AMENDED SPECIFICATION

Reprinted as amended in accordance with the decision of the Superintending Examiner, acting for the Comptroller-General, dated the fifth day of June, 1939, under Section 21, of the Patents and Designs Acts, 1907 to 1938.

(The Amendments are shown in italic type)

PATENT SPECIFICATION

Application Date: Nov. 2, 1936. No. 29763/36. **476,908***

(Patent of Addition to No. 451,989 dated July 22, 1935.)

Complete Specification Left: Sept. 9, 1937.

Complete Specification Accepted: Dec. 17, 1937.

PROVISIONAL SPECIFICATION

Improvements in Thermionic Electrodes

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British company, do hereby declare the nature of this invention (a communication from Patent-Treuhand-Gesellschaft für Elektrische Glühlampen m.b.H., of 11/14 Ehrenbergstrasse, Berlin O.17, Germany, a German company) to be as follows:—

This invention relates to an improvement in or modification of the method of manufacturing a thermionic cathode described and claimed in Patent Specification No. 451,989. According to the invention of that specification the manufacture of a thermionic cathode comprises the steps of filling the interior of helix of a refractory metal with a paste of material of high thermionic emissivity and then heating the resulting body so as to convert the said paste into a hard coherent mass.

It has now been found that in order to obtain most of the advantages of this method, it is not necessary to fill the whole of the interior of the helix with the paste. It is possible to start manufacture in the ordinary manner with a solid rod of material of high thermionic emissivity within the helix, and then to add paste merely to fill up any gaps between the rod and the helix. The paste may consist of the mixture of alkaline earth oxides, hydroxides, and carbonates with a liquid, such as water or alcohol; it may then be painted on the helix containing the rod with a brush, or in any other manner be introduced into any possible gaps. But the preferred method is to use molten alkaline earth nitrate as the paste. In this method the helix is heated, for example by a current passed through it, to a temperature above the melting point of the nitrate, and a small piece of the nitrate is passed over it. The body is then heated further, so that the nitrate is decomposed and a hard coherent mass of oxide is left in its place.

This last method is especially suitable when the helix containing the rod is, in known manner, a double helix consisting of two portions wound in opposite directions. Local heating of the spiral, where it is not fully in contact with the rod, is thereby prevented.

According to the invention the manufacture of a thermionic cathode comprises the steps of introducing within a helix of a refractory metal a solid rod of material of high thermionic emissivity, filling the gaps between the said rod and the said helix with a paste or liquid of a material of high thermionic emissivity, and heating the resulting body so as to convert the said paste or liquid into a hard coherent mass.

Dated the 2nd day of October, 1936.
For the Applicants,
NORMAN R. CAMPBELL.

COMPLETE SPECIFICATION (AMENDED)

Improvements in Thermionic Electrodes

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British company, do hereby declare the nature of this invention (a communication from Patent-Treuhand-Gesellschaft für elektrische Glüh-

lampen m.b.H., of 11/14, Ehrenbergstrasse, Berlin O.17, Germany, a German company) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improvement in or modification of the method of manufacturing a thermionic cathode described and claimed in Patent Specification No. 451,989. According to the invention of that specification the manufacture of a thermionic cathode comprises the steps of filling the interior of a helix of a refractory metal with a paste of material of high thermionic emissivity and then heating the resulting body so as to convert the said paste into a hard coherent mass.

It has now been found that in order to obtain most of the advantages of this method, it is not necessary to fill the whole of the interior of the helix with the paste. It is possible to start manufacture in the ordinary manner with a solid rod of material of high thermionic emissivity within the helix, and then to add paste merely to fill up any gaps between the rod and the helix. The paste may be any liquid or plastic body which has the properties (1) that it is readily introduced into interstices and (2), when heated after its introduction, produces material of high thermionic emissivity. Thus the paste may consist of the usual mixture of alkaline earth oxides, hydroxides, and carbonates with a liquid, such as water or alcohol; it may then be painted on the helix containing the rod with a brush, or in any other manner be introduced into any possible gaps. But the preferred method is to use molten alkaline earth nitrate as the paste. In this method the helix is heated, for example by a current passed through it, to a temperature above the melting point of the nitrate, and the solid nitrate is brought into contact with it. The nitrate melts and enters any interstices by capillarity. The body is then heated further, so that the nitrate is decomposed and a hard coherent mass of oxide is left in its place.

