March 23, 1948. C. MOREHEAD ET AL 2,438,181

FLUORESCENT AND/OR CATHODE GLOW LAMP AND METHOD

Filed May 27, 1943

Fig. 1.

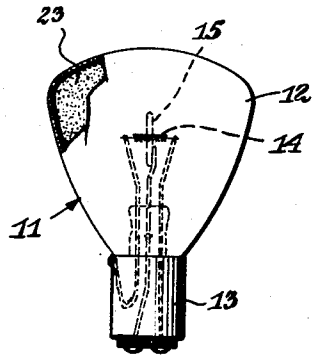


Fig. 2.

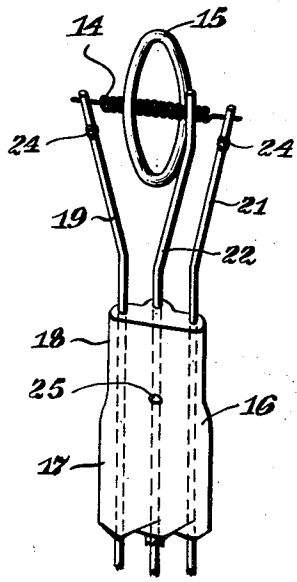


Fig. 3.

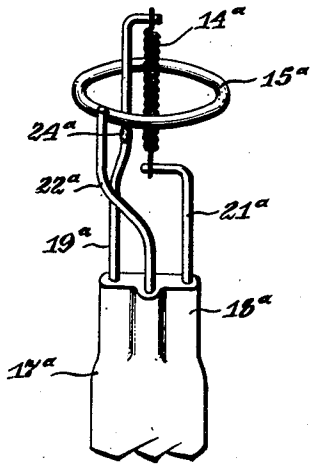
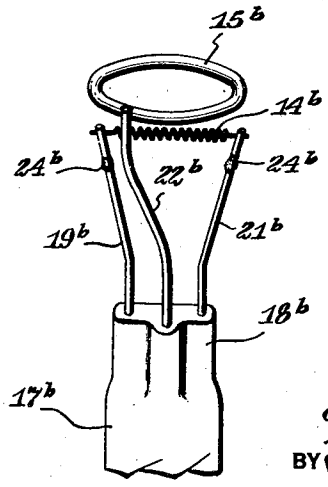


Fig. 4.



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FLUORESCENT AND/OR CATHODE GLOW LAMP AND METHOD

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12 Claims. (Cl. 176—122)

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This invention relates to negative glow lamps, which may also be used as fluorescent lamps, so constructed that they may be operated at low voltage.

The primary object of our invention, generally considered, is to produce a small low-potential glow lamp, the envelope of which, if desired, may be coated with fluorescent material to increase the visible light output or the ultra-violet output in the neighborhood of 3600 A. U.

Another object of our invention is to produce a lamp which contains closely spaced electrodes, that acting as a cathode being desirably coiled and coated with electron-emission material, and a getter containing caesium desirably mounted on one or more lead-in conductors at such a position that it is near the arc stream but not in it, whereby the lamp operating potential is lowered while at the same time heating of the getter to a temperature where it would vaporize onto and blacken the wall of the envelope is avoided.

A further object of our invention is to provide a negative-glow lamp of the gaseous-conduction type where the cathode and anode are closely spaced to provide a very short arc length, so that it is operated at low voltage.

A still further object of our invention is to use a getter material containing caesium in a negative-glow lamp, in order to lower the ionization potential, or as an ionization stimulator, said material being so located that the effect is obtained without bulb blackening.

An additional object of our invention is to provide a negative-glow lamp of the gaseous-conduction type comprising an oxide-coated coiled cathode and a preferably toroidal anode, both enclosed in an inert gas containing mercury vapor, in order to produce radiations of 2537 Angstrom Units, whereby fluorescent material on the inner surface of the bulb, if used, may be activated to give visible light or the ultra violet output around 3600 A. U.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the drawings:

Fig. 1 is an elevational view, with a part broken away, of a lamp embodying our invention.

Fig. 2 is a perspective view on an enlarged scale of the mount of the lamp illustrated in Fig. 1.

