March 29, 1960 L. F. BIRD 2,930,920

ELECTRICAL DISCHARGE LAMP

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Fig. 1.

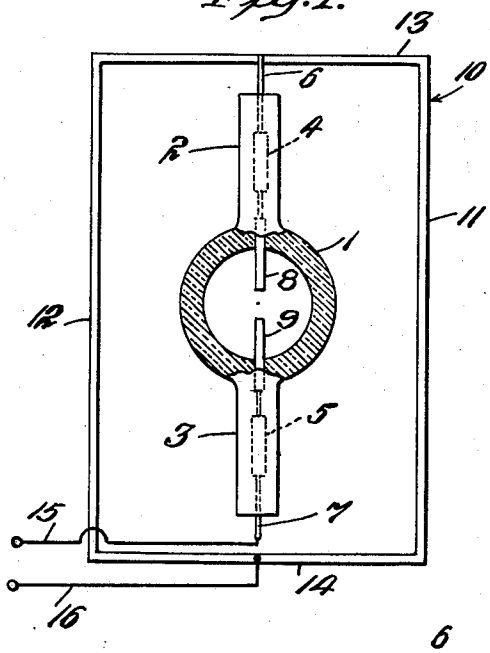



Fig. 2.

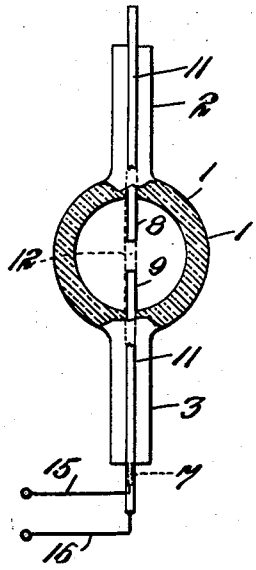



Fig. 3.

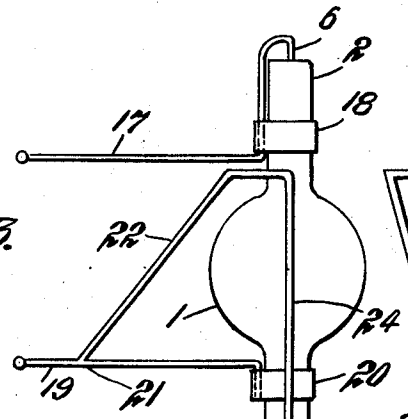



Fig. 4.

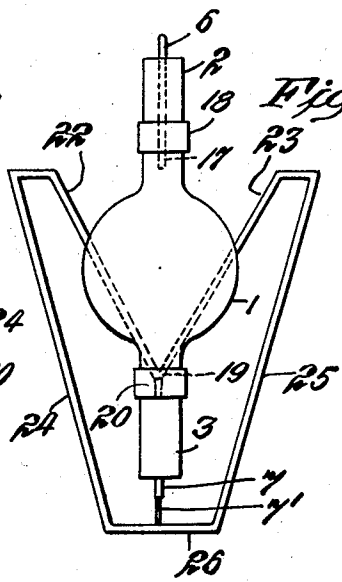
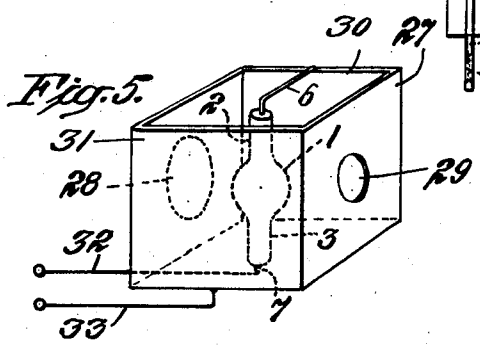



Fig. 5.




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# ELECTRICAL DISCHARGE LAMP

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2 Claims. (Cl. 313—161)

The present invention relates to electrical discharge lamps and more particularly to high pressure electrical discharge lamps.

