June 11, 1946. W. E. CARPENTER 2,402,019

GLOW LAMP

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Fig. 1.

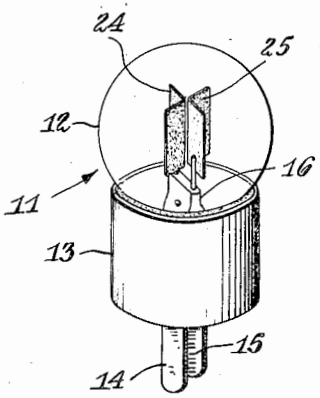


Fig. 3.

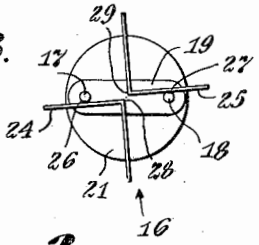


Fig. 2.

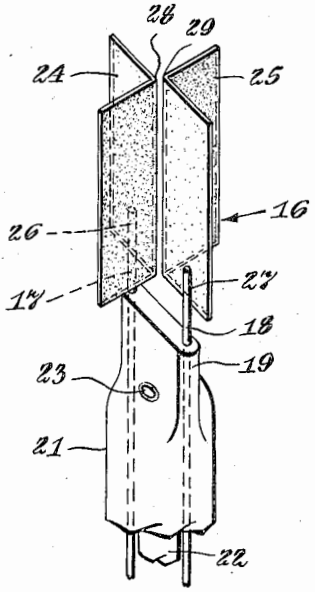


Fig. 5.

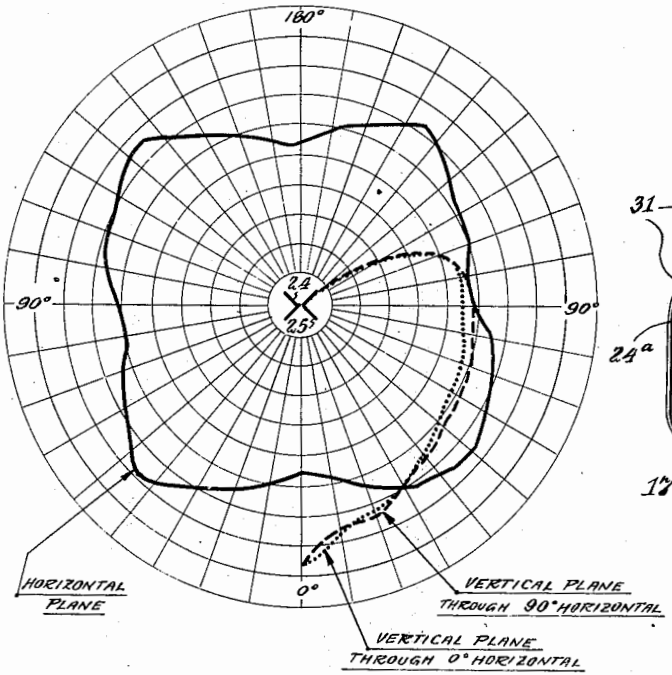
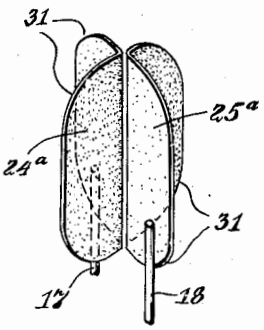


Fig. 4.



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2,402,019

GLOW LAMP

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9 Claims. (Cl. 176—126)

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This invention relates to negative glow lamps of the gaseous conduction type and, more particularly, to an improved form in which the discharge occurs from all surfaces of the electrodes.

The primary object of my invention, generally considered, is to produce glow lamps having electrodes of angular or L form, and symmetrically arranged with closely spaced vertices, so that they may be operated on ordinary household power.

Another object of my invention is to produce a negative glow lamp in which the electrodes are each formed of sheet metal, portions of which are angularly disposed with respect to each other, and the vertices of said electrodes being closely spaced to facilitate starting.

A further object of my invention is to provide a negative glow lamp with electrodes so shaped that the glow appears on all surfaces thereof, whereby no anti-glow material is necessary.

