

June 28, 1932.

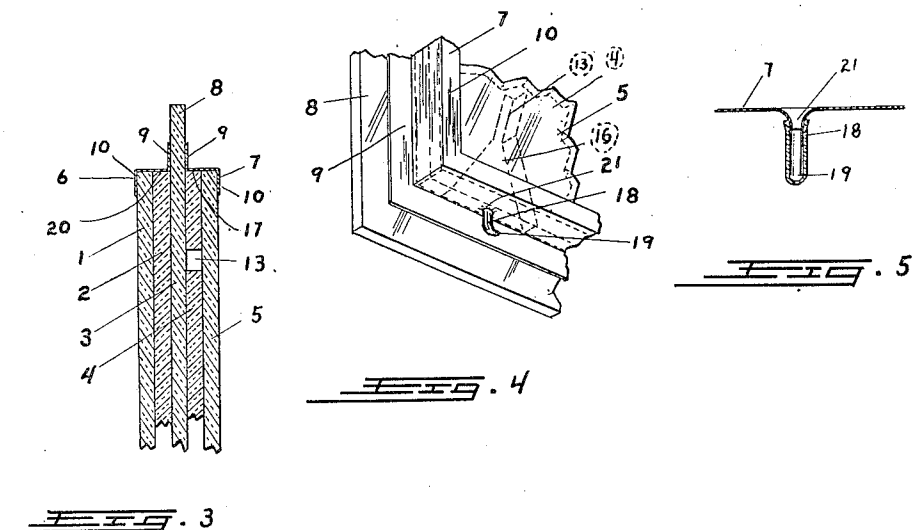
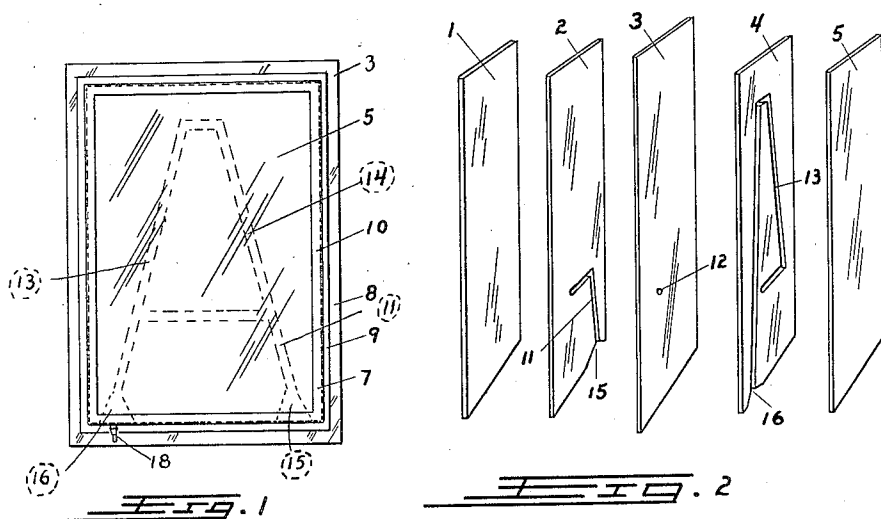
F. HOTCHNER

1,865,253

FLAT TUBELESS IONIZATION CONDUCTOR SIGN

Filed April 15, 1929

3 Sheets-Sheet 1



INVENTOR

Fred Hotchner

June 28, 1932.

