

1,918,309

GLOW DISCHARGE LAMP

Filed April 5, 1930

2 Sheets-Sheet 1

FIG. 1

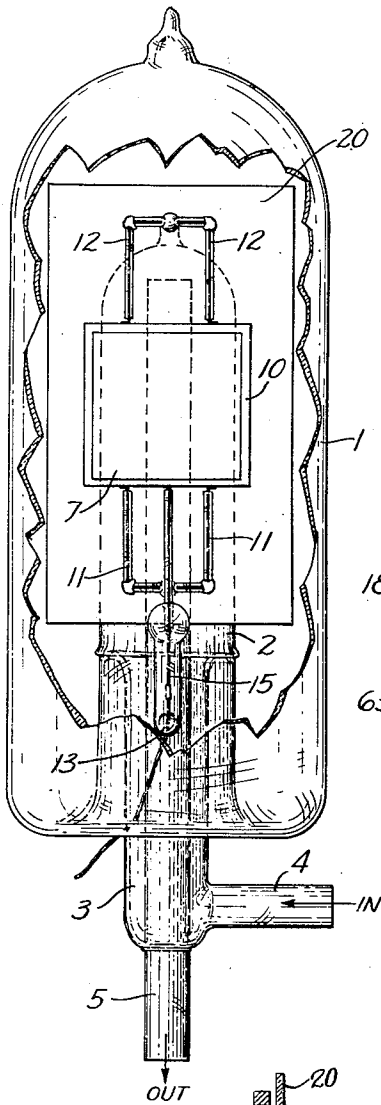


FIG. 2

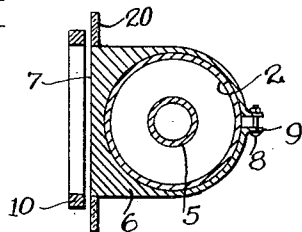
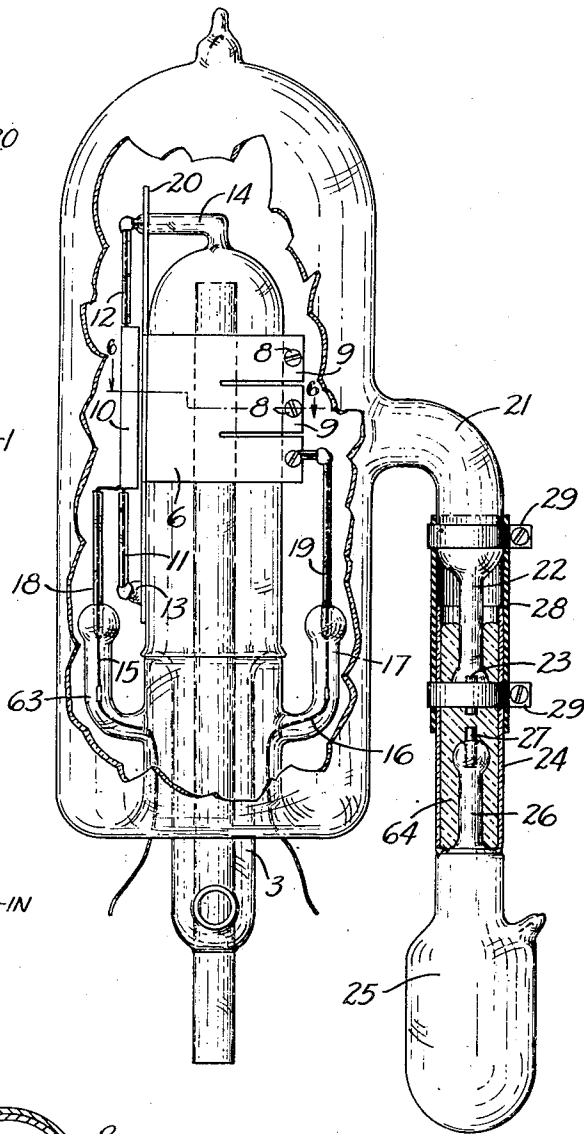


Fig. 6.

