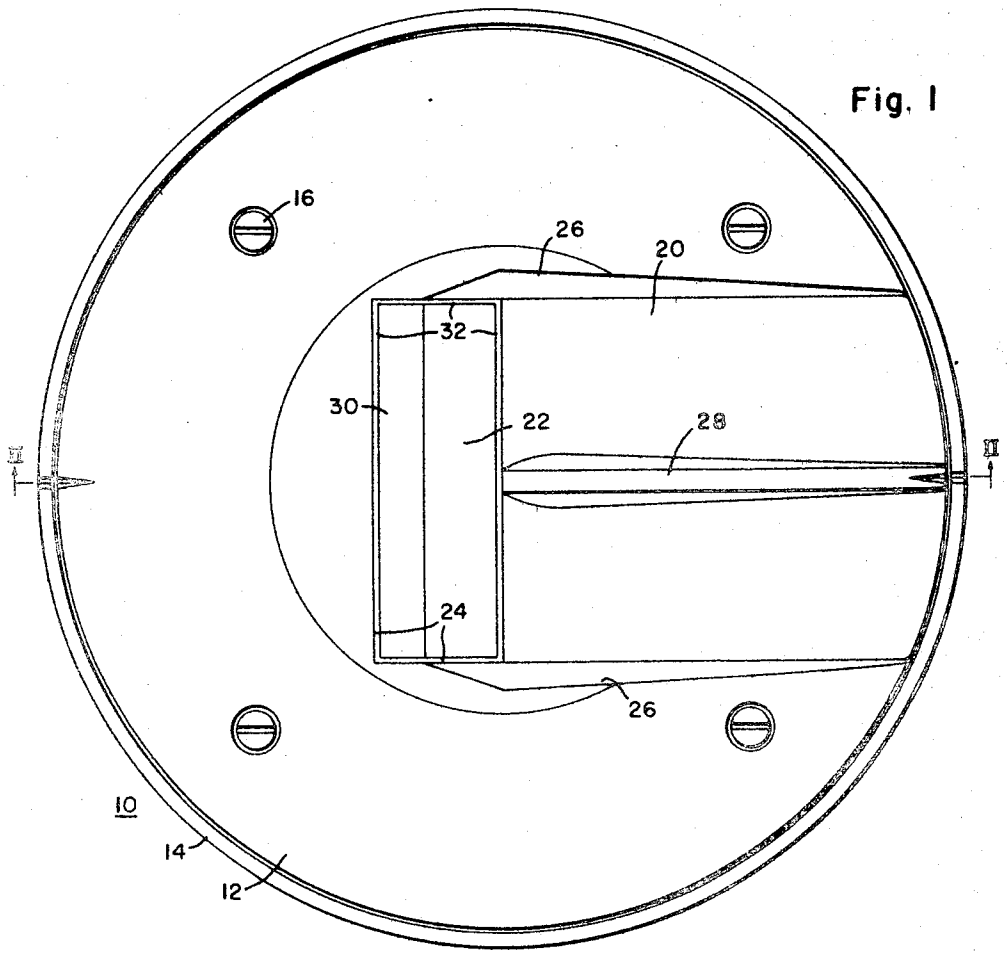
May 10, 1966 C. H. LOCH 3,250,906

RUNWAY LIGHTING UNIT

Original Filed Dec. 5, 1961 2 Sheets-Sheet 1

Fig. 1



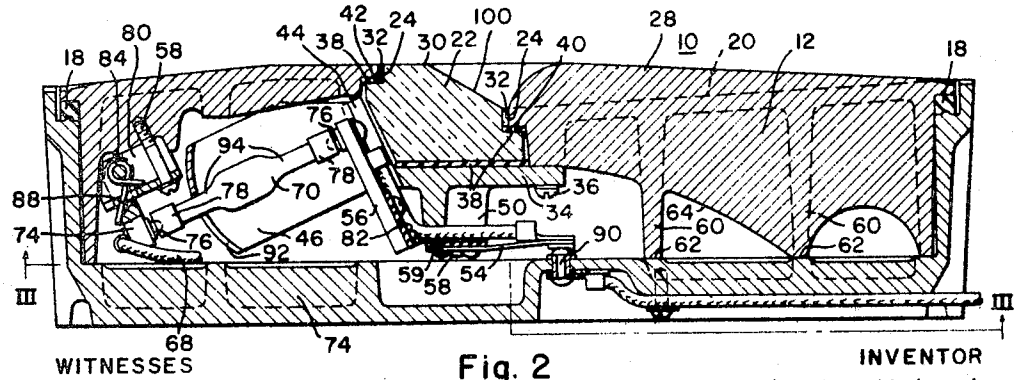


Fig. 2

WITNESSES

John E. Hearly, Jr.

