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SHORT METAL ARC TUBE MOUNTED WITHIN A CERAMIC REFLECTOR ENVELOPE

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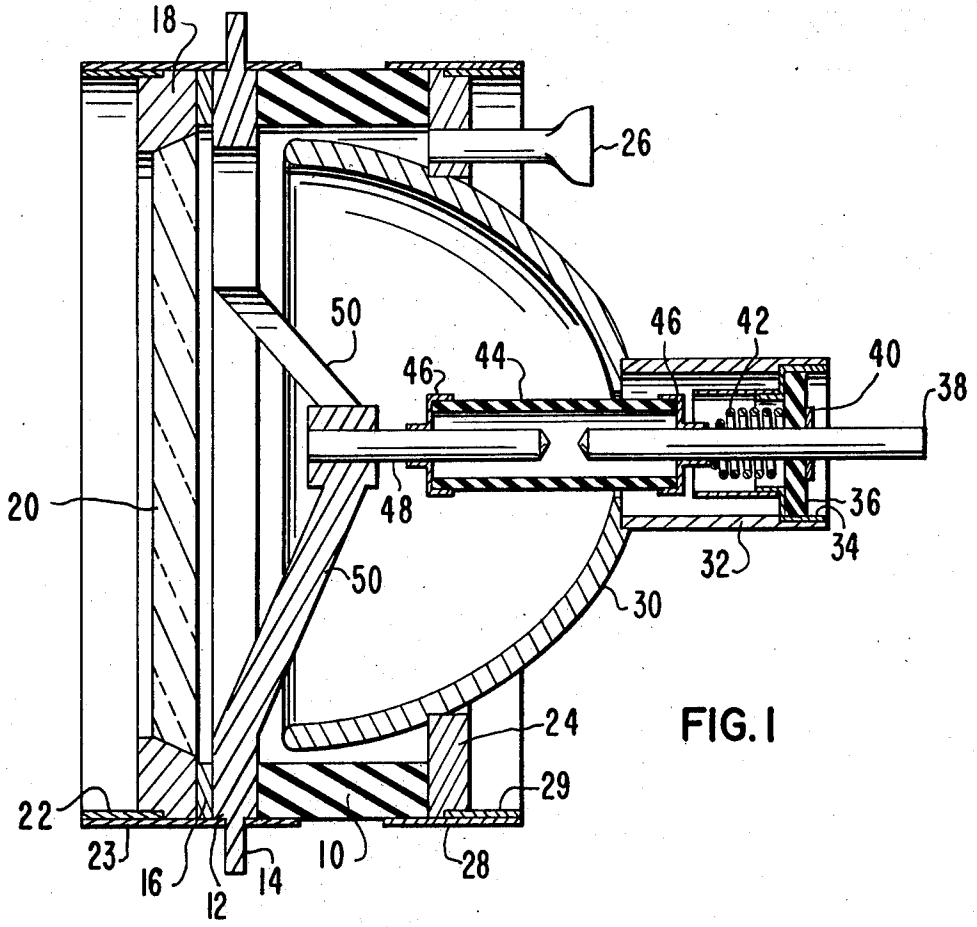


FIG. 1

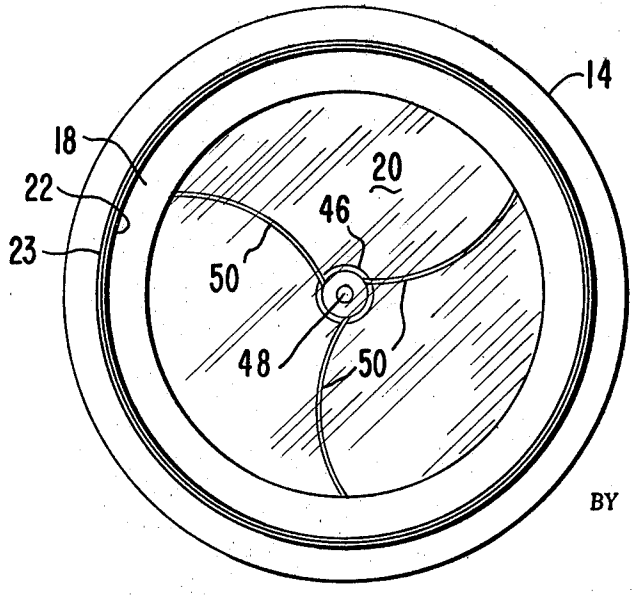


FIG. 2

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SHORT METAL ARC TUBE MOUNTED WITHIN A CERAMIC REFLECTOR ENVELOPE

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ABSTRACT OF THE DISCLOSURE

A metal vapor arc lamp comprising a sealed arc tube confining an ionizable alkali metal, two spaced electrodes which penetrate the arc tube to define an arc gap therewithin, and means for heating the alkali metal to enable a voltage impressed across the arc gap to ionize the heated metal vapor and ignite the arc lamp. The arc tube is housed in a sealed envelope having a ceramic cylindrical section hermetically closed at each end by envelope members which respectively comprise a reflector and an optical window.

