

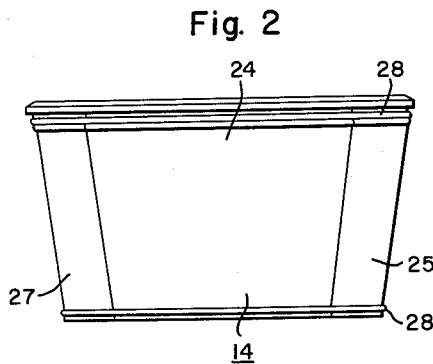
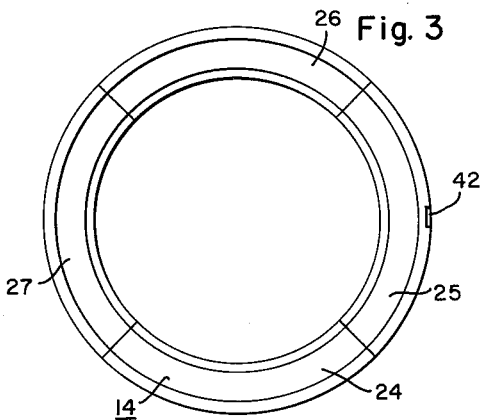
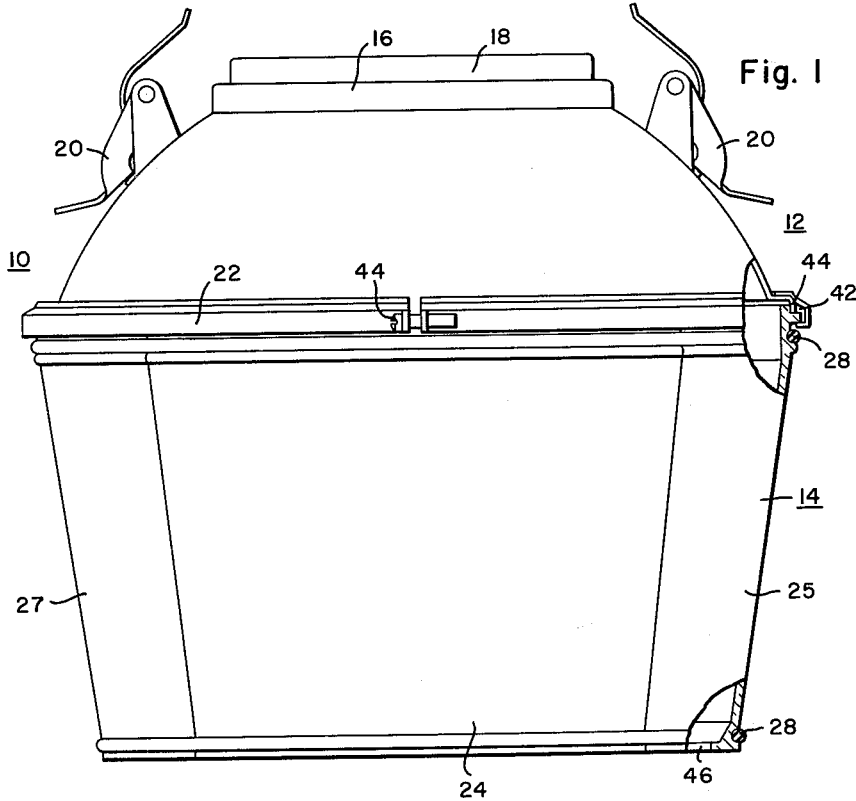
July 30, 1963

