Sept. 13, 1955 C. H. REX 2,717,954

ELONGATED ROADWAY LUMINAIRE

Filed Aug. 16, 1950 2 Sheets-Sheet 1

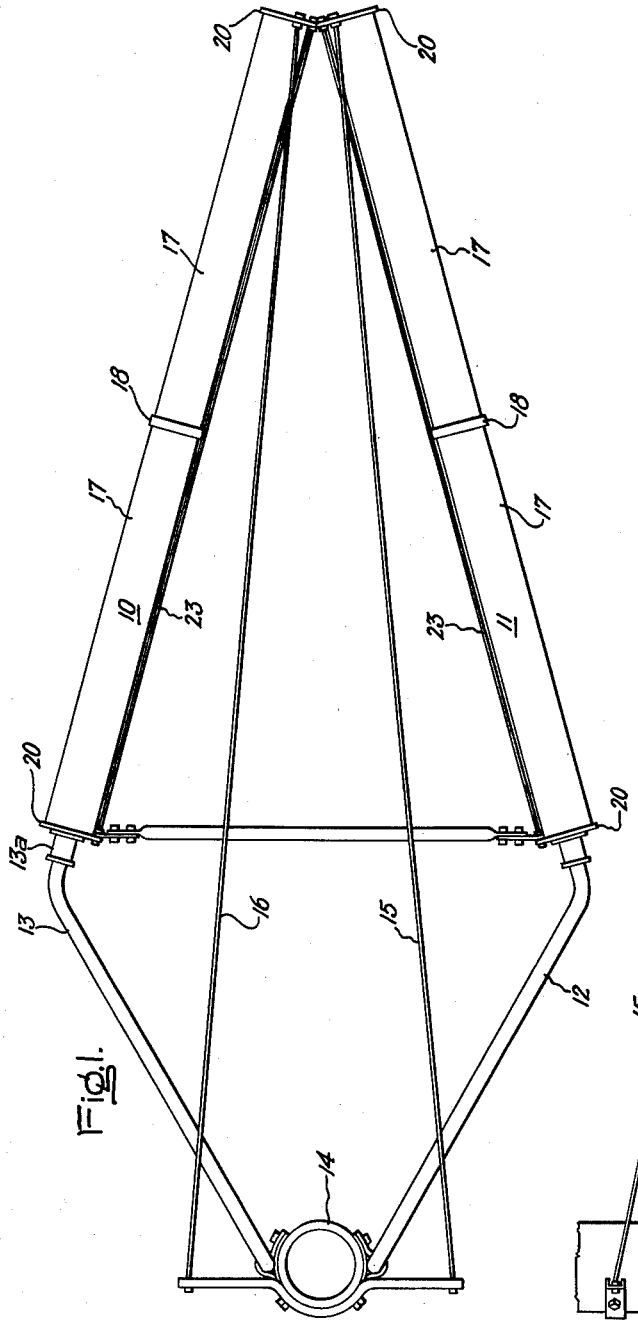


Fig. 1.

