March 19, 1957 W. B. ELMER 2,786,130

STREET LIGHTING LUMINAIRE

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Fig. 1.

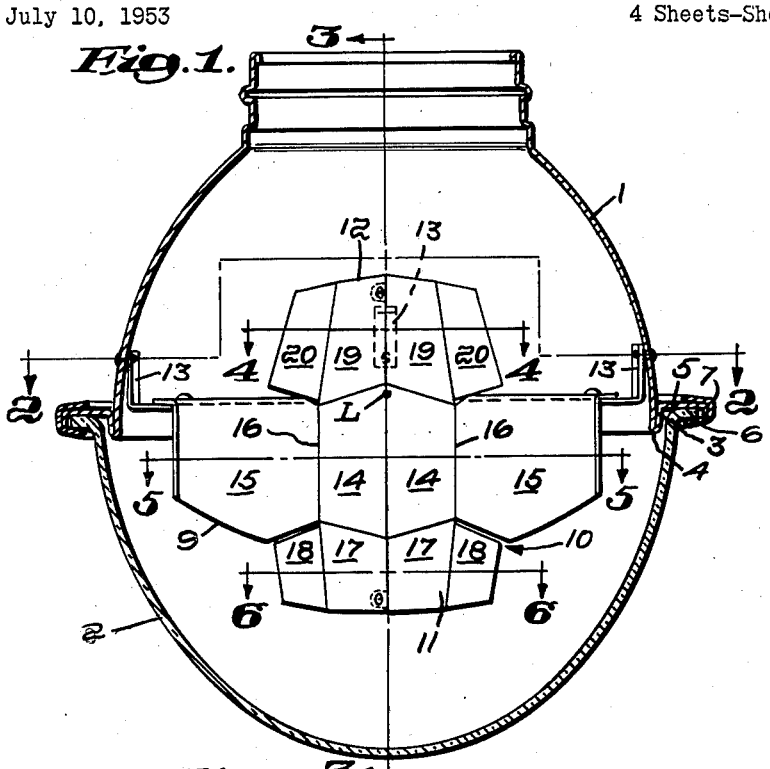
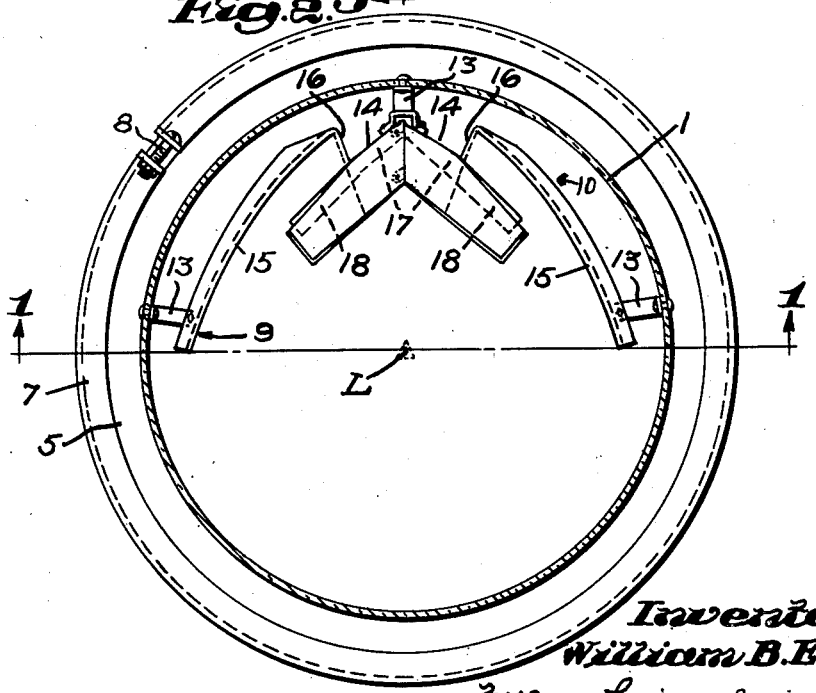


Fig. 2.



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STREET LIGHTING LUMINAIRE

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Fig. 3.