The modern development of mercury high pressure lamps has resulted in the production of lamps having increased vapor pressures up to very high values of the order of a hundred atmospheres.

Under these very high pressures, the gradient of the arc obtains values of 100 to 500 volts per centimeter, and the electric power dissipated per unit arc-volume is very considerable. The brightness of the arc, depending on the degree of the electrical power applied, amounts from about 10,000 to about 100,000 candles per square centimeter. In the ultra-violet and infra-red, a radiation corresponding to this high brightness also exists. The radiant efficiency in these spectral ranges is very considerable and, for example, a luminous efficiency of 50 to 70 lumens per watt is obtained. Because of these properties, the super high pressure lamps find an extremely wide field of applications in all branches of lighting and uses of radiation.

On account of the great strain produced by pressure and temperature, the discharge tube of these lamps usually consists of a thick-walled quartz glass of spherical shape and of such surface dimensions that in operation it acquires temperatures of about 800° C. to 1000° C. The electrodes of such lamps are arranged close to each other, so that the length of the arc, depending on the type of the lamp and the power consumed, amounts from a few tenths of a millimeter to several millimeters and such lamps are known as compact arc lamps. The discharge vessel generally contains a limited quantity of mercury to which cadmium may be added, and which under full operation of the lamps, is completely evaporated. Super high pressure lamps are of the same construction or are filled with krypton or xenon under high pressure of about 20 atmospheres and more thereby becoming lamps of high brightness and efficiency. Lamps of the kind above described have been made for an input of, for example, about 50 watts to 2000 watts.

These super high pressure lamps have not been used heretofore to an extent corresponding to their efficiency and the great variety of uses they may find, for the reason that their use has been limited by deterioration or distortion of the electrodes. The deterioration or distortion of the electrodes, under operating pressures, often occurs as a result of wandering arc discharge which migrates from one position on the electrode to another position and the arc discharge curves toward a wall of the enclosing vessel in the form of an unstable bow. The bowing of the discharge causes the arc to get longer and the ends of the electrodes to distort in the direction of the bow, and the tip of the electrode becomes plastically deformed with electrode metal accumulating on the sides of the electrode tips where the ends of the discharge become anchored in a position out of focus with a reflector when employed in combination with the lamp. This condition is caused primarily as a result of unbalanced magnetic fields existing around the arc and which magnetic fields are created by currents flowing through the electrodes and through the lead-in wires connected to the electrodes, whereby the magnetic field associated with the lead-in wires affects the magnetic field associated with the electrodes so that the arc is caused to bow and migrate especially with alternating currents. These conditions particularly prevail when the ionizable atmosphere in the lamp consists of a rare gas such as xenon under high pressures.



It is one object of this invention to provide a magnetically stabilized electrical discharge lamp for discharge operation under high pressures. It is another object of this invention to provide a stabilized electrical discharge lamp which has a great flexibility of use in that novel modifications enable its application for therapeutic uses, illumination, light projection, fluorescence analysis, etc. It is a further object of this invention to provide an electrical discharge lamp for super high pressure discharges. Other objects and advantages of this invention will become apparent from the description hereinafter following and the drawings forming part hereof in which:

Figure 1 illustrates a partly elevational and partly cross-sectional front view of a lamp according to the invention,

Figure 2 illustrates a side view of Figure 1,

Figure 3 illustrates an elevational side view of a modified form of lamp according to the invention,

Figure 4 illustrates a front view of Figure 3, and

Figure 5 illustrates a perspective view of another modification of the invention.

According to the invention there is provided a neutral magnetic field about the arc by means of a current carrying structure, e.g. a frame, so formed with relation to the lamp that the magnetic fields produced by the current-carrying conductors are effectively neutralized at the location of the discharge permitting the discharge to operate substantially coaxially with the electrode tips.

