

July 5, 1966

F. E. GUTH

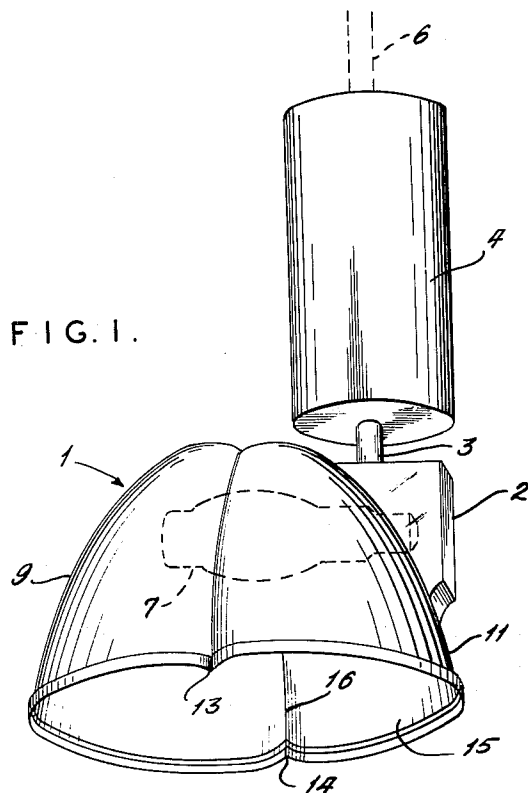
3,259,739

LUMINAIRE WITH SIAMESE DOMED REFLECTOR

Filed Jan. 6, 1964

3 Sheets-Sheet 1

FIG. 1.



— AVG.
 - - - A-A
 - - - B-B
 - - - C-C
 - - - D-D

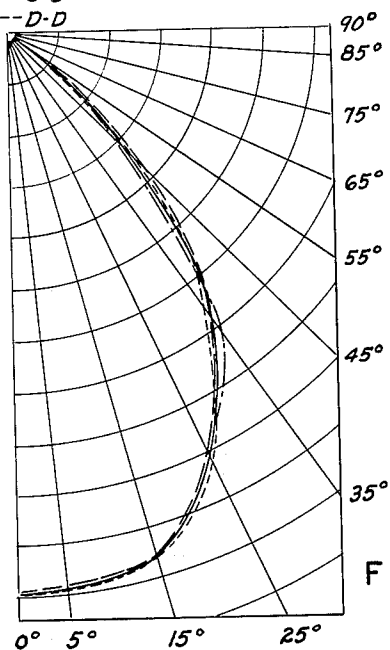
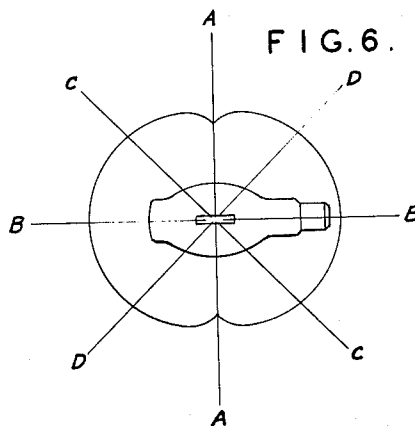


FIG. 5.

FIG. 6.