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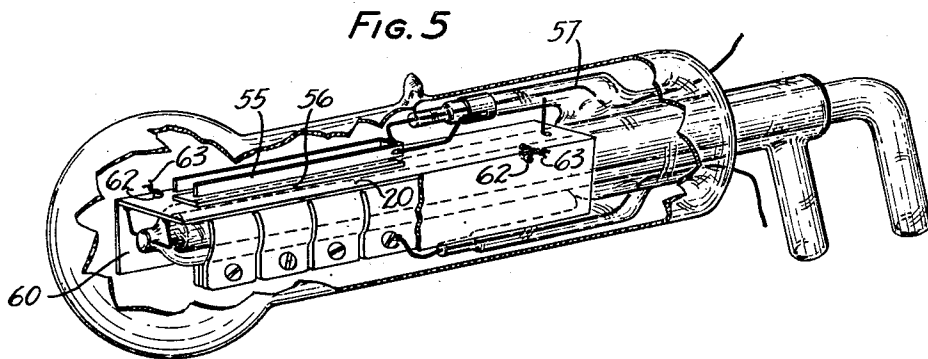
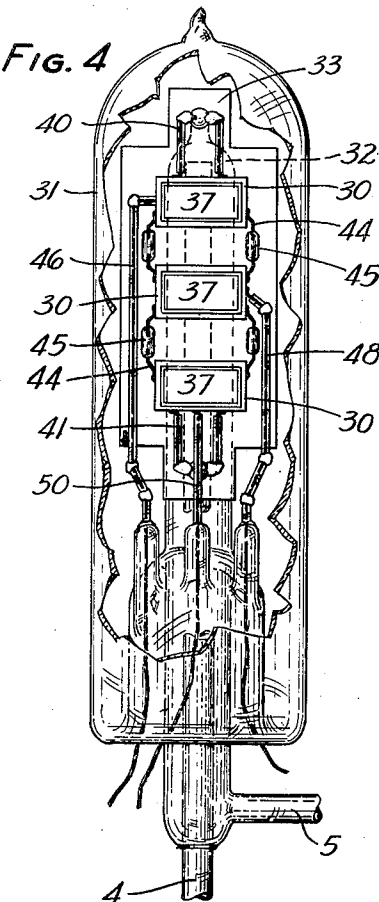
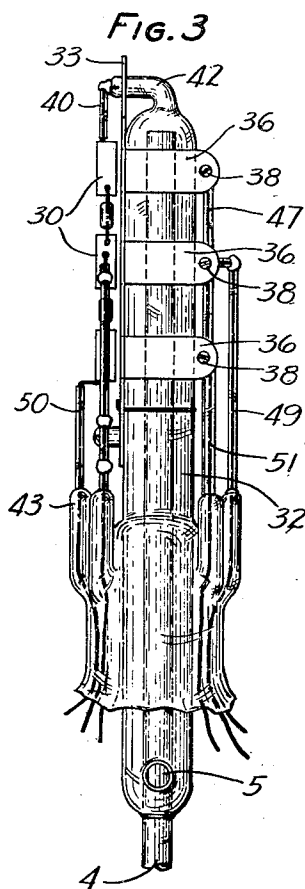
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2 Sheets-Sheet 2



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GLOW DISCHARGE LAMP

Application filed April 5, 1930. Serial No. 441,792.

This invention relates to glow discharge devices and more particularly to high power devices of that type.

It has heretofore been proposed to increase the power of glow lamps, in which the principal source of light is the negative glow area, by artificially cooling the cathode. This is accomplished by providing a metallic cylindrical cathode having one end closed and its other end sealed to a reentrant glass tube formed integral with the bulb. Cooling water circulates through the chamber, formed by the cylinder and cathode, in contact with the face of the latter opposite to that upon which the electric discharge occurs.

The present invention is directed to an improvement upon the lamp described above.

An object of the invention is to eliminate the glass-to-metal seal between the cylinder and reentrant tube, constituting the chamber through which the cooling medium is circulated.

Another object is to simplify the construction of the lamp.

A feature of the invention relates to the provision of a detachable electrode in a lamp of the type described above.

In one embodiment of the invention, the lamp is provided with a glass bulb having formed integral therewith a reentrant thimble-shaped duct or conduit through which the cooling water is circulated. The cathode element comprises a yoke-shaped member of copper, which surrounds the conduit. The yoke is provided with clamping screws for forcing it into intimate thermal contact with the conduit. The inner surface of the yoke is lined with soft copper, and it is provided with an extended flat square surface, which is plated with nickel or beryllium. The electric discharge takes place between the flat surface and a box-shaped anode of slightly greater dimensions. The bulb is supplied with a gas charge comprising a pure inert gas, or an inert gas combined with a small percentage of an inactive gas, at a pressure of a few millimeters of mercury.

