Nov. 5, 1963 N. C. BEESE 3,109,952

HIGH INTENSITY SHORT ARC LAMP HAVING AN ANNULAR CATHODE SHIELD

Filed March 15, 1962

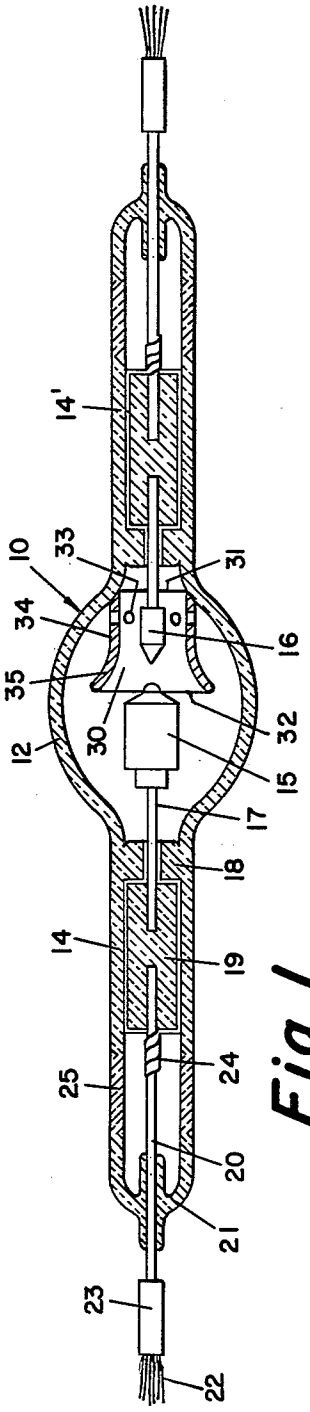


Fig. 1

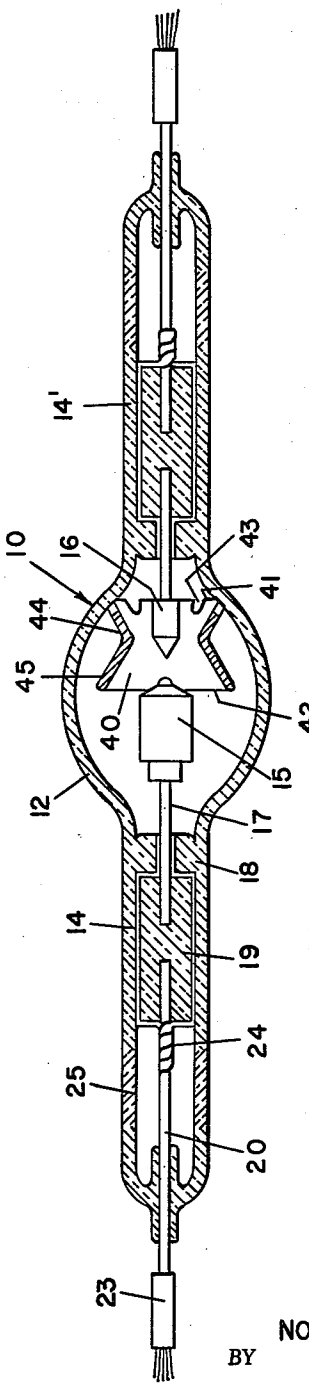


Fig. 2

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United States Patent Office 3,109,952 Patented Nov. 5, 1963

3,109,952

HIGH INTENSITY SHORT ARC LAMP HAVING AN ANNULAR CATHODE SHIELD

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Filed Mar. 15, 1962, Ser. No. 180,419
8 Claims. (Cl. 313—207)

This invention relates to electrical discharge lamps and more particularly to high pressure, high current gas or vapor discharge short arc lamps which are constructed to provide desired acoustical resonance properties to be operative in optical communication systems.

Lamps of the short arc type are known to the prior art and in general are constructed of a material capable of withstanding high temperatures and to provide a chamber for gases, such as argon, xenon, neon, etc., alone or with mercury or other vapor additives, and within which are located electrodes for forming the arc.

Operation of short arc lamps on A.C. power in the audio-frequency range or on D.C. power modulated by A.C. currents may be affected by sound vibrations produced within the gas chamber which are caused by thermally induced variations in gas pressure that result from changes in current density in the arc. At certain critical frequencies, acoustical resonance of appreciable intensity may be built up by reflections from the bulb walls causing distortion or instability of the arc which often results in extinction of the arc. In lamps of generally cylindrical shape, the critical frequencies are primarily caused by sound energy reflected from the ends of the lamp structure while in lamps of spherical shape the sound waves spread to the lamp walls and are then focused or directed back upon the arc to produce stability at the electrodes.