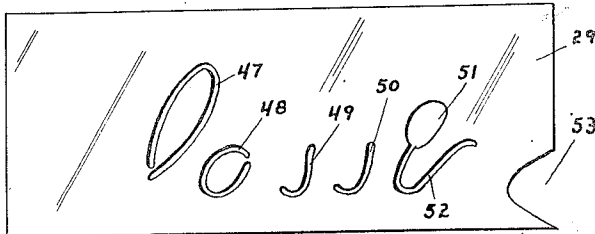
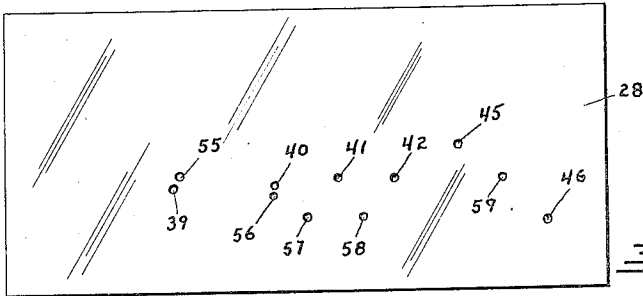
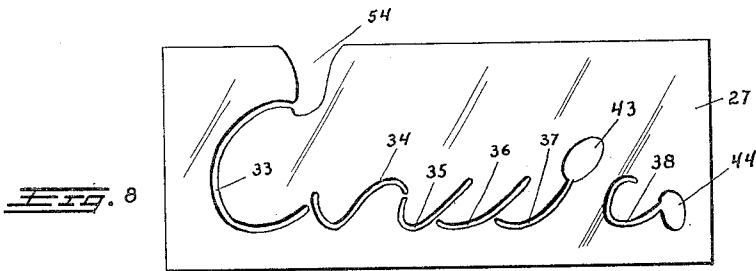
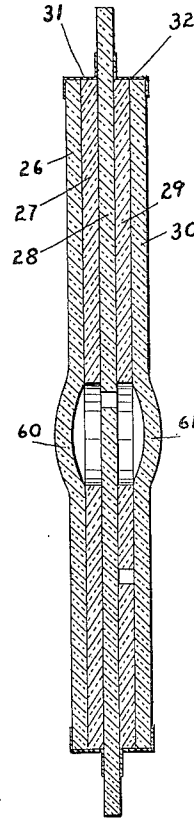
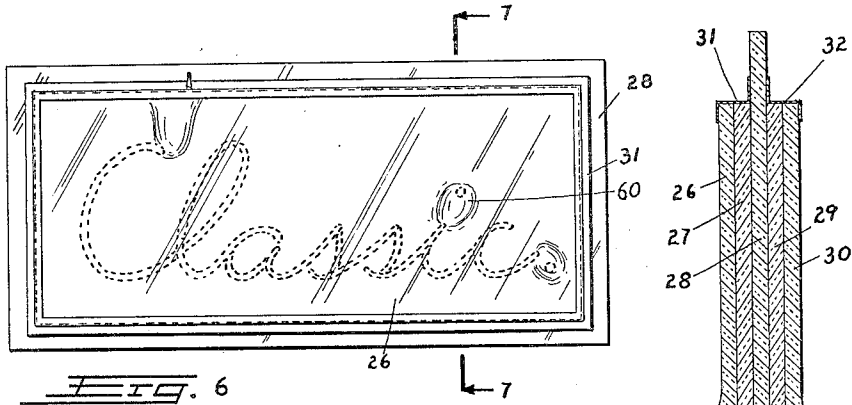
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FLAT TUBELESS IONIZATION CONDUCTOR SIGN

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3 Sheets-Sheet 2



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FLAT TUBELESS IONIZATION CONDUCTOR SIGN