James T. Young

INVENTOR

Charles H. Loch

BY

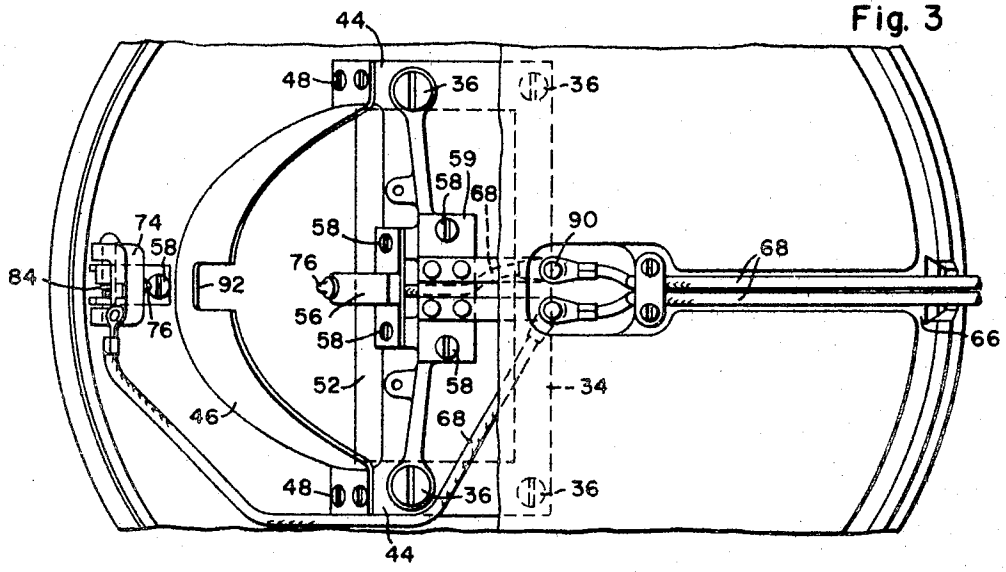
ATTORNEY

May 10, 1966 C. H. LOCH 3,250,906

RUNWAY LIGHTING UNIT

Original Filed Dec. 5, 1961 2 Sheets-Sheet 2

Fig. 3



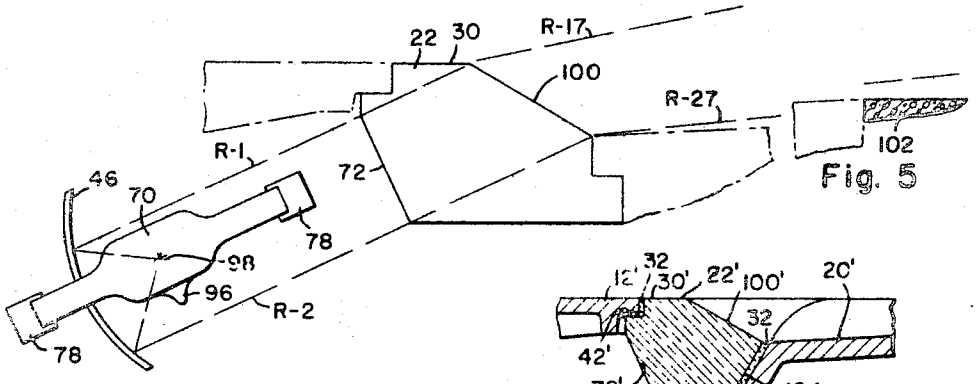


Fig. 5

Fig. 4

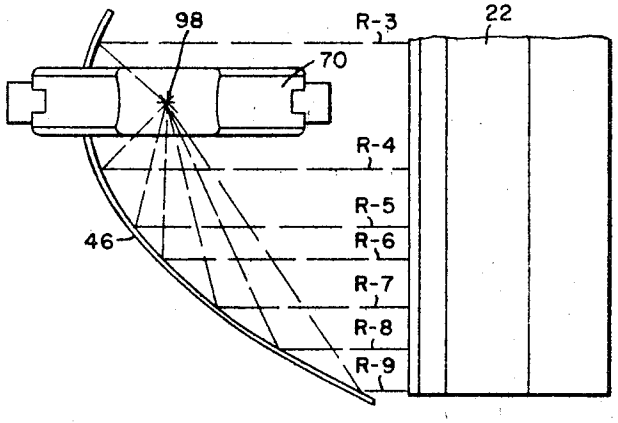


Fig. 6

United States Patent Office 3,250,906 Patented May 10, 1966

3,250,906

RUNWAY LIGHTING UNIT

Charles H. Loch, Berea, Ohio, assignor to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Continuation of application Ser. No. 157,218, Dec. 5, 1961. This application Mar. 25, 1965, Ser. No. 444,935
15 Claims. (Cl. 240—1.2)

This application is a continuation of copending application Serial No. 157,218, filed December 5, 1961 by the same inventor and assigned to the same assignee and now abandoned.

This invention relates generally to flush-type runway approach lighting units, and more particularly to a unique optical system therefor which presents a novel reflector and light source arrangement for producing a more efficient and powerful light distribution than heretofore known.

With the advent of high-speed jet aircraft, many new problems have been created for both military and civilian airports. Among these is the need for better lighting to ensure instant and continuous identification of the runway position and configuration for the pilot. To increase the safety margin for planes that land at high speeds, many airports have extended the paved area several feet beyond the runway threshold, or well into the area normally occupied by approach lights. This means that some of the approach lights have been forced to go underground, that is, to be embedded in the runway, so as to eliminate obstructions in this overrun area of the runway. In this way several flush approach lighting units have evolved.

In certain previous designs, there has been an inability to produce a sufficiently effective light distribution with high-powered lamps such as a 200 watt tubular quartz lamp having an iodine gas fill. By the present invention, relating to a different optical arrangement and utilizing particularly a novel reflector and lamp combination, optimum use of light flux from a high-powered lamp has been obtainable so as to direct light through an especially designed prism to present a light beam generally parallel with the runway surface in a substantially recessed lighting fixture. By use of the present invention, a wider beam is obtainable and means is provided to prevent damage to the prism by objects which are likely to engage the lighting fixture in its installed position, such as tail hooks of aircraft or runway snowplows.

