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K. V. GESSEL

2,346,522

FLUORESCENT LAMP

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Fig. 1.

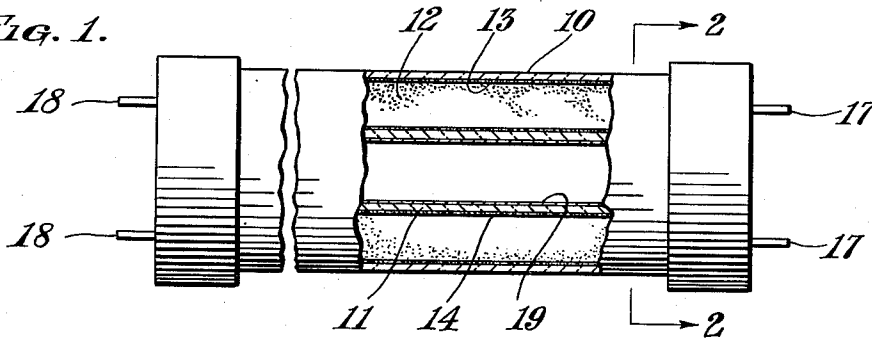


Fig. 2.

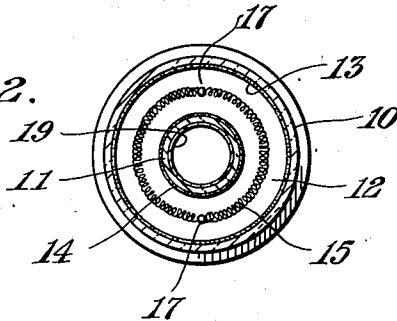


Fig. 3.

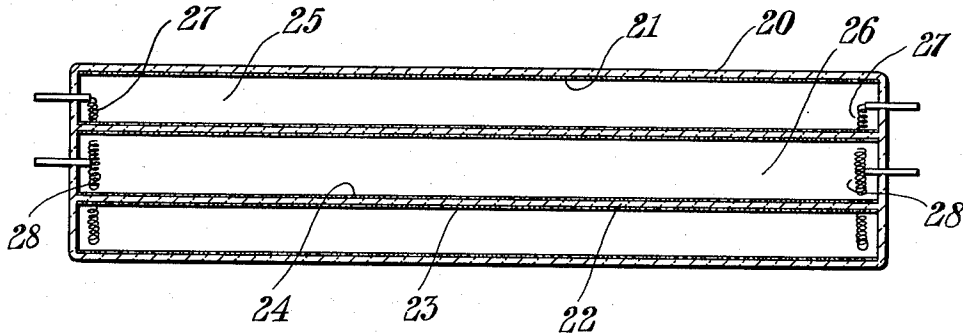
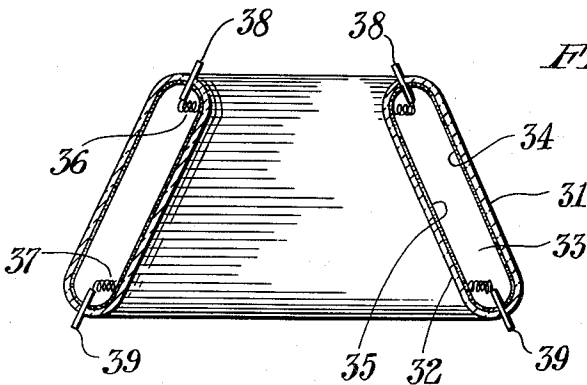


Fig. 4.



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FLUORESCENT LAMP

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Application May 12, 1942, Serial No. 442,669

3 Claims. (Cl. 176—122)

The present invention relates to fluorescent electric discharge lamps and more particularly to an improved fluorescent lamp characterized by a high operating efficiency.

In their usual form fluorescent lamps comprise a sealed cylindrical tubular envelope the interior surface of which is coated with a fluorescent material, and means to generate invisible ultra-violet radiations which impinge on the fluorescent coating and are converted into visible radiations. As the source of ultra-violet radiations, a gaseous discharge is used, and for this purpose the envelope contains a gaseous filling and is provided with suitable electrodes for starting and maintaining the discharge. In practice, mercury vapor is used as the discharge gas and the quantity thereof is regulated so that at the operating temperature the ultra-violet radiations generated fall predominantly within the spectral range of about 2537 Angstrom units at which wave length the most generally used fluorescent materials exhibit their greatest sensitivity. To the mercury vapor there may be added a suitable inert gas such as argon or neon, or a mixture thereof, to facilitate the starting of the discharge.