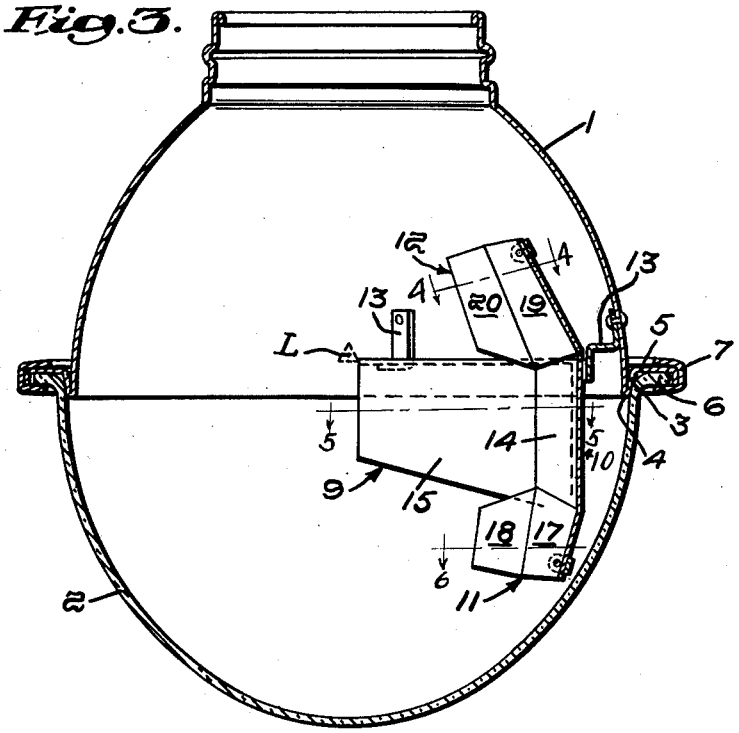


Fig. 4.

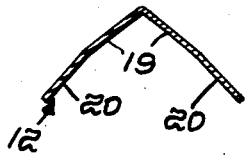


Fig. 6.

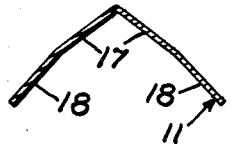
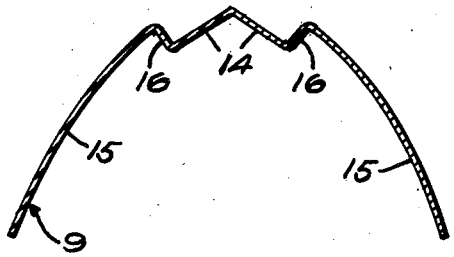


Fig. 5.



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STREET LIGHTING LUMINAIRE

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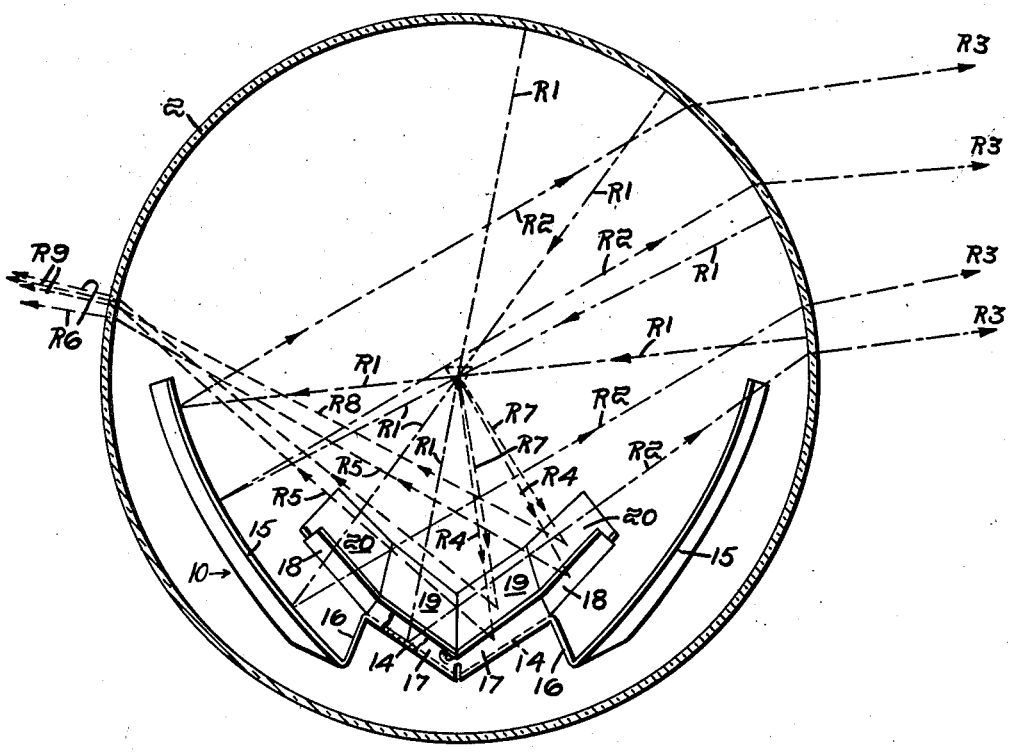
Fig. 2.



