PATENT SPECIFICATION

594,059

Application Date: June 25, 1945. No. 16168/45.

[Patent of Addition to No. 577,599 dated Jan. 19, 1944.]

Complete Specification Left: May 15, 1946.

Complete Specification Accepted: Oct. 31, 1947.

PROVISIONAL SPECIFICATION

Improvements in Thermionic Cathodes

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British Company, and HAROLD PERCY ROOKSBY and SIDNEY HOWARD NOBLE, both of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, and WILLIAM GEORGE SIMMONS BRANSON and JACK SHIRLEY HERRIOTT, both of The Osram—G.E.C. Lamp Works, Brook Green, Hammersmith, W.6., all British subjects do hereby declare the nature of this invention to be as follows:—

The present invention relates to thermionic cathodes and is an improvement in or modification of the invention set forth in Application No. 1021/44 (Serial No. 577,599).

It is concerned with thermionic cathodes of the type comprising a perforated metal container and within the container a rod of activating material consisting mainly of barium thorate. Usually the perforated container is a tungsten helix and the cathode is heated by passing a current through the helix.

In the parent application there is described a method of manufacturing a cathode of the type set forth in which a mixture of barium carbonate and thoria with a suitable binder is extruded to form a rod which is heated in a non-oxidising atmosphere to a temperature and for a time such that chemical combination takes place between the barium and thorium oxides. Part of the barium oxide may be replaced by calcium or strontium oxide or by a mixture of these oxides.

It has now been found that the addition to the said mixture of a small percentage of tungsten or molybdenum or both tungsten and molybdenum confers advantageous properties on the said rods. Thus the rods, after heating, are superior in shape, hardness and stability on exposure to the atmosphere to those prepared without the addition of these metals.

According to the present invention therefore there is provided a thermionic cathode of the type set forth containing a small percentage of a compound of barium oxide with tungsten or molybdenum oxide or with both tungsten and molybdenum oxides. This compound is believed to be of the form 3 Ba O. WO_3 where only tungsten oxide is added. As in the parent application, a part of the barium oxide may be replaced by calcium or strontium oxides or by both calcium and strontium oxides. Such replacement may probably be in any amount up to about one molecular replacement. Although it is believed that thorates of calcium and strontium are not formed, the calcium and strontium oxides, when present, take part in the formation of compounds with the tungsten or molybdenum oxides. Thus in the case where one molecule of the barium oxide is replaced by calcium oxide the compound is believed to the 2 BaO. 1Ca O. WO_3.

In carrying the invention into effect we may proceed as follows:—

There is prepared a mixture of 2.5 Ba CO_3 : 1 Ca CO_3 : 2.5 Th O_2 (molecular proportions) and 3% of tungsten by weight is added. These constituents are mixed with a suitable binder such as gum tragacanth, extruded through a suitable die in the form of rods, and the rods are placed in a molybdenum boat lined with magnesia plates and fired at 1600°C. in an atmosphere of hydrogen. The temperature of the rods is raised to 1600°C. in 7 minutes, kept at this temperature for 10 minutes, and cooled to room temperature in a further 10 minutes. The composition of the tungsten phase produced in this example is believed to be

2 BaO. 1 CaO . WO_3.

A part or the whole of the tungsten, in the above example, may be replaced by molybdenum and a part or the whole of the calcium carbonate may be replaced by strontium carbonate.

Dated this 25th day of June, 1945.

For the Applicants,
A. F. CORNOCK.
Chartered Patent Agent.

[Price 1/-]

COMPLETE SPECIFICATION

Improvements in Thermionic Cathodes

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British Company, and HAROLD PERCY ROOKSBY and SIDNEY HOWARD NOBLE, both of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, and WILLIAM GEORGE SIMMONS BRANSON and JACK SHIRLEY HERRIOTT, both of The Osram—G.E.C. Lamp Works, Brook Green, Hammersmith, W.6., all British subjects do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to thermionic cathodes and is an improvement in or modification of the invention set forth in Patent Specification No. 577,599.

It is concerned with thermionic cathodes of the type comprising a perforated metal container and within the container a rod of activating material consisting mainly of barium thorate. Usually the perforated container is a tungsten helix and the cathode is heated by passing a current through the helix.

In the parent application there is described a method of manufacturing a cathode of the type set forth in which a mixture of barium carbonate and thoria with a suitable binder is extruded to form a rod which is heated in a non-oxidising atmosphere to a temperature and for a time such that chemical combination takes place between the barium and thorium oxides. Part of the barium oxide may be replaced by calcium or strontium oxide or by a mixture of these oxides.

It has now been found that the addition to the said mixture of a small percentage of tungsten or molybdenum or both tungsten and molybdenum confers advantageous properties on the said rods. Thus the rods, after heating, are superior in shape, hardness and stability on exposure to the atmosphere to those prepared without the addition of these metals. The tungsten and/or molybdenum may be added in the form of either the metal or the oxide.

