

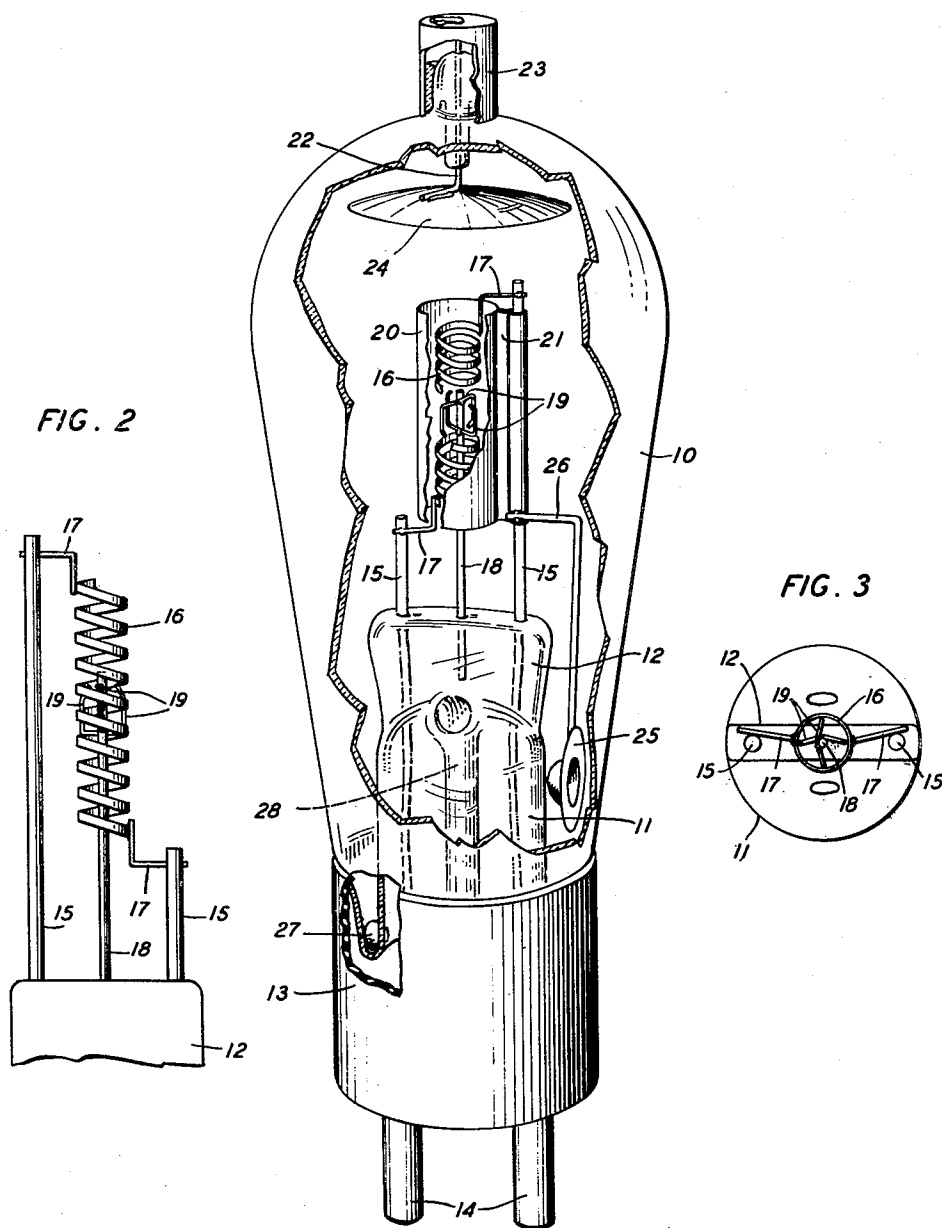
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ELECTRIC DISCHARGE DEVICE

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FIG. 1



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ELECTRIC DISCHARGE DEVICE

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8 Claims. (Cl. 250—27.5)

This invention relates to electric discharge devices and more particularly to gaseous rectifiers employing an incandescent cathode.

