June 18, 1935. C. J. LE BEL 2,004,995

GLOW DISCHARGE SIGN

Filed Oct. 30, 1931

Fig. 1

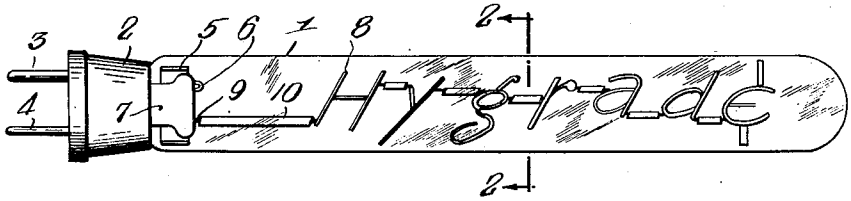


Fig. 2

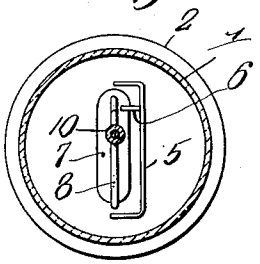
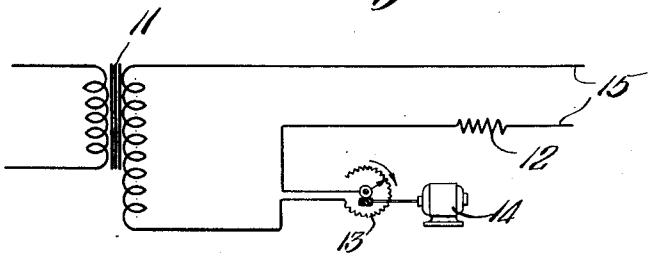


Fig. 3



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GLOW DISCHARGE SIGN

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9 Claims. (Cl. 176—124)

This invention relates to electric signs filled with neon or other noble gas or gases and having the cathode in the form of an elongate design of conducting material so that the design is displayed in the form of a cathode glow in well-known manner; and more particularly the invention relates to signs of the type in which successive portions of the design (successive letters of a word for example) are displayed progressively. While progressive displays are now commonly produced by means of a bank of incandescent lamps under the control of complicated switching apparatus, the use of such systems is restricted by many factors such as initial cost, bulk, maintenance expense of labor and materials, etc. The object of the present invention is to produce a sign of the neon type which when flashed on and off will produce a progressive display and which requires no moving parts other than a simple on-and-off switch such as an ordinary thermostatic switch to effect the progressive action.

It is a well-known principle that if the current be gradually increased the cathode glow will gradually spread over the surface of the cathode until the current is sufficient in magnitude to cover the entire cathode, but so far as I am aware I am the first to conceive that a progressive display can be produced by gradually increasing the current or to provide a tube in which the glow progresses uniformly and steadily in the desired manner each time the sign is displayed.

As heretofore constructed glow discharge signs have been incapable of functioning as aforesaid for two principal reasons. In the first place the cathode glow has erratic tendencies to start at different points on the cathode upon successive applications of current and to jump from point to point upon a single steady application of current, these tendencies being affected by such slight factors as the minute change in the surface of a portion of the cathode caused by touching the surface in the manufacture of the device; and secondly the sign cathode has been positioned transversely of the tube so that the different portions of the cathode are approximately equidistant from the anode, thereby aggravating these erratic tendencies.

According to the present invention the cathode is made in the form of an elongate design positioned with respect to the anode so that successive portions are progressively more remote from the anode, whereby the cathode glow progresses along the elongate design from the portion nearest the anode as the space current is gradually increased. If, as is usually the case, it is desirable to have the glow start at one end of the design, that end is positioned nearest the anode. While this arrangement is in most cases adequate to afford a uniform and regular progression of the cathode glow I have found that the aforesaid erratic tendencies can be counteracted more reliably by also closely confining the elongate cathode with a hollow insulator shaped to conform to the cross-sectional dimensions of the cathode throughout its length. While this insulator may be in the form of a tubular member mounted inside the device I have found that in most cases the glass bulb of the device may be shaped to serve the purpose in addition to its ordinary functions.

For the purpose of illustrating the genus of the invention a typical concrete embodiment is shown in the accompanying drawing in which;

Fig. 1 is a side elevation of a glow-discharge sign;

Fig. 2 is a section on line 2—2 of Fig. 1; and

Fig. 3 is a circuit diagram illustrating one way of recurrently illuminating the sign with gradually increasing current.

