

**Aug. 20, 1946.**

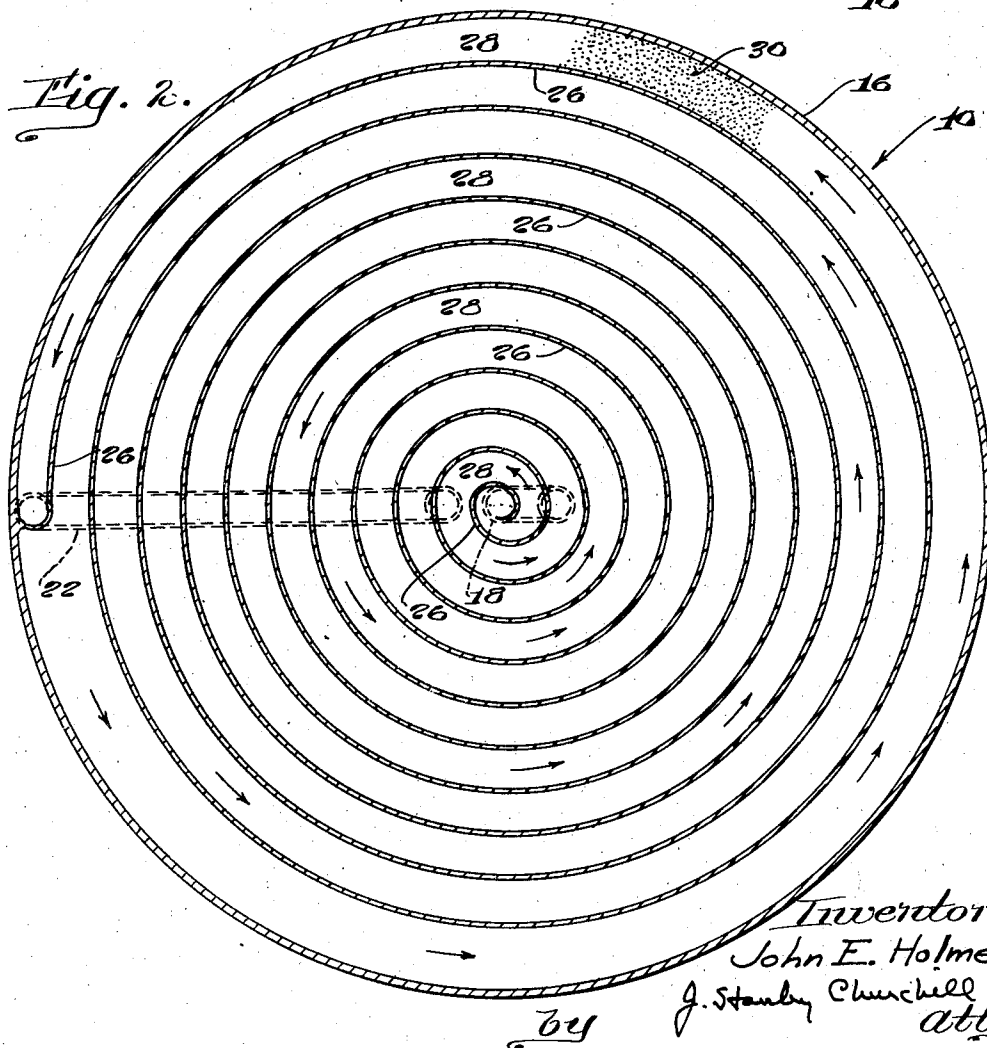
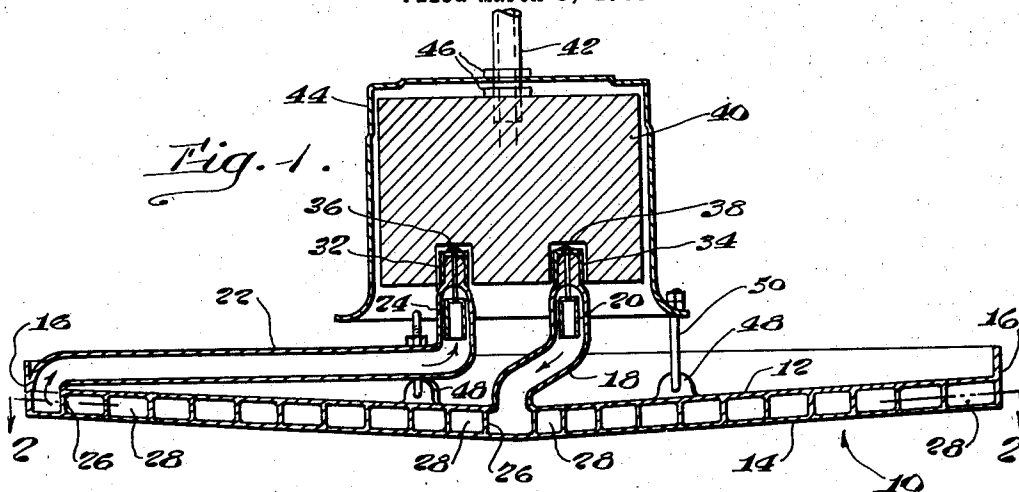
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**2,406,146**