The broad object of the invention is to provide a short arc lamp which is constructed in a manner to eliminate or minimize the effect of deleterious acoustical resonance on the arc stream when a resonant frequency is used to operate or modulate the arc in order to permit the lamp to be used over extended periods of time.

Another object of the invention is to provide a short arc lamp in which provision is made to prevent deleterious acoustical resonance which is developed when the lamp is operated or modulated by a resonant frequency from being reflected to the arc stream from the lamp walls.

Another object of the invention is to baffle or interrupt the deleterious acoustical resonance developed when the lamp is operated or modulated by resonant frequencies in order to prevent their interfering with the arc stream.

Other and more detailed objects of the invention will become apparent from a better understanding of the invention, which may be had from the accompanying drawings and description thereof.

FIG. 1 is a longitudinal sectional view of a short arc lamp showing one embodiment of the invention for baffling or interrupting acoustical vibrations and preventing them from being reflected from the bulb walls back to the arc stream;

FIG. 2 is a longitudinal sectional view showing a modification of FIG. 1.

Referring to FIG. 1, a gaseous discharge lamp of the short arc type with which the present invention is adapted to be used is generally designated by the reference 10 and is constructed of clear fused quartz and provides strong wall structure for withstanding the high temperatures and pressures encountered during operation. The lamp is shaped to provide a central envelope section 12 and outer sections 14—14' which respectively are equipped ped to form the anode and cathode structures of the lamp. The components for each of the anode and cathode structures are generally similar and differ only in the particular design of the anode electrode 15 and the design of the cathode electrode 16. Since the components of the anode and cathode structures are generally similar, only the anode section will be described in detail to provide an explanation of the manner of assembling the components and of their positional arrangement within the lamp 10.

The anode electrode 15 is constructed of tungsten and is mounted at the inner end of a tungsten rod 17 while a quartz collar 18 is positioned on the rod adjacent its outer end and the outer end is secured in a quartz coupling block 19. Another tungsten rod 20 has its inner end secured in the opposite end of the coupling block 19 while its outer end extends through a glass closure 21 to receive leads 22 by means of a connector 23. Conductors in the form of thin molybdenum ribbons 24 are suitably secured about the rod 20 and extend along the coupling block 19 and are welded to the first tungsten rod 17 inside the collar 18. After assembling the anode components, as described, the outer section 14 of the quartz envelope is shrunk on to the coupling block 19 and collar 18 to provide an integral structure; the end closure 21 is secured to the section 14 by means of a quartz to glass seal indicated at 25.

The quartz coupling block and quartz collar arrangement for mounting the tungsten conductors 17 and 20 provide strength to the lamp structure while the conductor ribbons 24 provide for the transmission of heavy current loads from the leads 22 to the anode electrode 15. In the drawing the similar components of the cathode are identified similarly to those of the anode.

In FIGS. 1 and 2, the discharge arc between the anode 15 and cathode 16 is shown located off the geometric center of the central section 12 of the lamp and toward the cathode section 14' of the lamp. Although this is a preferred lamp construction, it will be understood that the detailed structure of the invention, which will now be described, has utility with lamps in which the discharge arc has a different location.

According to the present invention, improvement in the performance of the above described lamp can be obtained by the provision of a baffle or shield which is indicated at 30 in FIG. 1. This component is formed of a siliceous material such as quartz and is in the form of an open end ringlike or annular structure having a cylindrical end portion and a flared end portion. As shown in FIG. 1, the baffle or shield has one edge 31 fixed to the lamp wall adjacent the inner end of the cathode section 14' and its other edge 32 extending inwardly of the lamp central section 12 a short distance beyond the tip end of anode 15. Thus the shield surrounds or embraces the cathode electrode, a portion of the anode electrode and the arc stream therebetween providing an arrangement for preventing the interference of reflected sound waves with the arc stream. A group of apertures 33 providing an apertured area are located in the cylindrical end portion 34 of the baffle or shield adjacent its fixed edge 31 while the other end portion is flared at 35 toward the wall of the lamp central station 12. The apertures 33 and the flared end portion 35 of the baffle or shield permits the flow or circulation of gas through the arc zone while the structure or body of the shield functions to prevent the sound vibrations which are reflected from the wall of the envelope from disturbing the lamellar flow of gas through the arc zone.

