Dec. 19, 1939. W. A. PENNOW 2,184,004

RUNWAY MARKER LIGHT

Filed April 30, 1937 2 Sheets-Sheet 1

Fig. 1.

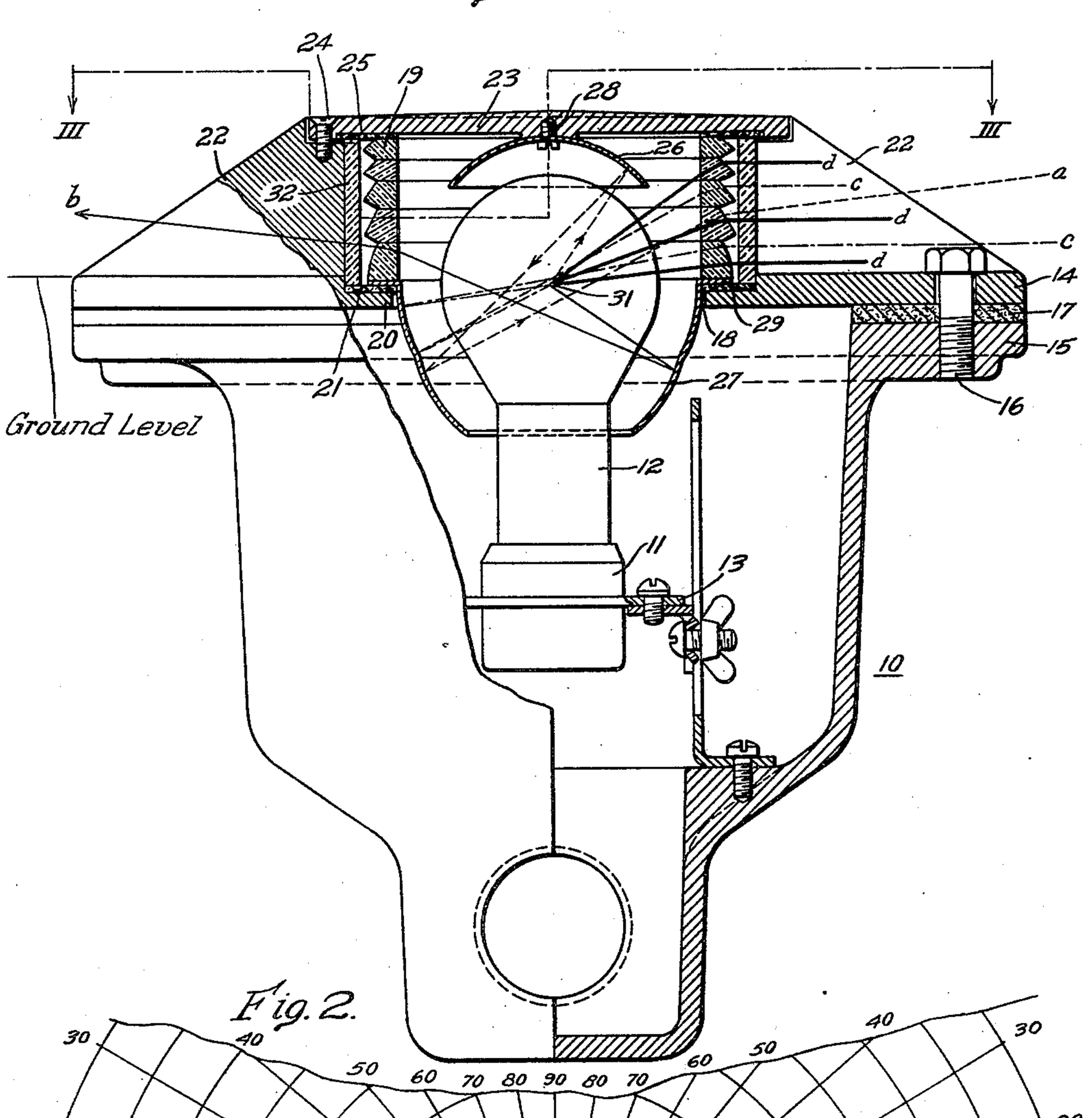
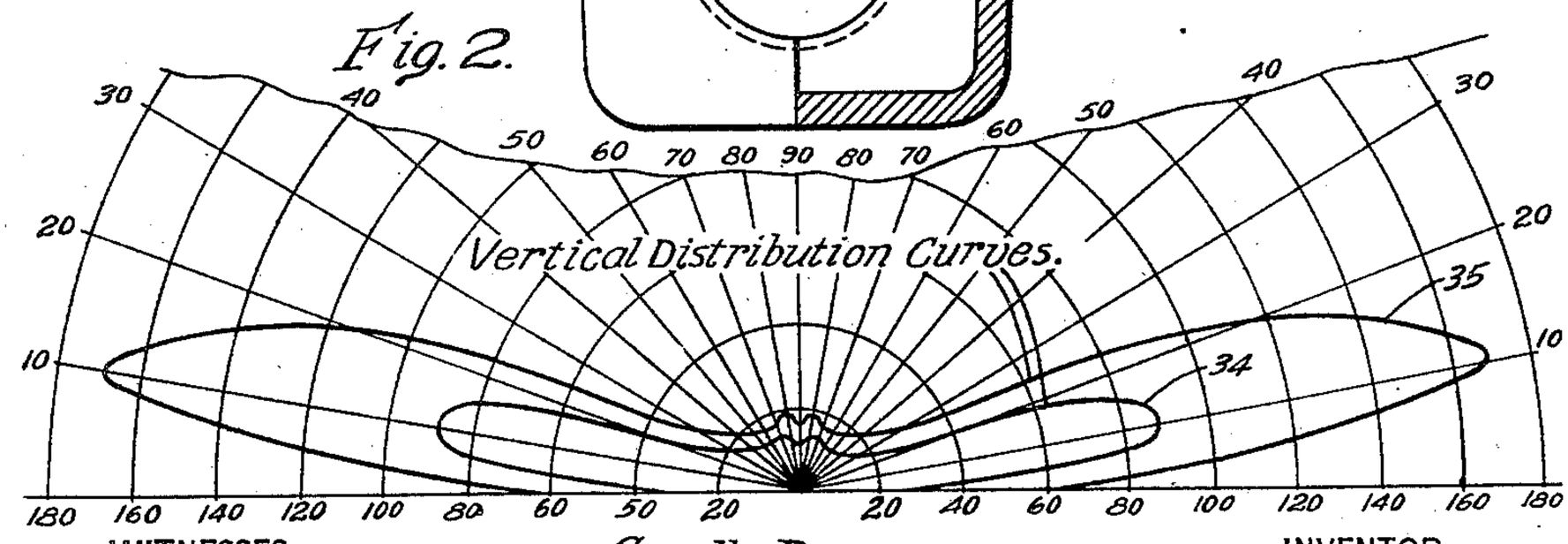