FLUORESCENT LIGHTING UNIT

Filed March 8, 1944

3 Sheets-Sheet 1



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FLUORESCENT LIGHTING UNIT

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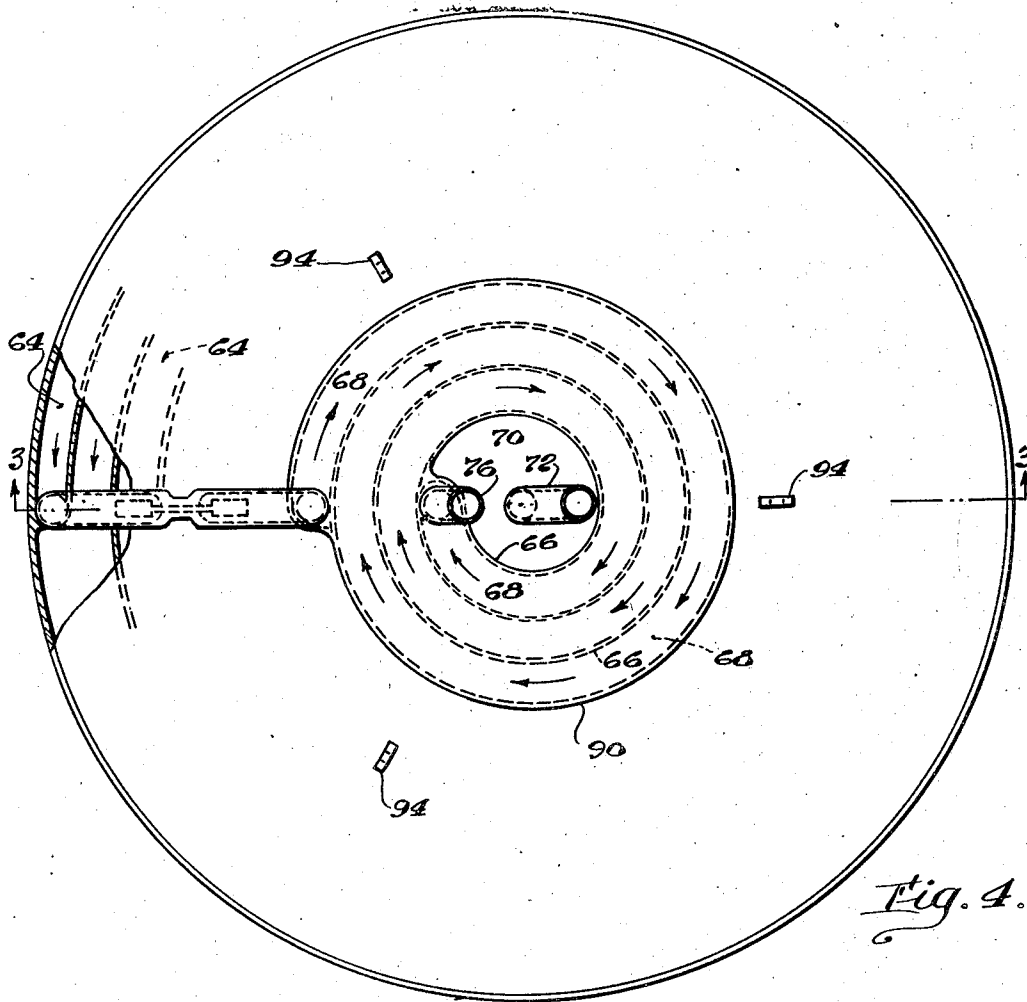


