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W. ZIEGENBEIN

2,078,360

CATHODE FOR ELECTRON DISCHARGE DEVICES

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Fig. 1

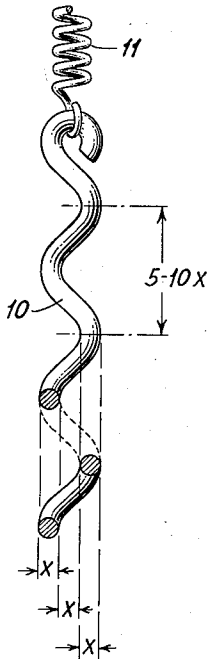


Fig. 2

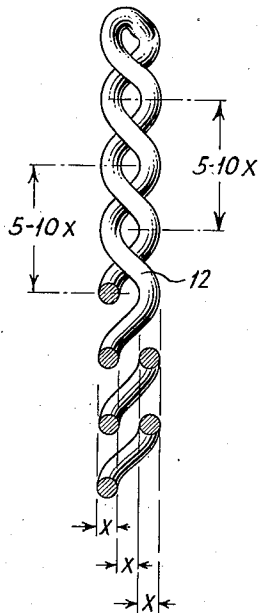


Fig. 3

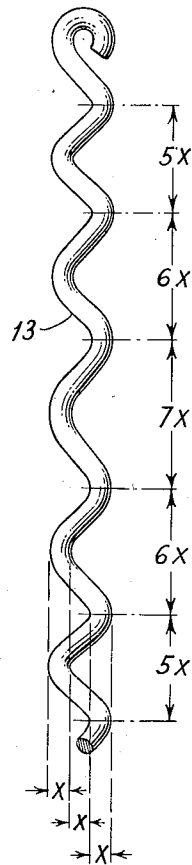
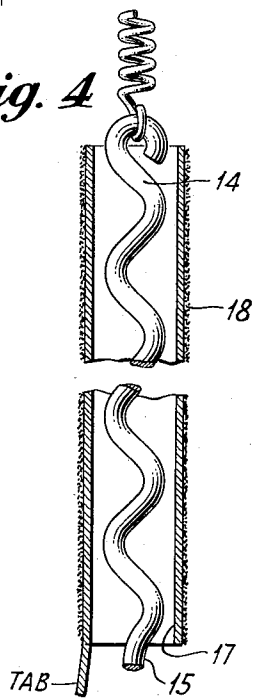


Fig. 4



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CATHODE FOR ELECTRON DISCHARGE
DEVICES

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4 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, more particularly to improvements in filament type cathodes in such devices.

In connection with the use of electrodes for electron discharge vessels which are wholly or partly constructed from metallic wires, it is often desirable to accommodate inside the available space a length of wire greater than a simple straight length. This situation exists in the case of directly heated cathodes where a comparatively high heating potential is used and the heating current is to be reduced. This also applies to heaters of indirectly heated cathodes. For this reason spirals of wire are frequently employed. However, spirals of the kind heretofore employed have frequently failed to give satisfaction inasmuch as they are very sensitive to forces acting at right angles to the axis of the spiral, that is, most particularly to shocks and electrostatic influences. The problem to be solved was to create a spiral or helical type filament cathode or heater which would be so rigid that it would possess roughly the mechanical properties of a stiff straight wire.

The principal object of my invention is to provide a filament type cathode or heater for use at high voltages and having a helical shape and which nevertheless is rigid and insensitive to lateral shock and electrostatic influences.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will best be understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 is a view partially in section of a directly heated cathode filament made in accordance with my invention, and Figures 2 and 3 are modifications of the filament shown in Figure 1, and Figure 4 is a longitudinal section of an indirectly heated cathode having a heater made according to my invention.

The present invention comprises a spiral or helical coil the inside diameter of which is roughly equal to the diameter of the wire used in the coil, while the pitch thereof is several times greater than the wire diameter. Particularly suitable has been found to be a spiral whose inside diameter is exactly as large as the wire diameter, while the pitch is from five to ten times the wire diameter. The spiral may be of the multiple-filament type and be connected as a reversed or looped spiral. It is also possible to make the coil with a pitch that is different at different points.

Inasmuch as the spiral here disclosed is very stiff, its inherent tension is generally not adequate to equalize changes in length upon heating. It is thus recommendable to tension a spiral as here disclosed by the aid of a distinct spring.

In Figure 1 the helical coil filament wire 10, for example of tungsten, is so wound that the inside diameter X of the coil is equal to the diameter X of the wire and the pitch between the turns as shown in the figures is from five to ten times the diameter of the wire. The heater wire may be supported in any convenient manner at its lower end from the press (not shown) and by means of spring 11 at its upper end to maintain the wire taut and in a vertical position when it is heated during operation of the tube in which the coiled wire is used as a cathode filament.

In Figure 2 is a coil 12 which may be of the double filament type or which may be of the reversely wound type.

In Figure 3 the coil 13 is another modification of my invention in which the coil has a variable pitch.

In Figure 4 the heater wire 14 is given the form shown in Figure 1 and supported at its lower end by lead 15 and at its upper end by a tensioning spring 16. This heater wire forms the heater for indirectly heated cathode 17 from which it is spaced, the cathode being coated with an emitting coating 18.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. A cathode for an electron discharge device including a coil of wire to be heated, said coil being wound in the form of a helix, the inside diameter of the helix having substantially the same dimensions as the diameter of the wire, the pitch between turns being less than ten but more than five times the diameter of said wire.

2. A cathode for an electron discharge device including a coil of wire to be heated, said coil being wound in the form of a double helix the inside diameter of the helix having substantial-

ly the same dimensions as the diameter of the wire, the pitch between turns being less than ten but more than five times the diameter of said wire.

- 5 3. A cathode for an electron discharge device including a coil of a wire to be heated, said coil being wound in the form of a reversely wound helix, the inside diameter of the helix having substantially the same dimensions as the diameter of the wire, the pitch between turns being
10 less than ten but more than five times the diameter of said wire.

4. A cathode for an electron discharge device including a coil of wire to be heated, said coil being wound in the form of a helix, the inside diameter of the helix having substantially the same dimensions as the diameter of the wire, the pitch between the turns varying between the limits of five times to ten times the diameter of the wire.

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