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ELECTRON DISCHARGE TUBE

Filed May 14, 1932

Fig 1

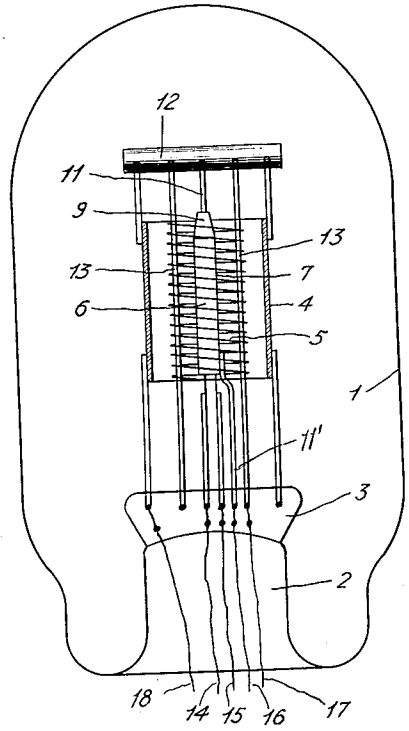


Fig 2

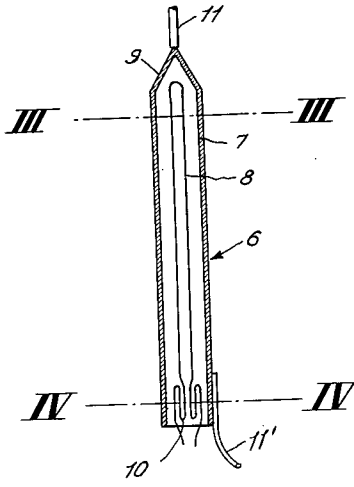
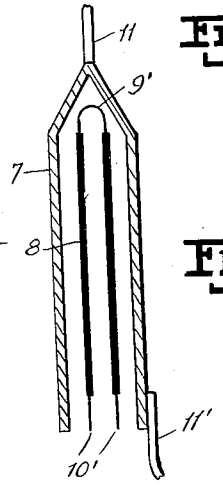


Fig 3

Fig 4

Fig 5



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ELECTRON DISCHARGE TUBE

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2 Claims. (Cl. 250—27.5)

The invention relates to electron discharge tubes and more particularly to tubes comprising an indirectly heated cathode. Such a cathode commonly consists of a cylindrical metal body, the cathode body proper, within which is arranged the heater which may consist of a hair-pin-shaped wire of refractory material such, for example, as tungsten. The cathode body usually consists of a nickel cylinder which surrounds the heater at some distance, if desired with the interposition of an insulating material, and the outer surface of which is covered with a strongly electron emitting layer, for example, with barium oxide. It is usual to mount a cathode thus constructed within the tube with the aid of supports secured to the upper end and to the lower end of the cathode body. One of these supports may simultaneously serve for the supply of current to the cathode.

It has been demonstrated that the operation of a discharge tube comprising such a cathode entails inconveniences substantially consisting in a very non-uniform emission. Now it has been found that this must be ascribed to the fact that the temperature at different points of the surface of the cathode body is non-uniform. More particularly the ends of this body have a considerably lower temperature than other points of the surface. It has been found that this results from the dissipation of heat which takes place at the ends of the cathode body for at these points the cathode is connected to supports or to current supply conductors.

The invention has for its object to remove this drawback by a plain construction of an electric discharge tube comprising an indirectly heated cathode.

An electron discharge tube according to the invention comprises an indirectly heated cathode, the heater and the cathode body of which are so shaped that the amount of heat developed per unit of the cathode surface by that portion of the heater which is located in the neighborhood of a point at which the cathode is supported, is larger than the amount of heat developed per unit of the cathode surface by a portion of the heater which is not located in the neighborhood of a point of support of the cathode. It is possible to obtain in this manner a uniform or substantially uniform distribution of the temperature over the whole surface of the cathode, which results in a better emission than with the indirectly heated cathode hitherto used.