D. E. HUSBY ET AL  
LUMINAIRE

3,099,405

Filed Jan. 6, 1961

3 Sheets-Sheet 1



WITNESSES

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3 Sheets-Sheet 2

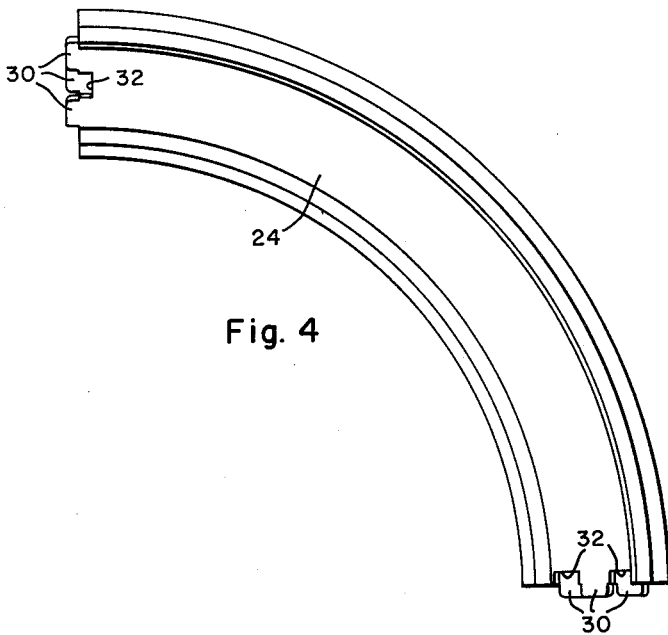


Fig. 4

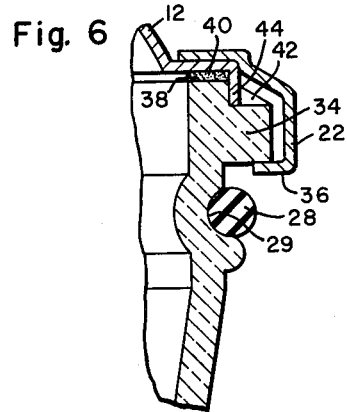


Fig. 6

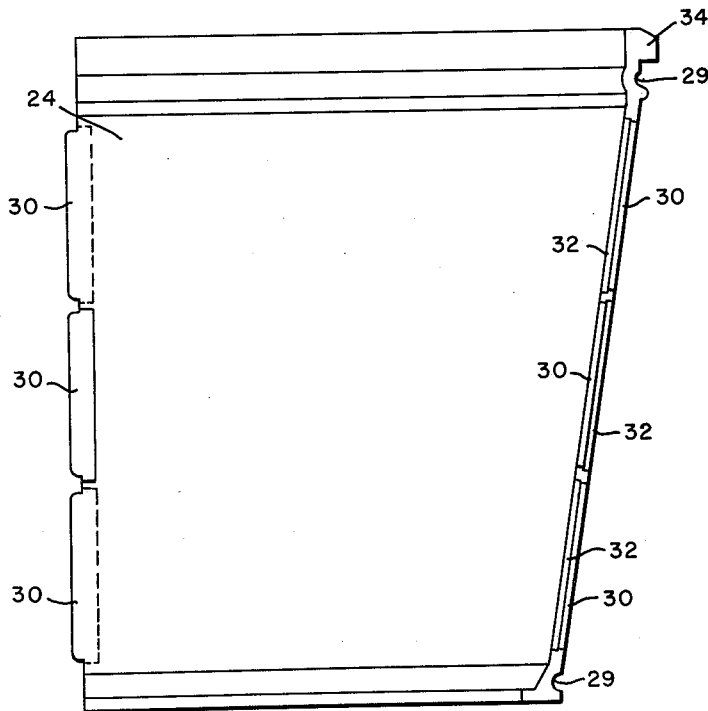


Fig. 5

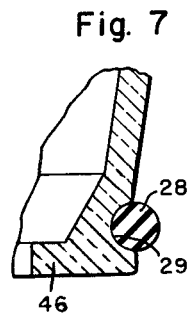


Fig. 7

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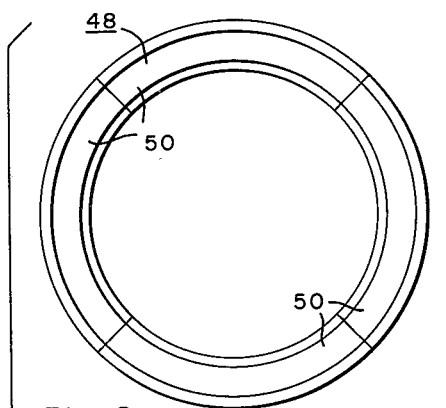