This last method is especially suitable when the helix containing the rod is, in known manner, a double helix consisting of two portions wound in opposite directions. Local heating of the spiral, where it is not fully in contact with the rod, is thereby prevented. Conversely, when the cathode belongs to an electric discharge lamp and is heated by the discharge only, difficulty in starting, due to imperfect contact between rod and helix, is avoided.

According to the invention the manufacture of a thermionic cathode comprises the steps of introducing within a helix of a refractory metal a solid rod of material of high thermionic emissivity, filling the gaps between the said rod and the said helix with a paste *or liquid*, and heating the resulting body so as to convert the said paste or liquid into a hard coherent mass of high thermionic emissivity.

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. The improvement in or modification of the manufacture of a thermionic cathode described and claimed in Patent Specification No. 451,989 which comprises the steps of introducing within a helix of a refractory metal a solid rod of material of high thermionic emissivity, filling the gaps between the said rod and the said helix with a paste *or liquid*, and heating the resulting body so as to convert the said paste or liquid into a hard coherent mass of high thermionic emissivity.

2. The manufacture according to Claim 1 wherein the said paste consists of molten alkaline earth nitrate.

3. The manufacture according to Claim 2 wherein the said helix is a double helix consisting of two portions wound in opposite directions.

4. An electric discharge lamp comprising a thermionic cathode manufactured according to any preceding claim and adapted to be heated by the discharge only.

Dated the 9th day of September, 1937.

For the Applicants,
NORMAN R. CAMPBELL.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1939.

lampen m.b.H., of 11/14, Ehrenbergstrasse, Berlin O.17, Germany, a German company) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improvement in or modification of the method of manufacturing a thermionic cathode described and claimed in Patent Specification No. 451,989. According to the invention of that specification the manufacture of a thermionic cathode comprises the steps of filling the interior of a helix of a refractory metal with a paste of material of high thermionic emissivity and then heating the resulting body so as to convert the said paste into a hard coherent mass.

It has now been found that in order to obtain most of the advantages of this method, it is not necessary to fill the whole of the interior of the helix with the paste. It is possible to start manufacture in the ordinary manner with a solid rod of material of high thermionic emissivity within the helix, and then to add paste merely to fill up any gaps between the rod and the helix. The paste may be any liquid or plastic body which has the properties (1) that it is readily introduced into interstices and (2), when heated after its introduction, produces material of high thermionic emissivity. Thus the paste may consist of the usual mixture of alkaline earth oxides, hydroxides, and carbonates with a liquid, such as water or alcohol; it may then be painted on the helix containing the rod with a brush, or in any other manner be introduced into any possible gaps. But the preferred method is to use molten alkaline earth nitrate as the paste. In this method the helix is heated, for example by a current passed through it, to a temperature above the melting point of the nitrate, and the solid nitrate is brought into contact with it. The nitrate melts and enters any interstices by capillarity. The body is then heated further, so that the nitrate is decomposed and a hard coherent mass of oxide is left in its place.

This last method is especially suitable when the helix containing the rod is, in known manner, a double helix consisting of two portions wound in opposite directions. Local heating of the spiral, where it is not fully in contact with the rod, is thereby prevented. Conversely, when the cathode belongs to an electric discharge lamp and is heated by the discharge only, difficulty in starting, due to imperfect contact between rod and helix, is avoided.

According to the invention the manufacture of a thermionic cathode comprises the steps of introducing within a helix of a refractory metal a solid rod of material of high thermionic emissivity, filling the gaps between the said rod and the said helix with a paste *or liquid*, and heating the resulting body so as to convert the said paste or liquid into a hard coherent mass of high thermionic emissivity.

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. The improvement in or modification of the manufacture of a thermionic cathode described and claimed in Patent Specification No. 451,989 which comprises the steps of introducing within a helix of a refractory metal a solid rod of material of high thermionic emissivity, filling the gaps between the said rod and the said helix with a paste *or liquid*, and heating the resulting body so as to convert the said paste or liquid into a hard coherent mass of high thermionic emissivity.

2. The manufacture according to Claim 1 wherein the said paste consists of molten alkaline earth nitrate.

3. The manufacture according to Claim 2 wherein the said helix is a double helix consisting of two portions wound in opposite directions.

4. An electric discharge lamp comprising a thermionic cathode manufactured according to any preceding claim and adapted to be heated by the discharge only.

Dated the 9th day of September, 1937.

For the Applicants,
NORMAN R. CAMPBELL.

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