Aug. 19, 1941. J. H. McCAULEY 2,253,441

LUMINOUS ELECTRIC DISCHARGE DEVICE

Original Filed Sept. 29, 1933

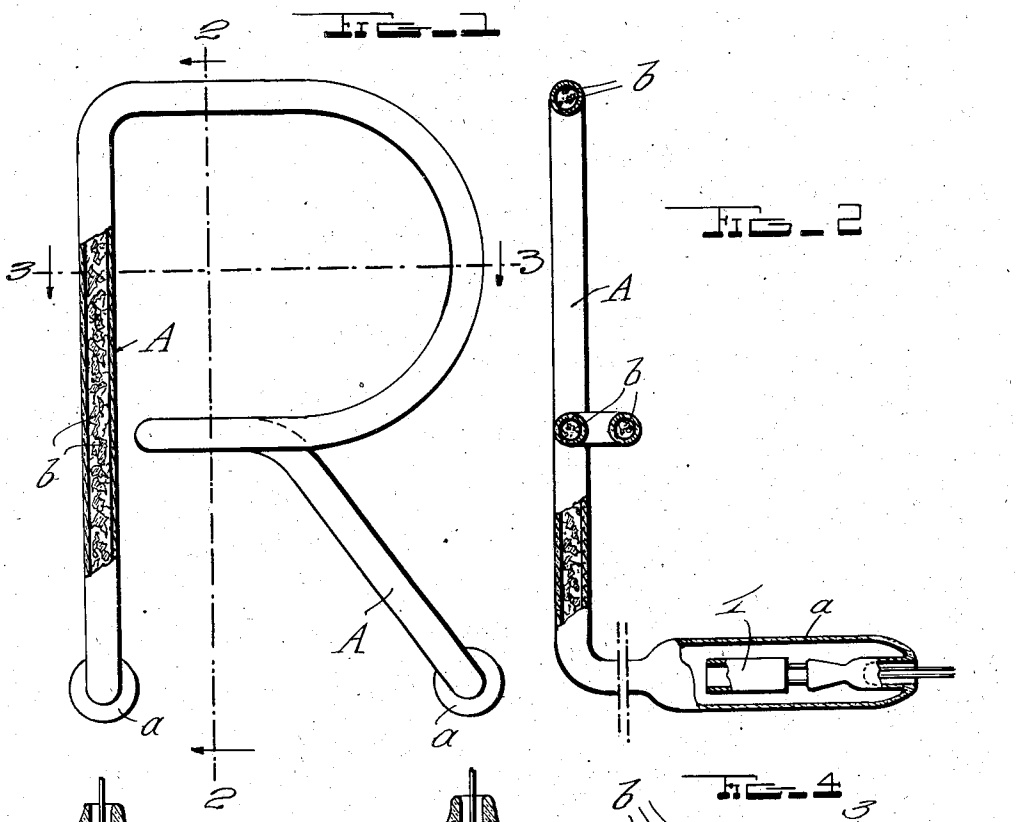


FIG. 1

FIG. 2

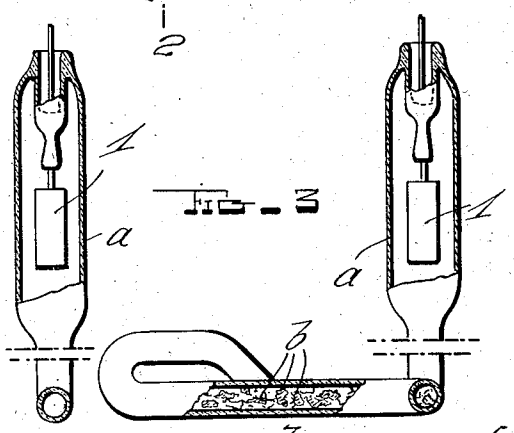


FIG. 3

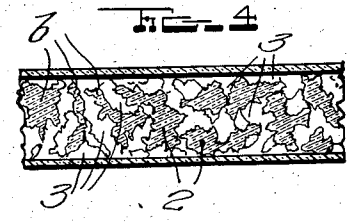


FIG. 4



FIG. 5

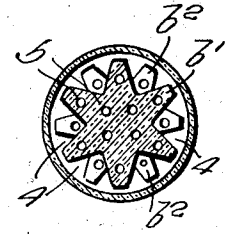


FIG. 7

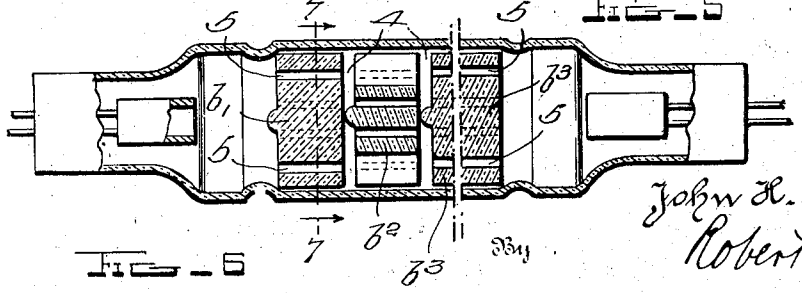


FIG. 6

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LUMINOUS ELECTRIC DISCHARGE DEVICE