A detailed description of the invention fol-

lows and is illustrated in the attached drawings.

Figs. 1 and 2 illustrate front and side views respectively, of one design of lamp embodying the invention;

Figs. 3 and 4 illustrate front view and side views, respectively, of the lamp shown in Fig. 1 provided with a plurality of sets of electrodes;

Fig. 5 is a perspective view of a lamp having an anode of different shape from that shown in the preceding figures.

Fig. 6 is a cross-section of the electrode assembly of the lamp on line 6—6, Fig. 2, the bulb being omitted.

Referring to Figs. 1 and 2 there is shown a lamp comprising a glass bulb 1 having a reentrant member 2, which is substantially thimble-shaped.

The member 2 is provided with a glass extension 3, which carries an inlet tube 4 and an outlet tube 5. Cooling water is supplied through the tube 4 for circulation within the member 2 and is discharged through the tube 5.

A yoke-shaped member 6 having an extended flat face 7, fits over the member 2 and is clamped thereon by means of the screws 8, which engage arms 9 of the yoke.

The member 6 is made of copper, is lined with soft copper, and the face 7 is plated with nickel or beryllium. The face 7 constitutes the active cathode surface for the discharge, and it is plated to reduce sputtering. The clamping screws 8 serve to force the yoke into good thermal contact with the member 2.

Associated with the flat surface 7 is a box-shaped anode 10. The anode is held in spaced relation parallel with respect to the surface 7 by supports 11 and 12, which are sealed in glass extensions 13 and 14 on the tube 2.

The positive terminal of the energizing source is connected to the anode 10 by a lead-in wire 15 extending through the glass extension 63.

The opposite or negative terminal of the energizing source is connected to the yoke by

a lead-in wire 16 carried by a glass extension 17.

Glass shields 18 and 19 are provided to insulate the portions of the lead-in wires 13 and 16 which project through the discharge space within the bulb. The back part of the yoke is insulated from the anode, by a mica shield 20, having an opening which is mounted upon and tightly fits the periphery of the surface 7. Thus the shield 20 serves to confine the electrical discharge to the area defined by the anode 10 and the cathode surface 7.

The bulb 1, after being freed of occluded gases and evacuated, is supplied with a charge of neon at a pressure of a few millimeters of mercury, for example about 10 millimeters.

Obviously the lamp may be charged with any one of the inert gases, or a mixture thereof, for example, neon, argon, helium, etc., in a pure state, or associated with any one of the active gases, for example, hydrogen, nitrogen, water vapor, carbon dioxide, etc.

When lamps containing neon are used to produce images in television systems, it has in general been found that the image is not clearly defined. This condition may be corrected by adding from one to ten percent by volume of active gas, for example hydrogen. An apparatus for this purpose is shown in Fig. 1.

The bulb 1 is provided with a glass extension 21 terminating in a reduced portion 22 carrying a porous plug 23. The extension 21 projects into a tube 24 which constitutes a part of a reservoir 25 and which is charged with hydrogen at about atmospheric pressure. The tube 24 surrounds an extension 26 of the reservoir which also carries a porous plug 27. The extensions 21 and 26 are flexibly connected together by a rubber tubing 28, secured to the respective extensions by the detachable bands 29. The tube 24 includes a body of mercury 64 to constitute an airtight seal for the bulb 1 and reservoir 25.

During the operation of lamps including a mixture of rare and active gases, the active gas tends to clean up and as a consequence the definition of the image suffers. To correct this, the above described apparatus may be used to introduce hydrogen into the lamp from time to time.

To supply hydrogen to the bulb, the two plugs are pressed into contact and hydrogen is transferred therethrough from the reservoir to the bulb. Because of the relative motion of the extensions 21 and 26, carrying the plugs, the level of the mercury will rise in the tube 24. The rubber tubing 28 is provided to prevent spilling the mercury, in case it is forced up beyond the top of the tube 24.

In operation energy is supplied through the lead-in wires to the cathode 7 and anode 10 to cause a discharge to occur between these electrodes. The heat developed in the cathode is conducted to and through the walls of the member 2 and is absorbed by the water circulating through it.

The hydrogen charging feature is not an essential element of the invention, and hence it may be dispensed with.

Figs. 3 and 4 illustrate a discharge lamp, which is operatively the same as that described above. However, it includes three rectangular shaped anodes 30 each associated with three rectangular cathode surfaces 37.

