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ELECTRON DISCHARGE DEVICE
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Fig. 1.

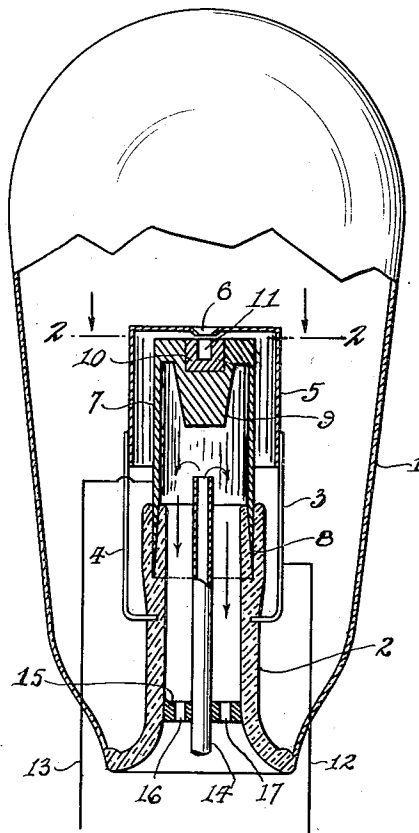
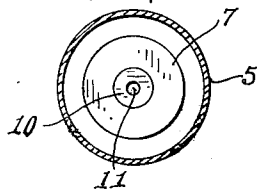


Fig. 2.



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ELECTRON DISCHARGE DEVICE

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Application May 15, 1931. Serial No. 537,593

4 Claims. (Cl. 176—126)

This invention relates to electric devices, and with particularly to electron discharge devices of the ionizable gas type.

An object of the invention is to provide an improved light source in the form of a concentrated luminescent spot.

Another object of the invention is to provide an improved construction of gaseous lamp for producing a concentrated spot of light.

Another object of the invention is to provide a gaseous discharge lamp of the water-cooled type.

A feature of the invention relates to a novel design and disposition of electrodes for a gaseous discharge lamp.

Another feature of the invention relates to a gaseous discharge lamp of the so-called crater type provided with an anode which also acts as a light shield for the luminescent cathode.

A further feature of the invention relates broadly to an electron discharge device having a reentrant portion to which is directly attached a cylindrical electrode.

A further feature relates to a novel design of electron discharge device having a bulb portion and a reentrant portion, the reentrant portion being formed partially of a cylindrical glass member and partially of a cylindrical metallic member.

A still further feature relates to a novel organization and arrangement of elements which go to make up an efficient and simple spot light source.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detail description and the appended claims.

Referring to the drawing:

Fig. 1 shows a view in elevation, and partial section, of a device according to the invention;

Fig. 2 is a sectional view taken along the line 2—2 of the device of Fig. 1 with the bulb omitted for the sake of clarity.

Referring more particularly to Fig. 1, the device according to the present invention comprises an envelope or bulb 1 which may be of glass, the said bulb being of any suitable shape, and while the drawing shows the bulb in the conventional shape of an incandescent lamp, it will be understood that the invention is not limited thereto. At its lower or constricted end the bulb 1 has united thereto a reentrant portion or stem 2. If desired, the bulb 1 and the reentrant portion 2 may be made out of a single glass blank instead of being made in separate pieces as shown in the drawing.

Sealed into the reentrant portion 2, preferably on opposite sides thereof, are support members or standards 3 and 4 respectively. These support members are preferably, although not necessarily, in the form of metallic wires or rods, al-

though if desired glass supports may be used. The members 3 and 4 support at their upper ends a hollow cylindrical thimble-shaped electrode 5, the top wall of said member 5 being provided with a central tapered boss having a perforation or opening 6. Sealed into the cylindrical end of the reentrant portion 2 is a hollow metallic thimble-shaped electrode 7, which is nested or telescoped within electrode 5. Preferably the seal between the members 2 and 7 is effected by tapering the edges of the member 7, as represented by the numeral 8 in the drawing, and fusing the glass portion 2 thereto. While the drawing shows the member 7 with its tapered edge embedded in the glass portion 2, it will be understood that any well known method of uniting a cylindrical metallic member to a corresponding glass member may be employed. If desired the member 7 may be made out of a single piece of metal which is capable of being sealed into the glass portion 2 without danger of breakage during the operation of the device. For example, the member 7 may be made out of a metal having the same temperature coefficient of expansion as the glass tube. Or if desired, the member 7 may be made out of any type of metal and provided at its edge with a tapered ring of another metal capable of being effectively sealed into the glass 2. For example, instead of the member 7 being embedded, the tapered portion 8 thereof may butt against the inner or outer wall of the cylindrical member 2, which may likewise be tapered as is well known in the art of manufacturing electron discharge devices of the so-called water-cooled type.

Thus the member 7 provides a closure for the reentrant portion 2 of the device, and the upper wall of said member 7 is thickened as indicated by the numeral 9, to provide an increased surface for conducting and radiating heat away from the luminescent electrode. In the drawing the luminescent electrode is in the form of a plug 10, having a recess or crater 11. The plug 10 may be of any suitable metal such as copper, or if desired a refractory metal may be employed such as tungsten or the like. The plug 10 may be fastened in the recess in the member 7 in any suitable manner, as by a drive fit or by welding or even by peening over the adjacent edges of the plug and the member 7. As shown in the drawing the plug is so positioned that its crater portion 11 is in registry with the opening 6 in the electrode 5. Suitable lead-in wires 12 and 13 are connected respectively to the electrodes 5 and 7 as shown in the drawing. While Fig. 1 shows the lead-in wires passing through the wall of the tubular portion 1, it will be understood that these lead-in wires may pass through any other portion of the device, as will be apparent to those familiar with the lamp art. Preferably

the crater 11 is of relatively small diameter, so as to enable the lamp to produce an extremely small spot of light. For example in one lamp actually constructed that was found to produce the desired results, the crater 11 had a circular cross section with a diameter approximately one mm. and a depth of three mm., and the electrodes 5 and 7 were mounted so that they were spaced at all points a distance of the order of one mm.