Accordingly, it is an object of the present invention to provide a novel optical arrangement for the more efficient application of a high-powered light source for a flush mounted runway lighting fixture.

Another object of the present invention is to provide a novel optical system wherein an elongated quartz lamp is mounted generally transversely rather than parallel to a reflector contained therein.

Still another object of the present invention is to present a novel optical system providing for an even distribution of light rays from an elongated lamp extending transversely to a reflector.

A further object of the present invention is to provide a novel light source, reflector and prism arrangement for providing a substantially broad and even light distribution for a flush-mounted runway lighting unit.

Still a further object of the present invention is to provide a unique lampholding arrangement for containing an elongated lamp within a relatively shallow runway lighting housing.

A still further object of the present invention is to provide a new prism type lens for a runway lighting unit particularly adapted for providing a high-powered wide-

spread beam substantially flush and generally parallel with a runway surface.

Another object of the present invention is to provide a novel support means for the prism mentioned in the previous object.

And still another object of the present invention is to provide a rib within a lighting cavity so as to prevent objects from interfering with the lens of a runway unit without substantially interfering with the light rays passing from a lamp.

Briefly then, it can be seen that in furtherance of the foregoing and other objects that the present invention relates to a novel combination of an elongated preferably high-powered lamp, curved reflector, and prism to produce a substantially wide beam of light making optimum use of the light flux from the lamp to present a beam substantially parallel to flux with a runway surface from an inset type lighting fixture. The invention further comprehends a novel quick release and engaging arrangement for holding the elongated lamp in a generally perpendicular position with respect to a generally transversely extending reflector and prism, with the main body of the lamp extending therebetween. The invention further envisions a novel prism for receiving light rays from such a high-powered light source as is necessary in present narrow gauge lighting systems. A modified housing is also comprehended so as to provide a rib in the lighting cavity, without generally interfering with the light beam presented by the high-powered light source, to prevent undesirable objects from damaging the lens of the lighting fixture.

