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INDIRECTLY HEATED CATHODE

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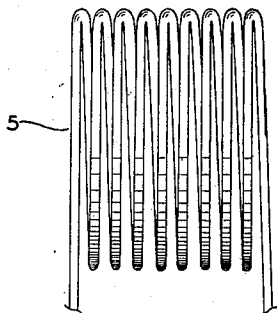


FIG. 1

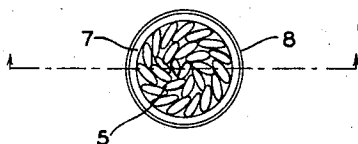


FIG. 2

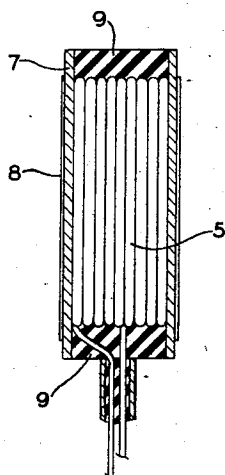


FIG. 3

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INDIRECTLY HEATED CATHODE

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6 Claims. (Cl. 250-27.5)

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My invention relates in general to electron discharge devices and more particularly to methods of constructing indirectly-heated cathodes for such devices.

In the construction of indirectly-heated cathodes, it is customary to employ a shell of conducting material coated with an electron emitting substance, a filament carrying heater current being placed within the shell. The methods of disposing this heater element within the cathode vary, but clearly it is important to construct the filament so that most efficient heating is obtained.

Accordingly, it is one object of my invention to provide an efficiently heated indirectly-heated cathode.

Another object is to provide a method of constructing a filament for a hollow cylindrical cathode.

Still another object is to utilize most efficiently the space available within a cathode for heating purposes.

These and other objects of my invention will be apparent to those skilled in the art upon reference to the following specification, claims, and drawings in which;

Fig. 1 is an elevational view of a coil employed in my invention;

Fig. 2 is an end view of a cathode into which the heater element of the invention has been inserted; and,

Fig. 3 is a longitudinal section of a cathode, and a heater, shown in elevation, within the cathode.

Referring now to Fig. 1, a wire 5 of any suitable ductile material, for example molybdenum, is wound in an elongated spring shape with a minimum suitable radius of curvature at the ends of the coils and being straight in the long sections. The spring may be wound with the coils close together to facilitate packing into the cathode shell.

It is next necessary to apply an insulating material to the wire to prevent short circuiting between the turns when heater voltage is applied. A convenient way of doing this is to spray the wire with a fluid suspension of an insulating ceramic such as aluminum oxide. The coil should be slightly stretched to insure that the entire surface is covered by the spray. The next step is to bake the sprayed coil at about 100° C. until most of the liquid binder in the spray has been driven off and the aluminum oxide is fairly well set but not hard. When this condition has been reached, the coil is compressed until the

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turns are close to one another and baked again at 1600° C. until the insulating material is very hard.

When this process has been completed the coil is then rolled into a spiral form and is inserted into a suitable cathode shell 7 which may be a cylindrical nickel sleeve coated with electron emissive material 8 as shown in Fig. 2. The free ends of the coil are allowed to project from the cathode shell to permit connection to any desirable form of terminal means. By employing a reasonable amount of care, this operation may be performed without damaging the ceramic insulating coating.

As shown in Fig. 3, it is preferable that the cathode 7 should be slightly longer than the coil in order that an insulating material 9 may be packed into both ends of the cathode. The reasons for doing this are two-fold: the filament is held securely in place thus preventing slipping or vibration of the wire, and wasteful radiation of heat from the ends of the cathode is greatly lessened. It has been found that aluminum oxide serves well as this insulating material.

Thus it can be seen that my invention allows efficient use of the volume within the cathode shell since the heater wire occupies by far the greatest portion of the available space.

It is to be emphasized that what has been described herein is a preferred embodiment of my invention and certain deviations may be made therefrom without exercise of inventive ingenuity. Hence, I claim all such modifications and adaptations which may fall fairly within the spirit and scope of the hereinafter appended claims.

What I claim is:

1. An indirectly heated cathode for a thermionic tube, said cathode comprising a hollow, metallic cathode cylinder, an electron-emissive layer on the outer surface of said cylinder, and a heater element within said cylinder, said heater element comprising a flat, compressed, helical, ribbon-shaped coil rolled into a flat spiral.

2. An indirectly heated cathode as defined in claim 1 in which the outer side-surface of said spiral is a right cylinder, the diameter of which is substantially equal to the inner diameter of said cathode cylinder, whereby said outer side-surface is in direct contact with the inner surface of said cathode cylinder.

3. An indirectly heated cathode as defined in claim 1 in which the said spiral is compactly wound and makes a snug fit within the cathode cylinder.

4. An indirectly heated cathode as defined in claim 1 in which said ribbon-shaped coil comprises a plurality of turns of insulated wire bent on itself whereby the thickness of said ribbon-shaped coil is substantially equal to twice the thickness of said insulated wire.

5. An indirectly heated cathode as defined in claim 1 in which said spiral has a plurality of convolutions, each successive convolution snugly fitting over the preceding convolution, and in which the axis of said spiral is perpendicular to two parallel planes defined by the lower and upper edges of said ribbon.

6. An indirectly heated cathode as defined in claim 1 in which the height of said flat spiral is substantially equal to the height of said electron emissive layer, the height of the latter being less than the height of said cathode cylinder.

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