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STREET LIGHTING LUMINAIRE

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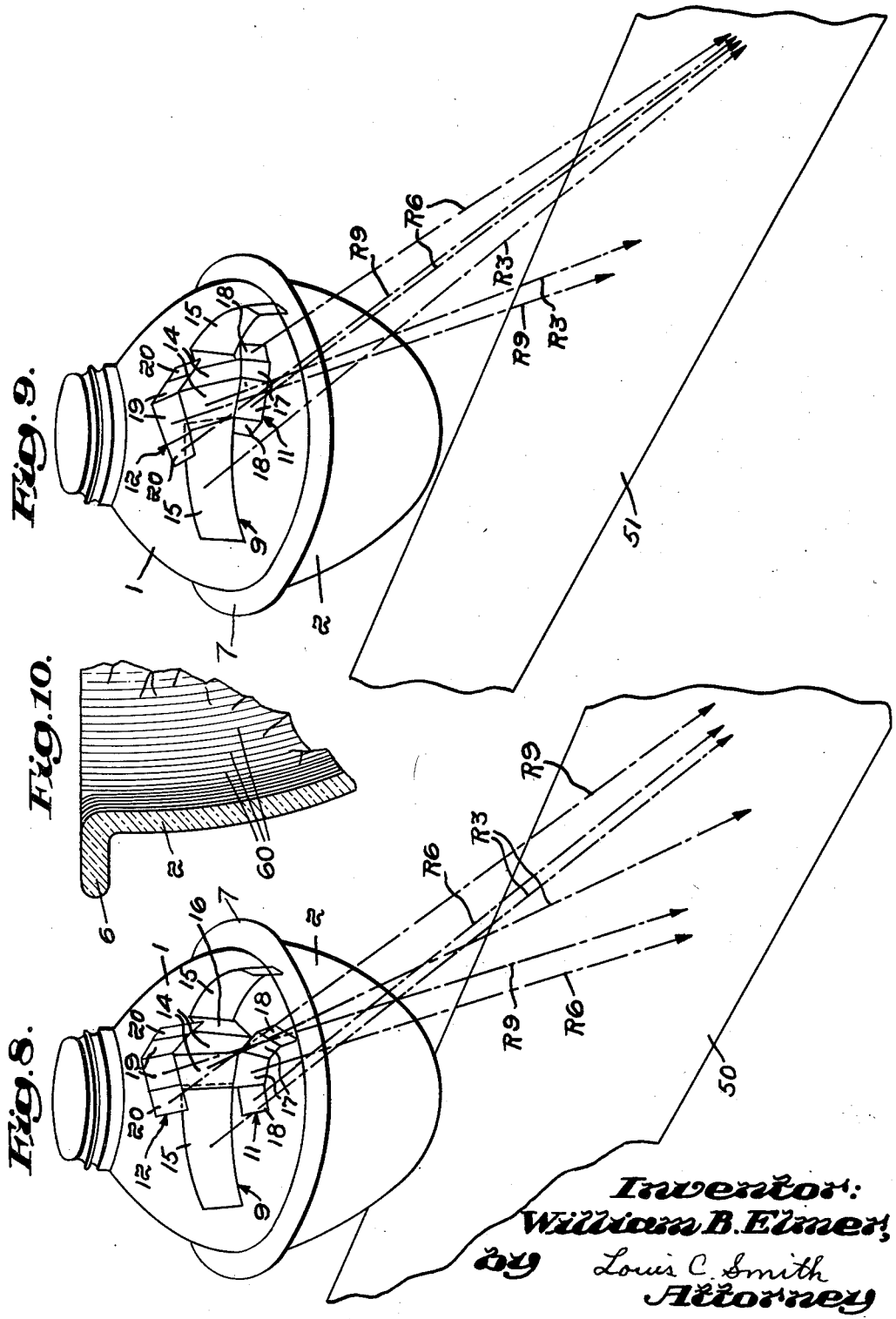

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United States Patent Office 2,786,130 Patented Mar. 19, 1957

2,786,130

STREET LIGHTING LUMINAIRE

William B. Elmer, Boston, Mass.