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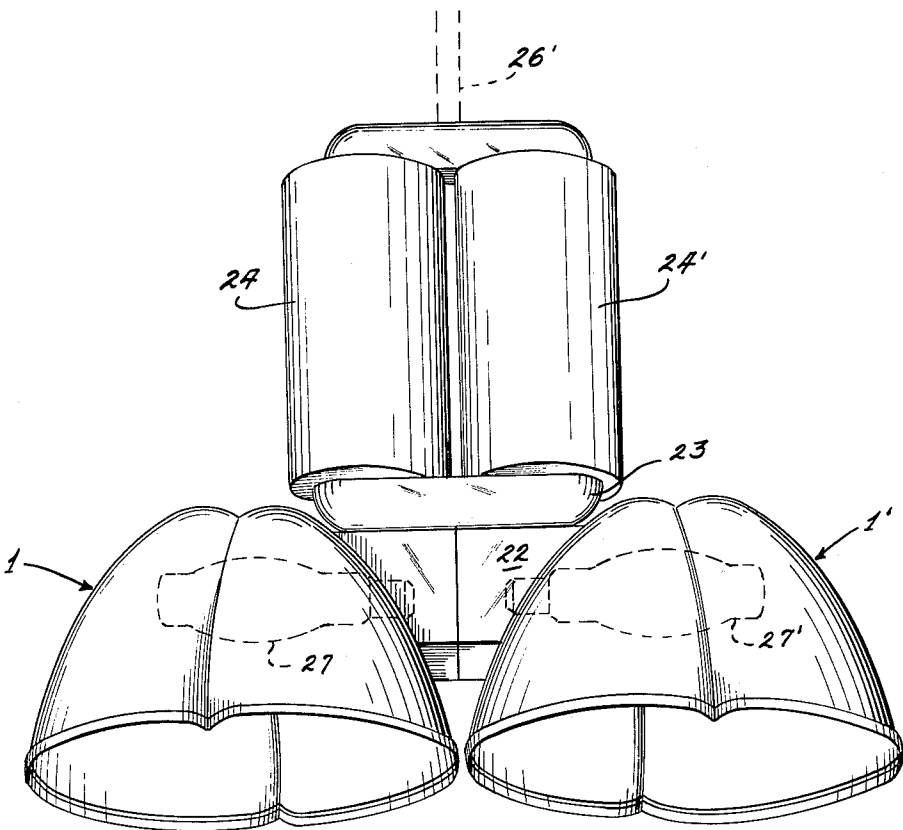


FIG. 2

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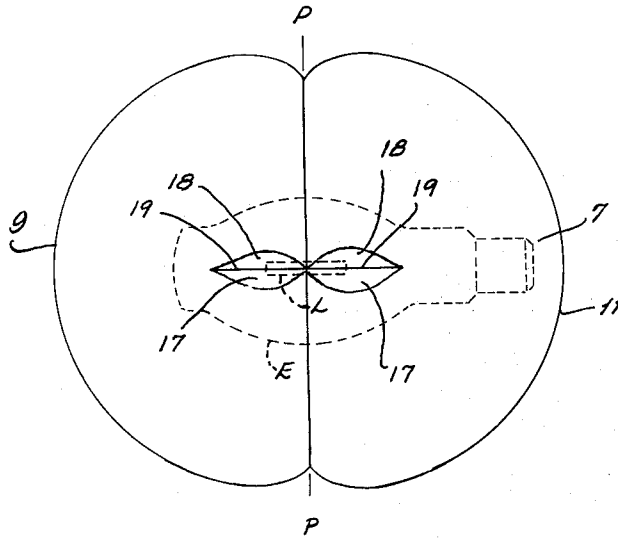


FIG. 3

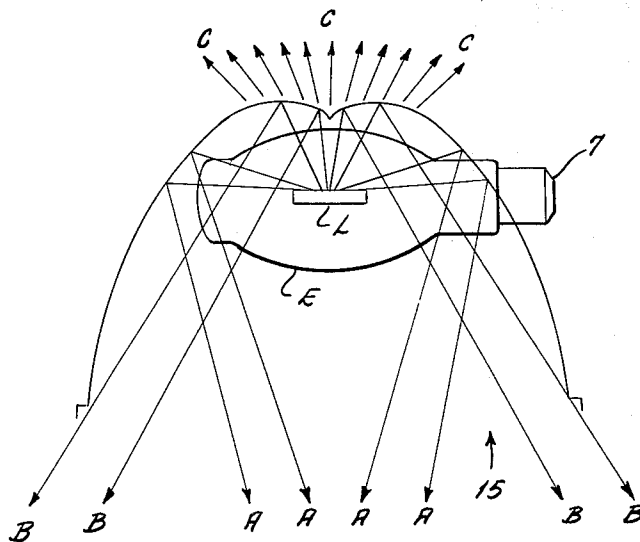


FIG.4

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LUMINAIRE WITH SIAMESE DOMED REFLECTOR
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1 Claim. (Cl. 240-103)

This invention relates to a luminaire, and more particularly to a luminaire with an elongated light source, such as a tube of the electric discharge kind in which the light is produced by the passage of electricity through a metallic vapor or through metallic vapor and gases, the metallic vapor being, for example, of mercury, sodium, and/or thallium. Such tubes are hereinafter generically termed "vapor discharge lamps," and they usually have a cylindrical tube (called the "arc tube") whose axial dimension is substantially greater than its diameter, sealed at opposite ends, and containing elongated filaments or electrodes, and the metal vapor-gas. Such an arc tube is usually enclosed in a protective sealed glass envelope having a metal base which can be threaded to fit a lamp socket in the luminaire. Where it was desired to produce a symmetrical pattern of illumination at the work area, such vapor lamps have required mounting with the axial dimension of the arc tube in the vertical direction, but recently a vapor discharge lamp of greater lighting efficiency has become available which requires a horizontal axial mounting of the arc tube.