Fig. 2.



Vertical Distribution Curves.

Candle Power

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Fig. 3.

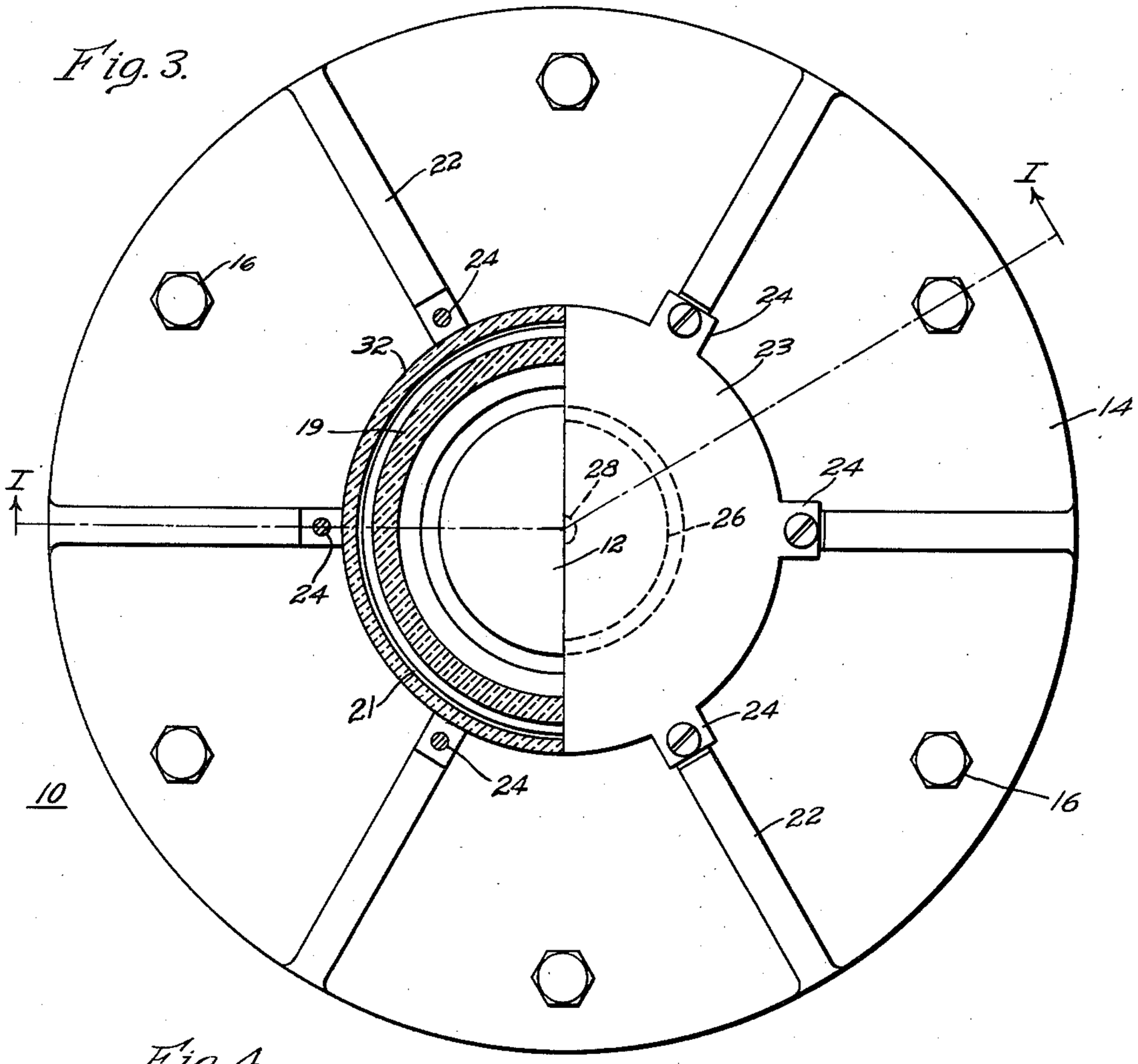
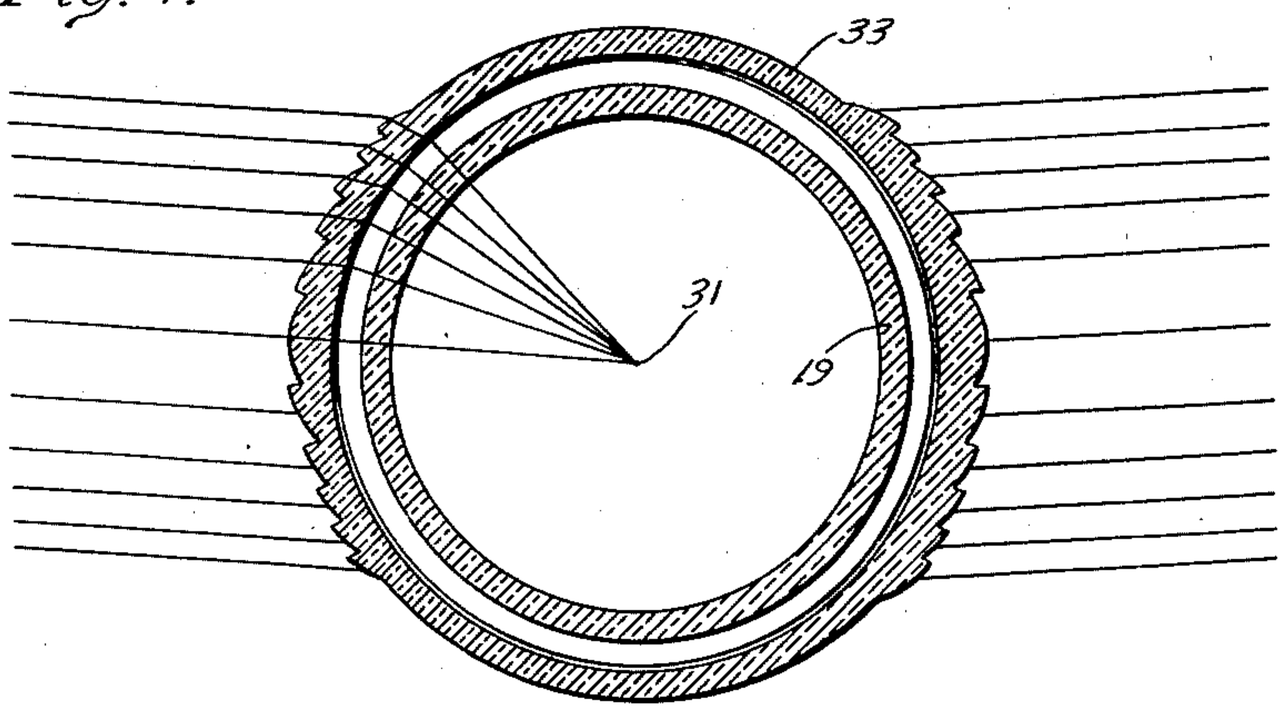


