

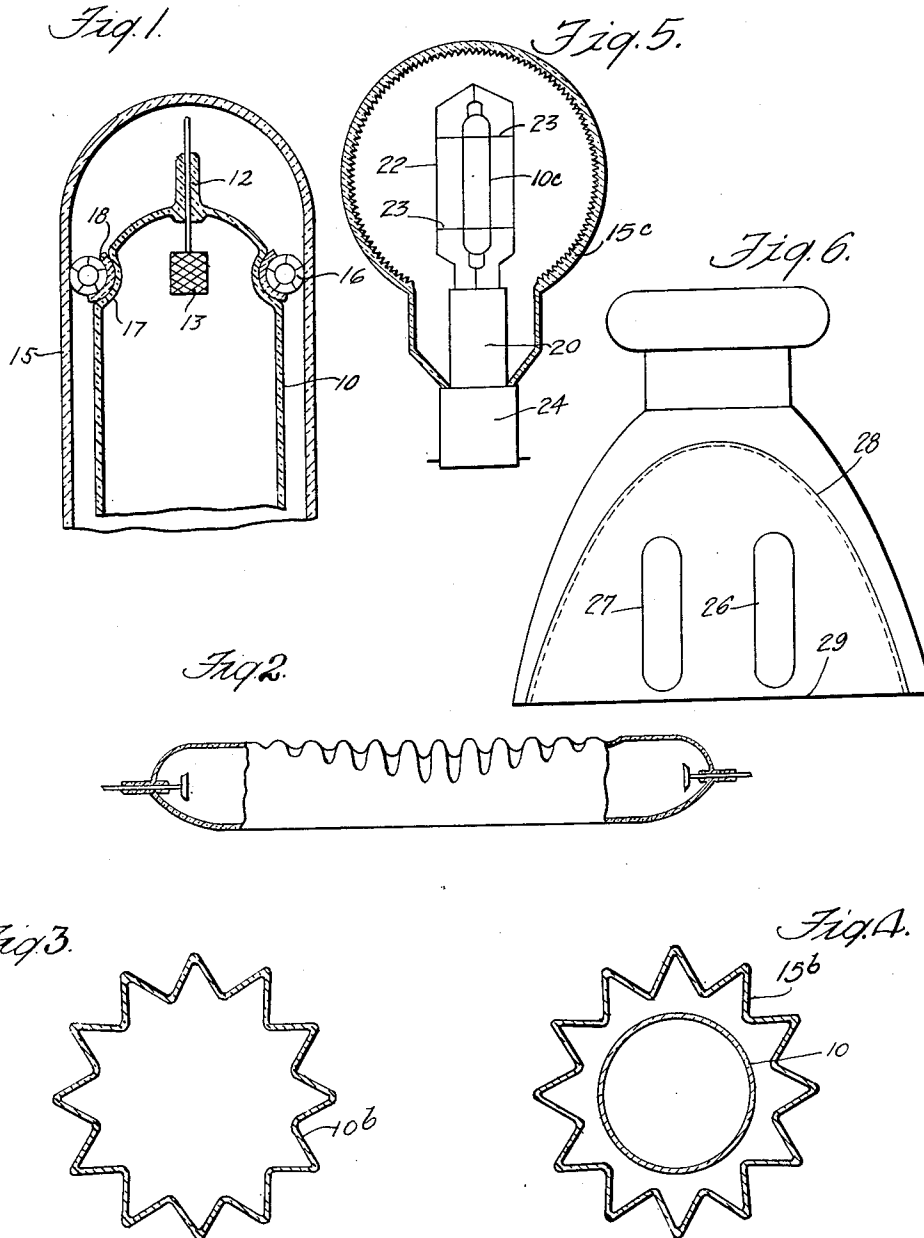
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ELECTRICAL DISCHARGE DEVICE

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ELECTRICAL DISCHARGE DEVICE

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6 Claims. (Cl. 176—122)

This invention relates to illuminating devices and particularly to such devices of the gaseous discharge type.