It is advantageous to constitute the cathode body by a small tube and to give the tube portion located in the neighborhood of the points of support a smaller diameter than the other portion. This portion located in the neighborhood of a point of support may be given for this purpose, for example, the shape of a cone. Very satisfactory results are obtained by giving a portion of the heater of the cathode which is located in the neighborhood of a point of support per unit of length of the cathode a greater length than a portion of this heater which is not located in the neighborhood of a point of support. Very good results may also be obtained by giving the heater and the points located in the neighborhood of a point of support of the cathode a higher resistance than the points of this heater which are not located in the neighborhood of a point of support of the cathode. It has been found that with these constructions a substantially uniform temperature of the cathode body can always be obtained.

By the amount of heat produced by a determined portion of the heater per unit of the cathode surface is meant this: a portion limited by two parallel planes perpendicular to the longitudinal axis of the cathode must be assumed to be removed from the latter. To this cathode portion there corresponds a determined portion of the heater. When the heater is traversed by a current, a certain amount of heat will be developed in this portion of the heater. The cathode portion under consideration has a certain emitting surface the size of which can be determined. When determining the quotient of the amount of heat produced and the size of this surface, one obtains an amount of heat which is produced by the heater portion under consideration per unit of the cathode surface. It is evident that this quotient depends on the intensity of the current flowing through the heater. The quotient valid for a determined cathode portion of the cathode may directly be compared with the quotient found for another cathode portion because one may start in this case from the same current intensity in the whole heater.

The invention will be more clearly understood by referring to the accompanying drawing in which,

Figure 1 represents one embodiment of a discharge tube according to the invention;

Figure 2 represents the cathode utilized in this tube,

Figures 3 and 4 are sections of this cathode, and

Figure 5 is another form of cathode structure according to the invention.

In Figure 1, 1 denotes the bulb of a discharge tube with a reentrant stem 2 and a pinch or press 3. The tube contains an anode 4, a grid 5 and a cathode 6. The latter consists of a cathode body 7 which may be constituted, for example, by a nickel tube which is coated with a strongly electron emitting layer, for example with barium oxide and within which is located the heater which may consist, for example, of a hairpin-shaped wire of refractory material.

Figure 2 distinctly shows the shape the cathode body and the heater may have according to the invention. In this figure, 7 denotes again the cathode body and 8 the heater whereas at 9 and 10 is shown the shape which the cathode body and the heater may have in order to obtain a satisfactory functioning according to the invention.

The cathode body is secured at its lower end to a support 11' and at its upper end to a support 11 (Figure 1) which is connected again to a rod of glass or other insulating material 12. In this rod are mounted, in addition, the supporting rods 13 of the grid, the rod itself being secured to the anode. The leading-in wires 14 and 15 of the cathode heater, the leading-in wire 16 of the cathode body, the leading-in wires 17 and 18 of the grid and of the anode are led out of the tube through the pinch or press 3.

In the embodiment shown in Figure 5 the cathode sleeve 7 is shown as having the same form as that shown in Figure 2, but the internal heater element 8' is of such construction, as above described, that those portions thereof such as 9' and 10' which are in the neighborhood of points of support of the cathode with supports 11 and 11' are of higher resistance per unit of length than other heater portions that are not in the neighborhood of a cathode support.

It is evident that although in the embodiments shown by way of example a determined construction of the cathode body and of the heater is shown, it is to be understood that it is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

For example, the invention is applicable to discharge tubes comprising an oblique or horizontal electrode system or to discharge tubes comprising more than one electrode system or a plurality of electrodes fulfilling the same function.

What we claim is:

1. An indirectly heated cathode for an electron discharge tube comprising an electron emitting element, a heater adjacent to and substantially coextensive with said emitting element, and a support connected to said emitting element, the resistance of that portion of the heater which is adjacent the point of connection between support and electron emitting element being greater than any other equal portion of the heater.

2. An indirectly heated cathode for an electron discharge tube comprising an electron emitting element, a support connected thereto, and a filamentary heater of the hairpin type adjacent to and substantially coextensive with said emitting element and of uniform resistivity except for that portion which is adjacent the point of connection between support and electron emitting element which has a higher resistivity than all other equal portions of the heater.

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