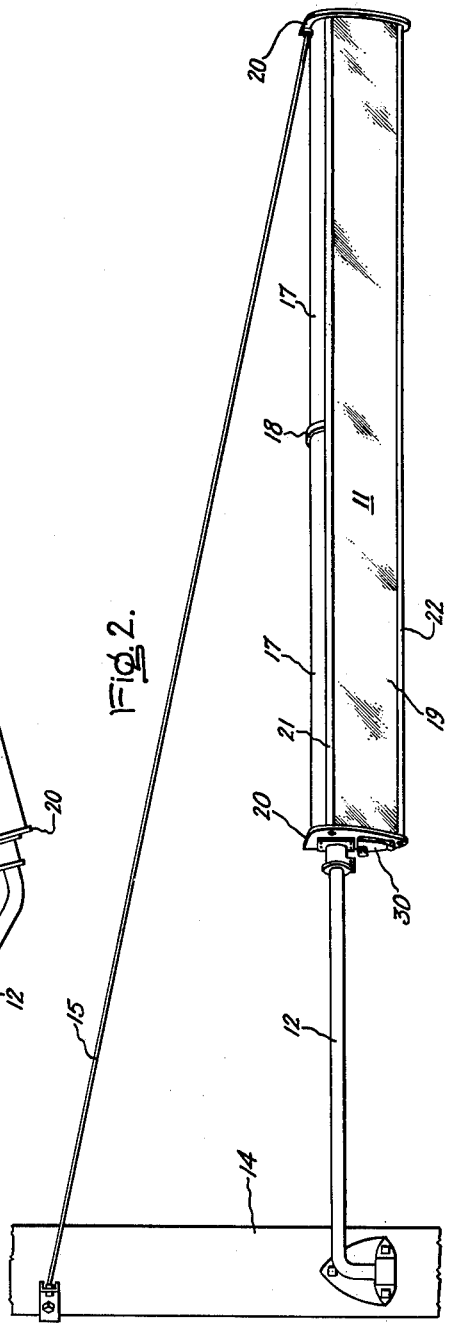


Fig. 2.

Inventor:
Charles H. Rex,

by Charles H. Rex
His Attorneu

Sept. 13, 1955 C. H. REX 2,717,954

ELONGATED ROADWAY LUMINAIRE

Filed Aug. 16, 1950 2 Sheets-Sheet 2

Fig. 3.

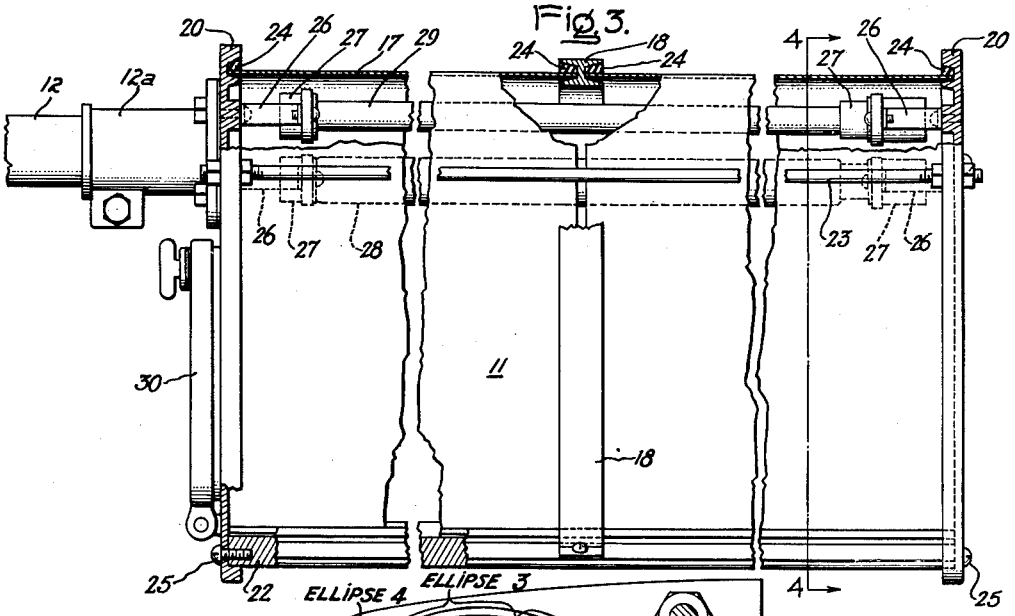
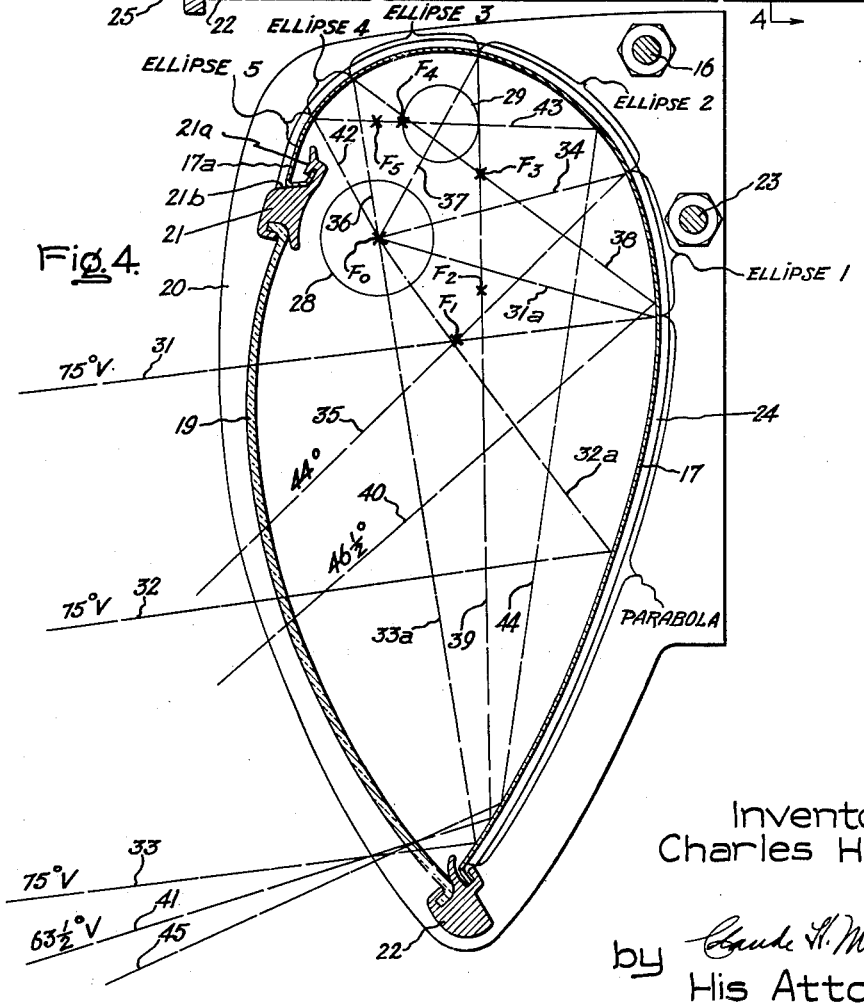