Fig. 4.

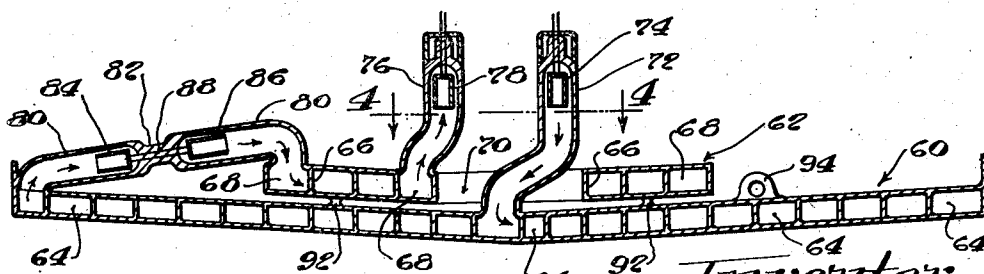


Fig. 3.

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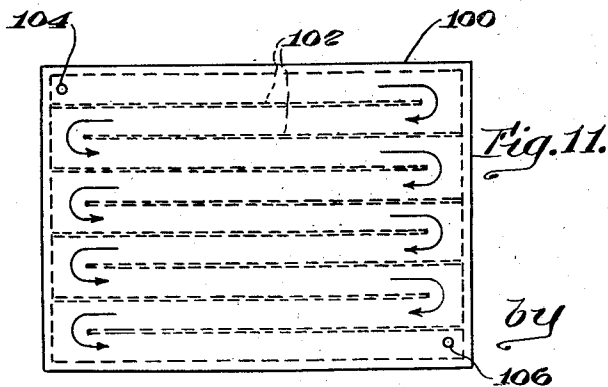
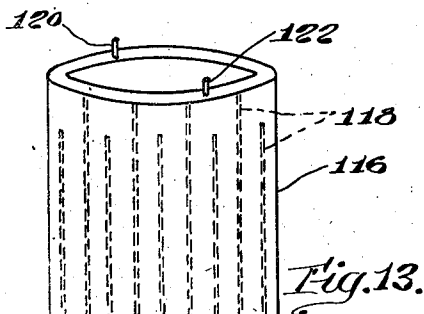
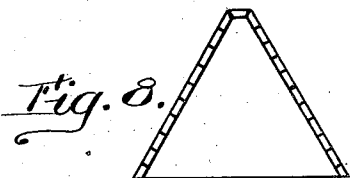
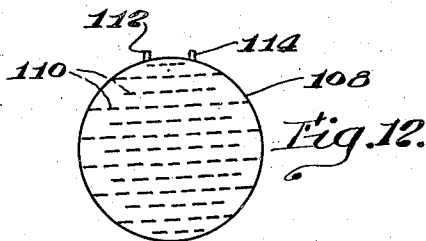
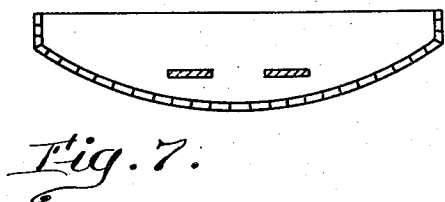
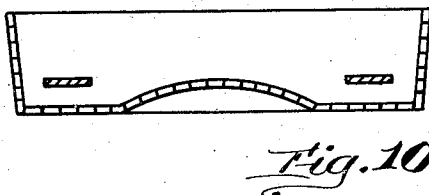
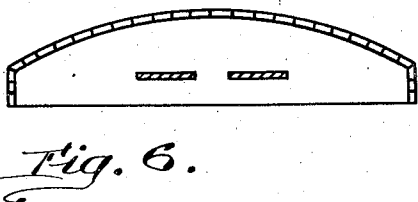
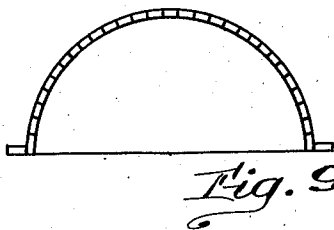
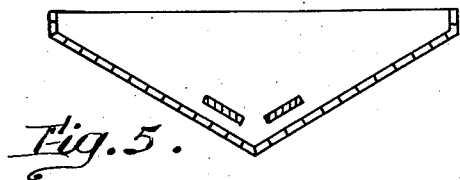
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FLUORESCENT LIGHTING UNIT