Fig. 3 is a view corresponding to Fig. 2, but showing another embodiment of our invention.

Fig. 4 is a view also corresponding to Fig. 2,

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but showing a further embodiment of our invention.

There are occasions where it is desired to obtain a small amount of light from a lamp with the employment of a very small amount of power at low voltage. As is well-known, discharge and fluorescent lamps satisfy the requirement of small power for a given amount of light, but ordinarily require a relatively high potential to operate. The operating potential is lowered by the use of electron-emission material, such as the usual oxide coating on the cathode, but that is not ordinarily sufficient to produce a lamp which may be operated with an arc drop of about 8 volts.

It is, therefore, our purpose to produce a negative glow lamp in which the bulb contains an inert gas admixed with mercury vapor whereby the discharge produced includes radiations of 2537 A. U. for activating a fluorescent coating, if employed, to efficiently produce visible light or ultra-violet around 3600 A. U., the necessary operating voltage being made very low by not only using a coiled filamentary cathode coated with an emission compound, such as the carbonates of barium and strontium, but also using an ionization stimulator or means to lower the ionization voltage, such as a compound containing caesium, which also functions as a getter, metallic caesium being prevented from distilling on the walls of the envelope by positioning the getter so that it does not get too hot during operation.

The location of the caesium-containing material is important. Locations on the anode, or on hot parts of the cathode produce blackening of the bulb. Locations on the press or other glass parts and on the cathode lead wires too far from the arc stream do not have the desired voltage-reducing effect.

Referring to the drawing in detail, like parts being designated by like reference characters, and first considering the embodiment of our invention illustrated in Figs. 1 and 2, there is shown a lamp 11 comprising a translucent vitreous or glass envelope 12, based as indicated at 13, and enclosing a coiled filamentary cathode-acting electrode 14 and a toroidal anode-acting electrode 15. The axis of the electrode 14 desirably passes through the center and is normal to the plane of the electrode 15. The outside diameter of the electrode 15 is very small, preferably about 10 millimeters, so that the arc length is also very small, that is in the neighborhood of 4 milli-

meters, making allowance for the thickness of the electrodes.

Both electrodes are supported from a stem 16, including a flare tube 17 which closes the neck of the bulb 12 and through the press 18 of which pass the lead-in conductors and electrode supports 19 and 21, for the coiled filamentary cathode 14, and 22 for the anode 15. The coiled cathode 14 is desirably formed of tungsten and coated with electron-emission material, such as a mixture of the carbonates of barium and strontium, which during the seasoning process break down into the oxides, as will be understood by those skilled in the art. The anode 15 is formed of some suitable conductive material such as molybdenum or nickel.

The inner surface of the envelope 12 is desirably coated with fluorescent material 23 which may be of any desired character which will respond to ultra-violet radiation, and particularly such as 2537 A. U.

Before assembling the mount illustrated in Fig. 2 in the envelope shown in Fig. 1 getter material 24 is applied to one or both of the leads 19 and 21, a short distance from the connection or connections with the electrode. The reason for applying it in the position illustrated is to have it near, but not in, the arc or glow to be produced between the electrodes, whereby it lowers the necessary break-down or ionization potential, while at the same time does not become heated enough to distill to the inner surface of the envelope wall and cause blackening thereof. The getter composition is such that it becomes active with the development of caesium during the baking process when the lamp is manufactured. For the purpose, it may consist of a compound of caesium with a reducing agent such as caesium chloride, and calcium or an alloy of calcium and magnesium, although we do not wish to be limited to this formula.

After the mount is sealed into the bulb 12, the bulb is exhausted, as by means of the usual exhaust tube through a stem aperture 25, and the air replaced by an inert gas, such as argon, neon or a mixture thereof. A small quantity of mercury may be introduced with the gas filling in order to increase the efficiency of ultra-violet generation.