Fig. 4.



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Patented Dec. 19, 1939

2,184,004

UNITED STATES PATENT OFFICE

2,184,004

RUNWAY MARKER LIGHT

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Application April 30, 1937, Serial No. 139,917

14 Claims. (Cl. 240—1.2)

My invention relates, generally, to lighting units and, more particularly, to runway marker lights for airports and the like.

The object of my invention, generally stated, is to provide a runway marker light which shall be of simple and compact construction, economical to manufacture and install and which shall function to effectively mark the runway.

A more specific object of my invention is to provide a runway marker light which may be embedded in the runway surface with its upper end exposed in such manner that the unit may be readily relamped without opening it at or below the ground level.

A further object of my invention is to provide a lighting unit of the above character which functions to direct or concentrate the light produced thereby in a vertically narrow zone extending at a slight angle to the horizontal plane or runway surface.

Another object of the invention is to provide for utilizing, in a unit of this character, a main prismatic lens to concentrate the light in a limited zone above the horizontal plane or runway surface and an auxiliary prismatic lens to redirect the concentrated light into certain areas in the horizontal plane.

These and other objects of the invention will become more apparent from a reading of the following description in conjunction with the drawings, in which:

Figure 1 is an elevational view partly in section of a lighting unit embodying the principal features of the invention;

Fig. 2 is a view showing typical vertical light distribution curves of the lighting unit of the invention;

Fig. 3 is a plan view of the unit through lines III—III of Fig. 1, showing the relative positions of the various parts of the unit; and

Fig. 4 is a plan view showing the lens arrangement used in one embodiment of the invention.

In the preferred embodiment of the invention, the unit comprises generally a housing having a cover secured thereto by means of a fluid-tight joint in order that the housing may be embedded in the runway or other surface with the joint slightly below ground level. The cover is provided with a central opening through which the lamp bulb extends to a point above ground level. A prismatic lens is mounted on top of the cover over the central opening in such manner as to surround the lamp bulb. The lens is protected by a number of radially disposed upstanding fin members of approximately the same height as the lens, and a removable cover plate is attached to the top of the fin members to close the top of the lens.

