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UNITED STATES PATENT OFFICE

NEIL R. COLLINS, OF REDWOOD CITY, CALIFORNIA, ASSIGNOR TO FEDERAL TELEGRAPH COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA

RADIO DEVICE

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This invention has to do with the preparation of electron-emitting cathodes for use in thermionic discharge devices such as three-electrode vacuum tubes and the like.

The invention relates more particularly to a method of applying electron-emitting oxide coatings and to a novel coating composition.

The primary object of this invention is to produce a filament or other form of electron-emitting cathode characterized by high electronic emissivity and long emission life. A secondary object is to devise a practicable and economical method of producing cathodes having the characteristics aforementioned.

In following the preferred practice in accordance with the present invention the final product is a filament or other cathode having an adherent coating comprising strontium and barium oxides, and does not differ apparently from what has heretofore been known. The process of production, however, and the coating composition employed are believed to be novel.

According to the preferred practice a cathode coating preparation is made as follows:

Approximately equal parts by weight of barium and strontium iodides are placed in a porcelain crucible, together with a very small portion, say, 0.5 per cent of barium hydroxide. Heat is then applied to the crucible and the water of crystallization thereby driven off. The temperature is then further raised until a quiet fusion takes place. This temperature is doubtless not above 800° C., since decomposition takes place near that point. As soon as the melt has reached a condition of quiet fusion it is poured into a warm mould and cast into pencils. These pencils consist probably of an homogeneous mixture of the fused iodides, although it may possibly be that some other chemical combinations are formed.

The filament core to be coated, which consists preferably of a ribbon or wire of platinum or platinum-iridium alloy, is stretched between two metallic contacts and sufficient current passed through to bring it to a dull red heat. While the current is still on, a pencil prepared as above described is rubbed along the wire quite slowly. The temperature of the filament is sufficient to melt that part of the pencil with which it makes contact. The molten coating covers the wire or ribbon uniformly and rapidly solidifies. With the filament at red heat decomposition occurs very rapidly, thereby leaving on the filament a coating which is presumed to consist mainly of a mixture of the oxides of barium and strontium. The decomposition is apparently complete but any residue of iodide which may remain is subsequently decomposed during the evacuating process.

Unless the coated filament is to be mounted immediately and the device in which it is to be incorporated is to be promptly evacuated it is preferable, if not essential, that it be given an additional protective coating adapted to protect it against moisture. A coating of paraffin is suitable for this purpose. The oxides of both barium and strontium are quite deliquescent, and consequently if the coated filaments are left exposed to the atmosphere without a protective coating for a substantial length of time the oxides will become converted to the hydroxides to an objectionable extent.

It was hereinbefore stated that a small portion of barium hydroxide is preferably included in the coating mixture. The reason for including this compound is that it has a desirable effect on the surface of the platinum or platinum-iridium alloy of which the filament core is preferably composed. The barium hydroxide apparently attacks and slightly roughens the metallic surface, thereby promoting adhesion of the oxide coating.

A substantial amount of hydroxide in the coating mixture is objectionable for reasons unrelated to that which prompts its use in small proportions as above stated.

When the filament is heated during the process of evacuation of the device in which it is used, the barium hydroxide as well as any residual iodides which may have remained are converted completely into oxides.

It is not essential that equal parts of strontium and barium iodides be used in making

the coating mixture, but experience indicates that optimum results are realized when approximately those proportions are adhered to.

As previously intimated, after the coated filament has been mounted and enclosed within a suitable envelope the surrounding air and occluded gases are removed in accordance with well known evacuation and gettering processes—the filament or other form of cathode being raised preferably to a rather high temperature during evacuation and gettering so as to remove as far as possible all objectionable occluded gases. It is during this step in the process of manufacture that any residual iodides or hydroxide in the coating material becomes converted to the oxides.

It is manifest that although only one particular composition of matter has been specified there are obvious equivalents which will immediately suggest themselves to those skilled in the art, and it is contemplated that those equivalents are embraced within the scope and spirit of this invention.

Since thermionically active elements are most commonly used as cathodes in vacuum tube devices, the claims define the body to be coated as a cathode. However, it is conceivable that electron emitting bodies may be used under such conditions that they do not form cathodes and, therefore, the term "cathode" as used in the claims is intended to apply to any electron emitting element, however used.

What is claimed is:

1. A coating preparation for electron-emitting cathodes comprising a halogen compound of alkaline-earth metal, together with a predetermined proportion of a hydroxide.

2. A coating preparation for electron-emitting cathodes comprising barium iodide, strontium iodide, and a small proportion of barium hydroxide.

3. The process in the manufacture of oxide coated cathodes which comprises melting a mixture of halogen compounds of different alkaline-earth metals, and heating the same until it reaches a state of quite fusion, allowing the fused mixture to cool and thereafter rubbing the same on a heated cathode core, thereby applying thereto an adherent coating, and thereafter raising the temperature of the coated core sufficiently to convert the coating thereon completely, or substantially so, to the oxide form.

4. The process in the manufacture of oxide coated cathodes which comprises melting a mixture of halogen compounds of different alkaline-earth metals, heating the same until it reaches a state of quiet fusion, pouring the melted mixture into a mould and allowing the same to cool and solidify, rubbing the solidified mixture on a heated cathode core, thereby applying thereto an adherent coating and at the same time converting the applied mixture to a mixture consisting mainly of oxides, and applying to the oxide coated cathode thus produced a temporary moisture proof fusible coating.

In testimony whereof, I have hereunto set my hand.

NEIL R. COLLINS.