It is an object of the invention to provide a fluorescent lamp in which substantially all of the invisible radiations of the discharge are converted into visible light.

A further object of the invention is to provide a fluorescent lamp of greater efficiency than could heretofore be obtained.

These and further objects of my invention will appear as the specification progresses.

In accordance with the invention, the light-conversion efficiency of a fluorescent lamp is increased by establishing a high ratio between the area of the fluorescent material exposed to the gaseous discharge and the volume of the discharge space, and hence the electrical energy supplied to the fluorescent lamp.

It is a further feature of the invention that the said high ratio between the area of the material exposed to the discharge and the volume of the discharge, is obtained by a construction which is simple to manufacture and of low cost.

The invention will be described in greater detail with reference to the appended drawing forming part of the specification and in which:

Figure 1 shows partly in cross-section a fluorescent lamp in accordance with the invention.

Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a cross-sectional view of a second

embodiment of a fluorescent lamp in accordance with the invention.

Fig. 4 is a cross-sectional view of another embodiment in accordance with the invention.

Referring to Fig. 1, the lamp there shown comprises a cylindrical glass tube 10 having its interior surface coated or lined with a suitable fluorescent material 13. Concentrically arranged within the tube 10 is a second glass tube 11 having its outer surface coated with a fluorescent layer 14. Coatings 13 and 14 are applied to the tubes 10 and 11 in known manner, for example, by painting or spraying the tubes with a suitable suspension of the fluorescent material in finely divided form, or by immersing the tubes in such a suspension. Suitable fluorescent materials may include for example, magnesium tungstate, zinc orthosilicate, zinc beryllium silicate and calcium tungstate. Other suitable fluorescent materials will immediately suggest themselves to those skilled in the art and a further reference to the same is believed to be unnecessary.

Tubes 10 and 11 are sealed together at their end portions to form an annular cylindrical discharge space 12 within which is provided a measured amount of mercury vapor and a mixture of neon gas and argon gas.

Electrodes 15—15 provided at opposite ends of the discharge space serve for starting and maintaining the discharge, said electrodes being formed preferably with an annular shape and surrounding the ends of the tube 11 to thereby bring about a uniformly distributed discharge through the space 12. As shown in the drawing (see Fig. 2), each electrode consists of two helical filaments connected in parallel, and in practice the electrodes are coated with an electron-emissive material such as barium oxide, strontium oxide or the like to facilitate the starting of the discharge. External electrical connections to the electrodes 15—15 are provided by suitable lead-in wires (not shown) connected to the electrodes and to connecting pins 17—17 and 18—18 respectively, which pins also serve as mounting members for the lamp.

The external electrical circuit for operating the fluorescent lamp is of the type well known in the art and a description of the same is believed to be unnecessary.

The novel construction above described brings about substantial increases in the surface area of the fluorescent material exposed to the discharge in a simple and economical manner. Furthermore, the ratio between the surface area

of the fluorescent material and the discharge volume is readily and simply adjusted within any desired value merely by controlling the diameter of tube 11. Thus by increasing the diameter of tube 11 an increase in the surface area of the fluorescent material and also a decrease in the volume of the discharge space is obtained.

Another advantage of the construction of the invention is that the ultra-violet radiations are generated immediately adjacent to the fluorescent layers, and since the radiations travel only a minimum distance from their point of origin before exciting the fluorescent material, there is substantially no reabsorption of the radiations by the discharge gas.

A further advantage of the construction of the invention is that it makes possible light sources of heretofore unavailable color-ranges and color-blends. For example, new color blends may be obtained by constituting the coating 13 of a fluorescent material of a particular characteristic color and the coating 14 of a material of a different characteristic color.

For even further increasing the efficiency of the fluorescent lamp the inner surface of the tube 11 is provided with a suitable reflecting layer of silver, aluminum or the like, such a reflecting layer being shown as 19 in Figs. 1 and 2.