Application July 10, 1953, Serial No. 367,234

5 Claims. (Cl. 240—25)

Street lighting luminaires which meet most street and highway lighting requirements have been classified generally in five classes or type as follows, the luminaires of each type producing a specific light distribution pattern:

Type 1, luminaire for two-way distribution.—A luminaire of this type is mounted approximately over the center of the street and it produces a light distribution pattern comprising two beams of light extending in opposite directions along the street.

Type 2, luminaire with narrow asymmetric distribution.—A luminaire of this type is mounted at or near the side of the street and it produces a light distribution pattern comprising two relatively narrow light beams extending in the general direction of the street and having a lateral width up to approximately 25°.

Type 3, luminaire with medium width asymmetric distribution.—The light pattern produced by a Type 3 luminaire is similar to that produced by the Type 2 luminaire except that the light beams have a lateral width up to approximately 40°. This luminaire is intended for lighting wide streets.

Type 4, luminaire with asymmetric distribution.—A luminaire of this type delivers a light pattern which is approximately 60° in width in the cone of maximum candlepower.

Type 5, luminaire with symmetric distribution.—This type of luminaire produces a light pattern which is the same throughout 360°.

Street lighting luminaires are commonly made with a reflector and an enclosing globe which may be either a prismatic globe (a globe having prisms for refracting light in a general horizontal direction) or a diffusing globe, and in order to produce the different light patterns specified above it has been customary to employ auxiliary internal reflectors within the main reflector.

Luminaires producing the Type 1 light pattern usually include merely a prismatic globe attached to a common reflector, the prismatic pattern in the globe producing the two-way light distribution pattern.

The light distribution pattern of Type 2 is usually formed by using a different prismatic globe or refractor from that used for producing Type 1 pattern and installing a small auxiliary reflector inside the luminaire to shield adjacent buildings on the street side thereof.

The Type 3 lighting pattern is usually obtained by using a still different refractor from that used in producing Types 1 and 2, and using the same small internal auxiliary reflector referred to above.

Type 4 light distribution pattern is usually obtained by attaching a nonprismatic diffusing globe to the common reflector and using a large auxiliary internal reflector.

Type 5 light distribution pattern is generally obtained by attaching the diffusing globe to a common reflector, no auxiliary internal reflectors being used.

From the above it will be observed that in order to obtain the five light distribution patterns it has been necessary to use four different type of globes or glassware and two different types of internal reflectors. The glassware and the internal reflectors are interchangeable components, and in servicing street lighting luminaires it has been necessary to maintain a sufficient quantity of these six interchangeable components in utility maintenance stockrooms and on trucks used by lamp patrolmen in examining installed luminaires for servicing operations.

One object of my present invention is to provide street lighting luminaire construction by which the five standard light distribution patterns can be produced by using only two different globes and two different internal auxiliary reflectors, thereby reducing from six to four the number of interchangeable parts which it is necessary to maintain in the stockroom and to equip the lamp patrolman's truck.

In order to obtain this end, I have provided a novel interior auxiliary reflector which can be used in producing light distribution patterns of Types 2, 3, and 4, said auxiliary reflector being made to produce either the narrow beam light distribution pattern or the wide beam light distribution pattern, with the same prismatic globe, depending on whether the luminaire is to be used for producing the Type 2 light distribution pattern or the Type 3 light distribution pattern. The wide angle distribution pattern of Type 4 is also produced by the same wide angle auxiliary reflector as is used in producing the Type 3 light distribution pattern in connection with a diffusing globe.

An auxiliary interior reflector embodying my invention is attached to the interior of the main reflector on the house side thereof and presents three reflecting areas, a central symmetrical reflecting area, a lower symmetrical reflecting area located centrally of and entirely beneath the central reflecting area, and an upper symmetrical reflecting area located entirely above the central reflecting area.