Fig. 4.



Inventor:
Charles H. Rex,

by Clarence A. Mott
His Attorney.

United States Patent Office 2,717,954 Patented Sept. 13, 1955

2,717,954

ELONGATED ROADWAY LUMINAIRE

Charles H. Rex, Marblehead, Mass., assignor to General Electric Company, a corporation of New York

Application August 16, 1950, Serial No. 179,689

5 Claims. (Cl. 240—25)

My invention relates to luminaires, and more particularly to cylindrical, elongated luminaires adapted to receive one or more elongated tubular light sources, such as fluorescent lamps. The invention is especially applicable to street or roadway luminaires of the fluorescent lamp type.

For roadway illumination it is desirable to project a wide flat beam of light downwardly and along the roadway; or, if the luminaire is mounted at one side of the roadway, the wide light beam should be directed downwardly and obliquely across the roadway. For this purpose a fluorescent source, being considerably elongated, is well adapted. With such a source utilized in a unilateral luminaire, it is necessary to control the beam in the vertical plane only, lateral spreading of the beam being unnecessary and lateral direction being provided by orientation of the luminaire itself. The large source area of a fluorescent source is also desirable in street lighting because of its consequently reduced brightness. Elongated cylindrical unilateral luminaires are particularly well adapted for mounting in pairs at the side of a roadway, where they may be mounted in diverging back-to-back relation to provide oppositely directed asymmetric beams without special design of the individual units of the pair.

Accordingly, therefore, it is a general object of my invention to provide a new and improved elongated cylindrical luminaire particularly adapted for street or roadway illumination.

It is still another object of my invention to provide a new and improved street or roadway luminaire having a large source area and low source brightness.

It is still another object of my invention to provide a new and improved cylindrical, inverted trough-shaped luminaire adapted to project a vertically concentrated band of light without redirecting any appreciable amount of the reflected light through the light source.

A further object of my invention is the provision of a new and improved cylindrical, inverted trough-shaped luminaire arranged to project unilaterally therefrom a vertically concentrated beam of light from either one or two elongated tubular light sources of the fluorescent lamp type.

It is still another object of my invention to provide new and novel means for assembling a cylindrical trough-shaped reflector together with a transparent cover plate overlying the open face of the reflector.