Fig. 8

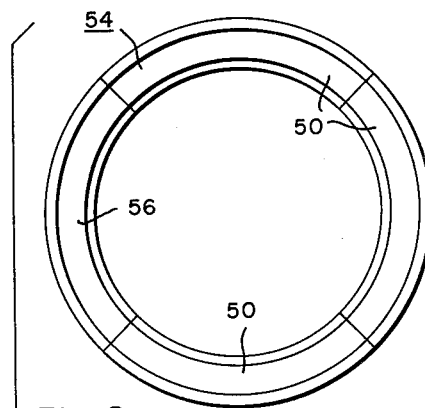
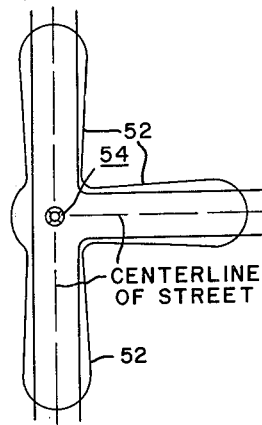
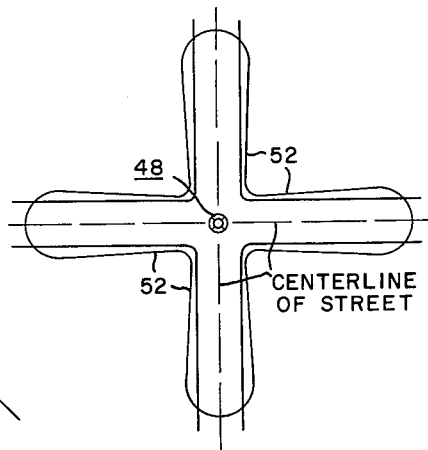


Fig. 9



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3,099,405  
LUMINAIRE

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Filed Jan. 6, 1961, Ser. No. 81,058  
10 Claims. (Cl. 240-106)

This invention relates to streetlighting luminaires and more particularly to a reflector and refractor combination with the refractor being of a segmented type providing for interchangeable parts when desired and for more efficient use of the luminaire under a greater variety of conditions.

Prior to the present invention refractors which were used for the control, direction, or redirection of the luminous output of lamps fell into two general categories. The most common of these was the one-piece refractor designed for one basic light distribution. Since a street luminaire must satisfy many different conditions, such as a luminaire for a cross type intersection, a T-shaped intersection, a right angular corner or turn, a straightaway, etc., this one-piece construction necessitated the design of a separate refractor for each of the conditions presented. Where the one-piece construction is used a separate mold must be provided to achieve each of the distribution types, referencing streetlighting usage for a given lamp. It is thus usually necessary to have fourteen or more molds when single piece refractors are relied upon. When the one-piece construction is utilized, the prismatic structure is molded on both the inner and outer surfaces of the refractor.

The other general category of refractor used prior to the present invention was that designed as a two-piece refractor, that is, having inner and outer refractors combined in one luminaire. This type of refractor is designed so that the distribution is achieved by using one refractor inside of the other. This allows one type of prismatic structure to be molded on the inside of the inner refractor and another type on the outside of the outer refractor, the inner refractor resting within the outer. This construction is more costly than the one-piece due to the duplicity of parts, but does have certain merits when quite specific light distributions are desired. However the disadvantage of the two-piece arrangement is that it is necessary to double the mold tooling and because of this the two-piece refractor is not in common usage.

In view of the complex molding and other disadvantages of the prior art refractors a segmented refractor has been developed within the scope of this invention. The refractor of this invention serves the purpose of accommodating generally vertical burning lamps, either base down or base up, which will provide all of the necessary light distributions utilizing generally just seven molds instead of fourteen or twenty-eight, as in the case of previous refractors, with these seven molds being much less complex and expensive than those previously used.