Referring now to the embodiment of our invention illustrated in Fig. 3, there is shown a mount consisting of a cathode-acting electrode 14^a, the axis of which passes through the center, and is disposed normal to the plane, of the toroidal anode-acting electrode 15^a. The cathode-acting electrode 14^a is supported by leads 19^a and 21^a, while the anode-acting electrode 15^a is supported by lead 22^a, all of which leads pass through the press 18^a of the flare tube 17^a. The only difference between the construction of the embodiment of Fig. 3 and that of Figs. 1 and 2 is that the cathode 14^a is disposed coaxial with the flare tube 17^a and the bulb, which is desirably like the bulb 12 of the first embodiment, rather than perpendicular to the axis thereof, and the getter 24^a, which may be identical with the getter 24 of the first embodiment, is shown disposed on only one lead 19^a, rather than on the two leads 19 and 21 of the first embodiment, said getter, however, being disposed close, say about 2 millimeters from the plane of the anode 15^a and the axis of the cathode 14^a, whereas in Fig. 2 it is disposed about 2 millimeters from the axis of the cathode 14. After completion, the mount of Fig. 3 is enclosed in a bulb and the lamp completed, as described in connection with the first embodiment.

Referring now to the embodiment of our invention illustrated in Fig. 4 there is shown a mount consisting of a cathode-acting electrode 14^b and a toroidal anode-acting electrode 15^b, the former supported from leads 19^b and 21^b and the latter from lead 22^b, extending through press 18^b of flare tube 17^b. In the present embodiment the construction is identical with that of Fig. 3, except that the cathode 14^b is disposed below and parallel to the plane of the anode 15^b, rather than extending through the center and axial thereof.

It is, however, desirably disposed close to the anode, in this case about 2 millimeters therefrom, and the getter 24^b, which may be identical with the getter 24 of the first embodiment, is positioned on one or both of the cathode leads 19^b and 21^b, about 2 millimeters from the point or points of connection of a cathode end or the cathode ends therewith. Otherwise the construction and manner of assembly with a bulb, seasoning and operation may be identical with that of the first embodiment.

From the foregoing disclosure it will be seen that we have devised a cathode glow lamp, the envelope of which is ordinarily coated with fluorescent material, which desirably uses a hot cathode coated with a barium-emission compound, said envelope containing a monatomic gas or mixture and mercury, so that the cathode-glow produced contains 2537 A. U. radiation. Caesium is desirably used to give both getter action and lower the ionization potential, such material being prevented from distilling on the walls of the envelope by locating it between one of said electrodes and the inner surface of the envelope, which is the right place for the purpose. Metallic caesium is intended to be produced by the heat of the exhaust baking oven and its effect depends on its presence near the arc stream, without being actually within it.

On account of the presence of mercury in the lamp an amalgam is formed of the caesium, which also affects its action, whereby said lamp may be operated on a voltage as low as that to give only an 8 volt drop between the electrodes. It is thus suitable for use where only 12 volts D. C. is available, as commonly distinguished from prior lamps designed for similar purposes which necessarily used either 24 volts or relatively costly "voltage boosters" if less than 24 volts are available.

Although preferred embodiments of our invention have been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

We claim:

1. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, closely spaced electrodes functioning as cathode and anode, and getter material disposed adjacent but beyond the path of the discharge to be produced between said electrodes and between one of said electrodes and the inner surface of said envelope, said material being of such a character as to lower the ionization potential of the envelope filling and make it possible to operate the lamp on low voltage.

2. A negative-glow lamp comprising an enclosing envelope, inert gas admixed with mercury vapor in said envelope, electrodes closely spaced with respect to one another and adapted to respectively function as a cathode and an anode,

and getter material disposed adjacent but beyond the path of the discharge to be produced between said electrodes and directly on at least one of the leads said material being of such a character as to one of said electrodes, to lower the ionization potential of the gas and make it possible to operate the lamp on low voltage.

3. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, closely spaced electrodes functioning as cathode and anode, and getter material containing caesium and disposed adjacent but beyond the path of the discharge to be produced between said electrodes and between one of said electrodes and the inner surface of the envelope, to lower the ionization potential of the gas filling and make it possible to operate the lamp on low voltage.

4. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, lead-in conductors supporting electrodes adapted to respectively function as a cathode and an anode and closely spaced with respect to one another to provide a very short arc length, and getter material of such a character and disposed directly on at least one of said lead-in conductors near the point of junction with its electrode in order to be positioned just right to, without blackening said envelope, lower the ionization potential of the gaseous filling and make it possible to operate the lamp on low voltage.

5. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, an oxide-coated coiled electrode adapted to function as a cathode, a lone toroidal electrode coaxially disposed with respect to said coiled electrode and adapted to function as an anode, and getter material disposed adjacent but beyond the path of the discharge to be produced between said electrodes and between said electrodes and the inner surface of said envelope, said material being of such a character as to lower the ionization potential of the filling and make it possible to operate the lamp on low voltage.

6. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, an inert gas admixed with mercury vapor and confined in said envelope, closely spaced electrodes surrounded by said gas in order to produce when a discharge occurs therebetween, radiations including those of 2537 A. U., and getter material disposed adjacent but beyond the path of the discharge to be produced between said electrodes and between one of said electrodes and the inner surface of the envelope, said material being of such a character as to lower the ionization potential of the gas and make it possible to operate the lamp on low voltage.

7. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, closely spaced electrodes, and getter material disposed adjacent but beyond the path of the discharge to be produced between said electrodes and between one of said electrodes and the inner surface of the envelope, said material being of such a character as to lower the ionization potential of said envelope filling and make it possible to create a desired low voltage discharge between said electrodes, the inner surface of said envelope being coated with fluorescent material in order that the generated ultra-violet radiations may impinge thereon and produce radiations of a character desired.

8. A negative-glow lamp of the gaseous conduction type comprising an enclosing translucent envelope coated interiorly with fluorescent material, a coiled oxide-coated filament adapted to act as a cathode, a lone toroidal anode-acting electrode disposed coaxially with respect to said coiled filament, leads for said electrodes, and getter material including caesium disposed adjacent but beyond the path of the discharge to be produced between said electrodes and on at least one of said leads to act as an ionization stimulator, while not being close enough to the arc produced between said electrodes to be vaporized on the envelope and cause blackening thereof, said envelope containing inert gas admixed with mercury vapor in order that ultra-violet radiations may be produced and activate the fluorescent material for the production of visible light or ultra violet around 3600 A. U.

9. The mehod of making a negative-glow lamp of the gaseous conduction type and of reduced operating voltage, while avoiding blackening the bulb by vaporization of the getter thereon, comprising coating one of a pair of electrodes with electron-emission material, positioning said electrodes close together, evacuating the envelope and replacing by an atmosphere of inert gas containing mercury vapor, positioning a getter containing caesium directly on at least one of the leads to the electrodes so as to be close to, but not in the discharge to be generated between said electrodes, and activating said getter during the baking-out process of the lamp.

10. A negative glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, a coiled filamentary electrode to act as cathode, a toroidal electrode to act as anode, said toroidal electrode being approximately ten millimeters in diameter, said filamentary electrode having its axis extending approximately normal to said plane of said toroidal electrode and passing approximately through the center thereof in order to provide about four millimeters of discharge length, and getter material positioned in said envelope at approximately two millimeters from the axis of the filamentary electrode so as to lie near but not in the discharge to be produced between said electrodes, whereby it is possible to operate said lamp on a potential of the order of eight volts.

11. A negative glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, a filamentary electrode adapted to be heated, and coated with electron emission material in order to act as a cathode, a toroidal electrode to act as an anode, said filamentary electrode extending on both sides of, and having its axis extending approximately normal to, the plane of said toroidal electrode and passing approximately through the center thereof in order to provide a short discharge path, and getter material positioned outside of said discharge path but close to the axis of said filamentary electrode, so as to lie near the discharge path produced, said materal being of such a character as to thereby greatly lower the necessary operating potential of said lamp.

12. A negative glow lamp of the gaseous conduction type comprising an enclosing translucent envelope, a pair of closely spaced electrodes, one of which includes electron-emission material so as to function as a cathode, and material disposed adjacent but beyond the path of the discharge to be produced between said electrodes, said material being of such a character that the ionization potential of the envelope filling is lowered,

making it possible to operate the lamp at greatly reduced voltage.

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