Sept. 17, 1935. J. W. McKAY 2,014,858

DISCHARGE LAMP FOR PRODUCING A LINE OF LIGHT

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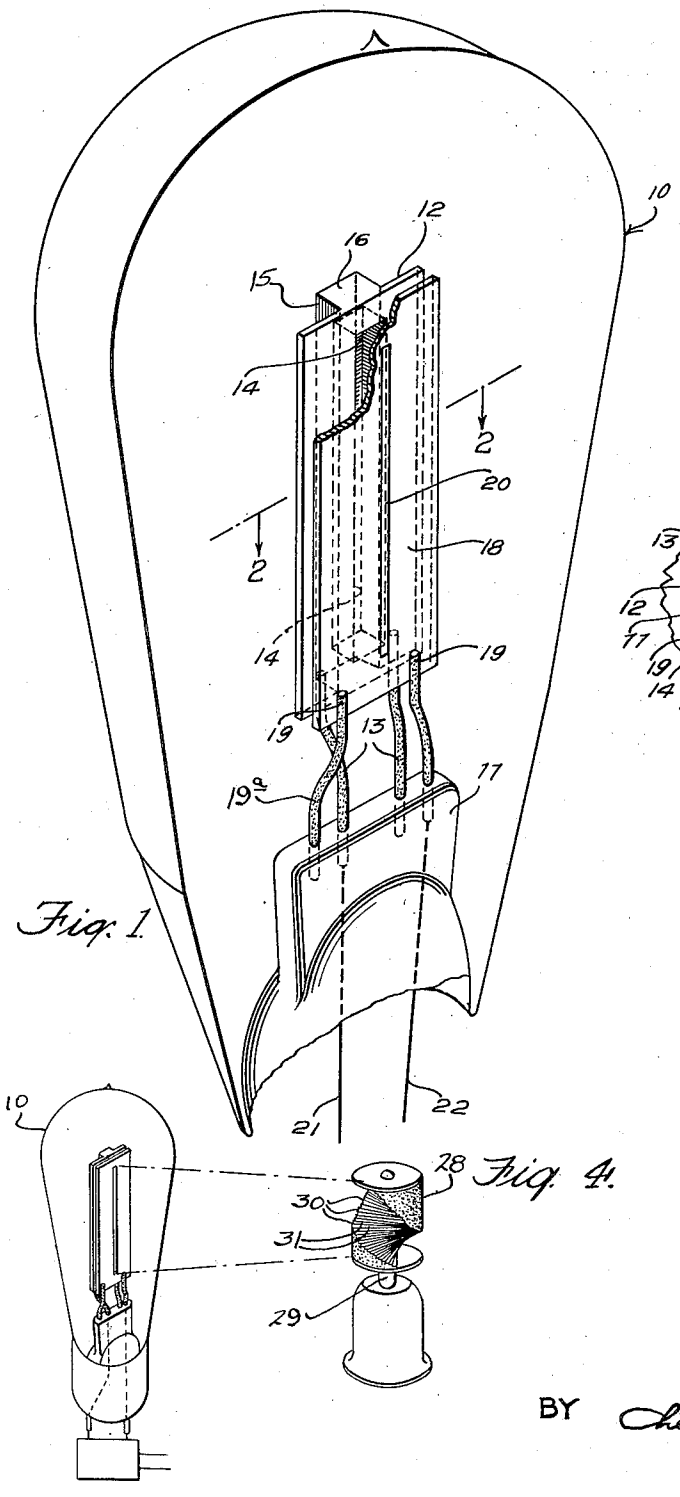


Fig. 1.

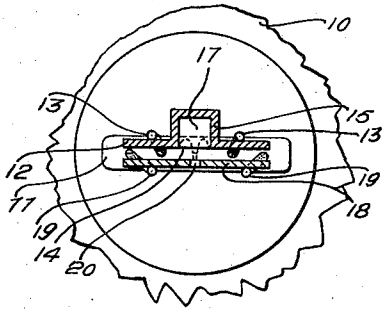


Fig. 2.

