Sept. 2, 1958 F. H. RIXTON 2,850,660

SUB MINIATURE GLOW LAMP

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Fig. 1.

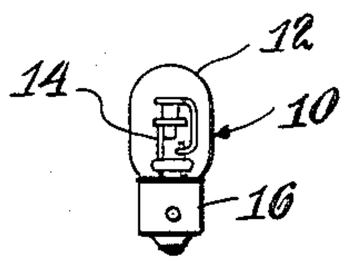


Fig. 2.

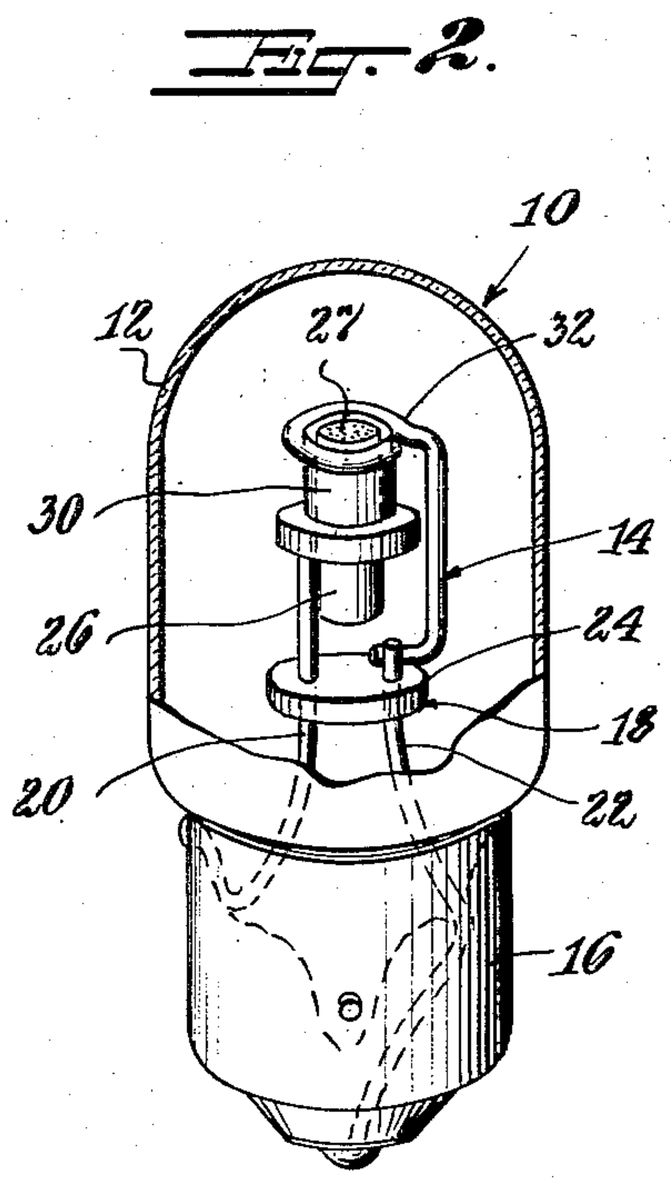


Fig. 3.

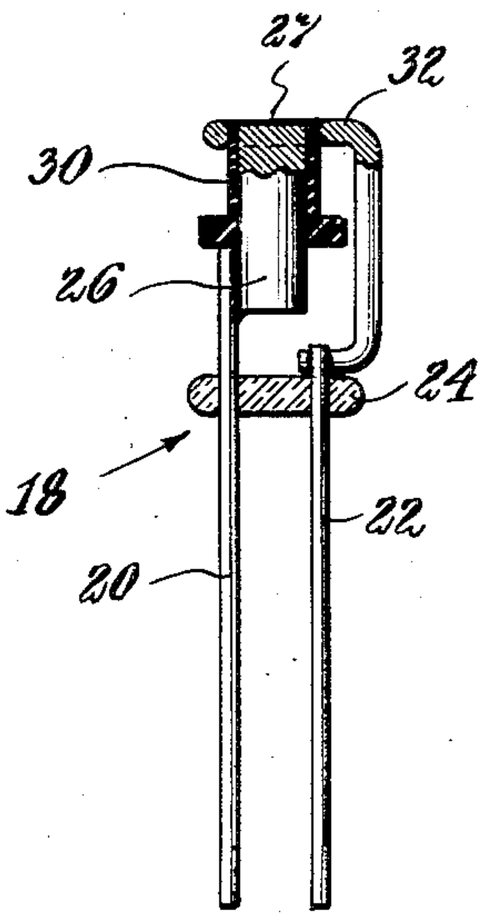
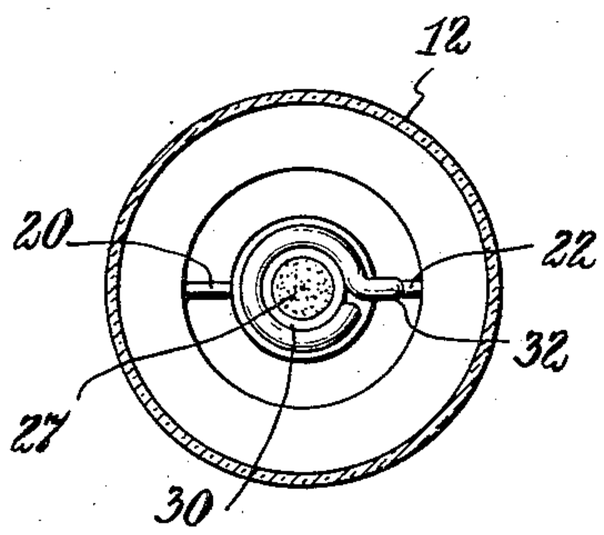