For most industrial, and many commercial, uses, it is highly desirable that luminaires deliver what is termed a "symmetrical" light pattern, which, in the parlance of the art, means that the intensity of the delivered light is, in the practical sense, substantially the same at every point on the periphery of a circular area to which nadir (through the light source) is perpendicular at its center. Such symmetry is difficult to achieve with a light source which is longer than it is wide normal to nadir, and the conventional reflector shapes, such as conic sections, which operate to produce down lighting in a symmetrical pattern from a vertical vapor lamp (which, as viewed along nadir, produces a substantially circular light source), will not do the same thing where the vapor lamp is mounted horizontally.

It is the primary object of this invention to solve this problem, and provide an efficient pattern of down lighting from a luminaire utilizing the combination of a horizontally mounted lamp tube and a reflector.

According to this invention, the luminaire includes a horizontally mounted vapor discharge lamp within a Siamese domed reflector. This reflector is characterized as "Siamese" because it is a couplet of identical halves. The respective halves may be considered as the major (i.e., more than half) segment of a segmented dome or conoid-like surface, and the respective halves merge into each other at their plane of segmentation to form a compound dome whose base is an aperture having a central constriction. This Siamese domed reflector, when viewed from the open bottom, approaches elliptical, except for the central constriction formed by opposite re-entrant portions which produce an internal rib extending over the top of the domed reflector from one bottom edge to the other, with terminal ends of the rib located on the minor axis of the elliptical open bottom. The interior reflector-active surfaces are approximately elliptical at all sections parallel with the open bottom, save where interrupted by the internal rib extending parallel to the minor axis from bottom edge to bottom edge, and over the top of the domed reflector.

The re-entrant portions of the two halves converge to form the internal rib so as to leave, on the inside of the reflector, an exterior angle greater than 180° and prefer-

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ably on the order of 240°, so that, at the crests of the respective halves, the incident light is reflected in a direction which bypasses the arc tube of the lamp. Additionally, the crests of the respective halves are indented athwart said internal rib so as to provide, on each side of the latter, paired downwardly converging surfaces which reflect the upwardly incident light in a direction which bypasses the arc tube.

The lamp tube used in this reflector is mounted horizontally and perpendicular to the plane containing the internal rib, which plane intersects the arc tube approximately at its longitudinal center, i.e., the light center.

This arrangement of the lamp places opposite ends of the arc tube and its elongated filament in each of the Siamese domed reflector parts. Of course, an arc tube of this kind emits little, if any, light axially (in the length direction of the tube). Light rays emitted in this direction are the weakest rays. More intense rays are emitted in a more radial direction. At the interior surface of the reflector, these more intense rays are reflected downwardly in a direction such as to substantially bypass at least the arc tube as well, preferably, as the entire lamp tube. The less intense rays emitted from the lamp tube ends are reflected downwardly in a direction such as to pass below at least the arc tube and preferably also the entire lamp tube. Thus, most, if not all, of the reflected rays bypass the lamp arc tube and bulb, and this provides the desired lower operating temperatures and, at the same time, a regular, uniformly lighted, pattern desirable for industrial or commercial type lighting, for example.

Other objects and advantages of this invention will appear from the following detailed description which is in such clear, concise and exact terms as will enable any person skilled in the art to make and use the same when taken in conjunction with the accompanying drawings forming a part thereof, and in which:

FIGURE 1 is a perspective view of a luminaire constructed in accordance with this invention;

FIGURE 2 is a perspective view of a modified form of luminaire constructed in accordance with this invention;

FIGURE 3 is a top plan view of the reflector shown in FIGURES 1 and 2, but for clarity of illustration omits the lamp support;

FIGURE 4 is a schematic illustration in elevation, illustrating the reflecting action of the luminaires such as shown in FIGURES 1 and 2;

FIGURE 5 is a view illustrating the shape of the lighting curves obtained, measured in vertical planes through the light center indicating a symmetrical light pattern of substantially uniform intensity produced by the luminaires shown in FIGURES 1 and 2; and

FIGURE 6 is a schematic illustration showing the vertical planes through the light center along which the measurements were made.