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,406,146

## FLUORESCENT LIGHTING UNIT

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Application March 8, 1944, Serial No. 525,532

1 Claim. (Cl. 176-122)

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This invention relates to fluorescent lighting units.

The invention has for an object to provide a fluorescent lighting unit of novel and improved construction characterized by the provision of a luminous surface of extensive area as distinguished from the conventional elongated tubular fluorescent lamps now in use.

With this general object in view, and such others as may hereinafter appear, the invention consists in the fluorescent lighting unit, and in the various structures, arrangements and combinations of parts hereinafter described and particularly defined in the claim at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention, Fig. 1 is a cross-sectional view of a fluorescent lamp embodying the present invention; Fig. 2 is a plan view in cross section taken on the line 2-2 of Fig. 1; Fig. 3 is a cross-sectional view similar to Fig. 1, illustrating a duplex form of the present lighting unit; Fig. 4 is a plan view of the lamp shown in Fig. 3, portions being broken away and shown in cross section; and Figs. 5 to 13 are diagrammatic views of various different shapes of lamps in which the present invention may be embodied.

In general the present fluorescent lighting unit includes a pair of electrodes which are spaced apart and connected by a long, non-opaque tube made up of a large number of closely spaced sections and containing any usual or preferred gases of the general type now used in commercial fluorescent lamps, and the interior of the tube is provided with a fluorescent coating, whereby to provide a luminous surface of substantial continuity and relatively large area. In one form of the invention the relatively long tube may take the form of a spiral with convolutions contiguous to one another. In another form of the invention the tube may comprise a plurality of straight sections with successive sections connected at alternate ends whereby to provide a zigzag path through which the discharge is caused to take place in passing from one terminal to another. Other forms of the invention will be more fully hereinafter described including a multiple unit structure.

Referring now to the drawings, Figs. 1 and 2 illustrate the present invention as embodied in a fluorescent lighting unit comprising a gaseous electric discharge lamp of a substantially flat, circular disk shape and includes a casing or envelope, indicated generally at 10, having substantially flat spaced upper and lower walls 12, 14

