Jan. 26, 1937. H. H. GEFFCKEN ET AL 2,068,741

GAS-FILLED DISCHARGE TUBE

Filed Nov. 9, 1934

Fig. 1

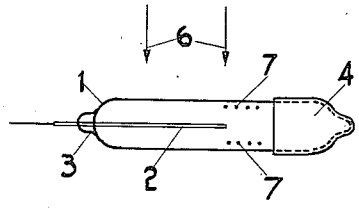


Fig. 2

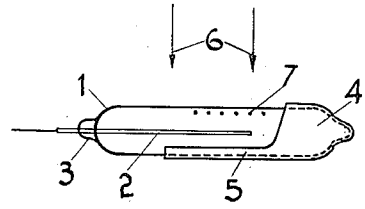


Fig. 3

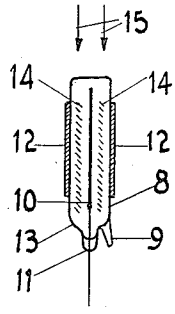


Fig. 4

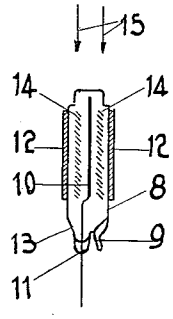


Fig 5

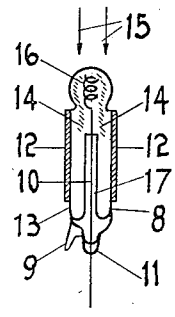


Fig. 6

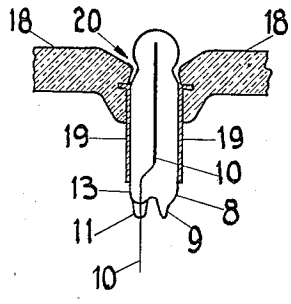
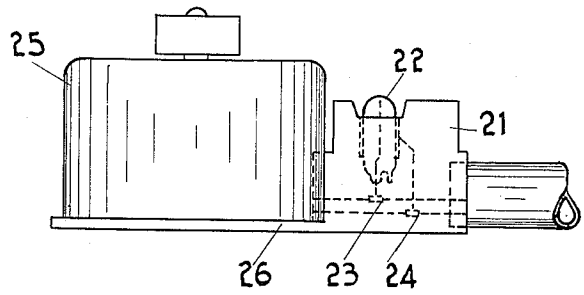


Fig. 7



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UNITED STATES PATENT OFFICE

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GAS-FILLED DISCHARGE TUBE

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Application November 9, 1934, Serial No. 752,214
In Germany November 11, 1933

4 Claims. (Cl. 176—122)

Our invention relates to gasfilled discharge tubes of the kind comprising a sealed glass bulb, filled with rarefied gas (especially neon) and having one fused and one capacitively acting condenser electrode. Tubes of this kind are especially manufactured in miniature dimensions and used for indicating and signalling purposes. In consequence of the dielectric resistance of the condenser electrode, such tubes can be used with alternating current without any series resistance.

In manufacturing such tubes under exactly comparable circumstances we have found, that the discharge potential varies in a disturbing manner, this being an especially serious drawback if the tubes are used under normal network voltages, such as for indicating open switches.

Our invention relates to tubes of the described kind, which are free of such drawbacks and which have a very low and constant discharge potential practically not differing one from another. Furthermore our new tubes give a relatively intense and well concentrated light which may be discerned from a distance of several meters, even if the tube current is below 0,1 m. a. The essential feature of our novel tubes consists in extending the electric conducting foil or layer, used as a condenser electrode, over the whole wall of the bulb except a little window and except the indispensable insulating spaces. Preferably the front of the tube is used as a window while the condenser electrode foil covers the entire cylindrical portions of the tube except the portions near the fusing point of the inner electrode.

Our invention will best be understood by detailed description with reference to the accompanying single sheet of drawing in which.

Figures 1 and 2 represent known types of discharge tubes, which show the beforesaid drawbacks.

Figures 3–5 represent schematically the cross-sections of three different embodiments of our invention.

Figure 6 shows another embodiment of our invention and—

Figure 7 shows a switch, equipped with a tube according to our invention.