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3 Sheets-Sheet 3

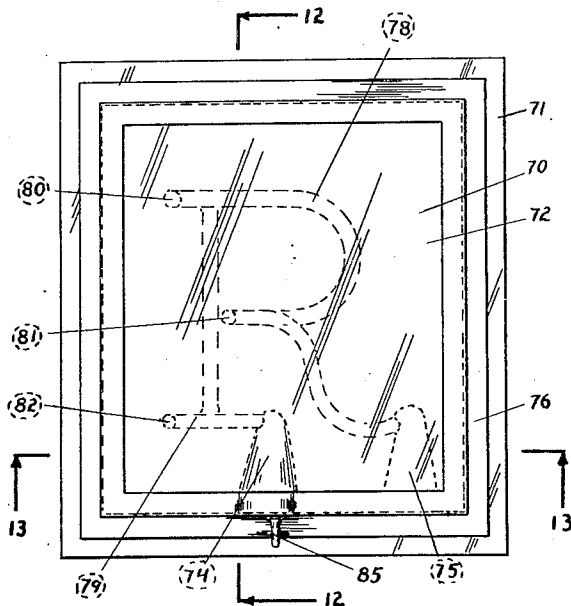


FIG. 11

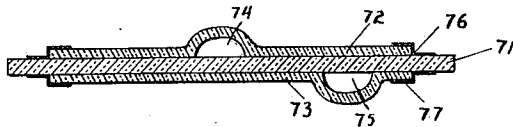


FIG. 13

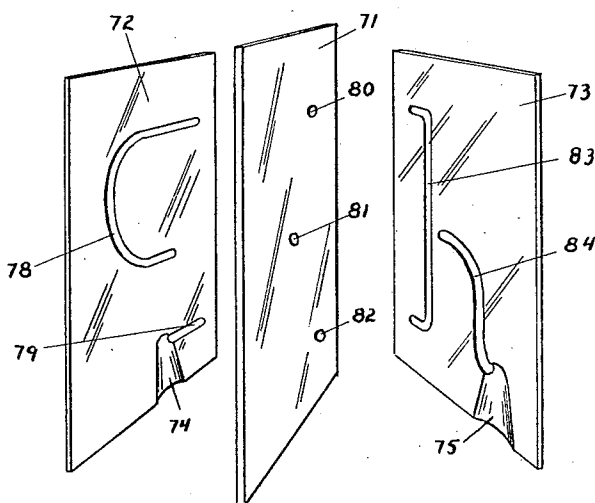


FIG. 14

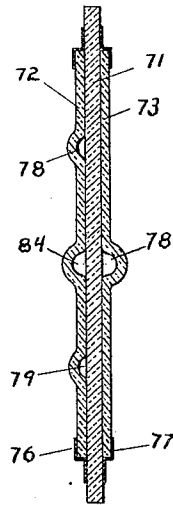


FIG. 12

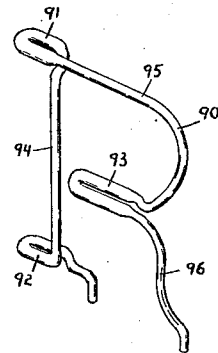


FIG. 15

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FLAT TUBELESS IONIZATION CONDUCTOR SIGN

Application filed April 15, 1929. Serial No. 355,266.

This invention relates to an ionization conductor sign of a type suitable for display advertising or ornamentation, altho it is to be understood that the novel features claimed can be applied to many other uses in the discharge tube art.

One object of the invention is to provide means of forming flat sided ionization conductor devices. As applied to the display art the object is to provide a flat sign of the general type described in a single self-supporting mechanical unit. Heretofore discharge tube signs were formed by bending glass tubes into the shape of the desired message or design. Such units were mechanically weak, could be transported only under the most severe limitations and required special provision for mechanical support upon installation. In the present invention the use of tubing is entirely dispensed with. This result is made possible by the new and novel provisions for the fabrication of a vacuum vessel with extended flat sides and having therein means to guide a discharge over a tortuous path representing the desired display matter.

Another object is to produce a display of the general type described in which the depth of the display is maintained at a minimum. With the prior devices it is necessary in making cross over and return bends in the tubing to provide a minimum clearance so great that the display, when viewed from a sharp angle loses its definition. In the present invention it is possible to reduce the depth to a value small enough to entirely overcome this effect and provide displays that are clear and readable at practically as great an angle as a true flat display could be distinguished at.

Another object is to provide a discharge display in which the electrode terminal will be self-contained and protected from injury.

Another object is to provide a unitary display which will be transparent and in which the illuminated matter appears out of a clear field with no apparent connection with any solid body.

