats of $BaCO_3$. Between the application of each coating the wire should be flashed to a red heat, which serves to burn off the paraffin, reducing the alkaline earth compound to an oxide which adheres closely to the filament.

Fig. 1 illustrates diagrammatically apparatus that may be employed for coating the filament.

Fig. 2 of the drawing illustrates a vacuum tube of the audion type, the cathode 1 of which is made in accordance with the above process.

Referring in detail to Fig. 1, the filament 1 to be used as a cathode, may be twisted as shown. During the coating process the filament may be held by suitable supports, such as 2 and 3. The battery 4, or other source of current, is adapted to supply current to the filament for heating the same to volatilize the wax carrier or to bake the coating thereon. To increase or decrease the heating current a resistance 6 is provided. While the filament is heated, the rod 5 which comprises a solid carrier in which is embodied coating material, as indicated above, passes along the length of the wire 2, the solid carrier melting and depositing the coating material on the filament. In case strontium and barium compounds are used as coating materials, it is preferred that only one of these in the form of a carbonate should be embodied in one rod 5 which may be of paraffine, while the other carbonate is embodied in a separate rod of paraffine. Good results may be obtained, however, by embodying both carbonates in a single rod.

A filament made in accordance with the process indicated above having a platinum core and multiple layers of strontium and barium compounds should preferably be finally baked in air about two hours.

It is not necessary that the particular coating material indicated above should be employed, as any suitable material may be embodied in the carrier, which, being in a solid form, affords a very convenient manner of applying the coating material to the filament. Moreover, it is not essential that platinum as indicated above should be employed as the filament core, for any other suitable material, such as nickel which has given good results, may be used.

What is claimed is:

1. A carrier, solid at ordinary temperatures and capable of being melted at higher temperatures, and thermionically active coating material embodied in said carrier.

2. A carrier, solid at ordinary temperatures and capable of being melted at higher temperatures, and thermionically active coating material mechanically mixed with said carrier.

3. A carrier of waxy material solid at ordinary temperatures and capable of being melted at higher temperatures, and a thermionically active alkaline earth metal compound embodied therein.

4. A carrier of paraffine and a carbonate of an alkaline earth metal embodied therein.

5. A carrier of waxy material, and a carbonate of an alkaline earth metal embodied therein.

6. The method of preparing a filament which comprises heating said filament, in coating said filament with paraffine containing a compound of an alkaline earth metal, and in baking said coating.

7. The method of preparing an electrode adapted to serve as a source of electrons which comprises coating said electrode with a carbonate of an alkaline earth metal, and in baking said coating.

8. The method of making a thermionically active filament which comprises applying to said filament while slightly heated a readily fusible carrier having embodied therein thermionically active coating material.

9. The method of making a thermionically active filament which comprises applying to said filament while slightly heated a readily fusible carrier having a compound of an alkaline earth metal embodied therein.

10. The method of making a thermionically active filament which comprises applying to said filament while slightly heated a readily fusible carrier having a carbonate of an alkaline earth metal embodied therein.

11. The method of making a thermionically active filament which comprises coating said filament with a readily fusible carrier having thermionically active coating material embodied therein.

12. The method of making a thermionically active filament which comprises coating said filament with a readily fusible carrier having a compound of strontium embodied therein.

13. The method of making a thermionically active surface which comprises coating it with a material containing a thermionically active substance, said material being solid at ordinary temperatures and capable of being melted at higher temperatures.

14. The method of making a thermionically active filament which comprises coating said filament a plurality of times with a readily fusible carrier having embodied therein thermionically active coating material.

15. The method of making an electron emitting electrode which comprises applying to an electrical conductor while slightly heated a readily fusible carrier having embedded therein a coating containing a metal of the alkaline group; baking said coating; then applying a readily fusible carrier comprising a coating containing another metal of the alkaline earth group; and baking said coatings.

16. The method of making an electron emitting electrode which comprises applying to an electrical conductor while slightly heated a readily fusible carrier having embedded therein a compound of strontium, and in baking said coating.

17. The method of manufacturing an electron emitting electrode which comprises applying to an electrical conductor while slightly heated multiple coatings of strontium and barium compounds which are embedded in a readily fusible carrier and in baking said coatings.

18. The method of making an electron emitting electrode which comprises coating platinum with alternate coatings of strontium and barium compounds embedded in a readily fusible carrier, the strontium coating being applied first to the platinum, the barium coating being applied subsequently, and in baking said coatings.

19. The method of making an electron emitting electrode which comprises coating platinum with alternate coatings of strontium carbonate and barium carbonate embedded in a readily fusible carrier, and in baking said coatings in air for about two hours.

In witness whereof, I hereunto subscribe my name this 30th day of August A. D., 1918.

CARL D. HOCKER.