A reflector is mounted beneath the lamp bulb and a second reflector is supported from the cover plate above the lamp in order to provide for directing substantially all of the light from the lamp through the lens.

The prismatic lens is so designed that the light produced by the unit is concentrated in a vertically narrow zone extending at a slight angle from the horizontal plane or ground surface.

If desired, a plain glass lens, clear or colored may be positioned about the prismatic lens to protect it or to both protect it and produce a colored light. A colored light may also be produced by using a colored prismatic lens. Further, the plain lens may be replaced by a second prismatic lens, clear or colored, for concentrating the horizontal light distribution into one or more restricted areas or zones.

The primary purpose of the foregoing arrangement is to provide a runway marker light that will produce a desired light distribution, and wherein provision is made for easily gaining access to the interior of the housing by simply removing the top cover plate, which is above ground level without necessitating the opening of the housing at the main joint between the lower and upper parts of the housing which is below the ground level.

Referring now to the drawings, the reference character 10 designates the main housing of the unit which is preferably of cast construction and adapted for mounting beneath the ground level, as indicated in a suitable pit or trench.

The socket 11 for supporting and conducting current to the lamp 12 is supported by the housing on an adjustable bridge 13 in order to provide for adjusting the vertical position of the lamp, and thus vary the position of the light center.

The housing 10 is provided with a main cover 14 which is securely attached to a circumferential flange 15 by means of bolts 16, a suitable gasket 17 being interposed in the joint to make it fluid-tight. The main cover 14 has a central opening 18 of somewhat larger diameter than the lamp bulb and through which the lamp bulb extends, as shown.

In order to provide for obtaining the desired light distribution, a prismatic lens 19 is positioned about the lamp bulb and may be supported by the cover 14 on the flanged edge 20 of the central opening or in any other suitable man-

ner. A gasket 21 is interposed between the bottom of the lens 19 and the flange 20 to provide a tight joint.

As shown best in Figs. 1 and 3, the main cover 14 is provided with a plurality of radially-disposed upstanding fin members 22 which serve to protect the lens and permit the wheel of an airplane or other vehicle to pass over the unit without damage thereto. The fin members 22 also serve to support the removable top cover 23 for the lens which is attached by means of screws 24. A gasket 25 is placed between the top cover and the upper edge of the lens to seal the joint.

The top cover 23 is a solid plate which renders the light source practically invisible from a point directly above the unit, and serves to hold the lens 19 in position and to compress the sealing gaskets 21 and 25 when the screws 24 are tightened to secure the cover in place.

In order to provide for utilizing substantially all of the light produced by the lamp 12, upper and lower reflectors 26 and 27 are provided. The upper reflector 26 may be supported directly above the lamp by means of the removable cover plate 23 to which it is attached by means of a screw 28. The lower reflector 27, which is of the double curvature type, is supported beneath the lamp bulb by the flange 20 on the main cover 14. As shown, the reflector is provided with a top flange 29 which rests upon the flange 20. It is to be understood, however, that these reflectors may be supported in any other suitable manner.

As stated hereinbefore, the purpose of this lighting unit is to provide for producing a vertically narrow light beam extending at a slight angle to the horizontal or ground level. It has been found that a total vertical beam spread of approximately 10 degrees gives satisfactory results, although it may be varied, if desired. The path of a number of typical light rays emanating from the light center 31 is shown in Fig. 1. The upper reflector 26 and lower portion of the lower reflector 27 are so coordinated that all of the light striking the upper reflector is directed upon the lower portion of the lower reflector and through the lens 19 in a zone slightly above horizontal, as is indicated by the dotted line *a*. All of the light from the light center which strikes the lower portion of the lower reflector directly is directed through the lens in a zone partially superimposed on and slightly above the first-mentioned zone, as indicated by the lightweight full line *b*. The light which strikes the upper portion of the lower reflector 27 is directed through the lens into a zone slightly less above the horizontal than the two aforementioned zones, as indicated by the dash-dot line *c*. The direct light, as indicated by the heavyweight full line *d*, is directed through the lens into a zone extending from practically horizontal to a point partially superimposed on the aforesaid first and second zones.

