Sept. 18, 1962 R. G. LYE 3,054,921

ELECTRIC LAMP

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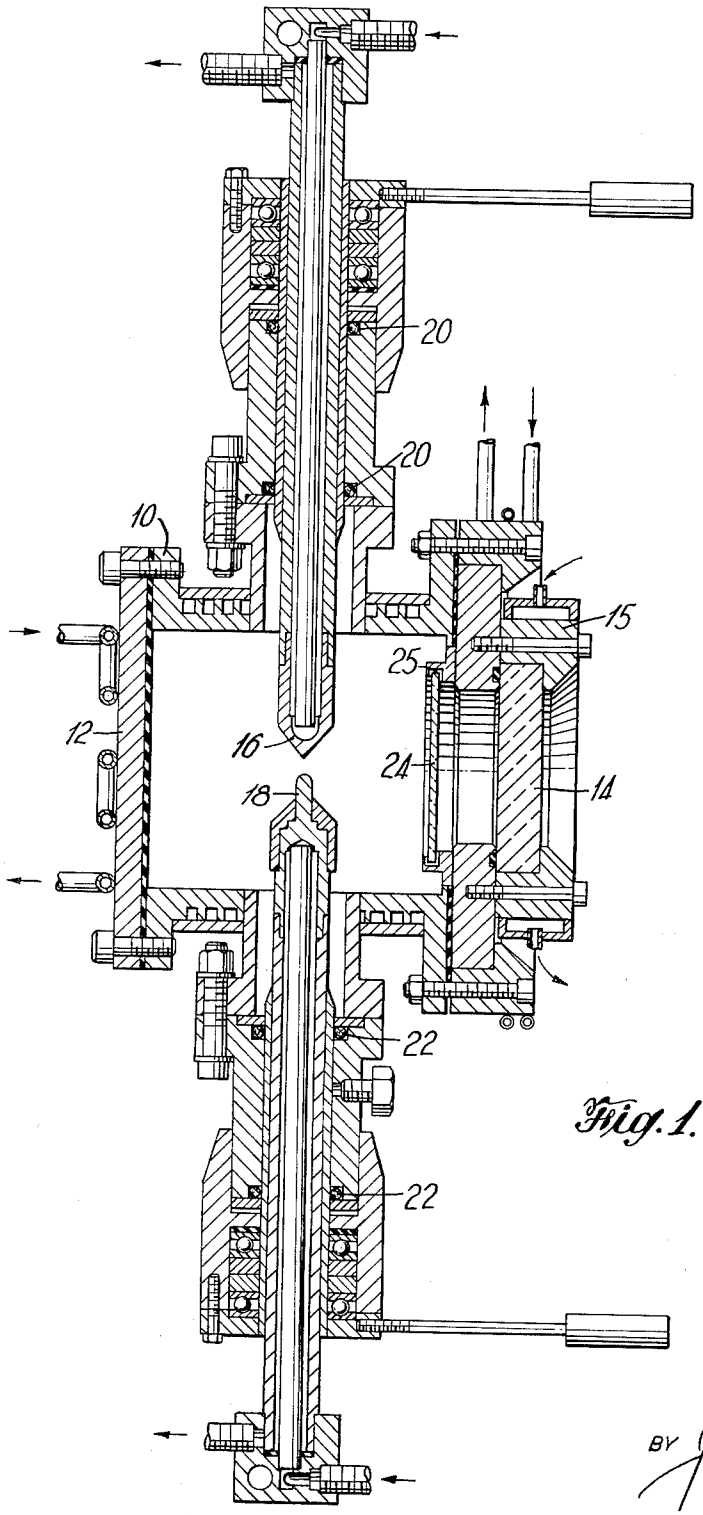


Fig. 1.