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respectively and an annular rim 16 joining the peripheral edges of the walls 12, 14 to form a flat disk shaped chamber. One of the walls 12, 14 of the casing 10 is formed of glass or other non-opaque material and preferably the casing 10 is composed entirely of glass. A tubular stem 18, which may comprise a section of standard round tubing, may be fused to the center of the casing or envelope in communication with the interior thereof and provided at its free end with an electrode 20. A second tubular stem 22 operatively connected adjacent the marginal portion 16 of the casing is provided at its end with a second electrode 24. As herein shown, a continuous spirally extended web or rib 26 starting at the center of the envelope 10 adjacent the electrode stem 18 and ending at the outer rim of the casing adjacent the electrode stem 22 extends between the upper and lower walls 12, 14 and forms a continuous spiral chamber or passageway 28 of substantially uniform cross section connecting said electrode tubes 18, 22 as clearly shown in Fig. 2. A fluorescent coating 30 of any usual or preferred composition is provided on at least the non-opaque walls 12, 14 and preferably the interior surfaces of the spiral chamber throughout the length thereof are coated with the fluorescent coating. A suitable gas together with a small quantity of mercury vapor is sealed within the casing according to the usual practice followed in the production of the commercial fluorescent lamps now on the market.

In operation, upon the application of a suitable potential across the terminals, ionization of the gas occurs with a resulting discharge between the electrodes, such discharge following the spiral path 28. In accordance with the well-known principles of operation of fluorescent lamps, the discharge vaporizes the mercury which sustains the arc between the electrodes generating invisible ultra-violet radiations which in turn excite the fluorescent coating to convert the latter into visible sources of light to be transmitted through the non-opaque wall or walls of the casing. The adjacent sections of the spiral passage 28 are disposed sufficiently close to one another to cause the exterior surface or surfaces of the present fluorescent lamp to present a continuous luminous surface of substantial area when viewed from the top or bottom of the unit.

The electrodes 20, 24 may be of any standard type now employed commercially, being coated with a suitable electron emitting material and, as herein shown, the ends of the electrode tubes 18, 22 are provided with caps 32, 34 for insertion

into the secondary voltage sockets 36, 38 of a transformer 40. The transformer may be supported above the lamp by a pendant tube 42 which carries the leads to the transformer. A canopy 44 may and preferably will be mounted over the transformer, as shown, the canopy being supported between lock nuts 46 on the pendant tube 42. In order to support the weight of the lamp, the upper wall 12 thereof may be provided with a plurality of eyes 48 cast thereto, and through which suitable hangers 50 may be extended. The hangers 50 may be conveniently attached to the rim of the canopy 44, as illustrated.

The casing or envelope 10 may and preferably will be made of a lead glass and is preferably slightly dished, as illustrated, so that when the fluorescent coating fluid is introduced through the outer electrode opening, prior to fusing of the tubular stem 22 thereto, the fluid will drain evenly to the center of the spiral. Thereafter, the envelope may be turned over to permit the fluid to flow back, coating the opposite face of the envelope, the excess fluid being drained out through the same opening.

It will be understood that the present fluorescent lamp structure may be adapted for either hot or cold cathode operation and that it may be made in a wide range of sizes as for example from a minimum of approximately four inches in diameter to a diameter of approximately ten feet. Likewise, the cross section of the spiral path defined by the distance between the upper and lower walls 12, 14 and the distance between adjacent web portions 26 as viewed in cross section in Fig. 1, may vary within wide limits in accordance with the number of lumens desired, the capacity of the transformer 40 and the current intensity being determined accordingly. The present unit may also be made to transmit any desired color of light as determined by the composition of the fluorescent coating material as is well known in the art.

Referring now to Figs. 3 and 4, as herein illustrated, the present invention may be embodied in a duplex design having a lower lamp section 60 similar in structure to that above described and a second section 62 disposed above the first section. The second casing or envelope 62 is also provided with a spirally extended web 66 between the spaced upper and lower walls thereof to form a spiral passage 68 within the casing. The central portion of the casing 62 may be provided with an opening 70 through which a tubular stem 72 extending from the center of the lower unit 60 projects, as illustrated, the outer end of the tube being provided with an electrode 74. A second tubular stem 76 provided with an electrode 78 extends from and is operatively connected to the inner end of the spiral passage 68 in the upper lamp section. The outer ends of each of the spiral passages 64, 68 are connected by a glass tube 80 which is provided with a solid glass section 82 intermediate the ends thereof to form a gas dam between the two sections 60, 62. A pair of electrodes 84, 86, disposed on opposite sides of said glass dam are electrically connected by wires 88 to electrically connect the two envelopes 60, 62 in series. Thus, in operation, it will be seen that when a suitable potential is applied to the electrodes 74, 78, the discharge effected is caused to move between the electrodes through one of the spiral paths 64, 68, then through the electrically connected electrodes 84,

86 and thence through the second spiral path to energize both fluorescent lamp sections.