In the prior devices a continuous line of tube must be provided from one terminal to

the other. Wherever illumination is not desired, as between letters, or the approaches to punctuation marks, or beyond the ends of the inscription approaching the terminals, it is necessary to cover the tube with a coating of opaque paint or the like. The general appearance of all such signs was that of an unfinished job. This has been heretofore considered as an essential characteristic of the devices. The present invention overcomes the disadvantages of such construction entirely and in addition provides means of conserving the better part of the energy that was wasted in the sections thus rendered opaque.

A further object of the invention is to provide for a uniform intensity of illumination of character outlines thruout the display. In the prior devices where the return bends occurred the illumination was double that of the places where only one line of tubing existed. In the present invention the intensity of each portion of the doubled over parts of the discharge path is substantially reduced so that the total is equivalent to the intensity of the single portions, with a corresponding saving in electric energy.

Other objects are attained in the provision of novel features of construction in furtherance of the above stated and other ends, said features of construction constituting contributions to the general art of constructing vacuum vessels. In the specification below the new and novel features of the invention are shown as applied to a particular device, that is, a display; but it is to be understood that they are applicable in many other ways in the arts and industries and the invention is not limited by the particular applications or forms illustrated, but only by the prior art and the appended claims.

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

Figure 2 is an exploded view of the plates or sheets of dielectric material forming the main structure of the device.

Figure 3 is a cross section of a portion of the sign shown in Figure 1.

Figure 4 is a perspective view of a corner

of the sign showing the tubulation as it appears after it is sealed off after the discharge passage has been evacuated through it and charged with a suitable ionization conductor.

5 Figure 5 is a cross section of the tubulation.

Figure 6 is an elevation of a complete sign made according to this invention.

Figure 7 is a cross section of the same
10 taken on the line 7—7, Figure 6.

Figures 8, 9 and 10 are elevations of the three central sheets or plates of dielectric material through which are formed the discharge passages of the sign shown in Figure 6.

15 Figure 11 is an elevation of a modified form of this invention applied to an individual letter.

Figure 12 is a vertical cross section of the same taken on the line 12—12, Figure 11, showing the discharge passages.

Figure 13 is a horizontal cross section of the same taken on the line 13—13, Figure 11, showing the electrode chambers.

25 Figure 14 is an exploded view of the dielectric plates forming the discharge passage structure of the sign shown in Figure 11.

Figure 15 is an illustration of a special application of one of the new features of this invention illustrated in the preceding figures.

30 In the drawings, Figures 1, 2, 3, 4 and 5 illustrate an individual sign letter made according to this invention. This letter may be installed as a unit in a display. The particular method of mounting and connecting to the circuit are optional as many different methods may be used with satisfactory results. The unit is self-supporting, and hence may be made to stand by itself secured only
40 at one edge. Contact can be made at any point around the edge.

The letter is made up of five plates of transparent, dielectric material, indicated by the numerals 1, 2, 3, 4 and 5, assembled in a
45 stack. The central plate 3 is larger than the others. On each side of this plate one of the electrode frames 6 or 7 are secured by cementation or fusion or any other suitable method. The two frames being at opposite
50 potentials are separated from each other by the extended portion 8 of the center plate. A long leakage path is thus provided between the frames.

The frames are made with a Z shaped cross section, one leg 9 being secured to the plate 3, and the opposite leg 10 being secured to the outer face of the outside plate, either plate 1 or plate 5.

As shown in Figure 2, the three inner
60 plates are provided with passages 11, 12 and 13, communicating with each other when the plates are assembled to provide a continuous passage through the structure for discharges following the outline of a letter or character as indicated by 14, Figure 1. The pas-

sage 11 in plate 2 terminates in an enlarged opening 15, forming an electrode chamber in conjunction with the inner face 20 of the frame 6. Likewise the passage 13 in the plate 4 terminates in an enlarged opening 16 forming with the inner face 17 of the frame 7 another electrode chamber.