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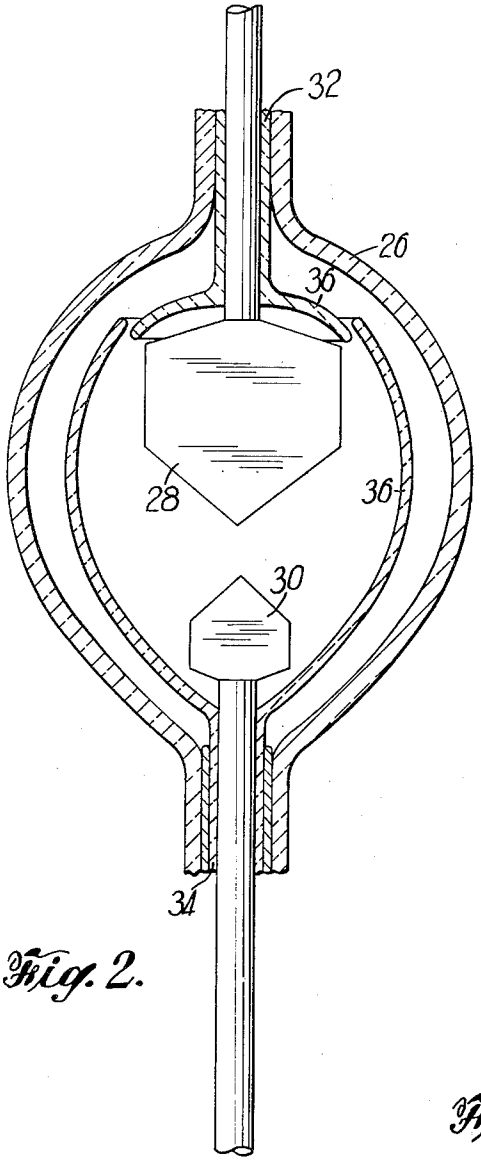


Fig. 2.

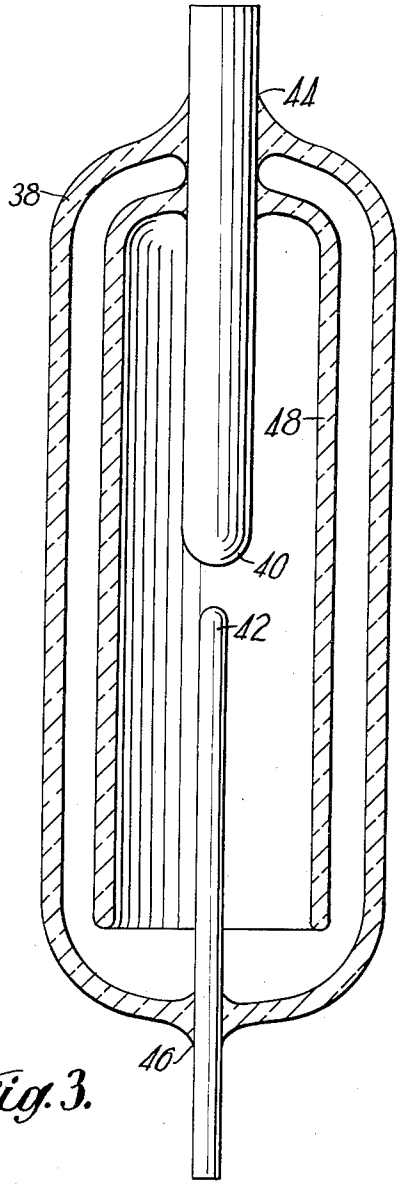


Fig. 3.

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ELECTRIC LAMP

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6 Claims. (Cl. 313—112)

The invention relates in general to electric lamps and refers more particularly to high pressure gas arc lamps.

High pressure gas arc lamps are well-known as sources of intense light. These lamps generally comprise a pressure container having a medium for transmitting light, two electrodes therein adapted to be energized by an electric current, and a gas therein which emits light upon excitation by energy supplied to it. Such lamps are used in street lights, motion picture projectors, and other devices which require intense illumination.

Due to mechanical problems concerning the lamp's pressure container, however, commercially available high pressure inert gas arc lamps are generally limited to two kilowatts of power. These mechanical problems exist in relation to the light transmitting medium of the pressure container. This medium, which in some cases is a window in an otherwise opaque pressure container and in other cases is the entire container, must be made of a transparent material that will withstand detrimental radiation and severe internal mechanical stresses.