Accordingly, one of the objects of the present invention is to provide a refractor adapted in an exemplary modification for vertical burning lamps which requires a minimum number of molds to provide the maximum number of different light distributions.

A further object of the present invention is to provide a segmented refractor to provide for differing light distributions.

A still further object of the present invention is to provide a segmented refractor wherein a multitude of combinations may be provided through the alternate use of basic segments of the refractor.

Still another object of the present invention is to provide a refractor which not only reduces the tooling and molding expense but also reduces the number and variety

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of refractors or refractor components necessary to be carried in stock.

A further object of the present invention is to provide a refractor which requires reduced storage facilities since the segmented sections of the invention in storage take less space than the complete refractors of previous luminaires.

Another object of the present invention is to provide a refractor whereby when an individual segment or portion thereof is damaged only that particular segment need be replaced, rather than the entire refractor, so as to reduce user cost and maintenance.

Still another object of the present invention is to provide a refractor which is not only more efficient to operate and maintain but is less expensive to produce.

A further object of the present invention is to provide means for aligning, interlocking and securing together segments of a sectional refractor constructed in accordance with the principles of the present invention.

A still further object of the present invention is to provide a reflector and clamping means joined thereto and adapted to receive a segmented refractor constructed in accordance with the principles of the present invention.

Still another object of the present invention is to provide locating means between the refractor and reflector whereby the refractor can be properly oriented with respect to the reflectors surfaces and the street to be illuminated.

These and other objects of the invention will become more apparent upon consideration of the following detailed description of a segmented refractor streetlighting luminaire incorporating various components constructed in accordance with the principles of the invention when taken in connection with the following drawings, in which:

FIGURE 1 is a side elevational view of a luminaire of the invention with portions broken away to illustrate certain features of the invention;

FIG. 2 is a reduced, side elevational view of the refractor of FIG. 1 without the reflector attached;

FIG. 3 is a top plan view of the refractor of FIG. 2, illustrating the segmented sections thereof in an assembled relationship;

FIG. 4 is an enlarged, top plan view of one segment of the refractor of FIG. 1;

FIG. 5 is an inside and end elevational view of the refractor segment shown in FIG. 4;

FIG. 6 is an enlarged fragmentary view of the upper broken away portion of FIG. 1 and showing a partial longitudinally sectioned view of the refractor;

FIG. 7 is an enlarged fragmentary view of the lower broken away portion of FIG. 1 and showing another partial longitudinally sectioned view of the refractor;

FIG. 8 is a top plan view of a particular segmented refractor arrangement and the lateral light distribution it is adapted to provide; and

FIG. 9 is a top plan view of another particular segmented refractor arrangement and the lateral light distribution it is adapted to provide.

In furtherance of the aforementioned principles and objects of this invention, there is provided a refractor which is composed of a plurality of interfitting and interchangeable segments, the segments being of the same or different prismatic construction as is necessary to provide the proper light distribution for the particular use made thereof.

Variations in light patterns about the circumference of a refractor is possible by shifting segments thereof with differing prismatic patterns or by interchanging a certain segment with one of a different optical quality. Variations of this sort are explained in more detail later with respect to FIGS. 8 and 9.

Although the particular modification shown in the

drawings is adapted to vertically supported lamps the principles of the present invention can equally well be employed for other types of luminaires which use lamps disposed at angles other than the vertical. The segments of the refractor, in this example, are secured together not only through their interlocking tongue and groove portions but by means of snap rings or springs located around the refractor and which are readily releasable when it is desired to interchange or replace a particular segment of the refractor. Provided further by this invention is a luminaire reflector which is adapted to receive a multi-segmented refractor and a clamping band to secure the segmented refractor and reflector together, in an operative and properly orientated position.

Referring more particularly to FIG. 1 there is illustrated a luminaire 10 having a reflector 12 and a refractor 14. The reflector 12, at the top thereof, has housing engaging shoulder 16 and flange 18 which is adapted to fit into a mating bottom aperture in the luminaire housing (not shown) and is secured thereto by means of the conventional hook latches 20. The refractor 14 is supported with the reflector 12 by means of the clamping band 22 which will be described in more detail later.