In order to evacuate the letter, a tubulation is provided as shown in Figures 4 and 5. A portion of the frame 7 is pressed out into a crater shaped protrusion 21 and the end of a glass tube 18 is fused to it. The tube is tipped off at 19 in the usual manner after pumping and filling the letter with a suitable ionization conductor. By the term "ionization conductor" I have reference to any fluid characterized by the emission of radiation upon the passage of current therethrough generated by the action of ionization and recombination set up in the fluid by the current. Typical of such fluids are the rare gases, vapors of certain metals, vapors of certain organic compounds and air as well as combinations of these mediums.

Figure 6 is an elevation of a sign made according to this invention in which a complete word in script is represented by the discharge. Figure 7 is a cross section of the sign illustrating one method of providing for resistance to the pressure of the atmosphere over sections of the sign where openings of considerable extent exist within the structure. The width of the discharge path over the greater part of its length can usually be made sufficiently small as compared with the thickness of the cover sheets that no other provision than the flat cover itself need be made to resist the air pressure. This sign is also provided with five sheets of dielectric material, 26, 27, 28, 29 and 30; and two frame electrodes 31 and 32.

The plate 27, shown in Figure 8, has the passages 33, 34, 35, 36, 37 and 38 cut through it. Each of these passages except 37 and 38, terminates in such a manner as to meet a hole cut through the plate 28, indicated respectively by the numerals 39, 40, 41 and 42, as shown in Figure 9. The passages 37 and 38 terminate in enlarged openings 43 and 44 cut through the plate 27, which openings communicate with the holes 45 and 46 in the plate 28. The openings in plate 28, in the order given, communicate with the passages 47, 48, 49 and 50, the enlarged opening 51, leading to the passage 52, and the opening 53, in the plate 29, as shown in Figure 10.

Another enlarged opening 54 in the plate 27 leads to the beginning of the passage 33. The openings 55, 56, 57, 58 and 59, in the plate 28 complete the communications necessary to provide a continuous tortuous passage through the structure from the opening 54 to 53. The opening 54 forms an electrode chamber with the frame 31 and the opening

53 forms an electrode chamber with the frame 32.

In order to resist the pressure of the atmosphere where the enlarged openings occur, the material of the outside or cover sheets 26 and 30 is formed with outward bulges as indicated by 60 and 61 in Figure 7. This device is evacuated and charged with a suitable ionization conductor in the same manner as the device shown in Figures 1 to 5.

The purpose of the enlarged opening is to spread the discharge, and reduce the luminosity thereof while still providing a path for continuous conduction. It is a fact that the luminosity of a discharge is not of necessity a function of conduction as we may have conduction over a space in an ionization conductor with practically no luminosity. In this device we are not depending entirely upon reducing the unit brilliancy by spreading the discharge, but can by the proper selection of conditions and dimensions provide for an absolute reduction of the total light given off in the intended non-luminous portions to an exceedingly small value. An advantage is here gained in that the resistance of the intended non-luminous portions is lowered and energy is conserved. This is a decided improvement over the prior art as exemplified by signs made of formed tubing in which the connecting portions of the tubes consume their full energy per unit length and are rendered opaque by painting out.

In this invention means are provided to make a sign in which the characters stand out of a transparent background with no apparent connection with any source of energy and no apparent connections between the characters.

In Figure 11 another form of this invention is illustrated. Three sheets of dielectric material are here used. Numeral 70 indicates an individual letter in which 71 indicates the central sheet and 72 and 73, the face sheets, as shown by the section in Figure 12. The passages for the discharge are formed by grooves or channels formed in the face sheets and holes through the center sheet. As shown by the section in Figure 13 and the exploded view in Figure 14, the electrode chambers are formed by enlarged bulges in the face sheets indicated by 74 and 75 corresponding to the electrode frames 76 and 77 respectively. The grooves in the front sheet 72 are indicated by the numerals 78 and 79. The connecting holes through the central sheet 71 are indicated by 80, 81 and 82. The grooves in the back sheet 73 are indicated by 83 and 84. The tubulation through which the discharge passage is evacuated and charged with a suitable ionization conductor is indicated by 85. The relative cross section of the electrode chambers as compared with the main discharge paths are so selected that, with a given nature and pressure of ioniza-

tion conductor, the effective luminosity is confined to the main discharge channels.