At the present time, quartz is generally considered to be the best available material for the light transmitting medium of the pressure container, but it is not free of problems. For example, ultraviolet radiation degrades the optical characteristics of the quartz, and severe internal stresses in the quartz caused by thermal gradients and high pressures tend to produce devitrification of the quartz. Moreover, explosion hazards are proportional to the severity of the internal stresses.

Since inert gas arc lamps are more efficient at high pressures, a construction which makes possible the use of higher pressures is desirable. Such a construction should also make possible the reduction of thermal stresses present in the quartz and the reduction of ultraviolet radiation striking the quartz.

The primary object of the invention is, therefore, to provide a new and improved electric lamp which has longer operational life and higher power outputs.

Another object is to reduce optical degradation, the possibilities of devitrification, and the explosion hazards of an electric lamp's pressure container.

In the accompanying drawing:

FIG. 1 is a vertical cross-sectional view of a high pressure gas arc lamp embodying the invention;

FIG. 2 is a vertical cross-sectional view of a high pressure gas arc lamp of somewhat different construction embodying the invention; and

FIG. 3 is a similar view of another form of high pressure gas arc lamp embodying the invention.

The invention comprises a construction of a high pressure gas arc lamp in which a transparent shield is interposed between the electrodes and the light transmitting medium of the pressure container. The shield is mounted so as to permit equalization of gas pressures on both faces of the shield and so as to parallel substantially the light transmitting medium of the pressure container.

In FIG. 1, the pressure container of the high pressure gas arc lamp there illustrated comprises a water cooled cylinder **10** with a water cooled plate **12** sealing one end and a circular quartz window **14** incorporated in a water cooled annular attaching assembly **15** sealing the other end. All of these parts except the quartz window are suitably made of stainless steel. The quartz window **14** is the light transmitting medium of the pressure container,

and the void in the pressure container is filled with xenon.

A water cooled anode **16** and a water cooled cathode **18** enter the pressure container from opposite points on the cylinder **10**, and are adapted to be energized by an external electric source (not shown). A packing gland **20** and a packing gland **22** seal the entrances of the anode **16** and the cathode **18**.

A circular quartz shield **24** is removably interposed between the quartz window **14** and the anode **16** and cathode **18**. Said quartz shield **24** substantially parallels said quartz window **14**. Also, said quartz shield **24** is mounted with small openings **25** around its outer edge to permit equalization of gas pressures on both faces of said shield **24**.

When the anode **16** and cathode **18** are energized by an electric current, an electric arc springs between the cathode **18** and anode **16**. The xenon gas within the arc is therefore in a state of high excitation, and said xenon emits intense white light as a result. The light escapes from the pressure container by passing through the quartz shield **24** and the quartz window **14**.

The xenon becomes extremely hot during lamp operation. This creates thermal convection currents within the pressure container which, but for the shield **24**, would transfer heat to the quartz window **14**, creating thermal gradients and internal stresses therein.

Since lamp efficiency rises with increasing pressure of the xenon, the quartz window **14** must withstand severe internal pressure stresses for efficient lamp operation as well as internal thermal stresses. The resultants of these two stresses produce severe mechanical loading of the quartz window **14**, particularly near its exterior surface.

As indicated, the quartz shield **24** restricts the thermal convection currents which otherwise reach the quartz window **14** and thereby reduces the internal thermal stresses in said quartz window **14**. This allows the lamp to operate at a higher pressure and efficiency or at a reduced mechanical loading in comparison with a similar lamp which does not have a quartz shield **24**. Moreover, since explosion hazards are proportional to the severity of internal stresses, the explosion hazards may be reduced.

During lamp operation, the xenon and the electrodes in coaction emit harmful ultraviolet radiation as well as intense white light. The quartz shield **24** diminishes the amount of ultraviolet radiation which would otherwise be received by the quartz window **14**. Since ultraviolet radiation degrades the optical characteristics of quartz, this reduces the rate of optical degradation of the quartz window **14**. When the quartz shield **24** loses its optical efficiency as a result of the ultraviolet radiation, said shield **24** can be replaced.