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Application September 29, 1933, Serial No. 691,551
Renewed April 16, 1935

12 Claims. (Cl. 176—14)

This invention relates to improvements in electrical discharge devices of the kind commonly used for signs and advertising purposes, consisting of a transparent tube containing a rare gas or gases through which an electrical discharge is passed to produce a luminous effect. The electrical discharge is derived from a transformer and when the apparatus is in proper working order, the gas has a steady luminous effect, the color varying according to the nature of the gas.

My invention relates to means for causing the electrical discharge passing through the tube to follow a constantly shifting course through the gas, thereby producing a flickering luminous effect instead of a steady glow.

In carrying out the invention, I partly or wholly fill the tube with pieces of insulating material, which may be fragments of broken glass or pieces of material molded or otherwise fashioned into regular forms. These pieces are relatively large and their form and arrangement are such as to leave spaces around and between the pieces for the free movement of the gas and they cause the electrical discharge to take a circuitous course through the gas. When the current is applied, the discharge takes the course of least resistance through the gas, heating the gas unequally in different parts of the tube. As the resistance of the gas increases with increase in temperature, the course of least resistance constantly changes in the tube and this results in shifting of the course of the electrical discharge laterally in various parts of the tube. Thus at a point where the current is diverted to one side of the tube by a piece of insulating material, the gas at that side will be heated more than the gas at the opposite side of the tube, and the cooler portion of the gas having less resistance than the hotter portion, the electrical discharge will seek the path of lower temperature. Occasionally the current will divide, following two or more paths through the same part of the tube. Thus the course of the current, and hence the luminosity, will be constantly changing throughout the part of the tube containing the insulating filler.

In the accompanying drawing, which illustrates the invention:

Fig. 1 is a side elevation of a discharge device in the form of the letter R, the tube being shown partly in longitudinal section;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1, the tube being partly in section;

Fig. 3 is a transverse section on the line 3—3 of Fig. 1, the tube being partly in section;

Fig. 4 is a detail view showing a part of the tube in longitudinal section;

Fig. 5 is a transverse section through the tube;

Fig. 6 is a longitudinal section through a tube, partly broken away, showing filling pieces made in regular forms, and,

Fig. 7 is a section on the line 7—7 of Fig. 6.

Referring to Figs. 1–4, inclusive, of the drawing, A indicates a glass tube, shown in the form of the letter R, and having electrode chambers *a* at its ends and metal electrodes *1* within said chambers. Before the tube is sealed, that part of the tube only which is between the electrode chambers and which constitutes the luminous part of the tube when the electrical discharge is passing through it, is filled with pieces of insulating material *b* and a rare gas, such as neon, argon, or helium. The filler of insulating material is preferably composed of fragments of glass 2 of relatively large size so that while they will cause the electric discharge between the electrodes to take a devious or tortuous course through the tube they will not interfere with the free movement of the gas but will provide gas spaces 3 around the fragments and between the fragments and the tube. Where the tube is not straight, the fragments should be of such size or shape that they can pass around the bends in the tube. The filler can be conveniently made from pieces of glass resulting from breakage in the manufacture of lamps or tubes.

When the electrodes are electrically connected to a high tension transformer, the electrical discharge between the electrodes will take a tortuous course through the tube, following the path of least resistance around and between the obstructing pieces of insulating material. The gas in the path of the discharge will be heated to a higher temperature than the gas which is not directly in the path of the discharge. Since the resistance of the gas increases with rising temperature, it follows that the discharge, continually seeking the course of least resistance, will shift laterally at numerous points throughout the tube from zones where the temperature is high into the zones where the temperature is lower, and this shifting will go on almost continuously causing a flickering luminous effect.

Instead of providing a filler composed of irregular or broken pieces of insulating material, these pieces may be of various geometrical forms, one of which is illustrated in Figs. 6 and 7, wherein molded pieces of glass b', b^2, b^3, etc., of star shape, are shown in staggered relation, separated to provide intervening gas spaces 4.