Referring now to Figs. 1 and 2 the tube 1 contains an inner electrode 2 sealed in at 3 and an outer capacitative electrode, represented by the foil 4 which may consist of metal foil or a metallic layer sprayed onto the surface of the tube or the like. In Fig. 1 the condenser electrode is formed in the manner of a cap; in Fig. 2 said electrode has an additional tongue 5 for increasing its capacity. The tube 1 is filled with rarefied gas, preferably with neon, helium, argon or a mixture of these gases at a pressure of about 5–30 mm. Hg. In use, the electrodes 2 and 4 are connected to the power line and the tube is viewed in direction of the arrows 6. As aforesaid great irregularities take place in the discharge potential of such tubes and we have found, that these irregularities are produced by uncontrolled electric charges on the intermediate parts of the walls of the vessel, said charges— schematically marked by the points 7—acting in the manner of the grid in a grid-glow-tube, and being able to enormously increase the discharge potential.

The remaining Figures 3–5 represent some tube constructions, according to our invention and which are characterized by the lack of any free portions of the glass walls in the neighborhood of the path where the discharge is started not covered by the outer metallic coating. The vessel 8 is filled with rarefied gas in the usual manner and sealed at 9. The inner electrode 10 consists of a straight wire, arranged concentrically in the tube 8 and sealed in at 11. The condenser electrode 12 covers the entire cylindrical portion of the tube except the insulation space 13. The front of the tube serves as a window and the discharge layer 14 is viewed thru the window in the direction of the arrows 15. In this manner the viewing direction is along the lengthwise dimensions of the layer resulting in a relatively high light intensity per unit area and a correspondingly good visibility.

In Fig. 4 the diameter of the tube is reduced on the front in order to simplify the mounting of the tube. In Fig. 5 the front of the tube is spherical and the wire electrode 10 bears a spiral head 16, thus increasing the lateral visibility of the glow; in order to concentrate the discharge, the lower end of the wire 10 is protected by a tubular glass envelope or sleeve 17.

The condenser electrode 12 consists preferably of a sprayed on metal coating; in some cases also a metal tube (preferably of split construction) may be used. Fig. 6 shows a discharge tube, constructed according to our invention and fitted in the wall 18 of a housing or the like. A slit metal tube 19 is molded in said body 18 and the tube 8 is pushed upward into the metal tube until its constricted front portion has passed the opening 20. In use the metal tube 19 and the electrode 10 are connected to the power lines.

According to Fig. 7 the body 21 contains the tube 22 and two contact elements 23, 24. The tube is mounted to the switch 25 by means of the

common base plate 26. The body 21 serves as an additional electrical device, which may be used in combination with any known type of switch. The tube 22 is connected in parallel to the switch 25 and therefore lights up when the contacts of the switch are open and is extinguished when the contacts are closed as is well understood. By these means the switch is made visible in dark rooms and can easily to be found. The current consumption of the tube 22 is negligible.

Having now described our invention, what we claim is:—

1. A luminous glow discharge tube comprising a cylindrical envelope, a gaseous atmosphere therein, a first co-axial wire shaped electrode mounted within said envelope and extending close to the front end thereof, and a second concentric electrode covering the outer wall of said envelope to such an extent as to be equidistant from said first electrode throughout substantially the entire length of the latter.

2. A luminous glow discharge tube comprising a cylindrical insulating envelope, a gaseous atmosphere therein, a first co-axial wire shaped electrode mounted within said envelope and extending close to the front end thereof, and a second electrode constituted by a coating of conductive material applied to the outer wall of said envelope to such an extent as to be equidistant from said first electrode throughout the entire effective length of the latter.

3. A luminous glow discharge tube comprising a cylindrical insulating envelope, a gaseous atmosphere therein, a first co-axial wire shaped electrode mounted within said envelope, and a second electrode covering substantially the entire outer surface of said envelope except for its end portions to provide mounting space and leave a viewing window, said first electrode extending close to said window.

4. A luminous glow discharge tube comprising a cylindrical insulating envelope, a gaseous atmosphere therein, a first co-axial wire shaped electrode mounted within said envelope, and a second electrode constituted by a conductive coating applied to substantially the entire outer wall of said envelope except for its end portions to provide mounting space and leave a viewing window, said first electrode extending throughout the entire length of said envelope and close to said window.

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