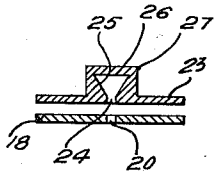


Fig. 3.

Fig. 4.

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DISCHARGE LAMP FOR PRODUCING A LINE OF LIGHT

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Application July 30, 1932, Serial No. 626,428

10 Claims. (Cl. 176—122)

This invention relates to gaseous discharge lamps and has for its principal object to produce a lamp in which the discharge occurs in a thin line.

Another object of the invention is to produce a gaseous discharge lamp in which the discharge produces a brilliant white light.

Another object of the invention is to produce a television lamp producing a thin line of light which may be readily modulated.

Other objects of the invention and objects relating particularly to a method of assembling and constructing the various parts will be apparent as the description of the invention proceeds.

The invention is illustrated in the accompanying drawing in which:

Fig. 1 is a perspective view of a lamp showing one embodiment of the invention;

Fig. 2 is a sectional plan view taken on the line 2—2 of Fig. 1;

Fig. 3 is a front elevational view of a lamp having a slightly different embodiment of the invention; and

Fig. 4 is a diagrammatic view of a television system using my improved lamp.

Referring more specifically to the drawing, the lamp of Fig. 1 is shown as comprising a bulb or envelope 10 formed of glass, quartz, or other suitable transparent material and having an inturned press 11 integral with the neck of the bulb for supporting the elements of the lamp. A cathode 12 is formed of a rectangular plate which may be any desired metal such as nickel, copper, iron, monel metal, or any of the refractory metals such as tungsten, molybdenum, or tantalum. The cathode may be mounted upon two support rods 13 which are sealed in the press 11 and to which the cathode may be welded.

An elongated slot 14 is provided in the center of the cathode 12 extending from a point near the upper edge thereof to a point near the lower edge. A channel-shaped member 15 may be formed integral with the cathode plate behind the slot 14, the upper end being closed by a wall 16 and the lower end by a wall 17. Thus constructed the channel-member 15 forms a rectangular box having an opening formed by the slot 14 in the cathode plate. While the channel member is preferably formed integral with the cathode plate, it may, however, be a separate member attached to the cathode plate by welding or by any other desired means, it being desirable that there are no cracks left at the juncture of this member with the cathode plate.

The cathode plate may be positioned close to the axis of the lamp and parallel to it and a rectangular anode 18 is preferably mounted about 1/16 of an inch from the cathode and parallel thereto. The anode plate may comprise the same metal as is used for the cathode and may be supported upon support rods 19 sealed in the press 11 as indicated. A thin slot 20 is provided in the anode plate corresponding in width to the thickness of the line of light desired and extending in length a little shorter than the slot 14 in the cathode plate. The slot 20 is so positioned in the anode plate that it lies directly in front of the center of the slot 14 in the cathode and acts as a window through which the light or discharge which takes place in the slot of the cathode may be observed.

A wire 21 may be connected to one of the support rods 13 for the cathode and a wire 22 may similarly be connected to one of the support rods 19 for the anode, forming the anode and cathode connections for the lamp.

With the elements thus mounted in the envelope 10 the envelope may be connected to an exhaust pump in order to remove the air or other gases from the inside of the bulb. While this is being done an oven may be placed over the bulb in the usual manner to raise the temperature of the glass and associated parts so as to drive out occluded gases therefrom. The temperature of the anode and cathode plates 12 and 18 may be raised also by external bombardment if desired, in order to insure the complete removal of occluded gases. When all of the air has been removed from the envelope, as is evidenced by the lack of fluorescence when high tension current is directed against the walls of the envelope, the requisite amount of an ionizable gas is admitted so as to produce a discharge when the wires 21 and 22 are connected across a suitable source of potential. Neon gas may be used for the conducting medium in the bulb but I have found that best results are obtained when a mixture of neon and helium is used in equal proportions at about 4 mm of mercury pressure. Other gases such as argon, krypton, and xenon, or the vapors of mercury, caesium, rubidium, and sodium may be used, or mixtures of any of the gases or vapors mentioned above may be used at pressures as high as 15 mm of mercury. When the pressure of the gas is right and the proper mixture of gas is used, there will be a discharge produced between the cathode and the anode occurring just inside of the slot 14 and assuming a funnel shape as indicated in Fig. 2 with the point of the funnel extending toward the