According to the present invention therefore there is provided a thermionic cathode of the type set forth containing a small percentage of a compound of barium oxide with tungsten oxide or molybdenum oxide or with both tungsten oxide and molybdenum oxide. This compound is believed to be of the form 3 Ba O. WO_3 where only tungsten oxide is added. As in the parent application, a part of the barium oxide may be replaced by calcium oxide or strontium oxide or by both calcium and strontium oxides. Such replacement may probably be in any amount up to about one molecular replacement. Although it is believed that thorates of calcium and strontium are not formed, the calcium and strontium oxides, when present, take part in the formation of compounds with the tungsten or molybdenum oxides. Thus in the case where one molecule of the barium oxide is replaced by calcium oxide the compound is believed to be the

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In carrying the invention into effect we may proceed as follows:—

There is prepared a mixture of 2.5 Ba CO_3 : 1 Ca CO_3 : 2.5 Th O_2 (molecular proportions) and 3% of tungsten by weight is added. These constituents are mixed with a suitable binder such as gum tragacanth, extruded through a suitable die in the form of rods, and the rods are placed in a molybdenum boat lined with magnesia plates and fired at 1600°C. in an atmosphere of hydrogen. The temperature of the rods is raised to 1600°C. in 7 minutes, kept at this temperature for 10 minutes, and cooled to room temperature in a further 10 minutes. The composition of the tungsten phase produced in this example is believed to be

2 BaO. 1 CaO. WO_3.

A part or the whole of the tungsten, in the above example, may be replaced by molybdenum and a part or the whole of the calcium carbonate may be replaced by strontium carbonate.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A thermionic cathode of the type set forth constituting an improvement in or modification of the invention set forth in Patent Specification No. 577,599, wherein the activating material contains a small percentage of a compound of barium oxide with tungsten oxide or molybdenum oxide or with both tungsten oxide and molybdenum oxide.

2. A thermionic cathode according to Claim 1, wherein the activating material contains a small percentage of a compound of calcium oxide with tungsten oxide or molybdenum oxide or with both

COMPLETE SPECIFICATION

Improvements in Thermionic Cathodes

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The present invention relates to thermionic cathodes and is an improvement in or modification of the invention set forth in Patent Specification No. 577,599.

It is concerned with thermionic cathodes of the type comprising a perforated metal container and within the container a rod of activating material consisting mainly of barium thorate. Usually the perforated container is a tungsten helix and the cathode is heated by passing a current through the helix.

In the parent application there is described a method of manufacturing a cathode of the type set forth in which a mixture of barium carbonate and thoria with a suitable binder is extruded to form a rod which is heated in a non-oxidising atmosphere to a temperature and for a time such that chemical combination takes place between the barium and thorium oxides. Part of the barium oxide may be replaced by calcium or strontium oxide or by a mixture of these oxides.

It has now been found that the addition to the said mixture of a small percentage of tungsten or molybdenum or both tungsten and molybdenum confers advantageous properties on the said rods. Thus the rods, after heating, are superior in shape, hardness and stability on exposure to the atmosphere to those prepared without the addition of these metals. The tungsten and/or molybdenum may be added in the form of either the metal or the oxide.

According to the present invention therefore there is provided a thermionic cathode of the type set forth containing a small percentage of a compound of barium oxide with tungsten oxide or molybdenum oxide or with both tungsten oxide and molybdenum oxide. This compound is believed to be of the form 3 Ba O. WO_3 where only tungsten oxide is added. As in the parent application, a part of the barium oxide may be replaced by calcium oxide or strontium oxide or by both calcium and strontium oxides. Such replacement may probably be in any amount up to about one molecular replacement. Although it is believed that thorates of calcium and strontium are not formed, the calcium and strontium oxides, when present, take part in the formation of compounds with the tungsten or molybdenum oxides. Thus in the case where one molecule of the barium oxide is replaced by calcium oxide the compound is believed to be the

2 BaO. 1 CaO. WO_3.

In carrying the invention into effect we may proceed as follows:—

There is prepared a mixture of 2.5 Ba CO_3 : 1 Ca CO_3 : 2.5 Th O_2 (molecular proportions) and 3% of tungsten by weight is added. These constituents are mixed with a suitable binder such as gum tragacanth, extruded through a suitable die in the form of rods, and the rods are placed in a molybdenum boat lined with magnesia plates and fired at 1600°C. in an atmosphere of hydrogen. The temperature of the rods is raised to 1600°C. in 7 minutes, kept at this temperature for 10 minutes, and cooled to room temperature in a further 10 minutes. The composition of the tungsten phase produced in this example is believed to be

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A part or the whole of the tungsten, in the above example, may be replaced by molybdenum and a part or the whole of the calcium carbonate may be replaced by strontium carbonate.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A thermionic cathode of the type set forth constituting an improvement in or modification of the invention set forth in Patent Specification No. 577,599, wherein the activating material contains a small percentage of a compound of barium oxide with tungsten oxide or molybdenum oxide or with both tungsten oxide and molybdenum oxide.

2. A thermionic cathode according to Claim 1, wherein the activating material contains a small percentage of a compound of calcium oxide with tungsten oxide or molybdenum oxide or with both

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tungsten oxide and molybdenum oxide.

3. A thermionic cathode according to Claim 1 or 2, wherein the activating material contains a small percentage of a compound of strontium oxide with tungsten oxide or molybdenum oxide or with both tungsten oxide and molybdenum oxide.

4. A method of manufacturing a rod of activating material, constituting an improvement in or modification of the invention set forth in Patent Application No. 1021/44 (Serial No. 577,599), which comprises mixing barium carbonate, thoria, and tungsten or molybdenum, in the form of either the metal or the oxide, with a suitable binder, extruding this mixture to form a rod and heating the mixture to a temperature and for a time such that chemical combination takes place between the barium and thorium oxides.

5. A method according to Claim 4, wherein calcium carbonate is added to the mixture.

6. A method according to Claim 4 or 5, wherein strontium carbonate is added to the mixture.

7. A method according to Claim 4, 5 or 6, wherein the constituents of the said mixture are substantially in the proportions described.

Dated the 15th day of May, 1946.

For the Applicants,
A. F. CORNOCK.
Chartered Patent Agent.

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