The cathode surfaces each form the outer face of a yoke 36, clamped by screws 38 upon the water circulating chamber 32 formed as a reentrant extension of the bulb 31.

A mica plate 33 is provided with openings which closely fit the peripheries of the cathode areas 37. The plate serves to insulate the back portion of the yokes 36 from the anodes and thereby prevents discharges occurring between the anodes and any portions of the yokes, except the cathode surfaces 37.

The upper and lower anodes 30 are carried by supports 40 and 41 secured in glass extensions 42 and 43 respectively, the intermediate anode is supported from the upper and lower anodes by wires 44 and glass beads 45. The supporting wires 44, secured to the respective anodes, are insulated from each other by the beads 45.

Water is supplied through the inlet and outlet tubes 4 and 5 for circulation through the chamber 2 to carry off the heat developed in the yokes.

The respective pairs of electrodes, upper, intermediate and lower, are supplied with energy from separate sources.

Current is supplied from one source through the leads 46 and 47 to the upper pair of electrodes, from a second source through the leads 48 and 49 to the intermediate pair of electrodes, and from a third source through leads 50 and 51.

The device of Figs. 3 and 4 constitutes a water cooled glow discharge lamp in which three separately controlled negative glow areas may be simultaneously produced.

Obviously for television operation, the glow areas may be controlled by image currents transmitted over separate communicating channels to produce either images of distinct fields of view scanned at the same or different transmitting stations or to cooperate in the production of a single image.

The lamp illustrated in Fig. 5 is designed to operate in the manner and for the purpose disclosed in application Serial No. 373,818 of applicant, filed on June 26, 1929. It differs from that shown in Fig. 1, in that it includes

a fork-shaped anode 55 operatively positioned with respect to a rectangular cathode surface 56 and a different type of shield is used. The anode is mounted as described in the above noted application, but the support does not serve to convey current to the electrode, a lead-in wire 57 is provided for this purpose.

The anode is insulated from the back portion of the cathode-carrying-yoke by a shield consisting of a mica plate 20 having an opening which snugly fits the active rectangular cathode surface 56 and has secured to its edges a pair of dependent mica plates 60. The securing means comprise the wires 62, threaded through holes 63 in the plates 20 and 60. To prevent the occurrence of discharges through the holes 63, they are covered with quartz cement.

What is claimed is:

1. A glow lamp comprising a bulb containing a gas charge, a plurality of electrodes and an insulating chamber, one of said electrodes having an extended flat face for receiving an electric discharge, means for supplying a cooling medium to said chamber, and means for securing said flat faced electrode in thermal contact with said chamber.

2. A glow lamp comprising a bulb containing a gas charge, a plurality of electrodes and an insulating chamber, one of said electrodes having an extended flat face for receiving an electric discharge, means for supplying a cooling medium to said chamber, and means for detachably securing said flat faced electrode in thermal contact with said chamber.

3. A glow lamp comprising a bulb provided with a reentrant chamber, a plurality of electrodes and containing a gas charge, one of said electrodes embodying an extended flat area, means for establishing thermal con-

tact between said last mentioned electrode and said chamber, and means for supplying a cooling medium to said chamber.

4. A glow lamp comprising a bulb, a chamber integral therewith, a plurality of electrodes and a gas charge enclosed by said bulb, one of said electrodes embodying an extended flat area, means for securing said last mentioned electrode in thermal contact with said chamber, and means for supplying a cooling medium to said chamber.

5. A glow lamp comprising a bulb provided with a reentrant chamber of vitreous material, a gas charge, an anode and a cathode having an extended flat area within said bulb, means for securing said cathode in thermal contact with said chamber, and means for supplying a cooling medium for circulation through said chamber.

6. A glow discharge lamp comprising a glass container having a glass reentrant stem, a cathode member of high thermal conductivity comprising a relatively massive portion having a flat face and portions extending from each side thereof to form a split ring, and means engaging the segments of said ring for securing said member in good thermal contact with said reentrant stem.

7. A glow discharge lamp comprising a glass container, a ring shaped cathode member of high heat conductivity having a plane face of metal suitable for a glow discharge, an anode member having an opening therein the periphery of which is uniformly spaced from said face whereby a glow of substantially uniform intensity is produced in said opening adjacent said face, said container having a glass reentrant portion about which said ring shaped cathode member extends in good thermal contact therewith.

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