June 6, 1939. J. H. McCAULEY 2,161,716

ANIMATED ELECTRICAL DISCHARGE DEVICE

Filed Jan. 25, 1939

FIG. 1.

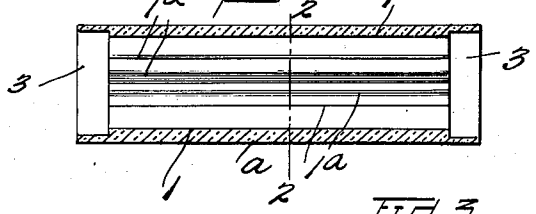


FIG. 2.

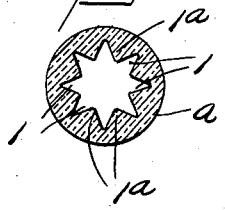


FIG. 3.

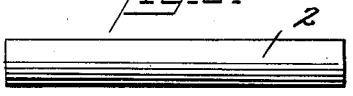


FIG. 4.

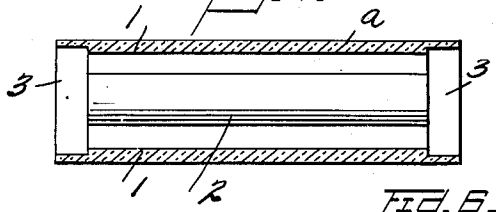


FIG. 5.

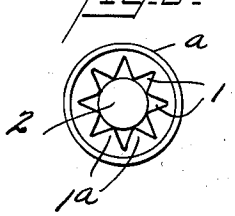


FIG. 6.

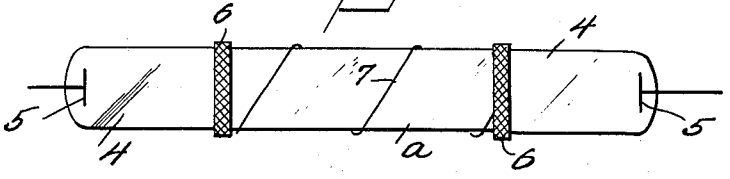


FIG. 7.

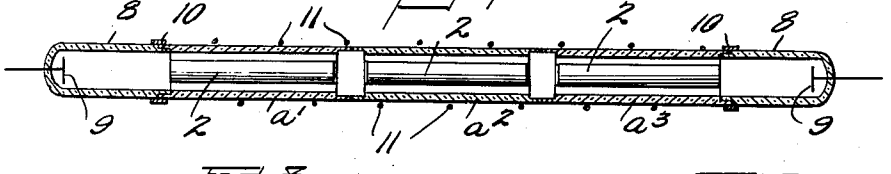


FIG. 8.

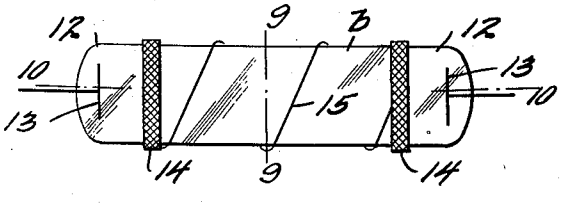


FIG. 9.

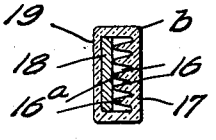
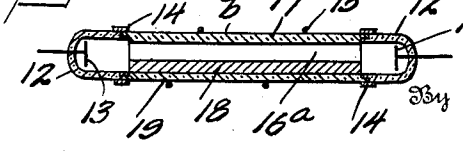


FIG. 10.



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UNITED STATES PATENT OFFICE

2,161,716

ANIMATED ELECTRICAL DISCHARGE DEVICE

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Application January 25, 1939, Serial No. 252,829

5 Claims. (Cl. 176—122)

This invention relates to luminous electrical discharge devices. In my patents, No. 2,132,427 and No. 2,133,206, I have shown such devices, each comprising a closed glass tube or envelope containing electrodes and a rare gas and a filler of insulating material within the envelope which provides a plurality of passageways for the electrical discharge. The discharge, in passing through the envelope, follows the course of least resistance and, in the part of the tube containing the filler, shifts from passageway to passageway, causing a flickering effect. In the structures illustrated in said patents, I have shown electrically conductive material applied externally to the tube or envelope, adjacent that part containing the filler, and this causes active shifting of the discharge throughout said portion.

In the present invention, instead of providing an envelope with a filler contained therein, I provide a glass unit, which forms part of the envelope, this unit being of tubular form and having a series of longitudinal grooves in its inner wall. A piece of insulating material fits within the unit and closes the open sides of the grooves, thus converting the grooves into independent passageways through which the discharge may take place. In order to accelerate the shifting of the discharge from groove to groove, I arrange electrically conductive material upon or closely adjacent the unit.

In the accompanying drawing,

Fig. 1 is a longitudinal central section through a tubular glass unit of cylindrical form having a plurality of longitudinal grooves in its inner wall, the section being taken on the line 1—1 of Fig. 2;

Fig. 2 is a cross-section through the same on the line 2—2 of Fig. 1;

Fig. 3 is a side view of a core of insulating material adapted for insertion in the unit shown in Figs. 1 and 2;

Fig. 4 is a longitudinal section through the aforesaid unit with the core inserted therein;

Fig. 5 is an end view of the same;

Fig. 6 is a side view of an electrical discharge device having one of the grooved units incorporated therein;

Fig. 7 is a similar view of a discharge tube having several of said units incorporated therein;

Fig. 8 is a plan view of a discharge device having a flattened glass unit incorporated therein;

Fig. 9 is a section on the line 9—9 of Fig. 8, and,

Fig. 10 is a section on the line 10—10 of Fig. 8.