With this construction, it will be apparent that in a duplex unit as described many different combinations of colored lighting effects may be obtained by providing the individual casings or envelopes with fluorescent coating materials of different compositions, or, if desired, one of the envelopes may comprise a bactericidal unit in which event the envelope may be made of a glass having special transmission characteristics, such as a quartz glass.

In the illustrated embodiment of the invention shown in Fig. 3, the upper envelope 62 may be smaller in diameter than the lower envelope and, as herein shown, the outer edge or rim 90 of the envelope 62 retains its spiral outline throughout, thus enabling a substantially uniform cross-sectional area of the path 68 to be maintained. The upper and lower lamp sections 60, 62 may and preferably will be connected by solid glass lugs 92 and the entire unit may be supported by hangers inserted through the glass eyes 94 cast to the upper wall of the lower unit 60, as shown.

A large number of variations of the present fluorescent lamp may be provided, a few of which are diagrammatically illustrated in Figs. 5 to 13 inclusive. All such modifications are characterized by a structure wherein adjacent sections of the discharge path are disposed sufficiently near to one another to impart a luminous surface of substantial area. Figs. 5 to 10 inclusive comprise variations of the unit shown in Fig. 1, each having a spiral path extending from the center to the outer rim of the envelope thus effecting an extensive luminous area in a fluorescent lighting unit in conformity with the accepted shapes of globes and lamps for incandescent lighting fixtures. The different shapes illustrated in Figs. 5 to 10 include cylindrical, cone, dome and dish-shaped forms or variations thereof and which may be upright or inverted. These various shapes may also be made rectangular in plan as well as cylindrical.

Another form of casing or envelope structure is diagrammatically illustrated in Fig. 11, which shows a substantially flat rectangular envelope 100 having a plurality of baffles 102 arranged to cause the discharge between the electrodes 104, 106 to follow a substantially zigzag or spiral path, back and forth around the ends of the baffles to effect transmission of visible light over an extensive flat area.

Fig. 12 illustrates a spherical adaptation 108 of the present lamp structure, provided with baffles 110 for directing the discharge between electrodes 112, 114 through a substantially spiral path formed between the walls of the sphere, the center being hollow, thus forming a luminous globe.

A further modification of the present fluorescent lamp, as diagrammatically illustrated in Fig. 13, comprises a hollow elongated cylindrical structure 116 with vertical walls and having elongated baffle plates 118 forming a zigzag path of substantially uniform cross section through which the radiations resulting from the discharge between the electrodes 120, 122 are directed.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claim.

Having thus described the invention, what is claimed is:

A fluorescent lighting unit, comprising: a

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closed generally circular disc-shaped casing having flat upper and lower walls spaced apart a distance so that the diameter of said casing is substantially greater than its height, at least the lower of said walls being of a light conducting material; a continuous partition member extending between said upper and lower walls and arranged so as to form a spiral chamber within said casing containing an ionizable gas, one of the ends of said spiral chamber being positioned substantially at the center of said casing and the other adjacent the periphery thereof; and a pair

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of hollow extensions communicating with each end of said spiral chamber and extending in a direction substantially parallel to the upper wall of said casing and adjacent thereto to points relatively closely spaced and symmetrically located with respect to the center of said disc-shaped casing, said extensions terminating in upwardly extending parallel electrode containing portions substantially perpendicular to the upper wall of said casing.

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