Each piece is shown with perforations 5 to permit the electrical discharge to pass through and these may be large or small, and the pieces may be arranged in the tube so that these perforations in the successive pieces will be out of alinement, as shown in the drawing. The star points in the successive pieces are staggered, as shown in Fig. 7. These pieces may be placed in the tube at random without particular care as to the relative positions of the star points and perforations and ordinarily these will be in a more or less staggered relation throughout the length of the tube. The gas may move freely around and between the pieces and in the pockets formed by the star points as well as through the perforations. The electrical discharge will take a tortuous course through the tube by reason of these insulating baffles and because of the heating and increase in resistance of the gas in the path of the discharge, the discharge will seek paths of lower resistance through zones wherein the gas is at lower temperature and resistance and this will produce the flickering luminous effect referred to in connection with the description of the preceding figures of the drawing.

The star shaped pieces of insulating material are used for the purpose of illustration but it will be understood that pieces made according to various other designs may be employed as baffles to cause the discharge to take a tortuous course and to provide gas spaces around and between the pieces.

What I claim is:

1. A luminous electric discharge device comprising a closed glass tube containing a rare gas and having spaced electrodes of solid material, and a filler in that part of the tube between said electrodes, the filler being composed of pieces of insulating material providing tortuous discharge courses through that part of the tube containing said filler and providing spaces around the said pieces for the movement of the gas.

2. A luminous electric discharge device comprising a closed glass tube containing a rare gas and having spaced electrodes of solid material, and a filler in that part of the tube between said electrodes, the filler being composed of pieces of insulating material of irregular form providing spaces around the pieces for the movement of the gas and affording a plurality of devious paths for the electrical discharge.

3. A luminous electric discharge device comprising a closed glass tube containing a rare gas and having spaced electrodes of solid material, and a filler in that part of the tube between said electrodes, the filler being composed of contiguous pieces of insulating material of irregular form providing spaces around the pieces for the movement of the gas and affording a plurality of devious paths for the electrical discharge.

4. A luminous electric discharge device comprising a closed glass tube containing a rare gas and having spaced electrodes of solid material, and a filler in that part of the tube between said electrodes, the filler being composed of pieces of insulating material of geometrical design providing spaces around the pieces for the movement of the gas and affording a tortuous electrical discharge course through that part of the tube containing the filler.

5. A luminous electric discharge device comprising a closed glass tube containing a rare gas and having spaced electrodes of solid material, and a filler in that part of the tube between said electrodes, the filler being composed of pieces of insulating material providing spaces around and through the pieces for the movement of the gas and affording a tortuous electrical discharge course through that part of the tube containing the filler.

6. An electric discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes of solid material and a filler composed of pieces of insulating material within that part of the envelope which lies between said electrodes, said filler affording a plurality of paths for the electrical discharge.

7. An electric discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes of solid material and a filler composed of pieces of insulating material within that part of the envelope which lies between said electrodes, said filler affording a plurality of paths for the electrical discharge with free gas spaces between the pieces.

8. An electric discharge device comprising a closed glass envelope containing a rare gas and spaced electrodes of solid material and a filler composed of pieces of insulating material within that part of the envelope which lies between said electrodes, said filler affording a plurality of tortuous paths for the electrical discharge.

9. An electric discharge device comprising a closed glass tube containing a rare gas and spaced electrodes of solid material and a filler of insulating material within that part of the tube which lies between said electrodes, said filler composed of units of approximately the same diameter as the internal diameter of the tube and constructed so as to provide a plurality of passageways for the electrical discharge.

10. An electric discharge device comprising a closed glass tube containing a rare gas and spaced electrodes of solid material and a filler of insulating material within that part of the tube which lies between said electrodes, said filler composed of units of approximately the same diameter as the internal diameter of the tube and constructed so as to provide a plurality of passageways for the electrical discharge between the units and the tube.

11. An electric discharge device comprising a closed glass tube containing a rare gas and spaced electrodes of solid material and a filler of insulating material within that part of the tube which lies between said electrodes, said filler composed of units of approximately the same diameter as the internal diameter of the tube and constructed so as to provide a plurality of passageways for the electrical discharge and free gas spaces between the units.

12. An electric discharge device comprising a closed glass tube containing a rare gas and spaced electrodes of solid material and a filler of insulating material within that part of the tube which lies between said electrodes, said filler composed of units of approximately the same diameter as the internal diameter of the tube, said units having openings therethrough affording a plurality of passageways for the electrical discharge.

JOHN H. McCAULEY.