Fig. 4.



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SUB MINIATURE GLOW LAMP

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1 Claim. (Cl. 313—205)

The present invention relates to discharge lamps and, more particularly, to glow discharge lamps for use as an indicator.

With the development of more complex and sensitive industrial machinery and inspection equipment and the design of automatic electrical appliances and devices, small lamps are being applied in ever increasing numbers, firstly to indicate whether or not a device is properly connected in the circuit; secondly to show whether or not the circuit is "alive"; or thirdly to give indication of the operating sequence of automatic machinery, the setting of a machine or the arrangement of the controls, or any one of many other conditions that exist with present day devices.

There are two basic types of lamps that can be used for such purposes—namely, the incandescent filament lamps and the less well known glow discharge or neon glow lamps. The small filament indicator lamp has a tungsten wire filament that produces visible light by incandescence and is generally of the vacuum type. These lamps are usually applied when both some degree of illumination and indication is required. On the other hand, glow lamps, in which the light is generated by a discharge of electricity through a gas, are especially satisfactory when only visual indication or recording of data on film is required.

Lamps for most industrial indicator applications are subject to rough service. In this field the glow lamp is unsurpassed because of its simple rugged construction. It is a small wattage light source that can be applied in conjunction with a small carbon type resistor at voltages as high as 450 to 600 volts, or as low as 110 volts. Essentially, these lamps consist of a side viewed glass bulb in which are sealed two rod-like vertical electrodes coated with an emission material.

Neon gas is used to fill the standard types. When energized the gas becomes ionized and current flows between the positive and negative electrodes, causing a characteristic orange-red glow to develop over the surface of the cathode (negative electrode). The lamps are often called "negative" glow lamps because only the negative electrode glows at any one instant. On D. C. operation, of course, only the cathode glows. On A. C. the polarity reversals are so rapid that both electrodes appear to glow together. This characteristic makes the glow lamp especially applicable for an inexpensive polarity tester.

To give a permanent record of the operating sequence of a group of desirably synchronized machines a plurality of glow lamps may be mounted within a camera housing adjacent a film moving at a known predetermined rate. Each of the glow lamps is connected electrically to the operating circuit of one of the machines. When each machine functions the glow lamp is fired and the light pattern recorded on the moving film. For applications of this type the side viewed conventional glow lamp will not produce the understandably desirable concentrated spot source of light required to produce an intelligible record pattern with sharp well defined boundaries on the camera film. In addition low striking voltages in the order of 100 volts D. C. and short ionization delay times in the order of less than 500 microseconds are needed in an application of this type. It is also required that lamps be as small as possible because of space limitations of the cameras. Prior to my invention there has been no commercial lamp of this type capable of performing the above desirable functions.

Hence it has been found advantageous according to my invention to provide an improved end viewed miniature glow discharge lamp having a concentrated spot source of light in the range of .060" to .080" in diameter with well defined boundaries, and having a low striking voltage in the order of 100 volts D. C. and a short ionization delay time in the order of less than 500 microseconds. The electrode mount of the improved glow lamp of my invention may comprise a bead type stem having an emissively coated rod-like cathode electrode secured to one lead, an insulator about the cathode, and a ring-like anode about the insulator and carried by the other lead.

In its general aspect the present invention has as its objective an improved end viewed miniature glow discharge lamp capable of producing a well defined concentrated spot source of light, with sharp boundaries for recordation on a moving picture film.

A specific object of the present invention is a miniature glow discharge lamp having a low striking voltage in the order of 100 volts D. C. and a short ionization delay time in the order of less than 500 microseconds.

An additional object is a glow discharge lamp having a bead type stem for carrying a rod-like emissively coated cathode on one lead and a ring-like anode on the other lead with an insulator between the cathode and the anode.

Other objects of the present invention will become apparent to those skilled in the art to which it appertains as the description thereof proceeds.