A still further object of my invention is the provision of a new and novel roadway luminaire adapted for side mounting and arranged to project obliquely along the roadway in opposite directions broad main beams of light at high angles above the vertical to the nadir.

In carrying out my invention in one form I provide a pair of elongated cylindrical lighting units, or luminaires, of the unilateral type, mounted in diverging back-to-back relation. Each luminaire unit comprises an elongated cylindrical reflector of generally spiral cross-sectional configuration and adapted to receive in the upper portion of smallest radius of curvature an elongated light source.

The reflector has a main rear portion of parabolic configuration arranged to project a wide main beam of parallel light through the open front face, and an upper portion of elliptical configuration curving behind and over the light source to redirect light from the source generally into the main beam without redirection through the source.

My invention itself will be more fully understood and its various objects and advantages further appreciated by referring now to the following detailed specification taken in conjunction with the accompanying drawing, in which Fig. 1 is a top or plan view of a dual-unit roadway luminaire adapted for roadside mounting and embodying by invention; Fig. 2 is a side elevational view of the luminaire shown at Fig. 1; Fig. 3 is a side elevational view, partly in section, of one of the luminaire units illustrated at Figs. 1 and 2; and Fig. 4 is an enlarged cross-sectional view of the luminaire unit shown at Fig. 3, taken along the line 4—4 of Fig. 3 and illustrating the optical characteristics of the luminaire.

Referring now to the drawing, I have illustrated at Figs. 1 and 2 a dual-unit side-mounted roadway luminaire including a pair of cylindrical, elongated inverted trough-shaped luminaire units 10 and 11 disposed in diverging back-to-back relation, each unit being arranged to project unilaterally along and obliquely across the roadway a wide light beam vertically concentrated at high angles from the vertical to the nadir. The elongated luminaire units 10 and 11 are each fixed at one end to supporting pipes 12 and 13 mounted upon a pole 14, and are supported at their outer ends by a pair of tie-rods 15 and 16 fixed to the pole.

Each luminaire unit comprises an inverted trough-shaped cylindrical reflector 17, formed for convenience in two sections disposed in end-to-end relation and connected by a collar 18. The reflectors 17 may be formed of any suitable light reflecting material, such as polished sheet metal having a specular reflecting surface. The reflectors 17 are of generally spiral transverse cross-sectional configuration, as will be more fully described hereinafter, and present at one side between their upper and lower longitudinal edges an open front face enclosed by a transparent cover 19. The cover 19 may, by way of example, be formed of glass or of any desired transparent plastic material. The reflector and cover of each luminaire unit are held together in assembled relation by a pair of end plates 20 which are tied together by connecting rods or bars 21, 22 and 23. The rod 23 is a tie rod located behind the reflector and illustrated at Figs. 3 and 4. The bars or rods 21 and 22 serve also to connect together the reflector 17 and cover 19 in assembled relation, as will be more fully described hereinafter.

Referring now more particularly to Figs. 3 and 4, I have there shown in greater detail one of the luminaire units, i. e. the unit 11, shown at Figs. 1 and 2. Fig. 3 is a rear view of such unit, partly in section, showing the cylindrical elongated reflector sections 17 mounted at their ends in the end plates 20 and the intermediate connecting collar 18. For this purpose the end plates 20 and the connecting collar 18 are slotted along curves corresponding to the transverse cross-sectional configuration of the reflector sections, and the reflector sections are set into these slots and sealed in place by suitable resilient gaskets 24. On the front side of the reflector the transparent cover plate 19 is similarly mounted and sealed in the end plate 20 and the connecting collar 18. The end plates 20 are held together by the tie rod 23 and also by the connecting bars 21 and 22. The bars 21 and 22 are longitudinally slotted, as illustrated at Fig. 4, and positioned in interlocking tongue and groove relation between adjacent longitudinal edges of the transparent cover plate 19 and the reflector 17. As illustrated at Fig. 3, the slotted con-

necting bars **21** and **22** are fixed to the end plates **20** by bolts **25**, and thus serve not only to support the cover glass **19** in the reflector face but also to tie together the end plates **20** and hold the entire luminaire in assembled relation.