The central reflecting area has two similar reflecting portions, both of which are designed to collect light reflected from the main reflector, one of which reflects such reflected light in a beam extending generally lengthwise of the street in one direction, and the other of which reflects a beam of light extending generally lengthwise of the street in the opposite direction.

The lower reflecting area also presents two similar portions, one of which collects direct light from the light source and reflects it in a beam extending generally lengthwise of the street in one direction, and the other of which also collects direct light from the light source and reflects it generally lengthwise of the street in the opposite direction. The lower reflecting area is situated so that it acts as means to shield the houses on the house side of the luminaire from excessive illumination.

The upper light reflecting area, being symmetrical, also presents two similar reflecting portions, both of which reflect direct light from the light source in the form of light beams extending generally lengthwise of the street, one beam extending in one direction and the other beam in the opposite direction. The direct light which is reflected onto the street surface by the upper reflecting area is light which would be normally reflected by the reflector laterally across the street and which, if not diverted as above specified, would cause excessive illumination on the houses on the far side of the street.

In the drawings wherein I have illustrated a selected embodiment of the invention:

Fig. 1 is a vertical sectional view through a luminaire

embodying the invention taken on the line 1—1, Fig. 2.

Fig. 2 is a section on the line 2—2, Fig. 1.

Fig. 3 is a section one the line 3—3, Fig. 1.

Fig. 4 is a section on the line 4—4, Fig. 3.

Fig. 5 is a section on the line 5—5, Fig. 3.

Fig. 6 is a section on the line 6—6, Fig. 3.

Fig. 7 is a light ray diagram illustrating the manner in which the auxiliary reflector operates.

Fig. 8 is a diagrammatic view illustrating the manner in which the auxiliary reflector functions in producing a wide angle light distribution pattern.

Fig. 9 is a similar view illustrating the manner in which said auxiliary reflector functions in producing a narrow angle light distribution pattern.

Fig. 10 is a fragmentary sectional view of a prismatic globe.

The luminaire comprises a main reflector element 1 which is circular in cross section at any point in its vertical axis, this being a common type of reflector used in street lighting equipment. Secured to the lower end of the reflector 1 is a globe 2 having light refracting characteristics. Such globe may be either a prismatic globe having interior prisms 60 as shown in Fig. 10 for refracting light horizontally or a diffusing globe, depending upon the light distribution pattern which it is desired to produce. L indicates the light source.

One feature of the construction herein shown relates to the manner in which the glassware or globe 2 is attached to the reflector 1. As illustrated in Fig. 1, the material of the reflector is bent back on itself at its lower portion as shown at 3, thereby to produce a folded lower edge 4, and the edge portion of the upwardly bent section 3 is bent outwardly to form an attaching flange 5 to which the globe 2 is secured, this attaching flange being located above the lower edge 4 of the reflector 1. The globe 2 has the usual flange 6 at its upper edge and said flange rests against the attaching flange 5 and is secured thereto by a clamping ring 7 having a U-shaped cross section which embraces both flanges, said clamping ring being a split ring, the ends of which are connected by a clamping bolt 8 so that when the ring is applied to the two mating flanges it can be tightened about the flanges to firmly hold the globe in proper position.

An advantage of this construction is that the inner reflecting surface of the reflector 1 extends clear to the lower edge 4 and the upper end portion of the globe encircles the lower edge portion of the reflector and is located above the lower edge 4 thereof. With this construction the reflecting surface of the reflector overlaps the refracting portion of the globe and, therefore, there is no circumferential space between the globe and the reflector which does not either reflect light or receive light to be transmitted and refracted. In other words, there is no circumferential "dead" space between the globe and the reflector.

As stated above, another feature of my invention relates to an interior auxiliary reflector by which the desired light distribution patterns above referred to may be secured. The auxiliary reflector is indicated generally at 10 and it is secured to the inside of the reflector 1 on the house side of the luminaire, it being understood that this auxiliary reflector is used in a luminaire which is mounted on one side of the street as distinguished from being located over the center of the street.

The auxiliary reflector is made with three sections, a central section 9, a lower section 11 located entirely and directly below the central section, and an upper section 12 located entirely above the central section, each section being symmetrical.

The auxiliary reflector may be secured to the main reflector in any suitable way as by means of attaching brackets 13, three such brackets being shown in the drawings.