A still further object of my invention is to provide a negative glow lamp of the gaseous conduction type in which the filling material is a rare gas such as neon at a pressure of about 35 millimeters.

An additional object of my invention is to provide a negative glow lamp of the gaseous conduction type comprising a pair of electrodes formed with sheet metal portions extending radially from approximately the lamp axis, and both surfaces of which are coated with electron-emission material, thereby economizing in the use of material for a given amount of glow.

Another object of my invention is to provide a fluorescent lamp, in which the enclosing envelope coated with fluorescent material, contains a pair of L-shaped electrodes with their vertices closely spaced and enclosed in a rare gaseous filling.

Other objects and advantages of the invention will appear from the following detailed description or from an inspection of the accompanying drawing.

Referring to the scale drawing:

Fig. 1 is a perspective view of a lamp embodying my invention.

Fig. 2 is a perspective view on a larger scale of the mount of the lamp illustrated in Fig. 1.

Fig. 3 is a plan of the mount illustrated in Fig. 2.

Fig. 4 is a view corresponding to Fig. 2, but showing a modification.

Fig. 5 is a chart showing the horizontal and vertical candlepower distribution from a one half watt lamp, embodying my invention, operated base up.

The present application relates to a glow lamp

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having "cold" or non-thermionic electrodes of new design for replacing electrodes of designs previously used. In accordance with the embodiment illustrated, I make the electrodes L-shaped or angular in plan, with the portions of each which meet at a vertex generally rectangular in shape, although the corners may be rounded if desired. The lamp is adapted to have the customary series resistance, but all surfaces of both electrodes glow during operation on alternating current, rather than just one surface of each electrode, as in previous designs. The proportion of height to width may be varied for different inductive heating effects during manufacture and lighting effects in use.

By virtue of the construction, which will now be described in detail, it is unnecessary to use any anti-glow material on the electrode surfaces and on account of the particular shape employed, the electrodes can be cut and formed at mounting, it being proposed to cut, form and weld in one operation. On account of the construction whereby the glowing surfaces are adjacent, an inherent low break-down voltage is provided for. Because of the special electrode construction, an economizing of material occurs and an inherently strong design is provided.

Referring to the drawing in detail, like parts being designated by like reference characters, and first considering the embodiment illustrated in Figs. 1, 2 and 3, there is shown in Fig. 1 a lamp 11 adapted for operation on household power of voltages say from 105 to 125. The lamp comprises an enclosing preferably substantially spherical envelope 12, based as indicated at 13. Although the base has contact prongs 14 and 15, it will be understood that, if desired, the lamp may be provided with a conventional screw-threaded base, or one of the well known "bayonet" type.

The envelope encloses a mount 16, shown enlarged in Figs. 2 and 3, said mount involving relatively widely-spaced preferably straight lead-in conductors 17 and 18 extending through the press 19 of the flare tube 21, which is joined to the bulb 12 in a conventional manner, and to which connects an exhaust tube 22 communicating with the bulb 12 through aperture 23. The upper or inner ends of the leads 17 and 18 respectively support electrodes 24 and 25, as by being spot welded thereto, preferably approximately midway between a side edge and the vertex, as indicated at 26 and 27.

Each electrode, in the present embodiment, is formed as a rectangular sheet of suitable metal,

such as nickel, iron, combinations thereof, or aluminum, bent at the middle so that each half is disposed at right angles to the other half, and so arranged in the finished mount that the vertices 28 and 29 thus provided are disposed close to one another to facilitate starting by allowing for a low break-down potential. The electrodes are desirably so arranged as illustrated, that except for the slight clearance therebetween at the vertices, there are approximately equal dihedral angular spaces between all of the electrode portions which project from the approximate axis of the lamp.

In order to facilitate starting and improve operation, all surfaces of the electrodes are desirably coated with good electron emission material, an example of which is a mixture of the oxides of the alkaline earth metals, that is, barium, strontium and calcium. In order to adapt the lamp for operation directly from a household voltage line, a resistor may be incorporated in the base in series with one of the leads, which resistor may be a tiny ring of carbon-impregnated insulating material and encircling the exhaust tube or exhausting portion of the envelope, as illustrated for example, in the Morehead application, Ser. No. 509,350, filed November 8, 1943, and owned by the assignee of the present application.