One object of my invention is to improve the efficiency of such devices. Another object of my invention is to provide illuminating devices adapted to give illumination of more satisfactory color value. Another object of my invention is to improve the length of the useful life of illuminating devices. Another object of my invention is to provide for the combining of such illuminating devices with pleasing visual effects. Another object of my invention is to improve the uniformity of illumination produced by such devices.

Other objects and advantages of the invention will be apparent to those skilled in the art from the following description and the accompanying drawings.

In the drawings:

Fig. 1 is a view in axial section of a lamp embodying my invention.

Fig. 2 is a view in side elevation of an arc tube designed for horizontal burning

Fig. 3 is a view in cross-section showing another embodiment of my invention designed particularly for use in connection with fluorescent materials.

Fig. 4 is a cross-sectional view similar to Fig. 3, but including both lamp and jacket and illustrating an embodiment of the invention in which the fluorescent material is carried by the jacket.

Fig. 5 is a view partly in axial section and partly in elevation of a so-called super high pressure type lamp embodying my invention.

Fig. 6 is a view in elevation partly broken away of a lamp and reflector combination.

Referring first to Fig. 1, I have there shown for example a gaseous discharge lamp adapted particularly for operation at high temperatures with a metal vapor atmosphere in which the discharge occurs. This may be, for example, a high pressure metal vapor discharge tube of the type described and claimed in my prior copending application, Serial No. 500,346, filed December 5, 1930. The lamp consists broadly of an inner sealed envelope 10 having in-lead wires 11 sealed through opposite ends thereof as indicated at 12 and supporting thereon activated self-heating electrodes 15. These electrodes may consist, for example as shown, of a cylindrical roll, advantageously several layers thick, of nickel wire mesh, into the interstices of which is worked the activation material, e. g., as set forth in my said prior application.

This inner envelope 10 is supported within a sealed jacket 15 to the end of which is advantageously secured a suitable connector base, e. g., of the Edison Mogul type.

Supporting the inner envelope 10 within the jacket 15 is a spring ring 16 at each end of the envelope 10. This ring may consist of a coiled wire spring or it may be a thin annular tube or other member, but preferably has some resilient compressibility towards the center of the tube or the spiral 16 as well as towards and away from center of the ring.

The end of the tube 10 as shown in the drawings is provided with a constriction 17 in which the metal ring 16 rests; and due to the confining action of the jacket 15, once the ring and tube 10 are inserted therein, the ring 16 is locked in the constriction 17 and there is no danger of its becoming separated from the tube 10.

Advantageously a strip of mica or other intercepting material 18 is inserted between the tube 10 and the ring 16. If desired also, and especially if the mica strip 18 is used, the rings 16 or either of them may be connected to the opposite electrode so as to serve as an auxiliary capacity electrode for starting of the discharge.

The space between the jacket 15 and the inner envelope 10 may be evacuated or filled with a suitable gas.

The wall of the tube 10a according to my invention is increased in surface area, e. g., by corrugating as shown in Fig. 2. Thus a greater surface for radiation and transmission of radiation from the vicinity of the arc path can occur.

An important advantage of this increased surface area e. g., as shown in Fig. 2 comes into existence when luminescent, e. g., fluorescent or phosphorescent, materials are used with the tube, either applied to its surface, inside or outside, 40 or in the material of the glass itself. It is often a disadvantage of such materials either that they are more or less opaque, in which case they tend to intercept light passing through the tube and thereby reduce the efficiency of the tube even as it is increased by the conversion of ultra-visible radiation into visible light, or that the fluorescent materials are deteriorated by intense radiation. In either case the extension of the surface, e. g., by corrugation, etc., is an advantage. In the one case it permits, with the same amount of fluorescent material, a lesser density in the glass or the coating and thereby a lesser loss of light by absorption. In the other case it permits, by 55

the extension of the surface, a less intense radiation of the fluorescent materials per unit area, so that their life may thereby be increased.