The central section 9, being symmetrical, presents two similar portions and the entire section has a generally curved formation in a horizontal plane extending through approximately 180°. Each half of the symmetrical central section presents an inner plane reflecting area 14 and an outer or end reflecting area 15 which is slightly curved in a horizontal direction, as best seen in Fig. 2. Each half of the central reflecting section is provided with an offset portion 16 which connects the inner reflecting area 14 to the outer reflecting area 15. The auxiliary reflector is shown as being so mounted that a major portion of the central section 9 is located below the lower edge of the main reflector 1, as indicated in Figs. 1 and 3. Each half of the central section 9, which comprises the reflecting areas 14 and 15, is designed to receive both direct light from the light source and light reflected from the main reflector and directed toward the house side of the luminaire and to reflect such light in a beam directed generally in the direction of the street which is being illumined by the luminaire, one half of the central section directing its light beam in one direction and the other half directing its light beam in the opposite direction. The light beams reflected from the two halves of the central section 9 are received and transmitted by the prismatic globe 2, which refracts said beams into substantial parallelism with the street, thereby producing the two beams of light extending in both directions from the luminaire in the general direction of the street to produce the desired light pattern. The manner in which the central section 9 functions will be more fully hereinafter set forth.

The lower section 11 is located at a lower level than the central section 9 and spans a much shorter angle in a horizontal plan than said central section. Said lower section is designed to reflect direct light from the light source and to deliver the light thus reflected in two oppositely directed beams which become consolidated with the beams reflected from the central section 9 to produce the desired light distribution pattern. The direct light which is received and reflected by the lower section 11 is light which would normally illuminate the house side of the street, and hence the lower section 11 serves as a shield to prevent excessive illumination of houses on said side of the street.

The upper section 12, which also is symmetrical, is located at a higher level than the central section and entirely within the reflector 1. Said upper section operates to reflect direct light from the light source and to deliver such light in two oppositely directed beams which also combine with the light beams reflected by the central section 9 and the lower section 11 to produce the desired light distribution pattern. With this invention, therefore, the street is illuminated by the light beams originated by the central reflecting section, augmented by the light beams originated by both the upper and lower reflecting sections. The upper reflecting section also spans a considerably smaller angle horizontally than the central section. The upper section 12 is positioned to intercept light rays which would normally be received by the house side of the reflector and reflected thereby toward the opposite side of the street, and which if not intercepted by the upper section 12 would excessively illuminate the houses on said opposite side of the street. The upper section, therefore, serves as a light shield for such houses. Both the central reflecting section 9 and the lower reflecting section 11 function to shield from any annoying illumination the houses on the side of the street on which the street light is located, and the upper reflecting section functions to shield the houses on the other side of the street from such annoying illumination. The interior reflector herein described, which is located entirely on one side of the axial line of the main reflector, serves to shield houses on both sides of the street.

Referring to Fig. 7, the arrows R1 indicate light rays which have been received by the reflector 1 direct from the light source and reflected therefrom onto the central section 9 of the auxiliary reflector. The reflected light rays R1 which are received by the inner area 14 of the

central section 9 are reflected thereby in the general direction of the length of the street, as indicated by the arrows R2, and the reflected light rays which are received by the outer curved area 15 will also be reflected thereby in the same general direction as the light reflected from the reflecting area 14, as indicated by the additional arrows R2; hence, the reflected light which is collected by the two areas 14 and 15 of each half of the central section 9 of the auxiliary reflector will be reflected in a beam indicated by the arrows R2. Since the light source L is approximately in the plane of the upper edge of the section 9, the beam of reflected light indicated by the arrows R2 will be inclined downwardly and will be received by the prismatic globe 2 and refracted thereby as indicated by the arrows R3 to form the light beam by which the street is illuminated.

In order to avoid confusion the ray diagram of Fig. 7 shows the manner in which one half only of the central section 9 functions.

The lower section 11 of the auxiliary reflector is also symmetrical and each half presents the two plane reflecting areas 17 and 18, these areas having a slight angular relation to each other and being inclined inwardly and downwardly from the lower edge of the central section 9 as best seen in Fig. 3. Said lower section 11 is designed to receive and reflect direct light from the light source L and, as shown in Fig. 7, the direct light rays from the light source indicated by the arrows R4 which are received by each half of the lower section 11 are reflected thereby as indicated at R5 and form a light beam which is received by the prismatic globe 2 and refracted thereby as indicated by arrows R6 to provide a beam which merges with and augments the beam emanating from the central section of the auxiliary reflector.