An object of this invention is to increase the efficiency of electric discharge devices.

Another object of this invention is to simplify and improve the structure of discharge devices.

The discharge device of this invention comprises, in one embodiment, an evacuated vessel having a reentrant stem, a cathode supported from the stem and extending longitudinally of the vessel, and an anode disposed adjacent the end of the cathode remote from the stem. The cathode consists of a helical ribbon adapted to emit electrons when heated and is supported by two upright metallic rods embedded in the stem. The ends of the helical cathode are connected to the upright rods by flexible links welded thereto.

In accordance with one feature of this invention the rigidity of the cathode structure is increased by an auxiliary supporting rod embedded in the press and extending axially within the cathode. The auxiliary rod carries two spaced arms which engage the cathode and prevent excessive jarring thereof by external shock and also prevent distortion of the cathode by temperature variations.

In accordance with another feature of this invention, a cylindrical metallic shield of relatively low heat conductivity surrounds the cathode throughout its entire length. The shield conserves and confines the heat radiated by the cathode and thereby increases the thermal efficiency of the cathode and the overall efficiency of the discharge device.

These and other features of this invention will be more clearly understood from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a perspective view of a mercury vapor rectifier made in accordance with this invention with portions of the cathode and of the heat shield broken away to show the cathode structure more clearly;

Fig. 2 is an enlarged detail view in elevation of the cathode structure; and

Fig. 3 is a plan view of the cathode structure shown in Fig. 2.

Referring now to the drawing, the electric discharge device, in accordance with one embodiment of this invention, comprises an enclosing vessel 10 having a reentrant stem 11 terminating in a press 12. The vessel 10 is attached to an insulating base 13 carrying terminal prongs 14 for associating the device with an electrical cir-

cuit. A plurality of rigid wires 15, each of which is electrically connected to one of the terminal prongs 14, are embedded in the press 12 and support a helical cathode 16 through flexible metallic link members 17, welded to the wires 15 and to opposite ends of the cathode 16. The link members allow longitudinal expansion and contraction of the cathode with temperature variations. The cathode consists of a flat nickel ribbon coated with alkaline earth oxides, for example, barium and strontium oxides and is formed into a cylindrical spiral or helix having closely spaced flat-wound turns, the axis of the spiral or helix being coincident with the longitudinal axis of the vessel 10.

Due to the length of the cathode and its suspension it is susceptible to external shock and subject to lateral displacement by temperature variations during operation of the device. To overcome vibration and displacement of the cathode a rigid metallic rod 18 is embedded in the press 12 and extends centrally within the helical cathode 16 along the axis thereof and parallel to the supporting rods 15. A pair of U-shaped arms 19, of a material having a high resistivity, such as molybdenum, are spaced along the rod 18 and are welded thereto at right angles to each other. The vertical prongs of the arms 19 engage the helical cathode 16 interiorly thereof at approximately the central portion of the helix. The coating on the cathode serves to some extent as an insulating medium between the arms 19 and the cathode 16 so that the convolutions of the cathode are not shorted electrically by the arms 19. Furthermore, the arms 19 being of a material having a high resistivity, the current there-through in comparison to the cathode heating current will necessarily be small.

This construction provides a compact and rigid cathode having a relatively large electron emitting surface and having a configuration such that a concentrated field of electronic flow is provided in the direction of the axis of the cathode. Furthermore, since the convolutions of the cathode are closely spaced, a substantially closed cylindrical structure is formed which increases the transfer of heat between the turns of the helix, decreases radiation of heat from the cathode and thereby improves the thermal efficiency of the cathode and the overall efficiency of the discharge device.

In order to further conserve the heat of the cathode and thereby reduce the current necessary to heat the cathode to a temperature required for satisfactory electron emission, a shield

20 of a material of relatively low heat conductivity, such as nickel, is disposed about the cathode 16 throughout its entire length. The shield 20 is preferably cylindrical in form and is closely spaced about the helical cathode and provided with a pair of integral flanges 21 which surround and engage one of the cathode supporting rods 15. The cylindrical shield serves as a heat reflector to confine and concentrate the cathode heat to a restricted space immediately about the cathode and minimizes heat radiation from the cathode to the wall of the enclosing vessel 10.