As will be readily understood, the light beam thus produced may be spread or contracted vertically by varying the position of the lamp 12 by means of the adjustable bridge 13 on which it is mounted. As shown, the light center 31 is positioned substantially at ground level.

While in this embodiment of the invention the prismatic lens 19 is shown to be of a cylindrical form, it is to be understood that any other suitable shape may be used such, for example, as a truncated cone-shaped lens, or any generally ring-shaped or sleeve-like lens which surrounds the light source or lamp 12 and functions to direct the light therefrom in a predetermined manner as described hereinbefore and which are generally referred to in the lighting art as cylinders, globes, envelopes or refractors. It is to be understood that it is the manner in which the globe, lens, refractor or whatever it may be called, functions to control the light which is of importance and not the particular shape of the globe or lens.

In order to protect the prismatic lens 19 from dust and rain or breakage, a plain lens 32 of glass or any suitable translucent material may be positioned about lens 19 and supported in the same manner. By using a colored lens for this purpose, a light beam of any desired color may be produced.

In the event that it is desired to concentrate the light into one or more restricted horizontal areas or zones, the plain lens 32 may be replaced by a suitable prismatic lens 33 of the type shown in Fig. 4. The lens 33 provides for concentrating the light in two opposite zones, whereas if this lens is not used the light produced by the unit extends in a zone of 360° about the unit. While the lens shown has the prisms on the outer surface thereof, it is to be understood that a lens having the prisms on the inner surface thereof may be used in place thereof to produce the same results.

A typical light distribution curve of the unit is shown in Fig. 2. Curve 34 shows the vertical distribution of light from the unit when a 600-lumen lamp is used, and the curve 35 shows the light distribution for a 1000-lumen lamp. From an examination of these curves, it will be apparent that the beam produced by the unit, regardless of whether it extends completely about the unit in a 360° zone or is concentrated into one or more restricted horizontal zones, is confined to a vertically narrow zone extending at a slight angle to the ground level. Thus it is apparent that the marker light is practically invisible from a point in the air directly over the light, but that the beam becomes visible to the pilot of an airplane when he approaches the landing field at the proper landing angle.

In view of the foregoing description, it will now be apparent that I have provided a runway marker light of sturdy and compact construction which has many advantages over the type of marker lights used heretofore. The principal advantage of the marker light of my invention over those of the prior art results from the fact that provision is made for readily gaining access to the interior of the housing without breaking the sealed fluid-tight joint between the housing and the main cover. The normal location of this joint when the light is installed is beneath the ground level where it is subjected to moisture. Once the joint is made, it should not be opened for repair or cleaning of the light, as such continued opening and closing thereof will result in leakage. By the provision of a removable cover plate 23 located above the ground level, the necessity for removing the main cover from the housing is eliminated. When the cover plate 23 is removed, any part of the unit may be readily removed from inside the housing. The prismatic lens 19 may be removed which then permits a removal of the lower reflector 27. The lamp 12 may be removed for replacement or cleaning without the removal of either the lens 19 or reflector 27. Likewise, if an auxiliary lens 32 or 33 is used, it may be

readily removed for cleaning after the cover plate 23 is lifted. Therefore, it is seen that the unit may be completely serviced without requiring its removal from the pit or trench in which it is mounted, or requiring that any main fluid-tight joint be broken.

Although I have described a specific embodiment of my invention, it will be obvious to those skilled in the art that various changes may be made in the details of construction such as in the proportion and the design of the several co-operating parts without departing from the principles herein set forth and defined by the appended claims.