The connecting bar **21**, being disposed on the upper longitudinal edge of the reflector, has a cross-section particularly designed to prevent the entrance of water into the luminaire. For this purpose the upper front reflector edge **17***a* is formed to provide an inturned reentrant lip, the slotted bar **21** interlocking with the inner edge of the lip at **21***a* and having a downwardly sloped upper surface **21***b* abutting the lower side of the inturned lip. This sloping edge allows water to run off without backing up and entering the luminaire.

Referring particularly to Fig. 3, it will be observed that the interior face of each end plate **20** is provided with two mounting brackets **26** upon each of which is supported a lamp socket **27**, the sockets being arranged in oppositely disposed and aligned pairs. The oppositely disposed pairs of sockets **27** are adapted to receive elongated tubular lamps **28** and **29**, which may suitably be of the fluorescent type. Electrical connections for the lamps (not shown) may suitably be made through the mounting pipe **12** and a flanged connecting collar **12***a* bolted to the end plate **20** on the pole end of the luminaire. To provide for mounting and dismounting of the lamps **28** and **29** within the luminaire, the end plate **20** adjacent the pole is provided with a hand hole or aperture covered by a hinged door **30**.

Referring now more particularly to Fig. 4, it will be observed that each cylindrical reflector section **17** is generally spiral in transverse cross-sectional configuration with its portion of small radius of curvature at the top, thereby to provide a main lower reflector portion at the rear opposite an open front face and a curved top reflector portion extending over and at least partially shielding the lamps **28** and **29**. Between those longitudinal edges of the reflector **17** defining the open front face of the reflector there is supported by means of the slotted connecting bars **21** and **22** the transparent cover plate **19**. The lamps **28** and **29** thus being mounted in the upper and more constricted portion of the reflector are kept warm by heat retained in this upper portion.

The lower rear or main portion of the generally spiral reflector **17** is of parabolic configuration from a level only slightly below the front upper edge of the reflector to the bottom of the reflector. This parabolic section has its focal point within the reflector adjacent the upper limit of the parabolic section and toward the front of the reflector. The locus of the parabolic focal points taken along the length of the elongated reflector defines a parabolic focal line extending longitudinally of the reflector and indicated at F_0 Fig. 4. The light source **28** is mounted with its axis substantially coincident with this parabolic focal line F_0. The parabolic axes of the rear parabolic lower reflector sections are inclined at a small acute angle below the horizontal, and the loci of these axes taken along the length of the elongated reflector define parabolic axial planes passing through the focal line F_0 and parallel to the reflected light lines **31**, **32** and **33** shown at Fig. 4. Preferably these parabolic axes are inclined at about 75 degrees above the vertical to the nadir, as indicated at Fig. 4. The lines **31**, **32** and **33** represent beams projected from the source **28** along lines **31***a*, **32***a* and **33***a*, respectively, and reflected from various parts of the rear parabolic reflector portion. This lower rear portion of the reflector **17**, then, redirects light from the source **28** along parallel lines defining a main downwardly directed beam of concentrated light disposed at a high angle above the vertical to the nadir.

Above the parabolic lower portion of the reflector **17** the reflector curves upwardly and forwardly over the top of the light sources **28** and **29** in an elliptical curve approaching the focal line F_0. The elliptical top portion of the reflector is connected to form a smooth continuous surface with the parabolic portion, and comprises a plurality of adjacent elliptical segments all of which have their primary foci on the parabolic focal line F_0. Thus, the primary foci of the elliptical top portion of the reflector, taken along the length of the reflector, define a primary focal line coincident with the parabolic focal line F_0. The adjacent elliptical segments of the reflector top are numbered **1** to **5** inclusive, progressing from the rear of the reflector over the top and around to the upper front edge. Each of the elliptical segments **1** to **5**, inclusive, is so shaped and oriented that its secondary focus is spaced apart by a predetermined distance from the parabolic and primary focal line F_0. The loci of the secondary foci, taken along the length of the elongated reflector, thus define a plurality of secondary focal lines lying in parallel spaced relation with respect to the primary focal line F_0. In the illustrated embodiment of the invention the secondary focal lines are indicated at Fig. 4 by the points F_1, F_2, F_3, F_4 and F_5, corresponding respectively to the elliptical sections **1**, **2**, **3**, **4** and **5**. It will be observed that the secondary focal lines F_1 to F_5, inclusive, are substantially equally radially spaced from the primary focal line F_0 and lie generally behind and above the focal line F_0, the secondary focal lines thus lying along an arc of an imaginary substantially circular cylindrical surface disposed generally behind and above the focal line F_0. These secondary focal lines progress around the primary and parabolic focal line F_0 sequentially and in the same rotational order as their associated reflector segments **1** to **5**.