The refractor 14 in this example is formed in the shape of an inverted truncated cone having an open top and bottom, with the general configuration being frustoconical. The body of the refractor 14, as illustrated in FIG. 3, comprises a plurality of segmented sections 24, 25, 26 and 27. It is of course understood that the number of segmented sections need not be limited to four and need not be limited to the particular shape illustrated herein to come within the principles of the present invention. Each of the segments 24, 25, 26 and 27 are of the same shape and size so that they are completely interchangeable and differ only in their prismatic or optical control surfaces. For example, the segment or section 24 is the same size and configuration as that of the segment 25, as seen in FIG. 3, so that if desired another section 24 could be substituted for the section 25 if desired. The interchangeability of the sections 24, 25, 26 and 27, and a few other similar sections, thus make up a refractor which can provide for differing light distributions depending on which segments are used and in what relationship they are used with respect to one another. Thus, if desired the segments that make up the refractor 14 could just as well all be sections 24 or could include two sections 24 and two sections 27 in opposed relationship. Refer to the later description of FIGS. 8 and 9 for an illustrative example of alternate use of different refractor segments.

The particular configuration of a single section, such as the section 24, is illustrated in somewhat more detail in FIGS. 4 and 5. As there shown, the section 24 is a quarter section of the refractor 14 and has at its opposite free ends the projections or tongues 30 and the grooves 32. It can be seen that the projections 30 alternate on each end and extend from either the inner or the outer surface of the section 24. That is, viewing the right-hand edge of FIG. 5, it can be seen that the top and bottom projections 30 extend outwardly from the outer surface while the middle projection 30 extends outwardly from the inner surface of section 24. The opposite true with the left-hand edge of the section 24 in that here the upper and lower projections 30 extend outwardly from the inner surface while the middle projection 30 extends outwardly from the outer surface of the section 24. Since the tongue and groove features above described, are common to all of the sections, when one section is abutted against another each tongue 30 of one section will mate with a groove 32 of another adjacent section so that an interlocking between these tongues and grooves will occur to align the sections with one another as seen in FIG. 3.

After being aligned and partially interlocked by means of the tongues 30 and grooves 32 the sections of the re-

fractor 14, such as the sections 24, 25, 26 and 27 of FIG. 3, are secured together by means of snap rings or annular springs 28 which fit into the furrows 29 in the upper and lower edges of the sections. These snap rings 28 are readily releasable when it is desired to replace or interchange one section with another, because of their resilient character. The upper and lower furrows 29 in each of the sections are so located within that when abutting sections are properly interengaged, by means of the tongues 30 and grooves 32, they are aligned so that in effect, a single upper and lower furrow 29 encircles the refractor 14. In this way the most effective engagement of the rings 28 in the furrows 29 can be had.

As best seen in FIGS. 5 and 6 the upper edge section of the refractor 14 contains an outwardly protruding flange 34 integrally molded with outside surface of the refractor and which is engaged by a clamping ring return flange 36 to secure the refractor 14 to the reflector 12. In this way the top edge 38 of the refractor 14 is engaged against the bottom shoulder 40 of the reflector 12. To correctly align the refractor 14 on the reflector 12, a notch 42 is provided in the flange 34 in which an indent or projection 44 of the reflector 12 can be engaged when the reflector and refractor are correctly orientated. It is generally only necessary to provide a single indent 44 and notch 42 combination to accomplish the correct alignment of the refractor 14 on reflector 12. Once the refractor is in the correct position for engagement with the reflector, the clamping ring 22 is tightened by means of the screw 44. The clamping ring 22 not only serves to secure the refractor and reflector together but also to aid additionally in securing the segmented sections of the refractor in an interlocked relation in much the same way as the rings 28.

The refractor 14, when in its operative assembled condition thus presents a truncated cone shaped control media wherein the inwardly extending flange 46 forms the open bottom of the refractor and the top periphery 38 forms the open top thereof.