It will be noted that the direct light which is received by the lower section 11 is light which is normally directed toward the house side of the street, and since this light is intercepted by the section 11 and reflected thereby to produce useful light for illuminating the street, said section constitutes a light shield for houses on the near or house side of the street.

The upper section 12 is also symmetrical and each half presents two plane reflecting areas 19 and 20 which have a slight angular relation to each other, as shown in Fig. 4, the two halves of said section also having the angular relation illustrated in said Fig. 4. The two halves of said upper section 12 incline inwardly and upwardly from the upper edge of the portions 14 of the central section 9, as best seen in Fig. 3, and said upper section is designed to receive direct light from the light source L which is projected laterally and upwardly and reflect such light in the general direction of the street.

Referring to Fig. 7, the arrows R7 indicate the direct light from the light source which is received by the reflecting areas 19 and 20 of the upper section 12, and the arrows R8 indicate the direction in which the light is reflected from said areas 19 and 20. This reflected light is directed downwardly onto the prismatic globe 2 which in turn transmits it and by refraction directs the reflected light in the general lengthwise direction of the street (see arrows R9), so that the light thus reflected from the upper section 12 merges with and augments the light reflected by the central section 9 and the lower section 11 in producing the desired light distribution pattern.

I have referred above to the light used for illuminating the street surface which is collected by and reflected from the auxiliary reflector. It will be understood, however, that this light constitutes a portion only of the light making up the complete light beam by which the street is illuminated since there is considerable light which is collected by the prismatic globe directly from the light source and refracted into a street illuminating beam, and also considerable light which is reflected from the main reflector and which by-passes the auxiliary reflector and is collected by the prismatic globe and refracted thereby in a direction to augment the street illuminating beam.

The auxiliary reflector collects light which is initially directed transversely of the street and which without said auxiliary reflector would be largely wasted so far as providing a street illuminating light beam is concerned, and puts such light to a useful purpose by so directing it to the prismatic globe that the refractive characteristic of the globe directs said light into the street illuminating beam extending in a dierction generally longitudinally of the street.

An auxiliary reflector having the above characteristics is used in connection with a luminaire having a prismatic globe to produce the light distribution patterns referred to above as Type 2 and Type 3, that is, a narrow angle beam or a wide angle beam. An auxiliary reflector having the above characteristic is also used in connection with a light diffusing globe for producing the Type 4 light distribution pattern.

While the auxiliary reflectors used in connection with the production of Type 2 and Type 3 light distribution patterns have the same general characteristics, yet they differ mainly in the relative angles between the central section 9 and the upper and lower sections 12, 11. For producing the narrow angle beam of Type 2 distribution pattern the upper section 12 has a lesser angle to the central section 9 than is required for producing the wide angle beam of Type 3. For producing the narrow angle beam the lower section 11 is also positioned at a slightly less angle to the central section than is required for the production of the wide angle beam.

This is illustrated diagrammatically in Figs. 8 and 9 wherein Fig. 8 shows the adjustment of the parts necessary to form the wide angle beam and Fig. 9 the adjustment necessary to form the narrow angle beam.

In Fig. 8 the arrows R3, R6, and R9 indicate the light rays which have been reflected from the auxiliary reflector and then refracted by the prismatic globe 2. It will be observed that the arrows R3 correspond to the arrows R3 in Fig. 7 and represent light which was reflected from the areas 14 and 15 of the central section 9. The arrows R6 represent light which was reflected from the areas 17, 18 of the lower section 11 and have been refracted in passing through the prismatic globe, while the arrows R9 indicate the light which was reflected from the areas 19, 20 of the upper section 12 and have been refracted by the globe 2. It will be observed from Fig. 8 that the light reflected from the area 17 of the lower section 11 and the area 19 from the upper section 12 is widely spaced in a lateral direction from the light reflected from the area 15 of the central section 9 and the area 18 from the lower section 11, thereby producing the wide angle beam which is designed for properly illuminating a wide street which is indicated at 50.

When the upper section 12 of the auxiliary reflector has been bent inwardly as indicated in Fig. 9 the light which is reflected from the section 19 and subjected to refraction by the globe 2, and which is represented by the left hand arrow R9, will be less widely separated from the light reflected from the central section and the light reflected from the area 17 of the lower section 11 will also be projected in substantially the same direction as the light originating from the central section and the area 20 of the upper section.