The above and other objects of the invention will become more apparent upon consideration of the following detailed description of a runway lighting unit incorporating an optical system and its physical supporting elements constructed in accordance with the principles of the present invention, when taken in conjunction with the following drawings, in which:

FIGURE 1 is a top plan view of an inset flush mounted lighting unit constructed in accordance with the principles of the present invention;

FIG. 2 is a cross-sectional view of the unit of FIG. 1 taken generally along the reference line II—II thereof;

FIG. 3 is a partial bottom view of the top casting and optical assembly of the lighting unit of FIGS. 1 and 2 taken generally along the reference line III—III of FIG. 2 with the lamp removed for purposes of clarity;

FIG. 4 is a partial cross-sectional view of a modified top casting illustrating a novel lens supporting arrangement;

FIG. 5 is a view similar to FIG. 2 only primarily directed towards the optical system and light ray traces and eliminating, for clarity, other mechanical structure unnecessary to show the system, and including a portion of the runway surface in which said assembly is mounted; and,

FIG. 6 is an optical system view similar to that described in FIG. 5 only showing instead a partial bottom view of the optical system shown in FIG. 5.

Referring more particularly to FIGS. 1 to 3, it can be seen that the lighting unit of this invention is generally of a circular configuration and is unidirectional in nature. The housing **10** contains a top casting assembly **12** which is designed to be mounted in a bottom receptacle **14**, which in turn is adapted to be set or otherwise permanently formed in a shallow hole in concrete runways, taxiways, approaches, and the like, so that the top surface of the assembly **12** is then substantially flush with the top surface of the concrete surface involved. It is generally desirable that the uppermost limit of the top surface of the assembly **12** be not more than a fraction of an inch above the runway surface. The bottom receptacle **14** is

adapted to receive the casting assembly **12** in much the same manner as that shown in the hereinafter mentioned copending applications. It is because the exact configuration of the bottom receptacle **14** is not important to the concept of the present invention that it is not shown in more detail herein, especially as to its interconnection with respect to the top casting assembly as through means of bolts **16**, for example. For a more detailed explanation as to the interengagement between the top casting assembly **12** and the receptacle **14**, the operation of the bolts **16**, and the securing and sealing of the two elements together, such as by way of the gasket **18**, reference can be made to copending application by W. A. Pennow et al., Serial No. 53,006, filed August 30, 1960 entitled "Runway Lighting Unit," now Patent No. 3,113,726, and owned by the present assignee.

The top casting assembly **12** has a somewhat triangularly or trough-shaped cavity **20** therein to provide a light channel in front of a refracting optical or prismatic lens **22** located in an opening or window **24** at the inner end of said channel. The top surface around the cavity **20** has been cut away slightly to present inclined side portions **26**. The inclined side portions **26** minimize the possibility of snowplow wheels, aircraft tail hooks and the like from snagging on the lighting unit or damaging the lens thereof.

The shape of the trough in front of the lens **22** is particularly such that it will readily lend itself to cleaning by brushes of runway sweepers. To this end, the trough **20** is kept as shallow as possible, consistent with beam requirements, and includes the sloping side **26** to eliminate, as much as possible, corners and notches that would collect dirt and be more difficult to clean. The slope of exit face **100** of the lens **22**, to be discussed in more detail hereafter, is inclined with this in mind. If this face **100** were not so inclined, but approached the perpendicular to the plane of the runway surface, it would make a corner more difficult to clean. Located generally centrally along the longitudinal length of the cavity **20** is a rib **28** to further aid in preventing the above aforementioned objectionable objects from entering the cavity **20** and injuring the prismatic lens **22**. The exact cooperation of the rib **28** with respect to the optical system will be described in more detail hereafter.

The prismatic lens **22** is generally similar to that illustrated in FIGS. 1 and 2 of copending application by M. E. Keck et al., Serial No. 92,049, filed February 27, 1961 and entitled "Runway Lighting Unit," and owned by the present assignee. That is, it contains an exposed top surface **30** and is secured into position by opposite side flanges nestled in the casting and is sealed in the opening **24** by means of the sealing material **32**. However, the prismatic lens **22** is somewhat different in shape to more efficiently accommodate the new optical arrangement of the present invention and is substantially wider to provide for a more intense, or higher candlepower beam. Also, the prism **22** is held in place by a casting **34**, rather than by a plate, the casting being adapted to carry the greater loads that are imposed on the longer top surface of the prism **22**. Another supporting arrangement shown in FIG. 4 will be described later.