A similar effect can also be obtained by lesser irregularities in the surface, e. g., by severe etching or frosting of the glass, by grooving, wafling, etc., or by other types of corrugation. These I have illustrated particularly in Figs. 3, 4 and 5.

In Fig. 3, I have shown in cross-section the inner envelope 10b made in star shape. In Fig. 4, the inner envelope 10 is of the usual circular shape whereas the outer jacket 15b is made star shaped. In Fig. 3, of course, the fluorescent material will be applied to the inner envelope, whereas in Fig. 4 it will be applied to the jacket, preferably the inside of the jacket. The luminescent material may also be divided between the jacket and the inner envelope, which again increases the surface on which the material is exposed to radiation. In this case both may for example be star shaped. With this double arrangement a material adapted to convert ultra-violet radiation into visible light may be used on the envelope and one for converting the blue and violet into longer wave length light may be used on the jacket.

The envelope and/or the jacket themselves may in any case be of clear or cloudy glass, silica or other suitable light permeable material and the fluorescent material may be applied to either the inner or outer surface or incorporated within the glass.

In Fig. 5, is shown an example using a super high pressure lamp in a globular jacket. These super high pressure lamps are ordinarily made of small bore quartz tubing, having electrodes sealed into opposite ends and a small drop of mercury. The lamp itself may vary from about one inch to several inches in length and may operate with a mercury vapor pressure of many atmospheres. The electrodes are of the solid activated type heated by the action of the discharge itself. In the example illustrated in Fig. 5, this inner envelope 10c is supported from the stem seal 20 by the wires 21, 22, one of which serves as the return lead for the current from the farther electrode. The cross wires 23 hold the envelope 10c between the wires 21 and 22. The outer jacket 15c, as shown in this figure, is made of pressed glass with the inner surface waffled or cross-grooved to form upstanding diamond shaped projections, thus increasing the surface area on which suitable fluorescent material may be carried, e. g., by coating, enamelling or reglazing, etc., or the surface-increasing projections on the interior of the tube may be formed by deep etching of the surface of the glass after it is blown or molded.

The globe 15c is secured, e. g., in the usual manner to a connector base 24 of any suitable design, and may be sealed, e. g., by fusing to the stem press 20 or may be cemented thereto or mechanically secured with a cushioning washer, e. g., of asbestos, between.

Instead of forming the surface-increasing projections only on the inside of the tube, e. g., by molding, the entire wall of the tube may be formed into surface-increasing projections, grooves, corrugations, or other irregularities, e. g., by blowing a thin walled globe into a mold of suitable shape.

Since the ultra-violet light passes readily through the quartz wall of the super high pressure lamp the fluorescent material is preferably

contained on the inner increased area surface of the pear-shaped globe and the space between advantageously is evacuated or filled only with gases which are readily permeable to ultra-violet radiation. Thus the ultra-violet radiation substantially undiminished is converted into visible light which passes easily through the wall of the jacket 15c. The efficiency of such an arrangement is as great as when fluorescent materials are used inside the inner envelope, but it is far more practicable because on the jacket they they are not subjected to excessively high temperatures, to ionic and electronic bombardment or electrolysis (conditions which may exist on the inner envelope), and it is not necessary to subject them to severe degassing treatment and finally because of the greater surface area the radiation to which they are subjected is less severe.

If, however, the increased surface and the coating of fluorescent material were on the outside of the jacket 15c, the ultra-violet radiation would be absorbed to a greater or lesser extent by any ordinary glass in the wall of the jacket. If such an arrangement is adopted, therefore, the glass of the jacket 15c would preferably be an ultra-violet permeable material. In general, however, it is better to utilize the inner surface for this purpose, and in such case the jacket 15c may be made of any light-permeable glass capable of withstanding the temperature conditions to which it is subjected in operation.

It should not be understood, however, that the exterior surface of the jacket could not be used, even if it is made of a material substantially impermeable to ultra-violet radiation. Even in such case, it may be desirable to give a better balanced radiation by converting a part of the short wavelength blue and violet light into a longer wavelength radiation within the visible spectrum. Obviously, also the light source 10c used in this case may be a larger ordinary high pressure vapor lamp or a low pressure hot or cold cathode discharge lamp, including the so-called cathode glow discharge lamp.