In FIG. 2, the high pressure gas arc lamp there shown has a spherical quartz envelope **26** as a pressure container and as a light transmitting medium. The anode **28** and the cathode **30** enter the quartz envelope **26** from opposite points on its surface, and are adapted to be energized by an external electric source (not shown). The void in the pressure container is filled with xenon, and gas tight seals **32** and **34** close the entrances of the anode **28** and cathode **30**.

A quartz shield **36** is interposed between the spherical quartz envelope **26** and the anode **28** and cathode **30**. The quartz shield **36** somewhat corresponds to the shape of the spherical quartz envelope **26** and substantially parallels said envelope **26**. A circular break exists in the quartz shield **36**, with an overlapping of the resulting edges, to permit equalization of gas pressures on both sides of said shield **36**.

In FIG. 3, the high pressure gas arc lamp there shown has a cylindrical quartz envelope **38** as a pressure container and as a light transmitting medium. The anode **40** and

the cathode 42 enter the cylindrical quartz envelope 38 from opposite ends of the cylinder, and are adapted to be energized by an external electric source (not shown). The void in the pressure container is filled with xenon, and gas tight seals 44 and 46 close the entrances of the anode 40 and cathode 42.

A quartz shield 48 is interposed between the cylindrical quartz envelope 38 and the anode 40 and cathode 42. The quartz shield 48 somewhat corresponds to the shape of the cylindrical quartz envelope 38 and substantially parallels said envelope 38. One end of the cylindrical quartz shield 48 is open to allow equalization of gas pressures on both sides of said shield 48.

In both FIG. 2 and FIG. 3, the operation of the completed lamp is the same as described for FIG. 1, except that the quartz shields 36 and 48 are not replaceable.

Experiments were made with a high pressure gas arc lamp similar to FIG. 1 using xenon as the gas. After 110 hours of operation at a power average of 2.4 kilowatts, during which period power levels as high as 7 kilowatts were maintained, the shield was removed, and its optical transmittance was measured. The optical transmittance had decreased by 10 percent. The quartz window, however, showed no darkening or degradation in properties. The lamp has also been operated at power levels up to 11.5 kilowatts with no darkening or degradation of properties of the quartz window. The power limitation of 11.5 kilowatts was due to other incidental difficulties, not to the novel shield.

The invention is not limited to any one chemical composition of gas in the pressure container. Mixtures of gases may even be used to change the color characteristics of the light. Moreover, any transparent refractory material, such as quartz and natural or synthetic sapphire, can be used for the shield and/or the light transmitting medium of the pressure container.

What is claimed is:

1. An electric lamp comprising a gas filled pressure container; a pair of electrodes mounted in said container and adapted to be electrically energized and when energized to produce light in coaction with said gas; a light transmitting medium in said container; and a shield made of a transparent material and interposed between said electrodes and said light transmitting medium; said shield being mounted so as to protect said light transmitting medium from detrimental radiation and thermal convection currents produced at said electrodes when said electrodes are energized and being mounted so as to permit equalization of gas pressures exerted on said shield; the gas pressures on each side of said shield being substantially equal at all times.

2. An electric lamp as defined in claim 1 wherein said shield is made of quartz.

3. An electric lamp as defined in claim 1 wherein said shield is removable and replaceable.

4. A high pressure gas arc lamp comprising a pressure container filled with a gas inert to chemical change; a pair of electrodes mounted in said container and adapted to be electrically energized and when energized to produce light in coaction with said gas; a light transmitting medium in said containers; and a shield made of a transparent material and interposed between said electrodes and said light transmitting medium; said shield being mounted so as to protect said light transmitting medium from detrimental radiation and thermal convection currents produced at said electrodes when said electrodes are energized and being mounted so as to permit equalization of gas pressures exerted on said shield; the gas pressures on each side of said shield being substantially equal at all times.

5. A high pressure gas arc lamp as defined in claim 4 wherein said shield is made of quartz.

6. A high pressure gas arc lamp as defined in claim 4 wherein said shield is removable and replaceable.

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