Preferably, although not necessarily, the electrodes are spaced so that for a given impressed voltage there is no visible ionization produced therebetween when the lamp is operating at the required brilliancy, except of course at the portions 6 and 11. For example, the electrodes 5 and 7 may be spaced a distance slightly less than the mean free path through which an electron must fall to produce visible ionization therebetween, although such spacing is not absolutely necessary. However, it will be seen that even though the faces of the electrodes 5 and 7 are spaced apart such a distance that no visible ionization is produced therebetween, nevertheless due to the recessed character of the crater 11 the effective path for the travel of electrons at this portion of the circuit is sufficiently long to permit visible ionization to be produced, and therefore, the glow is confined substantially entirely to the space within the crater 11. When the lamp is operating, the light being confined to the crater 11 and being of extremely high brilliancy, the member 10 is at a comparatively high temperature, and unless means are provided for lowering this temperature the useful life of the lamp is exceedingly decreased. For this purpose the lamp may be provided with an exterior cooling system.

As shown in the drawing, there is positioned within the reentrant portion of the lamp a conduit 14 which is held in position by means of a rubber plug 15, having outlet openings 16 and 17 therein. These openings may lead to a return conduit connected to a source of cooling medium such as running water or the like. The arrows in Fig. 1 represent the direction of flow of the cooling medium which is preferably of sufficient velocity to maintain a quantity of cooling medium at all times in contact with the inner surface of the electrode 7. As is well known in the art, the lamp 1 is preferably provided with an easily ionizable gas such as neon, argon, helium, by themselves or in any suitable mixture and proportions. In one type of lamp that was found to produce the desired results, the envelope 1 had a filling of a mixture of gas containing substantially 90% neon and 10% helium, although a small mixture of argon and helium might be employed in conjunction with the neon.

It will be understood, of course, that the bulb 1, prior to being filled with the luminescent gas is evacuated, and preferably the electrodes are previously cleansed and purified by procedure well known in the lamp art and the art of manufacturing radio tubes.

It will also be understood that the method of mounting the electrode 7 is not limited to lamps alone, but is capable of application in the electron discharge device art generally. For example, the electrode 7 may take the form of a plate or anode in a water-cooled audion or the like. In using the device as a lamp, the electrode 7 is preferably connected in circuit so that it acts as the cathode and the electrode 5 therefore

acts as the anode, in which case the lamp operates substantially entirely by the cathode glow within the crater 11.

The lamp shown in the drawing is intended to be used in any situation where an intense small light spot is desired. For example, in television systems of the so-called projected picture type, such as disclosed in the copending application of Allen B. DuMont, Serial No. 537,612 filed on even date herewith.

While one specific arrangement of elements is disclosed in the drawing, it will be understood that the invention is not limited thereto, and that various changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A crater lamp comprising an envelope, a metal thimble sealed in the wall of the envelope and forming therewith a closed vessel containing an attenuated gas therein, a second metal thimble telescoped over the first thimble and supported in spaced relation thereto from the envelope, the first thimble having a recess in the end wall thereof and the second thimble having an aperture therein in alignment with the recess and converging toward the recess, and leads from said thimbles passing through the envelope.

2. A crater lamp comprising an envelope having a reentrant stem tube, a metal thimble sealed to the inner end of the tube to form a closed vessel, said thimble opening exteriorly of the vessel through the tube, a recess on the end wall of the thimble, a second metal thimble nested over the first metal thimble, means for supporting the second thimble from said tube in spaced relation to said first thimble, said second thimble having a perforation in the end wall thereof in alignment with the recess in the first thimble, and conducting leads connected to said thimbles and extending through the walls of the envelope.

3. A crater lamp comprising an envelope having a reentrant stem, a metal thimble sealed in said stem and forming with the envelope a closed vessel, said vessel having an ionizable gas therein, a recessed member mounted in the end wall of said thimble, a second metal thimble telescoping over the first metal thimble, means for supporting the second thimble from said tube in spaced relation with the first thimble, a perforated boss on the end wall of the second metal thimble in alignment with the recess member on the first metal thimble, leads for said thimbles passing through the walls of the envelope, and means for circulating a cooling fluid within the first metal thimble.

4. A crater lamp comprising an envelope having a reentrant stem tube, a metal thimble sealed in said stem tube and forming with the envelope a closed vessel, the end wall of said thimble being of substantial thickness and having a recess therein, a second metal thimble telescoping with the first metal thimble, supporting standards mounted in said stem tube and secured to the second metal thimble holding it in spaced relation with the other thimble, the end wall of the second metal thimble having a tapered aperture in alignment with the recess in the first metal thimble, leads for said thimbles extending through the walls of the envelope, and means for circulating a cooling medium within and in contact with the first metal thimble, said envelope having an ionizable gas therein.