A leading-in wire 22 is sealed in the end of the vessel 10 opposite the stem 11 and is connected to a metallic cap 23 attached to the vessel 10 and serving as an external terminal for the anode of the discharge device. A dished anode 24, preferably of carbonized molybdenum, is supported from the leading-in wire 22 and is disposed with its base substantially perpendicular to the longitudinal axis of the cathode 16.

A helmet-shaped metallic disc 25 carrying a pellet of a getter material, such as magnesium, for fixing residual gases in the device, is supported from one of the rods 15 by a bent wire or shank 26 welded thereto.

In the assembly of the device, the vessel 10 is evacuated to a high degree and a quantity of mercury 27 is injected into the vessel 10 through a tubulation 28 within the stem 11 in accordance with the method disclosed in a copending application of D. S. Bond, Serial No. 480,654, filed September 9, 1930. During the operation of the device, the mercury is vaporized to form the conducting medium between the cathode and anode of the rectifier.

Although a specific embodiment of the invention has been disclosed and described herein, it is to be understood that the invention is not limited thereto and that many modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. In an electric discharge device having a stem, a hollow filamentary electrode supported above said stem, a support mounted on said stem and extending within said electrode, and a plurality of members mounted on said support, the outer portions of said members slidably engaging the inner surface of middle portions of said electrode for preventing lateral displacement thereof.

2. In an electric discharge device, an electrode structure comprising a stem, a plurality of parallel rigid members supported from said stem, a helical electrode mounted on said members, parallel rigid members supported from said stem, and extending within said helical electrode, and a helical electrode mounted on said members, engaging said electrode interiorly thereof.

3. In an electric discharge device, an electrode structure comprising a stem, a plurality of parallel rigid rods supported from said stem, a helical electrode mounted on said rods, a rigid member supported from said stem and extending within said electrode, and a metallic member having a high electrical resistance relative to said electrode mounted on said rigid member and engaging said electrode interiorly thereof.

4. In an electric discharge device, an electrode structure comprising a stem, a plurality of parallel rigid rods supported from said stem, a helical electrode mounted on said rods, a rigid member supported from said stem and extending within said electrode, and a plurality of U-shaped arms on said rigid member disposed at an angle to one another and engaging said helical electrode interiorly thereof.

5. A mercury vapor discharge device comprising an enclosing vessel having a stem, a plurality of rods extending from said stem, a helical cathode mounted on said rods and having its axis coincident with the axis of said stem, a rigid member supported from said stem and extending within said cathode, means on said member engaging said cathode interiorly thereof, a cylindrical shield mounted on one of said rods and encircling said cathode throughout its entire length, and an anode disposed adjacent an end of said cathode and substantially perpendicular to the axis thereof.

6. An electric discharge device comprising an enclosing vessel having a stem, a plurality of rods extending above said stem, a cathode supported by said rods, consisting of a flat ribbon forming a cylindrical spiral, a rigid member embedded in said press and extending axially within said spiral, and means on said rigid member engaging said spiral interiorly thereof.

7. An electric discharge device comprising an enclosing vessel having a stem, a pair of rigid rods extending above said stem, a cathode comprising a flat ribbon forming a linear helix having closely spaced convolutions, said rods serving as leading-in conductors for said cathode, link members between the ends of said helix and said rods, a heat reflecting member mounted on one of said rods and encircling said cathode, and an anode supported from the opposite end of said vessel substantially at right angles to the axis of said cathode.

8. An electric discharge device comprising an anode and a cylindrical helically wound cathode, means for supporting the cathode at its longitudinal ends and additional supporting means within said cathode and intermediate the ends thereof contacting with a plurality of turns of said cathode at a plurality of points on said turns.

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