The luminaire, shown in FIG. 1, has a reflector, generally indicated as 1, to which is attached a box 2 containing a light socket receptacle. A conduit 3 for lead-in wires is secured to the socket box 2 at one end, and to a casing 4 containing a transformer of suitable capacity and electrical characteristics for operating an electric discharge type lamp, in this case, a mercury-vapor lamp. The characteristics of such transformer, as is suitable for the purpose, are well known in the art, and will not be described in detail here. Casing 4 in turn may be supported by a wiring conduit 6 secured to the casing 4 and the building structure, so as to form a support for the entire luminaire assembly, including the transformer, socket box, reflector and lamp. The lamp 7 is shown in dotted lines supported in a horizontal position within the reflector 1 by threaded engagement of one end of the lighting tube 7 in a suitable socket in the socket box 2 of the luminaire.

Reflector 1 consists of two halves 9 and 11 which are identically shaped and sized except that one of them has box 2 connected to it as by means of bolts, rivets or otherwise, and a hole to accommodate passage of the lamp base into the receptacle within box 2. The halves 9 and 11 may be, and preferably are, integral, but, in any event, are joined edge to edge on a rectangular plane to form a Siamese domed reflector. Where the two halves are joined, there is formed an internal rib 16 which necessarily extends over the top of the domed reflector from one bottom edge at the point 13 to the other bottom edge at the point 14. These points 13 and 14 are on diametrically opposite sides of the open bottom 15 of the reflector 1. Rib 16 lies in the plane between the two halves 9 and 11, which plane intersects the light source 7 approximately at the longitudinal center of its arc tube.

As shown in FIG. 3, the crests of the respective halves 9 and 11 are further indented inward to provide, on opposite sides of rib 16, two pairs of substantially planar surfaces 17 and 18 converging into an internal ridge 19 which intersects internal rib 16. The surfaces 17 and 18 form, on the inside of the Siamese dome, reflecting surfaces for directing incident light downwardly astride the arc tube, and hence ridge 19 is of length at least as great as the length of the arc tube. In the embodiment shown, the surfaces 17 and 18 form an angle on the interior, at ridge 19, of about 250°; and the length of ridge 19 is about 1.5 times the length of the arc tube.

The modification, shown in FIG. 2, is a double fixture containing two luminaires constructed with two reflectors and two light sources, all as described in FIG. 1. This description will be confined to the difference between FIGS. 1 and 2. In FIG. 2, the socket box 22 is double-ended and joined to each of the reflectors 1 and 1'. There is a conduit housing 23 secured to the socket box 22 and also to duplicate casings 24 and 24' for suitable current-limiting transformers providing the necessary voltage for operating the lamps 27 and 27'. A conduit housing 26 is secured to the transformer casings 24 and 24', and this in turn may be supported on a wiring conduit 26' attached to the building structure. Each of the lamps 7, 27 and 27' is horizontally supported when the luminaires are properly suspended from the building structure. Each of the lamps 7, 27 and 27' is a typical metallic-vapor lamp except that it is engineered to be mounted horizontal rather than vertical. In this type of discharge lamp herein described, the light is obtained by the passage of an electric current through metallic vapor. Like all metallic-vapor discharge lamps, however, the lamps herein described (FIGS. 3 and 4) are constructed with two bulbs, an inner bulb L which contains the arc, and an outer bulb E which shields the arc tube L from changes in temperature and, in some cases, acts as a filter to remove certain wave lengths of the arc radiation. The arc tube L can be made of quartz or hard glass. The outer bulb or envelope E is usually made of hard glass, the exact type depending upon the application for which the bulb is designed and the portion of the arc spectrum which it is desired to transmit, all as well known in the art. The space between the two bulbs E and L is evacuated or filled with an inert gas. In such a metallic-vapor lamp, the light center is usually considered to be midway the ends of the arc tube L.

Turning now to a consideration of FIG. 4, the arrangement and support of the bulb 7 within the reflector 1 is such as to place opposite ends of the lamp tube 7 on opposite sides of the plane of symmetry PP which passes approximately through the light center of the arc tube L. Opposite ends of the lamp 7 are therefore located within the respective reflector parts 9 and 11.