I claim as my invention:

1. A runway marker light comprising a metal housing adapted to be mounted below the runway surface, a main metal cover member for the housing secured to the upper edge thereof by means of a fluid-tight joint, said cover member having a central opening therein and a plurality of spaced upstanding members surrounding the opening and extending radially therefrom, a lamp mounted within the housing and extending upwardly through the central opening in the cover member, a prismatic lens disposed in surrounding relation to the lamp and supported by the cover member over said opening, a plain lens surrounding the prismatic lens and supported by the cover member, and a metal cover plate for the lens detachably secured to the spaced upstanding members and adapted to engage the upper edge of the plain lens and press the lower edge of said plain lens into engagement with the top of the cover member, thereby to entirely enclose the said prismatic lens.

2. A runway marker light comprising a metal housing adapted to be mounted below the runway surface, a main metal cover member for the housing secured to the upper edge thereof by means of a fluid-tight joint, said cover member having a central opening therein and a plurality of spaced upstanding members surrounding the opening and extending radially therefrom, a lamp mounted within the housing and extending upwardly through the central opening in the cover member, a generally cylindrical prismatic lens supported by the cover member over said central opening, a generally cylindrical plain lens surrounding the prismatic lens, a reflector disposed beneath the lamp and supported by the cover member, a metal cover plate for the lens detachably secured to the spaced upstanding members on the main cover member, and a second reflector secured to said cover plate above the lamp.

3. A runway marker light comprising a metal housing adapted to be mounted below the runway surface, a main metal cover member for the housing secured to the upper edge thereof by means of a fluid-tight joint, said cover member having a central opening therein and a plurality of spaced upstanding members surrounding the opening, a lamp mounted within the housing and extending upwardly through the central opening in the cover member, a prismatic lens supported by the cover member over said opening in surrounding relation to the lamp, a lower reflector mounted beneath the lamp for reflecting light through the lens, a metal cover plate for the lens detachably secured to the spaced upstanding members on the cover member of the housing, an upper reflector attached to the cover plate above the lamp for directing the upward light from the lamp upon the lower reflector whereby substantially all of the light will be utilized, and a second prismatic lens positioned about said first lens for concentrating the horizontal light distribution into one or more predetermined restricted areas.

4. A runway marker light comprising a bowl-shaped metal housing member adapted to be mounted below the surface of the runway, a main metal cover member for the housing having a central opening therein, a lamp mounted in the housing and extending upwardly through the opening in the cover member, a prismatic lens surrounding the lamp and supported by the cover member, a plain protective lens for the prismatic lens supported by the cover member, and a metal cover member for the top of the lens and protective lens detachably secured to the cover member of the housing.

5. In a runway marker light, in combination, a bowl-shaped metal housing member adapted to be mounted below the surface of the runway, a main metal cover member for the housing having a central opening and a plurality of upstanding spaced members thereon, said cover member being detachably secured to the upper edge of the housing by means of a fluid-tight joint, a lamp supported from within the housing in a vertical position with a portion of bulb extending upwardly through the central opening in the cover member, a prismatic lens disposed in surrounding relation about the exposed end of the bulb and resting upon the edge of the opening in the cover member, a plain lens supported by the cover member in concentric relation with the prismatic lens, and a metal plate member disposed above the top edges of the prismatic lens and plain lens and detachably secured to the said spaced upstanding members of the cover member.

6. A runway marker light comprising a metal housing member comprising upper and lower sections joined together by means of a fluid-tight joint, said lower section being adapted to be set into the runway surface, a lamp supported within the housing, a prismatic lens disposed in surrounding relation to the lamp and supported by the upper section of the housing, a ring-shaped transparent protective member for the lens supported by the upper section of the housing and a removable cover plate attached to the top of the upper section of the housing.

7. A runway marker light comprising a metal housing member having upper and lower sections joined together by means of a fluid-tight joint, said lower section being adapted to be set into the runway surface, a lamp supported within the housing, a prismatic lens disposed in surrounding relation to the lamp and supported by the upper section of the housing above the surface of the runway, a bowl-shaped reflector supported from the upper section beneath the lamp, a removable metal cover plate attached to the top of the upper section, and a second bowl-shaped reflector supported from the cover plate directly over the lamp.