It is desirable because of the higher wattage lamp intended to be used with the lighting fixture of the present invention, and also to accommodate the larger prism structure employed, that the top casting **12** have a larger diameter than that illustrated in the aforementioned copending application Serial No. 53,006. Of course, the primary reason for the larger diameter is to be able to obtain more candlepower at lower angles by using a larger trough in front of the lens. But this larger diameter also provides more surface area for heat dissipation from the bottom receptacle to the surrounding pavement. This results in a lower temperature level in the fixture and on the outside surface of the receptacle. The lower temperature in the receptacle will permit the use of lower cost cement to mount the light in the pavement.

The prism **22** is clamped into place in the top casting by an elongated mounting casting **34** which is anchored on three sides around the prism by screws **36**. A gasketing material **38** is placed between the bottom surface of the prism **22** and the casting **34**. This gasket material **38** serves to accommodate any slight irregularity or unevenness on the mating surfaces of the prism and casting. Two flange surfaces **40** and **42** generally run the length of the prism **22**, one along the front side, the other on the back side, respectively. It can be seen that additional portions of hard gasket material **38** are also located on these flanges between the glass and the top casting. The thickness of the gasket material **38** is chosen such that when the prism is mounted in place, it is compressed to firmly hold the prism from moving. Since the top surface **30** of the prism is exposed to traffic, the mounting casting **34** must carry any loads applied to the prism **22** without deflecting in such a way that would impose undue stress on the prism causing it to break.

Instead of the prism being supported by a separate clamping casting **34**, by slightly changing the prism flanges, as in FIG. 4, for example, the clamping casting **34'** can be made an integral part of the top casting **12'** and the prism **22'** is inserted in place from the top side of the casting **12'**. In such an arrangement, the prism **22'** is held in place by a suitable sealing compound **32** around the prism, the prism **22'** seating on gasketing material **38**. The prism surfaces or faces **30'**, **72'** and **100'** are substantially similar to their respective counterparts **30**, **72** and **100** of the prism **22**. However, bottom prism faces **102** and **104** of the prism **22'** are different from those of prism **22** so as to mate with inclined seating contours **106** and **108** at the inner end of the trough **20'**. As is obvious, the contour **108** is sloped upwardly to prevent prism **22'** from moving forwardly into the trough **20'**. This does have the advantage of requiring few parts for mounting and supporting of the prism.

The upward projecting flanges or bosses **44** (FIGS. 2 and 3) are used to position and mount the reflector **46** through means of the screws **48**. Other bosses such as **50** and **52** serve as mounting points for the contacts **54** and stationary lampholder **56**, respectively, through means of screws such as **58**.

The bottom face of the casting assembly **12** is built up around a series of concentric ring-shaped ribs **60**, the bottom of which meet corresponding surfaces **62** in the receptacle **14** to serve as load carrying elements. They are particularly circular shaped for ease of machining and are interrupted only when necessary to accommodate other parts of the lighting unit. The ribs **60** are tied together by other transverse ribs **64** to give the necessary strength and rigidity. Besides containing surfaces **62** to match the ring-shaped ribs **60** of the casting, the receptacle **14** contains recesses or wireways **66** for electric leads **68** used in connecting the electrical system of the lighting unit **10** to an outside source of electric potential.

The receptacle **14** is preferably made of aluminum or other similar material to provide maximum heat dissipation. The lamp **70** is generally elongated and is preferably of a tubular quartz type having an iodine gas fill to form a beam of high intensity. Of course, it is understood that other types of lamps can be used if desired. The lamp **70** is generally disposed normally to the central surface of a reflector **46** and the entrance face **72** of the prism **22**. The lamp **70** is mounted using a stationary lampholder **56** at the end toward the prism face **72**. The other end of the lamp **70** engages a spring loaded movable lampholder **74** for easy removability and placing of the lamp in operative position. Each lampholder has a silver contact **76** of known configuration for engaging the cup ends **78** of the lamp **70**. It is preferred that the lampholders **74** and **56** be made of

aluminum to serve as heat sinks to control lamp temperature. Each lampholder is secured to the top casting **12** through an intermediate insulating piece, such as piece **80** for the lampholder **74** and piece **82** for the lampholder **56**. These are secured to the casting by means of additional screws **58**. The insulating piece **80** further includes a resilient spring **84** which is cammed against the surface **86** of the piece **80** and a flange **88** of the lampholder **74** to resiliently bias the lampholder **74** against the end cup **78** of the lamp **70**. Another electric lead **68** is employed to complete the circuitry to the lampholders. A button-type contact arrangement **90**, similar to that explained also in the aforementioned applications, is employed in the present illustration. An insulating piece **59** is located between the contact **54** and the boss **50** of the mounting casting **34** for obvious reasons.