The envelope 12 is desirably filled with a rare gas or mixture of rare gases, a preferred example being commercial neon at a pressure of about 35 millimeters at 25° C. If desired, the inside of the envelope may be coated with fluorescent material thereby making a fluorescent lamp.

In the embodiment of Fig. 4 the corners of the electrodes 24ª and 25ª are rounded off as indicated at 31, the construction being otherwise identical.

Lamps embodying my invention have been made in various sizes, from those nominally rated at 2 watts to such of the ¼ watt rating. The former have had electrodes each constructed from a nickel sheet ⅝ inch x $\frac{33}{64}$ inch, and .01 inch thick, formed as 90° L's, said plates having been hydrogen-annealed for ten minutes at from 1065° to 1128° C. With such electrodes, the spacing between their vertices was between .02 inch and .04 inch. Electrodes for the ½ watt size lamps, which is the kind of lamp illustrated to scale in the patent drawing, have been made from nickel sheet ½ inch x ⅜ inch and .01 inch thick, formed as 90° L's, said plates having then been hydrogen-annealed like the larger electrodes beforementioned. The spacing between the vertices in this instance was from .015 inch to .03 inch.

Electrodes for the ¼ watt size lamps, have been made from nickel sheet $\frac{3}{16}$ inch x $\frac{13}{64}$ inch and .01 inch thick, were formed as 90° L's, and hydrogen-annealed like the larger electrodes aforementioned. The spacing between the vertices in this instance was from .01 inch to .03 inch.

From the foregoing disclosure, it will be seen that I have produced a glow lamp with simply-formed "cold" electrodes in which the light radiates substantially uniformly from all sides, as well as from the end of the envelope. As the electrodes of my invention glow on all surfaces, for a given wattage lamp having the same electrode area glowing, the electrode thickness can be twice as great with the same weight of electrode material. This results in more uniform induction treating and better glow characteristics than have heretofore been possible.

It has been found that the light from the end, or that projected axially from the lamp, is at least as great as that from the end of conventional lamps with circular or semi-circular electrodes. This is valuable because my lamp can thus be used as an indicator where end-on light is important. As the electrodes of my lamp are generally rectangular, they are much easier to form than other shapes and involve an economy of material.

In order to illustrate the light distribution typical of lamps embodying my invention, Figure 5 has been shown reproducing the results of photometer readings on a lamp of the ½ watt size operated base up and embodying my invention as illustrated in Figs. 1, 2 and 3. From a consideration of this figure, it will be seen that the light distribution horizontally is fairly constant, the maximum candle power variation being less than 48% from the minimum. It will also be seen that the maximum horizontal light occurs approximately in the radial planes of the electrode wings and the minimum occurs approximately midway between the electrodes. As for the vertical light distribution, it will be seen that the maximum occurs axially away from the base and that there is a considerable amount of light thrown in the general direction of the base, as distinguished from previously constructed lamps in which the light directed beyond the horizontal median plane and in the general direction of the base is almost negligible.

It is proposed to provide equipment that will coat, form and spot weld these electrodes at mounting from rolls of ribbon, in much the same way that nickel L's are formed, cut, and welded from rolls of nickel wire for automobile headlight stems. This is possible because of the elimination of the anti-glow getter and the accompanying hydrogen firing, the mount-forming operation, and the expensive punching-drawing dies used at present to produce the odd-shaped electrodes of current designs.

When fluorescent material is applied to the bulb, uniform fluorescent light is produced due to the symmetrical geometry of the electrodes and bulb.

Although preferred embodiments have been illustrated, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, and a pair of "cold" electrodes therein to function as cathode and anode, each electrode having right-angularly-related rectangular portions meeting at a vertex, said electrodes being symmetrically arranged and the vertices thereof closely spaced to facilitate starting.

2. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, and a pair of "cold" electrodes therein to function as cathode and anode, each electrode being L-shaped in plan, symmetrically arranged, and having their vertices closely spaced to one another so that they present an arrangement + shape in plan.

3. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, and a pair of non-thermionic electrodes therein, said electrodes being formed as flat rectangular surfaces extending radially from the approximate axis of said lamp and defining four approximately equal dihedral angles therebetween so as to distribute light with comparative uniformity, por-

tions of said electrodes being closely spaced adjacent said axis to facilitate starting.

4. A negative glow lamp of the gaseous conduction type comprising an enclosing generally spherical envelope, and a pair of non-thermionic electrodes therein to function as cathode and anode, each electrode having right-angularly-related generally rectangular portions meeting at a vertex, the vertices of said electrodes being closely spaced to facilitate starting, said electrodes being symmetrically arranged to define four approximately equal dihedral angles between said generally rectangular portions, and the corners of said rectangular portions remote from said vertices being rounded.

5. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, and a pair of non-thermionic electrodes therein to function as cathode and anode, each electrode comprising a pair of sheet metal portions extending at an angle to one another and meeting at a vertex, said electrodes being symmetrically arranged so that the sheet metal portions define four approximately equal dihedral angles, all surfaces of said electrodes being coated with electron-emission material, and their vertices being closely spaced to facilitate starting.

6. A fluorescent lamp comprising a generally spherical envelope enclosing ionizable gas and coated interiorly with fluorescent material, and a pair of electrodes therein to function as cathode and anode, each electrode having right-angularly-related portions meeting at a vertex, said electrodes being symmetrically arranged to obtain a relatively uniform glow therefrom, the vertices of said electrodes being closely spaced to facilitate starting.

7. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, a pair of electrodes therein to function as cathode and anode, each electrode having a pair of right-angularly-related generally rectangular flat plate portions meeting at a vertex, the vertices of said electrodes being disposed close together to facilitate starting, and means supporting said electrodes in said envelope comprising a flare terminating in a press, a generally straight lead projecting from said press and supporting each electrode with its vertex line generally parallel to the lamp axis, each lead being relatively-widely-spaced from the other lead and connected to one face of a flat plate portion of its electrode, at the adjacent edge and approximately

midway of the sides, so as to hold said electrodes with the connected faces substantially co-planar and parallel, with the corresponding faces of the other flat plate portions similarly related and approximately normal to said press, and electron-emission material on all surfaces of said electrodes, whereby when operated the glow therefrom is quite uniformly distributed whether viewed axially toward the free edges of said electrodes, or from a side.

8. A negative glow lamp of the gaseous conduction type comprising an enclosing envelope, a pair of electrodes therein to function as cathode and anode, each electrode being formed from sheet metal about ½ inch by ⅜ inch by about .01 inch thick and bent to a 90° L, the vertices of said electrodes being disposed close together to facilitate starting, and leads supporting each electrode with its vertex generally parallel to the lamp axis, each lead connected to one face of a flat plate portion of its electrode at the adjacent edge and intermediate the sides thereof, so as to hold said electrodes with the connected faces substantially co-planar and parallel, with the corresponding faces of the other flat plate portions similarly related, whereby when operated the glow therefrom is quite uniformly distributed.

9. A fluorescent negative glow lamp of the gaseous conduction type, comprising a generally spherical enclosing envelope, fluorescent material on the inner surface thereof, a pair of non-thermionic electrodes therein to function as cathode and anode, each electrode comprising a pair of right-angularly-related generally rectangular flat plate portions meeting at a vertex, the vertices of said electrodes being disposed close together to facilitate starting, and means supporting said electrodes in said envelope comprising a flare terminating in a press, a pair of generally straight relatively-widely-spaced leads projecting from said press and each supporting an electrode with its vertex line generally parallel to the lamp axis, each lead being connected to one face of a flat plate portion of its electrode approximately midway of the sides, thereby holding said electrodes with the connected faces substantially coplanar and parallel, with the corresponding faces of the other flat plate portions similarly related and approximately normal to said press, and electron-emission material on all surfaces of said electrodes.

WALTER E. CARPENTER.