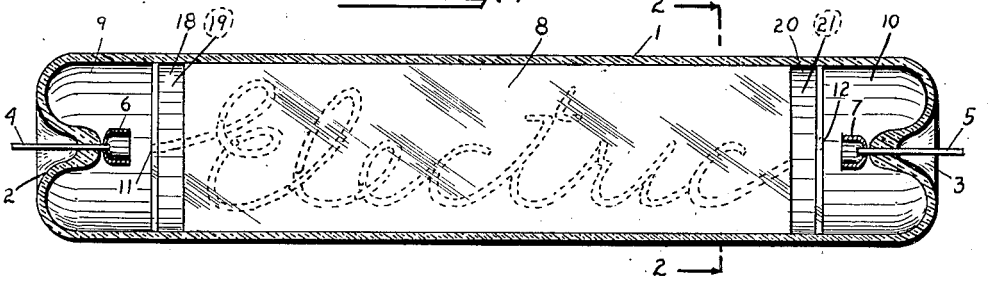
March 6, 1934. F. HOTCHNER 1,949,963

POSITIVE COLUMN LAMP LETTER

Filed Jan. 28, 1929 2 Sheets-Sheet 1

Fig. 1



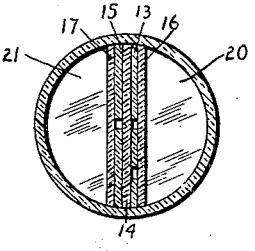


Fig. 2

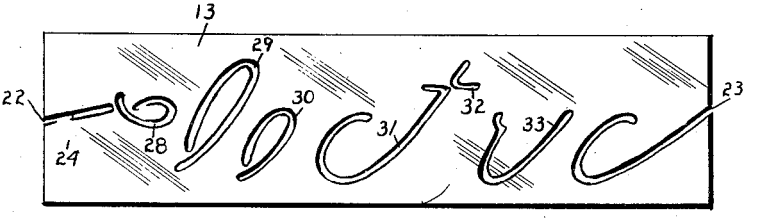


Fig. 3

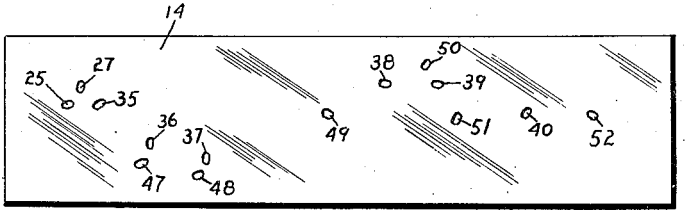


Fig. 4

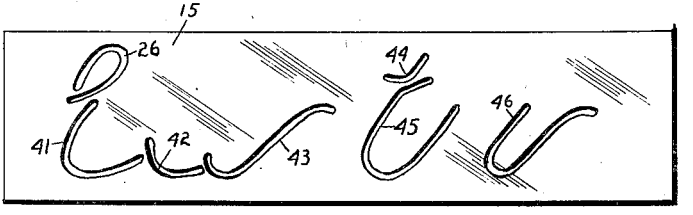


Fig. 5

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POSITIVE COLUMN LAMP LETTER

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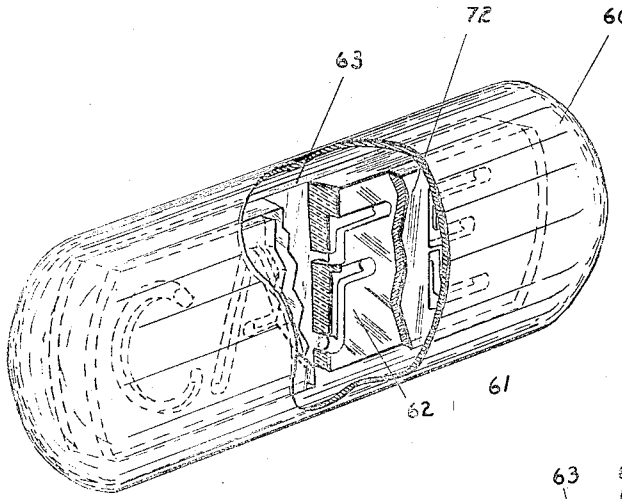