It can be seen in FIGS. 2 and 3 that one end of the lamp **70** protrudes through a cutout section **92** in the reflector **46**. The notch **92** is shaped to accommodate a flattened end **94** of lamp **70** and serves to index the lamp and keep the seal tip **96** out of the reflected beam area. This cutout section properly locates the center of the light source (lamp **70**) with respect to the curvature of the reflector as will be described in more detail hereafter with respect to FIGS. 5 and 6.

Referring now more particularly to the illustration of the optical system of the lighting unit **10** as shown in FIGS. 5 and 6, it can be readily appreciated that this lighting unit is designed to make optimum use of the light flux from the lamp **70**, and the relation of the components thereof are chosen to be the most efficient possible within the circular configuration and height limitations of that lighting unit. The contour of reflector **46** is preferably a parabola of revolution having a short focal length. However, it is to be understood that an ellipsoidal contour, either partly or wholly and in either the horizontal or vertical direction or modified parabolic or modified ellipsoidal contour can also be used where an even wider beam is required. It is to be noted that the lamp **70** is mounted with its longitudinal axis coincident to the reflector axis and with its filament at the focal center of the reflector, this point being indicated by the reference numeral **98**. As noted previously, the reflector has been notched out through its axis at **92** to accommodate the lamp **70**. In such an arrangement, each side of the reflector **46** is disposed around the lamp filament in the sectors where the most light flux is being emitted from the filament. The beam from this reflector lamp arrangement is essentially rectangular or oval-shaped being wider in a plane through the long dimensions of the reflector, as illustrated by the ray traces of FIGS. 5 and 6. The reflector **46** is parabolic in the vertical as well as in the horizontal plane in the modification of FIGS. 5 and 6. As can be seen, the stationary lampholder **56** blocks direct rays of light from the light source **70**, and consequently the light flux density at that area of the lens **30** in line with the lampholders is minimal. By positioning the rib **28** along this line, the least amount of light is blocked by it, while it still has the previously mentioned advantages.

It can be seen by following the ray traces **R1** and **R2** of FIG. 5, that exit face **100** of the prism **22** turns the beams downwardly to the desired elevation, so as to be generally parallel with the runway surface **102**. It is the intent that light rays **R1** and **R2** enter the entrance face **72** of the prism **22** at an angle generally normal to that face. It is generally only the light rays received by the entrance face **72** and refracted by the exit face **100** of the prism **22** which form the beam which is parallel with the runway surface **102**. Light rays **R3**, **R4**, **R5**, **R6**, **R7**, **R8** and **R9** are reflected into the prism **22** in a generally parallel manner after being reflected off of the paraboloidal curved horizontal contour of the reflector **46**. In the modification shown, all rays are generally parallel to the parabolic axis of the reflector.

Thus, there has been described a novel runway lighting unit of the inset flux-type, having a generally exposed lens for taking optimum advantage of a high-powered light by employing a novel reflector and prism with an elongated lamp generally extending transversely to the light receiving surface of the reflector and prism. Since it is obvious that the invention can be embodied in other forms and constructions within the spirit and scope thereof, as would be apparent to one skilled in the art, it is to be understood that the particular forms shown are but a few of such embodiments. Accordingly, with various modifications and changes being possible, the invention is not limited in any way with respect thereto. Moreover, it is to be understood that certain features of the invention can be employed without a corresponding use of other features thereof.

I claim as my invention:

1. An optical system comprising, a housing including an upper member having a trough in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough, flanges on said upper member extending the length of said elongated trough opening adjacent the upper and lower edges thereof, correspondingly projecting flanges on said lens mating with said upper member flanges to prevent movement of said lens outwardly through the opening in the top surface of said upper member, a flat support casting attached to the underside of said upper member and located contiguous to substantially the entire bottom surface of said lens, said lens having an entrance face disposed at an angle to said support casting, and an elongated light source supported within said housing located generally transversely of the entrance face of said lens and on the side of said lens opposite from said trough so that light rays emitted therefrom pass through said lens and out of said housing through said trough.