The principles of above described construction may also be applied to fluorescent lamps having high values of light output and in Fig. 3 such an embodiment of the invention is illustrated. The lamp there shown comprises a cylindrical glass tube 20 the interior surface of which is provided with a coating 21 of fluorescent material. Concentrically arranged within tube 20 is a glass tube 22 having its outer and inner surfaces provided with fluorescent coatings respectively 23 and 24. Coatings 21, 23 and 24 may be applied to the surfaces of the tubes 20 and 22 in known manner as previously pointed out.

The tubes 20 and 22 are sealed and joined together at their end portions to form an annular cylindrical discharge space 25, and a cylindrical discharge space 26. Each of the discharge spaces contains a gaseous filling, for example, of mercury vapor small amount of neon and argon.

For starting and maintaining a discharge within the space 25, annular shaped electrodes 27—27 conforming to the requirements of the electrodes 15—15 of Figs. 1 and 2, are provided at each end of the discharge space. Similarly, for starting and maintaining a discharge within the space 26 these are provided at the opposite ends thereof, electrodes 28—28 which for the reasons previously pointed out are also preferably of the coated filamentary type.

The fluorescent lamp illustrated in Fig. 4 comprises an envelope having two concentric conically shaped wall portions 31 and 32 sealed together at their base and apex portions to form an annular discharge space 33. Upon opposing surfaces of the portions 31 and 32 are fluorescent coatings 34 and 35 respectively and within the discharge space is a filling of mercury vapor and a small amount of neon and/or other insert gas. At opposite ends of the discharge space there are provided electrodes 36—37 consisting preferably of annular helically-wound filaments coated with a suitable electron emissive material to facilitate the starting of the discharge. External electrical connections to the electrodes are made at diametrically opposite portions thereof by metal pins

38—38 and 39—39 respectively, which are sealed into the envelope and the inner ends of which position and support the electrodes.

In the embodiment of the invention illustrated in Fig. 4 the light generated by the fluorescent coatings 34 and 35 diffuses directly from all surfaces of the envelope. It is also a novel feature of this construction that the lamp need only be mounted on a suitable pedestal to form a "reading-lamp" and the need of auxiliary equipment such as the usual lamp shade is dispensed with.

While I have described my invention in specific embodiments and by specific examples, I do not wish to be limited thereto as obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What I claim is:

1. A gaseous electric discharge lamp comprising an envelope having two substantially parallel concentric conically shaped wall portions joined together at their apex and base portions to form a truncated annular discharge space, a gaseous medium within said discharge space for generating high intensity radiations within the invisible portions of the spectrum, two annular shaped electrodes for ionizing the gaseous medium, one of said electrodes being positioned at the apex portion of the discharge space and the other of said electrodes being positioned at the base portion of the discharge space, and coatings of fluorescent material on the opposing surfaces of the wall portions and exposed to the discharge space.

2. A gaseous electric discharge lamp comprising an envelope having two substantially parallel concentric conically shaped wall portions joined together at their apex and base portions to form a truncated annular discharge space, a gaseous medium within said discharge space for generating high intensity radiations within the invisible portions of the spectrum, two annular shaped electrodes for ionizing the gaseous medium, one of said electrodes being positioned at the apex portion of the discharge space and the other of said electrodes being positioned at the base portion of the discharge space, a coating of a fluorescent material having one color characteristic on the surface of one of said wall portions exposed to the discharge space and a coating of a fluorescent material having a color characteristic different from that of said first coating on the surface of the other of said wall portions exposed to the discharge space.

3. A gaseous electric discharge lamp comprising an envelope having two substantially parallel concentric conically shaped wall portions joined together at their apex and base portions to form a truncated annular discharge space, a gaseous medium within said discharge space for generating high intensity radiations within the invisible portions of the spectrum, two electrodes for ionizing the gaseous medium each comprising a helical filamentary member arranged in annular form, terminal members connected to each filamentary member at diametrically opposite portions thereof, one of said electrodes being positioned at the apex portion of the discharge space and the other of said electrodes being positioned at the base portion of the discharge space, and coatings of fluorescent material on the opposing surfaces of the wall portions and exposed to the discharge space.

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