slot 20 in the anode and forming a very concentrated line of white light. This line of white light is visible through the slot in the anode which cuts off the bluish discharge adjacent the walls of the cathode and permits only the white light to be observed. Thus it is possible by properly constructing the anode plate 18 to produce a line of light of any desired width. This may be particularly advantageous in connection with certain television apparatus in which a thin line of light is desirable.

Successful results were obtained with a lamp constructed as above which was supplied with gases in the following manner. After the bulb had been exhausted, helium gas was admitted very slowly until a bright discharge was obtained with the plate and cathode connected in a circuit. Then a small amount of neon was admitted until the discharge turned to an orange color, whereupon helium was again admitted until the pressure was too high and quenched the discharge completely. Then the pump was turned on very slowly and allowed to withdraw some of the gases until a white concentrated light appeared through the slot in the anode. The bulb was then sealed off and was ready for use. This bulb was operated on 200 volts which appeared to be necessary to start the discharge and drew about 30 milli-amperes of current.

The light can be readily modulated and is, therefore, especially desirable for television apparatus or under any conditions where modulated light is used.

In Fig. 4 a television apparatus is shown diagrammatically with which the light may be used to produce excellent results. This television apparatus may be similar to that described in the patent to Gardner, No. 1,753,697 and comprises a drum 28 rotatably mounted on a shaft 29 and consisting of a plurality of flat plates 30 which may be formed of metal, glass or other desirable material, and are each provided with a reflecting edge 31. The plates are arranged in a stack with the edges 31 set at a slight angle to each other so as to form a helix, as clearly indicated in the figure. The plates are bolted or otherwise secured together so as to form the drum and there should be one plate for each line of the picture to be received. In other words, if the broadcasting station is sending sixty lines per picture, then there should be sixty plates or sixty reflecting edges which rotate successively past the eye of the observer and in synchrony with the sending machine. As each reflecting edge rotates in front of the observer, it picks up a portion of the line of light and causes it to appear to move from one side of the drum to the other so that a single tiny square of light appears to move across the drum for each line of the picture, and, as the light is modulated during the movement of this square, the image is reconstructed before the observer's eye. The distance the lamp is positioned from the rotating drum depends upon the size of the drum and this distance, of course, may be compensated for by arranging mirrors in various positions so that the whole apparatus may be placed in a compact cabinet provided with suitable shadow boxes for the lamp and drum.

While a particular type of television scanning apparatus is described above, the lamp is, of course, adaptable to any type where a line of light is desirable.

The support rods 13 and 19 should be coated preferably with an insulating material 19a which will prevent any discharge passing between them to the gas. Such an insulating material may be that described in the application of Samuel Ruben Serial No. 441,456 filed April 4, 1930, although any insulating material which can be attached to the wire with a suitable binder may be used, and even other materials which are not necessarily insulating but prevent the discharge from taking place may also be used. I have found that if the parts are coated with lamp black that the discharge is largely prevented and I prefer to treat the anode and cathode in this manner covering all parts with the lamp black except the interior of the slot 14 and the part of the anode which is immediately adjacent the slot 20. The treatment of the anode and cathode in this manner is not absolutely essential but it eliminates all the discharge except that which is observed through the slot 20 and hence cuts out any additional light which might be deleterious.