Fig. 6

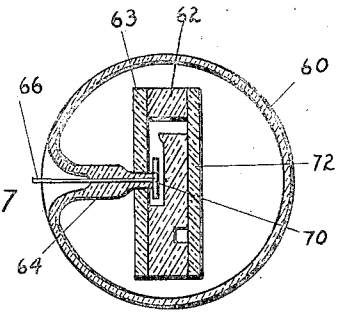

Fig. 7

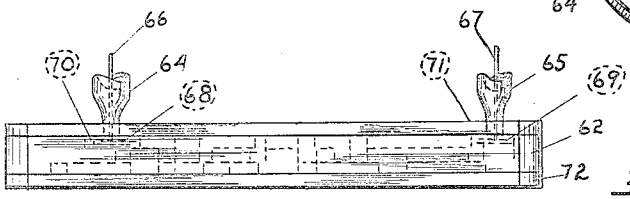

Fig. 8

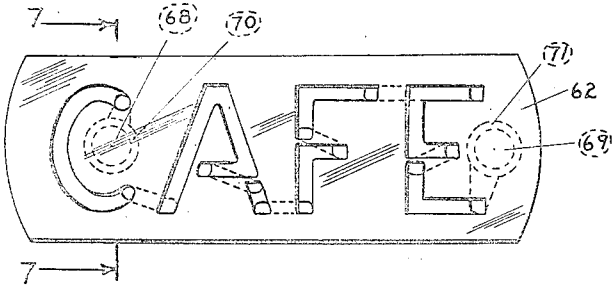

Fig. 9

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UNITED STATES PATENT OFFICE

1,949,963

POSITIVE COLUMN LAMP LETTER

Fred Hotchner, Los Angeles, Calif.

Application January 28, 1929, Serial No. 335,409

4 Claims. (Cl. 176—14)

This invention relates to a discharge tube lamp letter or sign and has for its object the production of a positive column sign in a single lamp in which the inscription is represented by a discharge which is caused to traverse a path of extremely small dimensions providing for the manufacture in a sign of small dimensions of a display of high intensity and legibility.

Heretofore the only known method of producing a positive column sign of continuous discharge has been by forming a glass tube into the desired shape with electrodes at the two ends of the tube. This method besides being extremely expensive does not permit of the production of a sign of much smaller than two inch letters. With my invention it is possible to produce a sign with letters of one half inch height with a continuous discharge, the path of the discharge crossing itself wherever necessary, thus making possible a very small and compact sign.

In signs having shaped tubing to guide the discharge, the only reserve of gas is that contained in the tube, another limitation being thus placed on the smallness of the signs as the disappearance of gas by occlusion become a serious factor with small tubes. Another object of my invention therefore is to provide a sign having a continuous positive column discharge of small cross section in which a reserve of gas is available outside of the dimensions of the positive column path.

In the forming of tubing of small size great difficulty is met in manipulating the glass. As it has been considered necessary to have the entire positive column path vacuum tight, attempts at producing positive column signs have been abandoned at signs of two inches height. Another object of my invention therefore is to eliminate the necessity of producing a lamp with a vacuum tight positive column pathway, thus providing for a loose assembly of parts and an economical method of manufacture.

The lamps described in this specification are "clear vision" lamps, that is, except in the special modified form described, they do not contain any large opaque masses of material. The positive column inscription appears to the eye out of a structure entirely of transparent material, and is distinct, readable and attractive.

In the drawings, Figure 1 is a sectional elevation of a lamp sign made according to this invention.

Figure 2 is a cross section of the same.

Figures 3, 4 and 5 are elevations of the three central guide plates which determine the path of the discharge.

Figure 6 is a perspective view of a modified form of this invention in which an opaque body of material is used for determining the path of the discharge.

Figure 7 is a cross section of the lamp shown in Figure 6, thru the center of the letter "C".

Figure 8 is a plan view of the discharge guiding assembly.