Referring now to the drawing in which like numerals of reference indicate similar parts throughout the several views:

Fig. 1 is a full size side elevational view of the glow discharge lamp of my invention.

Fig. 2 is an enlarged view of the lamp of Fig. 1 having its envelope partially cut away to more clearly show the electrode mount assembly.

Fig. 3 is an enlarged side sectional view of the electrode mount assembly of the glow lamp of Figs. 1 and 2.

Fig. 4 is an enlarged plan view of the lamp of Fig. 2.

Referring now to the drawing in detail, the reference numeral **10** designates an end viewed miniature glow discharge lamp of my invention for producing a concentrated spot source of light with sharp boundaries, for example, in the range of .060–.080" in diameter and having a low striking voltage in the order of about 100 volts D. C. and a short ionization delay time in the order of less than 500 microseconds.

It will be noted from a careful consideration of Fig. 1, a full size drawing, that the lamp **10** of my invention has an overall length of about 1 3/16" and a generally tubular vitreous envelope **12** of about 3/8 in diameter. This envelope is butt sealed to an electrode mount **14** and is provided with a suitable base **16** secured about the seal by a suitable cement.

The electrode mount **14** has a bead type stem **18**, shown particularly in Fig. 3, which comprises a cathode leading-in and supporting conductor **20** and the anode leading-in and supporting conductor **22**, suitably in-

tegrated or beaded together by a generally annular vitreous button **24**. Although Fig. 3 shows the outer portions of the conductors **20** and **22** as being straight, it will be understood that after the beading operation and prior to electrode mounting that they be formed or bent divergently outwardly so that the V thus formed in the leads will rest on the neck of the envelope **12** for proper sealing. The cathode conductor **20** carries a rod-like metallic cathode **26** secured, as by lap-welding, to the upper end of the conductor **20**. This cathode **26** may be a piece of nickel wire approximately .060–.080″ in diameter and 5 mm. long. The end of the cathode **26** is suitably ground flat and coated thereon with an emission material **27** (Fig. 4). The emission material may be a mixture of barium and strontium carbonate which is later reduced during the exhaust cycle to the oxide of these metals.

A hollow flanged ceramic insulator **30** is placed about the nickel cathode **26** and has its lower flanged portion resting on the upper end of the cathode leading-in and supporting conductor **20**. The insulator **30** has a wall thickness suitably in the range of .015″+.005″. Since the top of an anode **32**, the insulator **30** and the cathode **26** all desirably lie in the same plane, the wall thickness of the insulator **30** determines the cathode-anode electrode spacing. The ceramic insulator **30** is secured in place by the encircling ring-type anode **32** which surrounds in snug engagement therewith the upper portion of the insulator **30**. This anode **32**, suitably approximately .030″ in diameter nickel wire, has its upper end formed in the above mentioned ring and its lower depending portion bent downwardly transverse to the plane of the ring portion. The lower end of the depending portion may be secured, as by welding, to the upper end of the anode leading-in and supporting conductor **22** a short distance above the button **24**. The anode **32** may be coated with an ionizing agent for example, a radioactive material, such as radium bromide.

After the mount **14** has been fabricated it is then butt sealed to the open end of the envelope **12** and may be exhausted in the usual manner as, for example, through the exhaust tube added during the sealing-in operation. Prior to tip-off the lamp **10** may be made suitable for exposing black and white, infrared or color film by a proper selection of an inert gas fill which will give the

desired striking voltage and spectral characteristics. I have found that a gas fill comprising a mixture of 99.0–99.7% neon and the balance argon or some other inert gas or inert gaseous mixture (as determined by the application of the lamp) at a pressure in the order of 120 mm. gives an optimum breakdown voltage characteristic.

The miniature glow discharge lamp **10** of my invention is capable of being end viewed. The lamp **10** has a high intensity glow spot with sharp boundaries in the range of .060″ to .080″ in diameter, a low striking voltage in the order of 100 volts D. C. and a short ionization delay time in the order of less than 500 microseconds.

Although a preferred embodiment of my invention has been disclosed it will be understood that modifications may be made within the spirit and scope of the invention.

I claim:

A miniature glow discharge lamp for producing a high intensity glow spot in the range of .060″ to .080″ in diameter with sharp boundaries and having a low striking voltage in the order of 100 volts D. C. and a short ionization delay time in the order of less than 500 microseconds comprising a vitreous envelope, an ionizable medium in said envelope and an electrode mount substantially axially sealed to said envelope, said mount having a bead type stem comprising a vitreous bead and at least two leading-in and supporting conductors extending through said bead, a rod-like cathode on one of said conductors and coated with an emissive material, a flanged insulator about said cathode and supported by said cathode and its supporting leading-in conductor, and a ring type anode on said other conductor and about said insulator, said cathode, said insulator and said anode having their respective top portions lying in the same plane.

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