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INDIRECTLY HEATED CATHODE

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1 Claim. (Cl. 29—25.17)

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This invention relates to a method of manufacturing a cathode of the indirectly heated type and to a cathode made by this method.

Cathodes of the indirectly-heated type generally comprise a heater which, either with or without insulating material interposed, is surrounded by a cathode body in the form of a short length of tube, said tube being coated with a substance capable of readily emitting electrons, for example with barium oxide. Such a cathode may be manufactured by coating the heater in a suitable manner with an insulating layer which is baked to the heater at a high temperature, the body thus obtained having then slipped over it a thin-walled short length of tube that acts as a cathode body. It is also possible to turn this cathode body in the form of a thin foil around the insulating material and to weld it at the joint thus formed. Furthermore, instead of using powdered insulating material which is baked to the heater, use may be made of a solid insulating body which has formed in it one or more apertures for the parts of the heater.

The present invention is directed towards a special method of manufacturing a cathode of the indirectly-heated type of the form herein described, such method presenting particular advantages. According to this method, for example, a tubular body of conducting material is arranged with one or more conducting wires inside, the remaining space between the tubular body and the wires is then filled with insulating material and the aggregate thus obtained is given the desired dimensions and/or shape by drawing, rolling or similar operations. Use is thus initially made of component members of a cathode of the indirectly-heated type of given thickness, a cathode whose component members have the desired thickness being eventually obtained by the mechanical operations. The conductor which has to act as the heater may be arranged inside the element to be used as a cathode body in the form of one or more straight wires but also for example in the form of a spiral; in the latter case depending on the manner of drawing and rolling the said heater may be shaped in the final cathode either into the form of a straight wire or that of a spiral.

Apart from the surprising fact that in actual fact it is found possible for compound bodies such as cathodes of the indirectly-heated type having to satisfy certain requirements, to be manufactured in this simple manner, the method herein described has particular advantages. Thus, for example, there is a greater liberty in regard to

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the choice of the material of the heater; since in the case of the well-known cathode the insulating material has to be baked to the heater at a high temperature for example at 1400° C., it is necessary that for the constitution thereof use should be made of material capable of withstanding this high temperature. Tungsten or molybdenum is generally used for this purpose. Since these metals have a low resistance it is necessary for the heating wires, if used in cathodes that have to be operated at high voltages, to be very thin and in some cases this entails difficulty. The method according to the present invention permits of choosing other materials, such as, for example, nickel, nickel iron or the like for constituting the said heaters. It is probable that when the compound bodies according to the invention are being drawn the insulating material is pressed to the heater so as to be sufficiently adherent without the necessity for this material to be supplementarily sintered in position. Incidentally, the insulating material is enclosed in the cathode so as to be well compressed so that very uniform heat transmission between heater and cathode body is obtained while at the same time the temperature difference between filament and cathode may be comparatively slight.

An important advantage of a cathode according to the present invention consists in that there is a much greater versatility in relation to the shape to be given. Thus, for example the drawn cathode may be shaped in a simple manner into the form of a spiral, a helix or a similar body. In addition, the drawing and hammering operations may be effected in such manner that out of a body of cylindrical or oval-shaped form a flat cathode is obtained. In addition, the heater may be shaped into any form whatever and, as mentioned hereinbefore, when starting with a heater in the form of a spiral, it is possible to obtain either a straight wire or a thinner spiral upon rolling and drawing.

Due to all these possibilities, a cathode according to the invention may be used in a large number of different tube types such as transmitting valves, gas-filled rectifier valves or the like.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to an example in which a method of manufacturing a cathode of the indirectly-heated type according to the invention is set out in detail. According to this method, a tube for example of nickel

or copper whose diameter is 8 mms. and whose wall thickness is ½ mm. has two wires of nickel of about 1 mm. thickness introduced into it. These wires are set tightly relatively to the surrounding tube and the remaining space is then filled with powdered magnesia or alumina, this powder being compressed or mixed to the greatest extent. The body thus obtained is then drawn and/or rolled until the dimensions and/or shape desired for the cathode are obtained. It is found that in this manner cathodes whose cathode body has a diameter of from 0.1 to 4 mms. can be readily manufactured.

What I claim is:

The method of manufacturing an indirectly heated cathode comprising an outer conductive body and a conductive heater element, comprising the steps of arranging said element helically wound within said body and surrounded thereby, filling the space between said element and said body with a pulverulent insulating material, and thereafter drawing the said body so filled until the said helically wound element is substantially straightened.

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