BACKGROUND OF THE INVENTION

This invention relates to metal vapor arc lamps and particularly to high intensity, short arc metal vapor lamps having an integral reflector sealed within a ceramic envelope.

In copending application, Ser. No. 655,717, filed July 14, 1967, a high intensity short arc lamp is disclosed by applicant having a novel envelope comprising a ceramic cylinder hermetically closed at its ends by a reflector and an optical window. Housed within the envelope is an ionizable gas under pressure and two electrodes. This structure provides a high intensity arc lamp having a composite, rugged, integral bulb and reflector devoid of glass-to-metal seals and consisting of material which will not react with the internal atmosphere. The gaseous atmosphere may be an inert gas such as xenon, argon or krypton or a mixture consisting essentially of a metal vapor such as mercury, cesium, rubidium, sodium, potassium or lithium.

The present invention is an improvement in the just described lamp where the ionizable gas is a corrosive metal vapor such as cesium, rubidium, sodium and potassium. These elements are quite efficient as a source of radiation in the near infrared region of the spectrum. They must, however, be heated above room temperature before an electrical potential will ionize them and ignite the arc. But as the described lamp contains no heating means, an inert gas must be combined with the metal vapor as an ignition catalyst. This addition, however, alters the spectral emission of the lamp thereby diminishing, and in some applications, destroying its utility. Furthermore, high, total, energy conversion efficiency requires the high metal vapor pressures which are produced by heating of the vapor to temperatures as high as 1000° C. As the described lamp has an integral source and reflector, the entire structure has to be heated to achieve the pressure necessary for high conversion efficiency when filled with a corrosive metal vapor.

Accordingly, it is an object of the present invention to provide a high intensity arc lamp having an ionizable gaseous medium of metal vapors uncombined with extraneous catalytic vapors to provide high emission efficiency in the near infrared region of the electromagnetic spectrum.

Another object of the invention is to provide a short arc, high intensity metal vapor lamp capable of operating at temperatures as high as 1000° C. for high energy conversion efficiency.

Yet another object of the invention is to provide an improved metal vapor arc lamp having an envelope comprising a ceramic cylinder hermetically closed at its ends by a reflector and an optical window.

SUMMARY OF THE INVENTION

Briefly described, the present invention is a metal vapor arc lamp comprising a sealed arc tube confining an ionizable metal selected from the alkali metal group consisting of cesium, sodium, potassium and rubidium. Two spaced electrodes penetrate the arc tube to define an arc gap therewithin. Means are provided for heating the ionizable alkali metal to enable a voltage impressed across the arc gap to ionize the heated metal vapor and ignite the arc lamp. The arc tube is housed in a sealed envelope having a ceramic cylindrical section hermetically closed at each end by envelope members which respectively comprise an optical window and a reflector.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a side view in cross section of the preferred embodiment of the present invention.

FIGURE 2 is a frontal view in elevation of the embodiment shown in FIGURE 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing, in which figures like reference numerals represent like components, there is shown a metal vapor arc lamp having a ceramic, cylindrical section **10** which is preferably made of polycrystalline alumina and which is brazed to a metallic ring **12** having a flange **14**. Ring **12** and flange **14**, which preferably are made of Kovar, serve as a section of the lamp envelope and as an exteriorly accessible lamp electrode, respectively. Ring **12** is brazed to a metallic spacer **16** which in turn is brazed to window frame **18** also made of Kovar. An optical window **20**, in this case glass, is sealed within the window frame. A concentric ring **22** is then joined to frame **16** by heliarc welding to an intermediary ring **23**.

The other end of ceramic section **10** is brazed to another Kovar ring **24** through which a copper tubulation **26** extends. A concentric ring **28** is fitted about ring **24** and brazed to ceramic section **10**. Finally, the free end of ring **28** is welded by heliarc to the free end of a ring **29** which in turn is brazed to Kovar ring **24**.

A paraboloidic reflector **30** having an axial aperture is brazed to an inner edge of ring **24**. The reflector comprises a metal base having a very thin coating of gold, silver or platinum. The geometry of the reflector produces a beam divergence limited to but 1° to 2°.

One end of a Kovar tube **32** is brazed to the reflector adjacent the aperture periphery. The other end of tube **32** is welded to a cap **34**, which in turn is brazed to a ceramic disc **36** having an aperture coaxial with that of reflector **30**. An electrode **38**, extending through the aperture of disc **36**, is affixed thereto by means of sealing ring **40** to complete the lamp envelope.