2. An optical system comprising, a housing including an upper member having a trough in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough, flanges on said upper member extending the length of said elongated trough opening adjacent the upper and lower edges thereof, correspondingly projecting flanges on said lens mating with said upper member flanges to prevent movement of said lens outwardly through the opening in the top surface of said housing, a flat support casting attached to the underside of said upper member and located contiguous to substantially the entire bottom surface of said lens, said lens having an entrance face disposed at an angle to said support casting, an elongated curved reflector having its longer dimension extending generally parallel with the longitudinal dimension of the entrance face of said lens but spaced therefrom, and a light source located intermediate said entrance face and said reflector and extending transversely thereto so that light rays emitted from said light source pass through said lens and out of said housing through said trough.

3. An optical system comprising, a housing having a trough in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough, means for supporting said lens in said trough, a fixed lampholder support within said housing located generally adjacent and centrally of said elongated lens on the side thereof opposite said trough, a pivotal lampholder support attached within said housing in a generally opposed relationship to said fixed lampholder support and spaced therefrom in a direction generally perpendicular to the longitudinal dimension of said lens, an elongated curved reflector having its longer dimension extending generally parallel with the longitudinal dimension of said lens but having the main body portion thereof disposed between said opposed lampholder supports, and an elongated lamp having a portion thereof extending through a cutout in said reflector, said lamp being supported by said opposed lampholder supports and

being located generally intermediate said reflector and said lens and extending transversely thereto so that light rays emitted therefrom pass through said lens and out of said housing through said trough.

4. An optical system comprising, a housing having a trough in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough, means for sealably supporting said lens within said trough, an elongated parabolic curved reflector having its longer dimension extending generally parallel to the longitudinal dimension of said lens and located on the side of said lens opposite from said trough, a cutout at least partially through a central portion of said reflector, a first lampholder support secured within said housing generally adjacent and centrally of said elongated lens on the side thereof opposite said trough, a second lampholder support attached within said housing adjacent to and rearwardly of said cutout in said reflector, and an elongated lamp having a small extreme portion thereof extending through said cutout, said elongated lamp being supported by said opposed lampholder supports and extending generally transversely to said reflector and said lens, said lamp being releasably supported within said housing.

5. An optical system comprising, a housing having a trough cavity in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough cavity, means for supporting said lens in said opening, a fixed lampholding means located generally adjacent and centrally of said elongated lens on the side thereof opposite said trough cavity, a pivotal lampholder support attached within said housing in a generally opposed relationship to said fixed lampholder support and spaced therefrom in a direction generally perpendicular to the longitudinal dimension of said lens, and an elongated lamp supported by said opposed lampholder supports so as to extend generally transversely of the longitudinal dimension of said lens.

6. An optical system comprising, a housing having a trough cavity in the top surface thereof, an elongated lens matingly located in a correspondingly elongated opening at one end of said trough cavity, means for supporting said lens in said opening, a fixed lamp-holding means located generally adjacent and centrally of said elongated lens on the side thereof opposite said trough cavity, a pivotal lampholder support attached within said housing in a generally opposed relationship to said fixed lampholder support and spaced therefrom in a direction generally perpendicular to the longitudinal dimension of said lens, an elongated lamp supported by said opposed lampholder supports so as to extend transversely of the longitudinal dimension of said lens, and an elongated rib affixed to and extending along the surface of the trough cavity of said housing along an extension of a line through the longitudinal dimension of said lamp.

7. An optical system comprising, a housing having a trough in the top surface thereof, an elongated lens located in a correspondingly elongated opening at one end of said trough, an inclined and bottom extending contour portion at said one end of said trough, inclined and bottom portions of said lens mating with the corresponding portions of said trough, means for sealingly securing said lens in said housing, a lampholder support secured within said housing generally adjacent and centrally of said lens on the side thereof opposite said trough, another lampholder support attached within said housing in a generally opposed relationship to said first-mentioned lampholder support and spaced therefrom in a direction generally perpendicular to the longitudinal dimension of said lens, at least one of said lampholder supports being pivotal, and an elongated light source supported within said housing by said opposed lampholder supports and being located generally transversely of the longitudinal dimension of said lens so that light rays emitted therefrom pass through said lens and out of said housing through said trough.