The particular embodiment of the invention chosen for the purpose of illustration comprises a tubular glass tube 1, an insulating base 2 having terminals 3 and 4 for connection to the external circuit, an anode 5 connected to the terminal 3 through a lead 6 projecting from the press 7 and a cathode 8 in the form of a series of interconnected letters, the connections between the successive letters and between the first letter and the cathode lead 9 being covered with insulation 10 to prevent cathode glow around these connections. The cathode may be of any material in general use in cold cathode devices; aluminum, nickel, iron and aluminum-coated nickel are good. If it is desired to keep the voltage drop down to a minimum I recommend an alloy of nickel with about .001 to .1% barium. The shape of the electrode is not of great importance. The glow appears slightly brighter and more legible when the electrode is made of round wire rather than flat strip, though a thin narrow strip viewed edgewise is also good. It is desirable to keep the size of the wire down to a minimum. With a given gas pressure the current required to light the tube completely is proportional to the electrode area. The tube may be filled with any noble gas or a mixture of a metallic vapor such as mercury and a noble gas. In general any color may be produced which can be produced in neon signs of the con-

ventional positive column type, and by the application of similar technique. For example an orange color may be produced with neon, yellow with helium, and blue with argon. With a red glass bulb neon produces a fiery red. I prefer to use pure neon or 78% neon and 22% helium, at pressures of the order of 5 to 50 mm. of mercury. The higher the pressure the more luminous and legible is the glow; although the current required to operate the tube goes up rapidly as the gas pressure is increased. A typical embodiment comprises a cathode of pure nickel wire thirty-five thousandths inch in diameter in a bulb about one inch in diameter filled with neon at a pressure of about thirty millimeters of mercury.

While this device may be operated with either direct or alternating current Fig. 3 illustrates an alternating current arrangement comprising a transformer 11, a fixed resistance 12 and a variable resistance 13 controlled by a motor 14 through suitable mechanism such as a worm and gear. With the arm of the rheostat 13 rotating in a clockwise direction and the secondary circuit 15 connected to the terminals 3 and 4 of the glow-discharge device shown in Figs. 1 and 2 current is applied to the device in recurrent cycles, the current gradually increasing during each cycle and abruptly terminating at the end of each cycle, thereby causing the letters constituting the cathode to be illuminated in sequence, beginning with the letter nearest the anode, the characteristics of the tube and supply circuit being correlated so that the maximum current is sufficient to illuminate all of the letters.

The subject-matter of this application is also disclosed in copending application Serial No. 572,090 filed on even date herewith in which I claim unique circuit arrangements for supplying current to devices of the kind here claimed.

I claim:

1. In a glow discharge display sign comprising an enclosing envelope containing a conductive gas, an anode and a cathode adapted to support a cathodic luminescent glow substantially confined to predetermined spaced regions of the cathode, said anode being positioned adjacent one end only of said cathode, said cathode being strip-like and shaped to a preselected display configuration and insulator means to confine the visible glow to said predetermined regions.

2. A cathodic glow discharge display sign comprising an enclosing envelope containing a conductive gas, a continuous wire cathode shaped to the configuration of predetermined indicia, insulator means carried by said wire for restricting the cathode glow to predetermined spaced sections of said wire, and an anode mounted adjacent one end of said cathode.

3. A cathodic glow discharge display sign according to claim 2, in which the wire cathode is formed to represent a plurality of separate indicia, and the said insulator means are positioned on the wire between adjacent indicia to restrict the cathode glow only to the said indicia.

4. A cathodic glow discharge display sign comprising an enclosing envelope containing a conductive gas, an anode and a wire-like cathode within said envelope, said cathode being shaped to the configuration of an advertising display, said anode being abbreviated in length as compared with said cathode and being adjacent one end only of said cathode so that for increasing current flow between anode and cathode the cathodic glow spreads gradually and uniformly along said cathode, and means for substantially confining said glow to predetermined spaced regions of said cathode.

5. A cathodic glow discharge display device comprising an anode and cathode in an atmosphere of a conductive gas, said cathode being of wire formed to the shape of selected display indicia and extending away from said anode, a transparent tubular insulator member coextensive with said cathode and closely confining the same, and means including said member and a source of current of regularly recurrent amplitude variations for confining the cathodic glow to a configuration determined by said wire cathode and for causing said glow to spread progressively and uniformly along the length of said cathode in synchronism with said variations.

6. A cathodic glow discharge sign comprising a transparent tubular enclosing member containing an anode, a cathode in the form of an elongated strip positioned with respect to the anode so that successive portions are progressively more remote from the anode, and an atmosphere of conductive gas enveloping said cathode, said tubular member closely confining the gas about the cathode to cause the cathode glow gradually to extend in length along the cathode when gradually increasing values of current flow between cathode and anode.

7. A cathodic glow discharge sign comprising an abbreviated anode, a cathode in the form of an elongated strip having its longitudinal dimension in alignment with the anode, an elongated tubular envelope enclosing the cathode and anode, a filling of conductive gas within said envelope, said envelope closely confining said cathode to cause the cathode glow gradually to extend in length along the cathode for gradually increasing values of current between said anode and cathode.

8. A cathodic glow discharge sign including an anode, a cathode in the form of an elongated design positioned in end-on relation with respect to the anode so that successive portions of the cathode are progressively more remote from the anode, and means including an elongated hollow insulator closely confining the cathode and a source of varying current for causing the cathode glow to progress in length along the elongated cathode from the portion nearest the anode and in synchronism with variations of said source.

9. A cathodic glow discharge sign including a glow discharge device having an elongated sealed tube of insulation material, an anode in said tube, a cathode in said tube in the form of an elongated strip extending lengthwise of the tube, the cathode being closely surrounded by the wall of the tube and means including said tube and a source of current having regularly recurrent amplitude variations to cause the cathode glow to progress in length along the cathode from the portion nearest the anode and in synchronism with said variations.

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