Where a balanced white light is desired, I have found that a particularly desirable effect can be obtained by combining the spectrum of mercury and the spectrum of sodium with fluorescence produced by a rhodamin fluorescent layer. For this purpose, an arrangement similar to that shown in Fig. 7 may be used, with the rhodamin contained on the inner surface of the globe 15c and the filling within the envelope 10c consisting of carefully regulated amounts of mercury and sodium and adapted to produce joint emission, e. g., as set forth in the copending applications of Hans J. Spanner, Serial No. 558,148, filed August 19, 1931, Serial No. 643,502, filed November 19, 1932, Serial No. 714,949, filed March 10, 1934, Serial No. 190,642, filed February 15, 1938.

Rhodamin has been combined before with mercury light to add its red radiation to the blue-green light of the mercury spectrum. Such combination, however, still fails of perfect balance because of a lack in the orange-yellow range in the spectrum, which according to my invention is provided by the sodium spectrum. This combination of the mercury spectrum, the sodium spectrum and the rhodamin fluorescence spectrum gives a particularly well balanced light and a much higher efficiency than the combination of the mercury lamp with an incandescent lamp.

In Fig. 8, I have shown another way of achieving a similar result. In this case a mercury spec-

trum and the sodium spectrum are provided by separate lamps 26 and 27 within a common reflector 28. This reflector 28 may serve as the heat confining jacket for the lamps 26 and 27, protecting them from draughts and excessive convection currents. In some cases it will be preferable to provide a closed end of glass or other transparent material at the bottom 29, in many cases the bell shaped reflector will so far trap the hot gases which tend to rise from the lamps as to be adequate without a bottom.

The reflecting surface 28 may also be corrugated, waffled or otherwise provided with an increased surface area, as already described above, to reduce the intensity of the radiation per unit of surface on the fluorescent material. Other fluorescent materials than rhodamin, and other types of lamps using other spectrum producing gases or vapors can be similarly combined and advantage taken of the increased area of the reflector as described.

Obviously, instead of a metal vapor filling using a permanent gas only for starting, the tubes may also be filled with permanent gases like, e. g., neon-helium and the spectra of the gases utilized for light production.

What I claim is:

1. In an illuminating device the combination of a light source adapted to give ultra-violet radiation and a wall exposed to radiation from the light source having a surface provided with projections, depressions and the like, whereby to increase its surface area, and a luminescent material on said surface of increased area exposed to radiation from the light source.

2. An illuminating device as defined in claim 1, in which the wall having the surface of increased area and carrying the luminescent material is a jacket enclosing the light source and

made of a material permeable to light but relatively impermeable to ultra-violet radiation and the surface of increased area which carries the fluorescent material is the inner surface exposed to the ultra-violet radiation of the light source.

3. In an illuminating device the combination of gas discharge means adapted to excite to luminous radiation mercury vapor and sodium vapor and a wall exposed to radiation from both vapors of said discharge means and carrying thereon rhodamin.

4. In an illuminating device the combination of a light source adapted to give both visible and ultra-violet radiation, and a wall exposed to said radiation, the wall having faces which are angularly related to the light source and to one another, and having luminescent material at said faces to convert ultra-violet to visible light, said luminescent material being on the side of said faces exposed to the light source, whereby to have a large surface of luminescent material exposed to the light and to cause light reflected by the luminescent material to be incident upon a neighboring part of the wall.

5. In a luminescent lamp the combination of a light source and a carrier body having a surface thereof uneven so as to increase the surface area which is exposed to the light source and a luminescent substance distributed thereon and held thereby.

6. In a luminescent lamp the combination of a light source, an envelope therefor at least a part of which has a surface area substantially greater than is required by its major dimensions and a luminescent material distributed on said part and exposed to radiation from the light source and visibly to the exterior of the lamp.

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