Figure 1 shows a compact arc type lamp having a light transmissive substantially spherical envelope **1** with a pair of oppositely disposed seal stems **2** and **3** extending outwardly therefrom and containing seal foils **4** and **5** sealed therein and connected to lead-in conductors **6** and **7** and electrodes **8** and **9**. A conductive frame **10** having wire sides **11**, **12**, **13** and **14** is positioned about the lamp so that two sides, e.g. wires **11** and **12**, are substantially equally laterally spaced from the axis of electrodes **8** and **9**. The frame **10** has one of its sides connected to one of the lead-in conductors, e.g. side **13** is connected to conductor **6**, and the other lead-in conductor, e.g. lead-in **7** is connected to a source of current by means of an input lead **15**. Another input lead **16** is connected to another side of said frame **10**, e.g. side **14**. It is of critical significance that one of said input leads **16** is so connected to the frame and the frame to one of the electrodes **8** that the current is effectively divided, the frame being essentially a current dividing means having substantially equal current distribution on both sides of the arc, whereby the magnetic fields associated with conductor sides **11** and **12** effectively counteract each other at the location of the discharge so that an otherwise existent magnetic field inside the lamp and associated with the electrodes is effectively counteracted and, in fact, there is no longer an undesirable magnetic field within the lamp envelope **1**. The arc, therefore, operates substantially coaxially with the electrode tips.

Figure 2 illustrates a side view of Figure 1 showing the current divider side **11** in alignment with the electrodes **8** and **9**.

Figures 3 and 4 illustrate a modification of the form of the current dividing frame. One input conductor **17** is connected directly to the lead-in **6** and secured to the

seal stem 2 by means of a clamp 18 or other equivalent securing means. The other input conductor 19 is secured to the seal stem 3 by means of a similar clamp 20. At location 21, the conductor 19 divides into two conductor arms 22 and 23 which spread out and are directed toward one end of the lamp, and at a location in alignment with the electrodes the arms 22 and 23 change directions toward the other end of the lamp forming sides 24 and 25 which join together into side 26 beyond the end of lamp lead 7, thus forming a frame having the sides 24 and 25 equally spaced from the electrodes and substantially aligned therewith. The frame side 26 is connected to electrode lead 7 by conductor 7; at a location whereby the current to the frame is equally divided between the two sides 24 and 25, and whereby the magnetic fields set up along the lengths of the sides 24 and 25 effectively counteract each other so that an otherwise existent magnetic field around the lamp discharge is effectively neutralized.

Figure 5 illustrates still another modification of the invention. The lamp 1 is positioned inside an electrically conductive container 27 with a reflector 28 positioned in the container and with a projection aperture 29 through a side of the container. The sides 30 and 31 are spaced laterally and equidistant from the lamp electrodes. One input lead 32 is connected directly to an electrode lead-in conductor 7 and the other input lead 33 is connected to one side 31 of the container 27. The lead-in conductor 6 is connected to the opposite side 30 of the container. The connections of the input lead 33 and electrode lead-in conductor 6 to the container 27 are so located that the current through the container is effectively divided through sides 30 and 31, whereby the lamp magnetic field



is neutralized in the same manner as with the current divider frames illustrated by Figures 1 through 4.

Other functionally equivalent modifications of the invention are contemplated within the scope of the appended claims.

What I claim is:

1. A magnetic stabilizing means for a gaseous discharge lamp comprising in combination a gaseous discharge lamp containing two spaced electrodes and an ionizable atmosphere, lead-in conductors connected to the electrodes, an input conductor connected to one of the lead-in conductors, an electrically conductive container with the lamp positioned therein substantially equidistant between the sides of the container, a second input conductor connected to a portion of the container, and the other lead-in conductor connected to the container remotely from said portion, the container being a magnetic stabilizing means for the discharge arc.

2. A magnetic stabilizing means according to claim 1, comprising an aperture through the wall of said container for the projection of light therethrough.

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