A resistive heater wire **42** is wound about a portion of electrode **38**. One end of the heater wire is affixed to the electrode while the other end is affixed to tube **32**. In this manner both electrode **38** and tube **32** serve as exteriorly accessible lamp electrodes, as does flange **14**.

Electrode **38** extends within the lamp envelope into an arc tube comprising a transparent, sapphire tube **44** sealed at each end by caps **46** which preferably are made of columbium. Electrode **38** terminates within the arc tube adjacent the terminus of another electrode **48** which extends through the other end cap **46** along the axis of elec-

trode 38. The spacing between the electrodes defines an arc gap which approximates the diameter of the electrodes. This geometry places the lamp in the category commonly referred to as short arc.

The arc tube is filled with cesium, sodium, potassium or rubidium. These alkali metals are in a solid state at room temperature. Upon being heated the metals change into their vapor state and typically assume a pressure of some ten standard atmospheres.

The end of electrode 48 outside of the arc tube, but within the lamp envelope, is brazed to one end of three arcuate supports 50 which are preferably made of Kovar or molybdenum. The other end of supports 50 are brazed to ring 12 providing electrical connection between electrode 48 and flange 14. The arcuate shape of supports 50 permits stress release during high temperature lamp operation.

After assembly, the envelope is evacuated through means of tubulation 26 which is then sealed. Alternatively, the envelope may be backfilled with an inert gas.

The described metal vapor lamp is uniquely suited for use as an intense source of infrared radiation in the spectral region of from 7,500 to 12,000 angstroms. Here full advantage can be taken of the capability of the metal vapor arc tube to operate at high temperatures to produce high vapor pressures which in turn yield increased infrared radiation at a sacrifice in total luminous emission. Thus as a convert source, less visible radiation is produced and more energy is converted to infrared radiation.

It should be understood that the above-described embodiment is merely illustrative of applications of the principles of the invention. Obviously, many modifications may be made in the illustrated example without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. A metal vapor arc lamp comprising an envelope having a ceramic cylindrical section hermetically closed at each end by envelope members, a sealed arc tube housed within said envelope and confining an ionizable metal selected from the alkali metal group consisting of cesium, sodium, potassium and rubidium, two spaced electrodes penetrating said arc tube to define an arc gap therewithin, and means for heating said ionizable alkali metal to enable a voltage impressed across the arc gap to ionize the heated metal vapor and thereby ignite the arc lamp.

2. The metal vapor arc lamp of claim 1 wherein said heating means comprises a resistor wound in spaced relation about a portion of at least one of said electrodes.

3. The metal vapor arc lamp of claim 2 wherein said resistor is electrically and mechanically connected to the electrode.

4. The metal vapor arc lamp of claim 1 wherein said sealed arc tube comprises a sapphire tube and apertured columbium caps sealed to each end thereof.

5. The metal vapor arc lamp of claim 1 wherein one of said envelope members comprises an optical window pervious to the passage of infrared radiation.

6. The metal vapor arc lamp of claim 1 wherein one of said electrodes penetrates said envelope.

7. A metal vapor arc lamp having a sealed envelope comprising a ceramic cylindrical section hermetically closed at each end by envelope members, one of said members comprising a first metallic component and an optical window and the other of said envelope members comprising a second metallic component and an apertured dielectric body, said envelope housing an arc tube which confines an ionizable metal selected from the alkali metal group consisting of cesium, sodium, potassium and rubidium; said arc lamp further comprising a first electrode extending through said aperture dielectric body and into said arc tube, a second electrode electrically and mechanically connected within said envelope to said first metallic component and extending into said arc tube adjacent said first electrode to define an arc gap therebetween, and means within said envelope electrically coupled to said second metallic component for heating said metal to ignite the arc lamp.

8. The metal vapor arc lamp of claim 7 wherein said heating means comprises a resistor wound in spaced relation about a portion of said first electrode.

9. The metal vapor arc lamp of claim 8 wherein said resistor is electrically and mechanically connected to said first electrode.

10. The metal vapor arc lamp of claim 7 wherein said second metallic component is a tube disposed coaxially about said first electrode to form a by-terminal male connector.

11. A metal vapor arc lamp of claim 7 wherein said arc tube comprises a sapphire tube.

12. The metal vapor arc lamp of claim 11 wherein said arc tube further comprises apertured columbium caps sealed to each end of said sapphire tube.

13. The metal vapor arc lamp of claim 7 wherein said sealed envelope comprises a reflector defining an aperture and wherein said arc tube extends through said reflector aperture.

14. The metal vapor arc lamp of claim 7 having an arcuate reflector affixed to said metallic component.

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