8. A runway marker light comprising a metal housing member comprising upper and lower sections joined together by means of a fluid-tight joint, said lower section being adapted to be set into the runway surface, a lamp supported within the housing, a prismatic lens supported by the upper section of the housing, a sleeve-like protective member of translucent material disposed about the lens and supported by the upper section of the housing, and a removable cover plate attached to the said upper section.

9. A runway marker light comprising a metal housing adapted to be set into the runway surface and provided with a top opening, a lamp mounted in the housing, a prismatic lens for controlling the vertical light distribution mounted at the top of the housing above ground level and surrounding the lamp, a second prismatic lens surrounding said first mentioned lens for controlling the horizontal light distribution, and a removable cover plate for the top opening in the housing.

10. A runway marker light comprising a metal housing adapted to be set into the runway surface and provided with a top opening, a lamp mounted in the housing, a generally ring-shaped prismatic lens mounted at the top of the housing and surrounding the lamp, a generally ring-shaped member of transparent material surrounding said lens, and a removable cover for the top opening in the housing, said cover including a removable plate providing access to the lamp.

11. A runway marker light comprising a bowl-shaped metal housing member, a main metal cover member for the housing having a central opening and a plurality of upstanding spaced members thereon, said main cover member being detachably secured to the upper edge of the housing by means of a fluid-tight joint, a lamp supported from within the housing in a vertical position with a portion of the bulb extending upwardly through the central opening in the main cover member, a sleeve-like prismatic lens disposed about the exposed end of the lamp bulb and resting upon the edge of the opening in the main cover member, a sleeve-like plain lens of translucent material disposed about the prismatic lens and also resting upon the main cover member, and a removable cover plate secured to the spaced upstanding members of the main cover plate above the said lens and plain lens of translucent material.

12. A runway marker light comprising a bowl-shaped metal housing member adapted to be set into the surface of the runway, a main metal cover plate for the housing having a central opening provided with an inwardly extending flange and a plurality of spaced upstanding radial members disposed about the central opening, said main metal cover plate being secured to the upper edge of the housing by means of a fluid-tight joint, a lamp supported from within the housing and extending upwardly through the central opening in the main cover plate, a prismatic lens disposed about the upper end of the lamp bulb and supported by the inwardly extending flange on the main cover plate, a generally ring-shaped protective member of translucent material supported by the said flange in concentric relation about the lens, a reflector mounted beneath the lamp bulb and supported from said flange, and a metal cover plate for the lens and protective member detachably secured to the spaced upstanding radial members of the main cover plate.

13. A runway marker light comprising a metal housing adapted to be mounted below the runway surface, a main metal cover mmeber for the housing secured to the upper edge thereof by means of a fluid-tight joint, said cover member having a central opening therein and a plurality of spaced upstanding members surrounding the opening and extending radially therefrom, a light source mounted within the housing and extending upwardly through the central opening in the main cover member, a prismatic lens mounted at the top of the housing adjacent the light source and supported by the main cover member to extend upwardly above the runway surface for concentrating the light from the source in a vertically narrow zone extending at a slight angle to the horizontal and a detachable cover plate for the prismatic lens supported by the spaced upstanding members on the main cover member above the prismatic lens.

14. A runway marker light comprising a metal housing adapted to be set into the surface of the runway, a main metal cover member for the housing joined thereto by a fluid-tight joint that may be positioned at or below the runway surface, said main cover member having a central opening therein surrounded by spaced upstanding guard members extending radially therefrom, a lamp mounted within the housing and extending upwardly through the central opening in the main cover member, a prismatic lens supported by the main cover member adjacent to said lamp above the runway surface for controlling the light distribution of the lamp to produce a vertically narrow beam of light extending at a predetermined angle of less than ninety degrees to the horizontal, a bowl-shaped reflector supported by the main cover member below the light source in the lamp to increase the intensity of the beam and a cover member for the housing detachably secured to the spaced upstanding guard members above the prismatic lens.

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