If desired the cathode may be made in the manner indicated in Fig. 3. Here the plate 23 is provided with a slot 24 somewhat narrower than the slot 14 in the cathode plate 12. The side walls 25 of the slot are preferably formed to diverge from the face of the plate 23 so that the rear wall 26 of the slot is a good deal wider than the opening of the slot. The channel-shaped member 27 into which the slot opens is preferably formed integral with the plate 23 as in the cathode previously described although it may be made separately and attached to the plate 23 by welding or in any desired manner.

Many other modifications may be made in the arrangement of the parts and also of the kind of gases used as well as the pressure thereof and I do not, therefore, desire to limit myself to what has been shown and described except as such limitations occur in the appended claims.

What I desire to claim and secure by Letters Patent is:

1. In a discharge lamp a cathode, a crater in said cathode longer than it is wide, an anode positioned adjacent said cathode, a slot in said anode substantially parallel to said crater and in alignment therewith so that the discharge formed in said crater is visible through said slot in said anode, and a coating of lamp black on said cathode and anode on all points other than the cathode crater and anode slot.

2. In a device of the class described a plate, a groove dividing said plate into plate sections, a second plate positioned in close proximity to the sections of said first plate and parallel therewith, and a slot in said second plate substantially parallel to the groove in said first plate and in alignment therewith and forming sections substantially parallel to the sections of the first plate.

3. In a device of the class described a substantially flat plate, a rib on one side of said plate, a groove cut into the other side of said plate and extending into the material of said rib, a second plate positioned substantially parallel to said first plate but out of electrical contact therewith, and a slot in said second plate substantially parallel to the groove in said first plate and in alignment therewith.

4. In a device of the class described a plate of metal, a relatively deep groove in said plate extending substantially in a straight line throughout the length of the plate and terminating adjacent the ends thereof, a second plate positioned substantially parallel to said first plate and spaced relatively closely thereto but out of electric contact therewith, and a slot in said second plate

narrower than the groove in said first plate but substantially parallel thereto and in alignment therewith.

5. In a device of the class described a substantially flat plate, a rib on one side of said plate, extending from end to end thereof and substantially integral therewith, a depression in the other side of said plate extending into said rib and having a length slightly less than the length of said rib, a second plate positioned in close proximity to said first plate and substantially parallel therewith, and a slot in said second plate narrower than the depression in said first plate but substantially parallel therewith and in alignment therewith.

6. In a device of the class described a plate of metal, a groove in said plate, said groove being longer than it is wide, a second plate of metal positioned in close proximity to said first plate in front of said groove, and a slot in said second plate being narrower than the groove in said first plate but positioned substantially parallel thereto and in alignment therewith.

7. In a device of the class described a sealed envelope, a plate cathode therein, a groove in said cathode, a plate anode spaced in close proximity to said cathode but electrically separated therefrom at a distance of approximately one-sixteenth inch, a slot in said anode substantially parallel to the groove in said cathode and in alignment therewith, and an ionizable gas surrounding said anode and cathode.

8. In a device of the class described a sealed envelope, a plate cathode, a groove in said cathode, an anode spaced in close proximity to said cathode but electrically separated therefrom, a slot in said anode substantially parallel to the groove in said cathode and in alignment therewith, and an ionizable gas containing neon surrounding said anode and cathode, the anode with the exception of the slot interior and cathode with the exception of the groove interior being coated with lamp black.

9. In a device of the class described a sealed envelope, a plate cathode, a groove in said cathode, an anode spaced in close proximity to said cathode at a distance of approximately one-sixteenth inch, a slot in said anode substantially parallel to the groove in said cathode and in alignment therewith, and an ionizable gas containing helium and neon surrounding said anode and cathode, the anode with the exception of the slot interior and cathode with the exception of the groove interior being coated with lamp black.

10. In a device of the class described a cathode, a groove in one side of said cathode, an anode spaced in close proximity to said cathode on the side with said groove, a slot in said anode substantially parallel to the groove in said cathode and in alignment therewith, and a mixture of helium and neon gas in substantially equal proportions within or surrounding said cathode and anode and having a pressure of less than 5 mm of mercury.

JOHN W. McKAY.