At Fig. 4 I have indicated, by direct and reflected light lines, the manner of redirection of light by each of the elliptical segments **1** to **4**, inclusive, the small segment **5** being omitted to avoid confusion on the diagram. By the lines **34** and **35** I have indicated that light from the source emanating along the line **34** and striking the elliptical section **1** is redirected by single reflection out of the luminaire through the open front face of the reflector and along a line **35** disposed at approximately 44 degrees above the vertical to the nadir. Light from this elliptical section **1**, therefore, is directed lower than the main parabolic beam, and serves to build up the illumination of an area closer to the luminaire than that toward which the main parabolic beam is directed. Similarly, light reflected from the lower or rear end of the elliptical section **2** and passing through the secondary focal line F_2 serves to further build up this illumination close to and immediately below the luminaire.

Light emanating from the source **28** along lines **36** and **37** and reflected by the front part of the elliptical segment **3** and the upper or front part of the elliptical segment **2** is redirected through the secondary focal lines F_3 and F_2, respectively, along lines **38** and **39**, respectively, whereupon it is redirected by secondary reflection along lines **40** and **41**, respectively. This secondarily reflected light is thus directed into the main beam at various angles appreciably above the vertical to nadir, as indicated diagrammatically at Fig. 4.

Finally, light projected from the source **28** along line **42** to the front part of the elliptical segment **4** is reflected along line **43** through the focal line F_4 and then by secondary reflection along the line **44** to the bottom of the reflector, whereupon it is projected by a third reflection along line **45** slightly below the main beam. Light from the source **28** falling upon the last elliptical section **5** is similarly redirected, but has not been shown to avoid confusion in the diagram.

It will now be observed that all light emanating from the source **28** and redirected by the reflector, either by single reflection or multiple reflection, is projected out through the open face of the reflector without passing through the envelope of the tubular light source **28**. It is highly desirable to avoid passing reflected light through the light source, since the intensity of reflected light is

considerably reduced and the temperature of the lamp envelope is undesirably increased by such passage of reflected light through the source. It is principally for this purpose that the secondary focal lines F_1 to F_5, inclusive, of the elliptical segments **1** to **5**, inclusive, are disposed, as described, in parallel spaced relation with respect to the primary and parabolic focal line F_0.

I have also indicated at Fig. 4 that, if desired, a second light source **29** may be positioned eccentrically with respect to the main focal line F_0 of the reflector, but behind and above the principal light source **28** in such a position that it adds to the total illumination emanating from the reflector without appreciably disturbing the light distribution described above. By reason of the eccentric and elevated location of the secondary light source **29**, it will now be evident that light from this source is somewhat diversely reflected, and in general is directed below the main parabolic beam originating at the beam source **28** and projected by the main lower reflector portion. The secondary light source **29** thus serves principally to build up the amount of illumination below the luminaire and at points between the luminaire and the remote portions of the roadway lighting pattern defined by the main parallel beam.

While I have described only a preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art, and I, therefore, wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A roadway luminaire adapted to receive an elongated tubular light source and comprising a cylindrical inverted trough-shaped reflector having a generally spiral transverse cross-sectional configuration and an open front face, the lower rear portion of said reflector opposite said front face being parabolic in cross-section and having a parabolic focal line lying within said reflector adjacent the upper limit of said lower portion, the upper portion of said reflector being elliptical in cross-section and having a primary focal line substantially coincident with said parabolic focal line, said upper portion joining said lower portion to form a continuous curved surface extending upward and horizontally over said focal lines and comprising a plurality of adjacent elliptic segments having secondary focal lines lying within said reflector and positioned in parallel spaced relation with said primary focal line, and means for mounting in said reflector an elongated tubular light source disposed with its axis substantially coincident with said parabolic focal line.