Referring first to Figs. 1–5, inclusive, of the drawing, *a* represents a piece of glass tubing molded with a circular series of longitudinal grooves 1 in its inner wall, the grooves being all alike in length and cross-section. The ridges 1ª between the grooves project inwardly to the same radial distance from the axis of the tube. A cylindrical core of insulating material 2 (Fig. 3), when inserted in the tube, fits against these ridges and closes the open side of all of the grooves, as shown in Figs. 4 and 5, thereby converting the grooves into separate and independent passageways through which the electrical discharge may pass when the unit is made part of a luminous electrical discharge device. The core 2 may be made of any suitable insulating material which will not be affected by the electrical discharge. Like the tubular part *a*, the core may be made of glass, either clear or colored, but preferably the core is made of white ceramic material which is light in weight and reflects the light caused by the discharge. If desired, the core may consist of a tube of glass or other insulating material closed by a plug or otherwise so that the electrical discharge cannot pass through the core and will be forced to take the course through the grooves.

The ends of the unit *a* are suitably formed for connection to other units, or for connection in any part of a luminous electrical discharge tube. As shown in Figs. 1, 4 and 5, sockets 3 are formed in the ends of the units and the ends of the socket walls are joined to sections of tubing 4, closed at their outer ends and containing electrodes 5. The sections 4 are sealed gas-tight to the unit *a* and the sections and unit together form a closed glass envelope. This is exhausted and de-gasified and then filled with a rare gas, such as neon, argon or helium, or mixtures of gases, or vapors, in the usual way, and when the electrodes are connected to the high tension side of a suitable transformer, the discharge will take the course of least resistance through the gas. The gas in the parts 4 will be luminous, with a steady glow, while in passing through the unit *a*, the discharge will shift at intervals from groove to groove, or, depending upon the size of the grooves and the resistance of the columns of gas therein, it may not shift at all. That is, if the grooves are made relatively large in cross-section, with consequent low resistance of the gas columns in the grooves, which is desirable, the shifting of the discharge from groove to groove will be less active than if the passageways are made smaller in diameter, with consequent gas columns of higher resistance. In order to insure active shifting of the discharge from groove to groove, I apply electrically conductive material to the outer surface of the

grooved unit. This conductive material is shown in Fig. 6 as bands of wire gauze **6**, arranged at the ends of the grooved unit and connected by a wire **7**. With this arrangement of conductive material, active shifting of the course of the discharge from groove to groove takes place, giving the appearance of shifting bands of light.

One or more of the internally grooved units can be arranged anywhere in a neon sign structure, to attract attention. In Fig. 7, I have shown three of these units connected in series between tubular parts **8** containing electrodes **9**, the various parts, when sealed gas-tight, forming a closed glass envelope. When this is filled with a rare gas in the usual way and the current is applied to the electrodes, shifting of the course of the discharge through the grooves in the several units will take place, and this shifting will be very active because of the application to the units of electrically conductive material. Thus, bands of conductive material **10** are shown applied to opposite ends of the units a' and a^3, and these are connected by a conductor **11**, which is preferably, though not necessarily, wrapped around the units.

In Figs. 8, 9 and 10, I have shown an internally grooved glass unit *b*, in the form of a flattened tube, to the ends of which are sealed flattened tube sections **12**, closed at their outer ends and containing electrodes **13**. Electrically conductive bands **14**, applied to the ends of the unit, are connected together by conductor **15**. As shown in the sectional view, Fig. 9, grooves **16** are formed on the inner side of the wall **17** of the unit, and a flat strip of insulating material **18** is interposed between the ridges **16a** which form the grooves and the opposite side wall **19**, the strip **18** thus closing the open sides of all of the grooves, thereby converting the grooves into separate and independent passageways. The discharge device thus formed and filled with a rare gas, operates in the same way as does the cylindrical form of discharge device previously described. When the current is applied to the electrodes, very active shifting of the course of the current from groove to groove takes place, giving the appearance of rapidly shifting bands of light when observed through the wall **17**, or through both walls **17** and **19** if the insulating strip **18** is made of glass.

If the core is omitted from one of the units, flickering will not take place in that unit because the current will follow the course of low resistance through the core space. Thus, in a discharge device built up as in Fig. 7 with a series of the units, if the core is omitted from the central unit a^2, for instance, the gas in that unit will be luminous, with a steady glow, while in the other units a' and a^3 containing the insulating cores, active shifting of the discharge from groove to groove will take place.

What I claim is:

1. An animated electrical discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes, said envelope comprising a tubular part having a plurality of grooves in its inner side extending longitudinally of the envelope, and a core of insulating material fitting within said part and closing the open sides of said grooves.

2. An animated electrical discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes, said envelope comprising a tubular part having a plurality of grooves in its inner side extending longitudinally of the envelope, and a core of insulating material fitting within said part and closing the open sides of said grooves, and electrically conductive material associated with said part for influencing the course of the discharge through said grooves.

3. An animated electrical discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes, said envelope comprising a tubular part having a plurality of grooves in its inner side extending longitudinally of the envelope, and a core of insulating material fitting within said part and closing the open sides of said grooves, and electrically conductive material applied to the outer surface of said part for influencing the course of the discharge through said grooves.

4. A unit adapted to form part of a luminous electric discharge comprising a glass tube having longitudinal grooves in its inner wall, and a core of insulating material adapted to fit within the tube and close the open sides of said grooves.

5. A unit adapted to form part of a luminous electric discharge device comprising a relatively flat glass tube having longitudinal grooves in one of its inner walls, and a core of insulating material adapted to fit within the tube and close the open sides of said grooves.

JOHN H. McCAULEY.