In order to provide for a uniform appearing outline, provision is made for reducing the intensity of the illumination in the channels at the places where they are doubled. As shown in Figure 12 by numerals 84 and 78, the cross section of the channels is increased in area at the doubled over portions so that less energy is consumed in each channel and less light is given out in each channel but the combined illumination of the two channels is substantially equal in practice to that given out by the single channel as indicated by 79 in Figure 12.

In the practice of this invention these signs may be made in many different forms. For instance the type of individual letter illustrated in Figure 11 may be installed in frames as a part of a vertical sign, or a horizontal sign and it may contact with the supply terminals at any point around the frame. The sign can be made as a single unit fabricated sign in which letters and designs appear out of the transparent sheet as tho unconnected with any source of supply and thus providing an unique effect never before secured with ionization conductor lights.

A special application of one of the features of this invention is shown in Figure 15, in which 90 indicates a letter formed of tubing in which the tubing of the doubled over portions as indicated by numerals 91, 92 and 93 is enlarged in order that the luminosity of such portions will be substantially equal to that of the single tube portions indicated by 94, 95 and 96. As used herein, the term "display pattern" is to be understood as including any letter, character, figure, legend, ornament or design, or any combination of said devices, and also as including the passageway in the lamps having the form of said devices.

While I have shown my invention in a plurality of different forms, it will be obvious to those skilled in the art that it is susceptible of various other modifications without departing from the spirit thereof and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or are set forth in the appended claims.

What I claim is:

1. In a vacuum electric or ionization conductor device, an envelope having a wall incapable in itself of resisting the difference in the pressure on the inside and on the outside of said wall, and a discharge guiding device within said envelope supporting said wall against the unbalanced pressure aforesaid; said discharge guiding device having portions recessed away from said wall to provide a discharge path therebetween; the width of the portions of said wall remaining unsupported by direct contact with said dis-

charge guiding device by virtue of the existence of said recessed portions being of such low value that said unsupported portions of said wall remain self-supporting against the aforesaid difference of pressure.

2. In a vacuum electric or ionization conductor device, an envelope having an extended wall incapable of itself resisting the difference in pressure between the inside of said envelope and the outside thereof, discharge passage ridges formed in said wall bulging outwardly, and a plate of material within said envelope in connection with said wall completing the discharge passage with said ridges and supporting said wall.

3. In a vacuum gaseous, or vapor electric device, an envelope having a wall of insufficient thickness to resist, if flat, the difference in pressure between the inside and outside of said envelope, a discharge guiding passage within said envelope along said wall, said wall over said passage having such a contour that it can resist said difference in pressure.

4. In a vacuum gaseous, or vapor electric device an envelope having a wall of insufficient thickness to resist, if flat, the difference in pressure between the inside and outside of said envelope, a discharge guiding passage within said envelope along said wall, said wall over said passage having an outward bulge so that it can resist said difference in pressure.

5. A tubeless ionization conductor display comprising a plurality of plates of dielectric material having therebetween a discharge passage extending over a portion of the area outlined by said plates, said plates being sealed to prevent leakage to said passage, and an electrode structure closing the end opening from said passage and completing the sealing of said passage, said electrode structure being an integral part of the total sealing means for said plates.

6. In a vacuum electric device, a structure including a plurality of plates of dielectric material assembled together in juxtaposition to form a stack, there being suitable formations in at least one of said plates to form a chamber within said structure, and a metallic sealing member extending around the edge of said stack sealed to the outside plates and closing the joints between the plates from the atmosphere, said sealing member being provided with a port opening in communication with said chamber and a tubular member of vitreous material sealed to the said metallic sealing member around said opening through which said chamber may be evacuated.

7. A tubeless, ionization conductor display device including a plurality of plates of dielectric material assembled together in juxtaposition to form a stack, at least one of said plates having a suitable formation in a

joining face thereof providing a discharge passage through said device extending up to an edge of said stack, an ionization conductor in said passage, and means around the edge of said stack to seal the space between said plates from the atmosphere, said means including an element of metallic material closing the said passage at the end aforesaid at the edge of the stack and serving as an electrode to convey current to said ionization conductor.