2. A roadway luminaire adapted to receive an elongated tubular light source and comprising a cylindrical inverted trough-shaped reflector having a generally spiral transverse cross-sectional configuration and an open front face, the lower rear portion of said reflector opposite said front face being parabolic in cross-section and having a parabolic focal line lying within said reflector adjacent the upper limit of said lower portion, the upper portion of said reflector being elliptical in cross-section and having a primary focal line substantially coincident with said parabolic focal line, said upper portion joining said lower portion to form a continuous curved surface extending upward and horizontally over said focal lines and comprising a plurality of adjacent elliptic segments shaped and oriented therein to have at substantially the same radial distance from its said primary focal line laterally spaced secondary focal lines lying between said primary focal line and said reflector and positioned in parallel spaced relation with said primary focal line about which they progress sequentially in the same rotational order as their said associated elliptic segments, said lower parabolic portion having an axial plane disposed at a small acute angle below the horizontal thereby to define a main reflected light beam projected downwardly and outwardly from said reflector, and means for mounting in said reflector an elongated tubular light source disposed with its axis substantially coincident with said parabolic focal line.

3. A roadway luminaire adapted to receive an elongated tubular light source and comprising an inverted trough-shaped reflector having a generally spiral transverse cross-sectional configuration, said reflector including an elongated lower parabolic portion at the rear opposite an open front face and including also an elongated upper elliptical portion constituting a top portion of said reflector ad joining said lower parabolic portion to form a continuous curved surface, said lower parabolic portion having a parabolic focal line lying within said top elliptical portion of said reflector and an axial plane disposed at a small acute angle below the horizontal, said top elliptical portion having a primary focal line substantially coincident with said parabolic focal line and comprising a plurality of adjacent elliptical segments having secondary focal lines disposed in substantially parallel spaced relation from said primary focal line and lying along a substantially cylindrical arc within said top portion of said reflector behind said primary focal line, and means for mounting in said reflector an elongated tubular light source disposed with its axis substantially coincident with said parabolic and primary focal lines, whereby all light reflected by said reflector is directed along lines spaced by at least a predetermined minimum radial distance from said parabolic and primary focal lines.

4. A roadway luminaire comprising an elongated inverted trough-shaped reflector having a generally spiral transverse cross-sectional configuration and an open front face, said reflector being disposed with its portion of diminishing radius of curvature forming a top and overhanging front portion and having an inturned reentrant lip at its upper front edge, an elongated transparent cover plate, and a pair of elongated longitudinally slotted connecting bars disposed in interlocking relation between said reflector and cover plate and mounting said plate to enclose said open front face, one said bar interlocking with the inner edge of said reflector lip and having a downwardly sloped surface abutting the bottom of said lip.

5. A luminaire comprising an elongated reflector having a curved transverse cross-sectional configuration and a pair of spaced-apart longitudinal edges defining an open front face, an elongated transparent cover plate, and a pair of elongated connecting bars mounted upon said edges of said reflector and mounting said cover plate to enclose said front face, said connecting bars being slotted longitudinally to receive adjacent edges of said reflector and cover plate in interlocking tongue and groove relation, and a pair of end plates engaging opposite ends of said reflector and cover plate and connected together by said bars to hold said reflector and cover plate in assembled relation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,300,202	Stubblefield	Apr. 8, 1919
1,421,058	Barkschat	June 27, 1922
1,753,885	Gerhardt	Apr. 8, 1930
2,205,310	Robinson et al.	June 18, 1940
2,216,084	Libson	Sept. 24, 1940
2,297,124	Anderson et al.	Sept. 29, 1942
2,304,445	Doane	Dec. 8, 1942

FOREIGN PATENTS

170,610	Great Britain	Oct. 27, 1921
782,163	France	Mar. 11, 1933
783,540	France	Apr. 8, 1935
100,349	Australia	Feb. 22, 1937
477,560	Great Britain	Jan. 3, 1938
357,369	Italy	Mar. 12, 1938
109,077	Australia	Nov. 9, 1939
493,398	Belgium	May 16, 1950
669,180	Great Britain	Mar. 26, 1952