8. An optical system for a runway lighting unit or the like, said system comprising, a housing having a trough cavity in the top surface thereof, an elongated lens matingly positioned in a correspondingly elongated opening at one end of said trough cavity, means for supporting said lens in said opening, said lens having an entrance face angularly disposed a predetermined amount from the vertical and an exit face inclined from the top surface of said housing to the bottom surface of said trough cavity, a first lampholder support attached within said housing and located generally adjacent to and centrally of said elongated lens on the side thereof opposite said trough cavity, a second lampholder support attached within said housing in a generally opposed relationship to said first lampholder support and spaced therefrom in a direction generally perpendicular to the longitudinal dimension of said lens, at least one of said lampholder supports having a pivotal portion, an elongated lamp releasably supported by said opposed lampholder supports and extending generally transversely of the longitudinal dimension of said lens, terminal means for electrically connecting said lamp to a source of power, an elongated reflector secured within said housing, said reflector having a cutout portion fitting around said lamp intermediate its light center and said second lampholder support, said reflector conformed and positioned to reflect light rays generated by said lamp with reflected rays being generally parallel to one another and generally normal to the entrance face of said lens, and the exit face of said lens conformed to refract said reflected light rays downwardly and substantially flush with a surface to be illuminated.

9. An optical system comprising, a housing having a trough cavity in the top surface thereof, an elongated lens matingly positioned in a correspondingly elongated housing opening at one end of said trough cavity, means for supporting said lens in said opening, a pair of generally opposed lampholder supports secured within said housing along a line generally perpendicular to the longitudinal dimension of said elongated lens, at least one of said lampholder supports having a pivotal portion, and an elongated lamp releasably supported by said opposed lampholder supports so as to extend generally transversely of the longitudinal dimension of said lens.

10. In an optical system, the combination comprising:

(a) a shallow housing adapted to be mounted generally horizontally and having a shallow generally radially disposed trough in the top surface thereof, said housing provided with an elongated opening traversing the inner end of said trough;

(b) elongated light-refracting means located in the elongated opening provided in said housing, said light-refracting means having a substantially flat exterior surface which slants upwardly and away from said trough, and said light-refracting means having an interior surface which is disposed nearer to the vertical than the slanting exterior surface of said light-refracting means to cause light striking such interior surface and traversing said light-refracting means to be refracted downwardly upon exit from the exterior surface thereof;

(c) elongated reflector means supported within said housing and spaced a substantial distance laterally from and also lower than said light-refracting means on the opposite side thereof from said trough and facing the interior surface of said light-refracting means, said elongated reflector means having a predetermined configuration which defines a focal point positioned intermediate said light-refracting means and the body of said reflector means, with light generated proximate the focal point of said reflector means and emanated toward said reflector means being reflected thereby substantially uniformly onto

the interior surface of said light-refracting means; and

(d) lampholder means affixed within said housing and adapted to support a light source proximate the focal point of said reflector means; whereby light generated proximate the focal point of said reflector means is reflected thereby substantially uniformly onto the interior surface of said light-refracting means and in turn is refracted downwardly by said light-refracting means as a beam which is generally horizontal and passes through the trough provided in said housing.

11. The optical system as specified in claim **10**, wherein a light source having a filament is engaged by said lampholder means and is disposed between said light-refracting means and said reflector means, and the filament of said light source is positioned proximate the focal point of said reflector means.

12. The optical system as specified in claim **11**, wherein heat sink means are included within said housing in thermal contact with said light source to remove heat therefrom.

13. The optical system as specified in claim **10**, wherein said elongated reflector means has the configuration of a parabola which is formed by a portion of a paraboloid of revolution.

14. The optical system as specified in claim **13**, wherein an elongated lamp is supported proximate the focal point of said reflector means by said lampholding means and disposed with its elongated dimension generally coincident with the axis of said reflector means.

15. The optical system as specified in claim **13**, wherein said light-refracting means is prismatic in shape having a flat interior light entrance face in addition to the flat exterior light exit face thereof.

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NORTON ANSHER, *Primary Examiner.*