8. A tubeless, ionization conductor display device including a plurality of plates of dielectric material assembled together in juxtaposition to form a stack, an inner plate of said stack being of greater extent and extending beyond the edges of the rest of said plates, there being suitable formations in said plates providing spaces communicating with each other to form a continuous passage for a discharge through said stack, each end of said passage terminating at an edge of said stack on opposite sides of the said inner plate, an ionization conductor in said passage, and a sealing element on each side of said inner plate extending around the edge of said stack sealed to said inner plate and the corresponding outer plate and including an element of metallic material closing the corresponding end of said passage and serving as an electrode to convey current to said ionization conductor.

9. A tubeless, ionization conductor device including a plurality of plates of dielectric material assembled together in juxtaposition to form a stack, said plates having suitable formations in their joining faces providing spaces within said device communicating with each other to form a discharge passage through said device, an end of said passage extending up to and terminating at an edge of said stack, an ionization conductor in said passage, and a sealing frame of conducting material extending around the edge of said stack forming a vacuum tight seal for the space therewithin, said rim serving as an electrode to convey current to said ionization conductor.

10. In an ionization conductor device, a pair of plates of dielectric material in juxtaposition forming a stack, one of said plates having an outwardly arching formation extending over a course following an inscription forming with the other plate a discharge passage in the form of said inscription within said device, means to seal the passage thus provided, an ionization conductor in said passage, and means to pass current through said passage.

11. In an ionization conductor device, three plates of dielectric material in juxtaposition forming a stack, each of the outside plates having an outwardly arching formation extending over a course representing a portion of an inscription, there being a hole

through the central plate connecting the chambers provided by said formations into a continuous discharge passage through said device, means to seal said passage from the atmosphere, an ionization conductor in said passage and means to pass current through said passage.

forming a discharge passage in cooperation with the inner surface of one of said sheets, said means supporting said sheet against said unbalanced pressure except over said passage, said sheet being provided with an outwardly arching formation over portions of said passage to prevent mechanical breakdown due to the unbalanced pressure.

FRED HOTCHNER.

12. In an ionization conductor device, three plates of dielectric material in juxtaposition forming a stack, each of the outside plates having outwardly arching formations extending over courses representing portions of an inscription, there being holes through the central plate connecting the chambers provided by said formations into a continuous discharge passage through said device, means to seal said passage from the atmosphere, an ionization conductor in said passage, and means to pass current through said passage.

13. In an ionization conductor device, a plurality of plates of dielectric material in juxtaposition forming a stack, there being suitable formations in said plates whereby upon the assembly of said plates a tortuous passage for a discharge is provided through said stack, said passage traversing a course delineating a display pattern in which is included an element which is preferably to appear when said device is activated as though disconnected from the rest of the pattern, said element being delineated by a hole through one of said plates included in said passage, each portion of said passage adjacent said hole being on opposite sides of the plate through which said hole is formed and of cross sectional area materially greater than that of said hole, an ionization conductor in said passage and means to pass current therethrough.

14. In an ionization conductor device, a plurality of plates of dielectric material in juxtaposition forming a stack, there being suitable formations in said plates whereby upon the assembly of said plates a tortuous passage for a discharge is provided through said stack, said passage traversing a course delineating a display pattern in which is included a portion which is preferably to appear as non-luminous when said device is activated, said portion occurring in a plate second from one of the outer plates of said stack and being of enlarged width and opening toward said outer plate, said outer plate at said portion being provided with an outwardly arching formation, an ionization conductor in said passage and means to pass current therethrough.

15. In a vacuum electric or ionization conductor device, an envelope including outer sheets subjected to a difference in pressure between the inside and outside of said envelope, said sheets being of insufficient thickness to be capable of themselves of resisting the unbalanced pressure thereon, and means within said envelope provided with a recess

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