Figure 9 is a front elevation of the opaque discharge guiding member shown in Figure 6.

In Figure 1 a lamp is illustrated by which an inscription is illuminated in a transparent envelope in which very little is apparent to the eye besides the illuminated discharge path. The envelope consists of a glass tube indicated by numeral 1, the ends thereof being closed by the reentrant stems 2 and 3, thru which the lead-in wires 4 and 5 are sealed, and supporting the electrodes 6 and 7. The discharge-path assembly 8 separates the ends of the tube into individual chambers 9 and 10 for the purpose of providing around the electrodes an ample body of gas to permit the proper functioning of the electrode. The discharge passes from the end chambers into the assembly thru the holes 11 and 12.

The discharge path assembly consists of the three perforated plates of transparent insulating material 13, 14 and 15; the solid plates of transparent insulating material 16 and 17; and the semi-circular end baffle plates 18, 19, 20 and 21. The plates are made as flat as possible and fit together with as little clearance as possible. This permits all the necessary expansion between the plates without excessive stress. However an absolutely perfect fit is not necessary as the passage of a discharge between the plates is not liable to take place unless there is a very poor fit. In the assembly of the semi-circular baffles, a very slight clearance is allowed on account of expansion stresses. This clearance in all cases is held to a value materially less than the mean free path of the atoms of the contained gas, and the passage of a discharge around the edges of the baffles instead of between the plates is rendered very improbable. While such discharges by leakage between the various elements might on occasion take place, they are momentary and can not be sustained so long as the conditions above indicated are substantially adhered to. At the same time all of the spaces within the tube are in communication with each other so far as the diffusion of the gas is concerned, and the tube may thus be manipulated on the pump as a single tube, and the total contained gas can be counted on for sustaining the life of the tube against occlusion. Were the only gas available for this purpose that contained in the discharge path proper, the life of the tube would be very short indeed. With the ample reserve of gas it is possible to reduce the cross sectional area of the discharge path to a small value, thus securing a very thin sharp line of light of high intensity that may be given any path desired; an altogether new result in the art.

The discharge path proper is defined by the three perforated plates 13, 14 and 15, the plates 16 and 17 providing the outside walls of the passages. The discharge enters the first passage at the point 22 and leaves the last passage at the point 23 corresponding to the holes 11 and 12 respectively formed by the assembly of the plates with the baffles. The first passage 24 in the plate 13 terminates in connection with the opening 25 in the plate 14, thru which the discharge passes into the passage 26 in the plate 15, returning thru the opening 27 in the plate 14 to the passage 28 in the plate 13. In this manner the discharge passes over itself, the potential difference between the closest points of the passages 24 and 28, for instance, being too small to cause a short circuit if the parts are made with reasonable care.

The passages 28, 29, 30, 31, 32, and 33 in the plate 13 terminate in communication with the openings 35, 36, 37, 38, 39 and 40 in the plate 14, respectively; each of said openings meeting in the order given the beginnings of the passages 41, 42, 43, 44, 45 and 46 in the plate 15. Each of the last mentioned passages communicates by means of the openings 47, 48, 49, 50, 51 and 52, in the plate 14, with the passages 29, 30, 31, 32, 33 and 34, in the order given, in the plate 13.

In the operation of this lamp any material vaporized from the electrodes is deposited on the walls of the chambers 9 and 10, and because of the higher temperature therein cannot enter the discharge passages. The transparency of the perforated plates and the wall plates is thus maintained thruout the life of the lamp. When the lamp has served its life, it may be recharged as no deterioration of the structure takes place in the discharge path assembly.

In Figure 6, a perspective view of a modified form of this invention is shown in which the transparent discharge-guiding structure is replaced by a single moulded element of dielectric material such as porcelain in which all of the passages are formed, having a flat wall plate on the rear and a transparent wall plate on the front thereof. In this form of the invention the advantage of rendering portions of the discharge not desired as part of the inscription invisible is gained. Cross-over points are made by causing the portions of the discharge at the crossing point to occur on opposite sides of the porcelain block.