The construction of the lamp of FIG. 2 is similar to that of FIG. 1 and differs thereover only in the details of the baffle or shield construction. In FIG. 2 this component is indicated at 40 and has a different shape from shield 30. The shield 40 also has its inner edge 41 fixed to the lamp wall adjacent the inner end of the cathode section 14' and its outer edge 42 positioned some-

what beyond the tip end of the anode 15. The apertured area is formed by a group of notches 43 in the end portion 44 of the baffle or shield and this end portion is flared outwardly as is the outer end portion 45.

In the construction of FIGS. 1 and 2, the dimensions or relative size of the baffle or shield to that of the electrode structure are such as to provide a space therewith and to position it relative to the lamp wall for interrupting the reflected sound waves and thereby, when the lamp is modulated, reduce or eliminate the resonant frequencies below that encountered in normal use of the lamp. A lamp generally of the design of FIG. 1 with the baffle or shield having a diameter of the order of 1.8 cm. across the arc zone was found, when modulated with audio frequencies, to produce only slight disturbances below the resonant frequency at about 11,800 c.p.s. and that arc extinction occurred with about 20 percent current modulation, while similar lamps not having the baffle or shield, when modulated, reacted violently to resonant frequencies at about 11,800 c.p.s. and cause arc extinction with 8 to 10 percent current modulation. Also, in lamps not having the baffle or shield, it was observed that there were strong arc disturbances at resonant frequencies in the neighborhood of 9600 c.p.s., indicating that the baffle or shields were effective in reducing the intensity of severe resonant frequencies.

In the preferred embodiments of the invention, the shields 30 and 40 of FIGS. 1 and 2, respectively, are shown mounted adjacent the cathode section of the lamp but in some lamp constructions it may be advantageous to mount the shields adjacent the anode section to extend toward the cathode section and embrace the arc zone. The invention therefore is intended to cover all modifications of the embodiments herein described which do not depart from the spirit of the invention.

I claim:

1. In an electric discharge lamp comprising a light transmissive central gas chamber disposed between end electrode sections one containing anode components including a conductor having an anode electrode disposed within the central chamber and the other containing cathode components including a conductor having a cathode electrode disposed within the central chamber and wherein the anode electrode and the cathode electrode are spaced to provide an arcing gap therebetween, the improvement which comprises an annular shield within the central chamber and extending from the central chamber wall adjacent one of the electrode sections toward the other electrode section, said shield being of sufficient length to embrace the electrode of the one section and the arcing gap and to position its other end in alignment with the tip end of the electrode of the other section and said shield having a diameter to provide an inner space with the electrodes for gas flow and an outer space with the wall of the central chamber for sound vibrations.

2. An electric discharge lamp as in claim 1, further characterized by said one end of the annular shield being provided with an apertured area to permit the circulation of gas through the inner space.

3. An electric discharge lamp as in claim 2, further characterized by said other end of the annular shield being flared outwardly.

4. An electric discharge lamp as in claim 1, further characterized by said annular shield having an apertured area adjacent its one edge and flaring from a generally central line toward both edges.

5. In an electric discharge lamp comprising a light transmissive central gas chamber disposed between an anode end section containing anode components including a conductor having an anode electrode disposed within the central chamber and a cathode end section containing cathode components including a conductor having a cathode electrode disposed within the central chamber and wherein the anode electrode and the cathode electrode are spaced to provide an arcing gap therebetween, the improvement which comprises an annular shield within the central chamber having one end secured to the central chamber wall adjacent the cathode section and extending toward the anode section, said shield being of sufficient length to embrace the cathode electrode, the arcing gap and a portion of the anode electrode and said shield having a diameter to provide an inner space with the electrodes for gas flow and an outer space with the wall of the central chamber for sound vibrations whereby interference of sound vibrations with the arc gap is minimized.

6. An electric discharge lamp as in claim 5, further characterized by said one end of the annular shield being provided with an apertured area to permit the circulation of gas through the inner space.

7. An electric discharge lamp as in claim 6, further characterized by said other end of the annular shield being flared outwardly.

8. An electric discharge lamp as in claim 5, further characterized by said annular shield having an apertured area adjacent its one edge and flaring from a generally central line toward both edges.

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