In the adjustment of the auxiliary reflector shown in Fig. 9 the two areas 18 of the lower section 11 are adjusted backwardly so that in producing the light beam illustrated in Fig. 9 the right hand area 18 of the lower reflecting section instead of the left hand area 18 as in Fig. 8 is the active area which produces the light going to make up the light beam in the direction shown. With the adjustment shown in Fig. 9, therefore, a narrow angle light distribution pattern will be produced which is that used in illuminating a narrow street.

In both Fig. 8 and Fig. 9 the same prismatic globe is used, and the difference in the character of the two light beams produced is determined by the angular positions of the upper and lower sections **11** and **12** with relation to the central section **9**.

I claim:

1. In a street lighting luminaire arranged to be positioned on one side of a street and of the type comprising a main symmetrical reflector having an interior reflecting surface, a globe having light-refracting characteristics secured to and depending from said reflector, and a light source enclosed in said reflector and globe, the combination with said main reflector and globe, of an auxiliary interior reflector secured to the interior of the main reflector on the house side thereof and presenting a symmetrical central reflecting section having a generally curved contour in a horizontal plane, the major portion of said central section being located below the lower edge of the main reflector, said central reflecting section extending through an arc approaching 180° having two similar but oppositely disposed portions, each portion being positioned to collect light reflected from the main reflector and to reflect such collected light in a beam directed through the globe and generally in the direction of the street, the beam of light reflected by one of said portions being in the general opposite direction from that reflected by the other portion, said auxiliary reflector also having a symmetrical lower reflecting and shielding section located centrally of and entirely below the central reflecting section and having a horizontal dimension considerably less than that of the central section, said lower reflecting section presenting two similar oppositely disposed portions, one portion positioned to reflect direct light from the light source in a beam directed through the globe and generally lengthwise of the street in one direction and the other portion positioned to reflect direct light from the light source in a beam directed through the globe and generally lengthwise of the street in the other direction, said lower reflecting section being positioned to shield the houses on the near side of the street from direct light from the light source, said globe refracting into merging relation the beams of light originating from the central and lower reflecting sections.

2. A luminaire as defined in claim 1 in which the auxiliary reflector has an upper symmetrical reflecting section located centrally of and entirely above the central reflecting section and presenting two similar but oppositely disposed portions, each portion inclining upwardly and inwardly from the upper edge of the central reflecting section and having reflecting surfaces positioned to reflect direct light from the light source in a beam extending generally lengthwise of the street, each portion reflecting its beam in a generally opposite direction from that reflected by the other portion.

3. A street lighting luminaire as defined in claim 1 in which the central reflecting section comprises two midsection plane reflecting areas arranged at an obtuse angle to each other and two concavely curved end areas.

4. A street lighting luminaire arranged to be positioned on one side of a street and of the type having a main symmetrical reflector provided with an interior reflecting surface and a light source within the reflector, the combination with said reflector and light source, of a prismatic globe below and secured to the lower edge of the main reflector, an auxiliary reflector secured to the interior of the main reflector on the house side thereof and presenting a symmetrical central reflecting section having a generally curved contour in a horizontal plane and extending below the main reflector, said central reflecting section having two similar but oppositely disposed portions, each portion being positioned to collect light reflected from the main reflector and to reflect such collected light in a beam which is directed in the general direction of the street and is projected through the prismatic globe which refracts said beam into substantial parallelism with the street, said auxiliary reflector also having a symmetrical lower reflecting section located centrally of the central reflecting section and entirely below the latter, said lower reflecting section having two similar, oppositely disposed portions, each positioned to reflect direct light from the light source in a beam directed in the general direction of the street and through the prismatic globe, the latter being operative to refract such light beam into merging relation with the refracted beam originating from the central reflecting section.

5. A luminaire as defined in claim 4 in which the auxiliary reflecting section has an upper symmetrical reflecting section located centrally of and entirely above the central reflecting section and presenting two similar but oppositely disposed portions, each portion inclining upwardly and inwardly from the upper edge of the central reflecting section and having a reflecting surface positioned to reflect direct light from the light source in a beam directed in the general direction of the street and through the prismatic globe, the latter being operative to refract said beam and direct it into merging relation with the refracted beam originating from the central and lower reflecting sections.

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