In the view in Figure 6, numeral 60 indicates a tubular envelope within which is positioned the discharge-guiding structure 61, consisting of the moulded porcelain block 62, the back plate 63 and the transparent front plate 72. These guiding elements are secured together in any suitable manner such, for instance, as by cementing. Figures 7, 8 and 9 illustrate the manner in which the electrodes may be arranged in this type of lamp. The electrode structures consist of the reentrant stems 64 and 65, thru which are sealed the lead-in conductors 66 and 67, to the end of which are secured the electrodes 68 and 69. Each electrode is positioned in a chamber formed in the back of the porcelain block as indicated by 70 and 71.

In this form of the invention by the use of a block of clear white material practically all of the light is sent forward and the intensity of the display is exceptionally high.

It is to be understood that the term "inscription" as I use it in the claims is intended to mean, a sign, character, figure, letter, symbol or ornamental design.

The devices made according to this invention may be provided with an atmosphere of conducting medium such as one of the noble gases or the vapor of a metal such as mercury or any combination of such mediums. The term "gaseous conductor" as used in the claims is to be understood in the generic sense of including any gaseous conducting medium capable of emitting visible radiation upon the passage of electric current.

This invention is not limited to the above particularly described forms but may be modified in many ways within purview of the claims.

In the following claims the expression "electrodes within said envelope" when used is to be understood as having the following import. An electrode to be within the envelope is an electrode having an emission surface in contact with the contained gaseous medium. This is not limited to electrodes having a definite body and substantially wholly enclosed within the envelope, but includes electrodes which are made as part of the wall of the envelope itself whether of conducting material or not. This also includes electrodes which have no definite body but consist of portions of the body of the contained gas from which the discharge starts or terminates being induced by electrostatic or magnetic forces from the outside of the envelope.

What I claim is:

1. A positive column gaseous discharge device comprising an envelope providing a main gas chamber, a gaseous conductor in said chamber and a structure wholly immersed in said conductor and consisting of a plurality of plates of dielectric material assembled together in juxtaposition to form a stack and said plates having formations in the meeting faces thereof providing a secondary chamber in said structure said secondary chamber being in the form of a tortuous discharge passage of small cross sectional area, electrodes at the ends of said passage and lead in conducting means connecting the same to the outside of said envelope, said passage being in gas communication with the main chamber in said envelope.

2. A positive column gaseous discharge device comprising an envelope providing a main gas chamber, a gaseous conductor in said chamber and a structure wholly immersed in said conductor and consisting of a plurality of plates of dielectric material assembled together in juxtaposition to form a stack and said plates having formations in the meeting faces thereof providing a secondary chamber in said structure in the form of a tortuous discharge passage therethrough of small cross sectional area, said plates being positioned so closely together as to prevent discharges passing therebetween except through said passage, electrodes at the ends of said passage and lead in conducting means connecting the same to the outside of said envelope, said passage being in gas communication with the main chamber in said envelope.

3. A positive column gaseous discharge device comprising an envelope providing a main chamber, a gaseous conductor in said chamber, and a structure wholly immersed therein and including a plurality of plates of dielectric material in juxtaposition to form a stack said plates having formations in the meeting faces thereof providing a secondary chamber in said structure in the form of a tortuous discharge passage therethrough, said structure forming with the walls

of said envelope two spaced electrode chambers, each end of said passage opening directly into one of said electrode chambers, an electrode in each of said electrode chambers and conducting means connecting said electrodes with the outside of said envelope.

4. A positive column discharge device comprising an envelope providing a main chamber, a gaseous conductor in said chamber, and a structure immersed therein and including a plurality of plates of dielectric material in juxtaposition to form a stack said plates having formations in the meeting faces thereof providing a secondary chamber in said structure in the form of a tortuous discharge passage therethrough, said structure being positioned in said envelope so as to isolate from each other two spaces to form terminal chambers and fitting the walls of said envelope so closely as to prevent a discharge passing therebetween, each end of said passage opening directly into one of said terminal chambers, an electrode in each of said terminal chambers and conducting means connecting the same with the outside of said envelope.

FRED HOTCHNER.