As indicated in FIG. 4, a lamp tube of this kind emits little, if any, light axially of the tube. The rays of up-light, which are emitted more in the axial than in a ra-

dial direction, are indicated by A, i.e., the weakest of the light rays emitted are reflected downwardly and back toward the nadir (through the center of tube L) beyond the ends of tube L. The more intense rays of light are emitted more radially than axially of the tube, and are here indicated as B. The more intense rays B of the up-light are reflected outwardly away from nadir, beyond the ends of the arc tube L and downwardly through the open end 15 of the reflector. All of the reflected rays bypass the arc tube L, and most bypass the lamp 7 entirely. As was stated heretofore, the use of any reflecting equipment that might concentrate heat and light rays on either the inner arc tube L or the outer bulb B must be avoided, or excessive temperatures will build up to cause lamp failure or unsatisfactory performance.

In either of the modifications above described, if it is desirable to illuminate the area above the reflector, this can be provided by perforating or cutting out some or all of the indented surfaces 17 and 18, or otherwise aperturing the upper portion of the Siamese domed reflector so that light rays C, shown in FIG. 4, can escape to provide this top illumination.

FIG. 5 plots the candle power measurements taken with a reflector as shown in FIG. 1 designed for hanging at twenty feet or more above the work area to be illuminated and for concentrating its light out-put within a 60° zone (i.e., 30° each side of nadir). The reflector was made of sheet aluminum cold-drawn to shape, but without polish or other finish. For the purpose of test, it was equipped with a 400 watt clear mercury-vapor lamp rated at 20,100 lumens. In taking the measurements, photometer readings were made in a plane normal to nadir, twenty feet distant from the light center, and at 0°, 5°, 15°, 25°, 35°, 45°, 55°, 65°, 75°, and 85°, from nadir. Such readings were taken in each of the vertical planes A—A, B—B, and C—C shown in FIG. 6, and it was assumed (consistent with the custom in the art) that, due to the substantial geometric symmetry of the Siamese dome reflector about planes A—A and B—B, the readings in plane D—D would be the same as the readings in plane C—C. The candle power values at locations within the cut-off range, are set forth in the following table:

Degrees from Nadir	Measurements in Plane		
	A—A	C—C	B—B
0	10,608	10,608	10,608
5	10,537	10,580	10,633
15	9,664	10,143	10,345
25	8,259	8,301	8,301
35	5,928	5,449	5,492
45	2,299	2,746	1,703
55	468	596	607
65	213	234	234
75	128	128	85
85	85	85	43

When it is realized that, in the lighting industry, such measurements are considered to demonstrate "symmetry of light pattern" when the individual values, on the same circle within the zone of concentration, vary from their average not more than about ten or fifteen percent, it is apparent from the foregoing table that the luminaire of the present invention achieves such result with a horizontally mounted elongated light source. Obviously, the candle power values will vary depending upon the light source used, but they will serve here as an example to illustrate the utility of the invention, and to show that it accomplishes its objects without suggesting that the invention is limited to luminaires which yield the same finite values.

While FIGURE 3 illustrates the reflective action of the reflector in its upper regions, it will be understood that a comparable action occurs in its lower regions. That is to say that where, as shown, the internal ridge

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16 extends below the lamp, the stronger light rays emanating more radially than axially are reflected outwardly downward, while the weaker light rays emanating more or less axially are reflected inwardly downward; and such differential reflective action occurs all the way down to the open bottom of the reflector insofar as concerns light rays which are incident to the reflector.

Changes in and modifications of the construction described may be made without departing from the spirit of my invention or sacrificing its advantages.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

A luminaire comprising an open-based reflector composed of a couplet of two identical halves wherein the respective halves each consists of a segment of a conoid-like surface which segment embraces substantially more than 180°, said segments being joined together at their plane of segmentation to define an internal rib extending from the open base of the reflector across the top thereof substantially normal to said open base, a vapor discharge

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lamp having an elongated filament, and means for positioning said lamp within said reflector with said filament extending substantially normal to the plane of said internal rib for a substantial distance on both sides of said plane so that said filament is substantially bisected by said plane; said filament being otherwise so positioned within said reflector and said reflector being so shaped that a symmetrical light pattern of substantially uniform intensity is produced at areas substantially parallel with the open base of said reflector.

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