For a more complete understanding of the advantages of interchangeable refractor segments, FIGS. 8 and 9 have been added to show two different lateral light distributions and how the one shown in FIG. 9 can be obtained by the interchanging of a single segment in a refractor used to obtain the distribution shown in FIG. 8. It is, of course, understood that several other combinations can be obtained by using the seven different molds now employed in different arrangement.

FIG. 8 illustrates a refractor 48 having identical prismatic segments 50 all around to give what is known in the art as a Four-way Type I, sometimes called Type IA, lateral light distribution. In this arrangement the distribution curves illustrate four principal light concentrations 52 at lateral angles of approximately 90° to one another, each with a width range of 10° to less than 20°. This distribution is generally applicable to luminaires located over or near the center of a right angle intersection.

FIG. 9 illustrates a refractor 54 having three prismatic segments 50 and one prismatic segment 56 to give what is known in the art as a Three-way Type I lateral light distribution. As is apparent, the refractor 54 differs from the refractor 48 of FIG. 8 in that one segment 56 has been substituted for one of the four segments 50 in order to substantially block off one of the four principal light concentrations 52 shown in FIG. 8. The distribution of FIG. 9 is generally applicable to luminaires located over or near the junction of a T-shaped intersection where little light is desired on the house side of the luminaire.

Thus, it can readily be seen that the segmented refractor of this invention presents a unit which, because of the interchangeability of its segmented sections, requires fewer types of molds necessary to obtain different combinations of prismatic surfaces as is necessary to provide for the many light distributions required in different situa-

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tions. Thus, the number of items necessary to carry in stock is decreased as well as is the tooling expense that is involved. Also an advantage of the segmented refractor is that the storage facilities required are greatly reduced since segmented sections take up considerably less space than complete refractors. Of course, due to the great tendency of refractors of this nature to be damaged sometimes due to natural conditions or juvenile delinquency, it is necessary only to replace the section which is actually destroyed rather than replacing an entire refractor.

Since it is obvious that the invention can be embodied in other forms and constructions within the spirit and scope of the invention, as would be apparent to one skilled in the art, it is to be understood that the particular form shown is but one 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 the corresponding use of other features thereof.

We claim as our invention:

1. An illumination refractor for achieving a predetermined pattern of visible radiations, said refractor comprising:

- (a) a plurality of solid joined curved sections of predetermined limited thickness, each of said sections being substantially similar in size and shape and interchangeable with one another;
- (b) disengageable light-transmitting interconnecting means forming an integral part of oppositely disposed edge portions of each of said sections and substantially positioned within the predetermined thickness dimension of said joined sections, said interconnecting means being complementally formed and interfittingly engaged and joining together oppositely disposed edge portions of each of said sections to an edge portion of other of said sections to form a single open-ended hollow unitary refractor body, and said interconnecting means forming a part of exposed surface portions of said refractor body; and
- (c) each of said sections having predetermined light-refracting properties with respect to light generated within the volume encompassed by said refractor body; whereby a section may be interchanged with another one of said sections to achieve a predetermined light-distribution pattern.

2. The refractor as specified in claim 1, wherein said refractor comprises four of said sections each forming a quadrant of said refractor.

3. The refractor as specified in claim 1, wherein at least two of said sections comprising said refractor have different predetermined light-refracting properties.

4. The refractor as specified in claim 1, wherein said single open-ended hollow unitary body has a frustoconical configuration.

5. An illumination refractor for achieving a predetermined pattern of visible radiations, said refractor comprising:

- (a) a plurality of solid joined curved sections of predetermined thickness, each of said sections being substantially similar in size and shape and interchangeable with one another;
- (b) disengageable light-transmitting interconnecting means forming an integral part of oppositely disposed edge portions of each of said sections and substantially disposed within the thickness of said sections, said interconnecting means being complementally formed and interfittingly engaged and joining together oppositely disposed edge portions of each of said sections to an edge portion of other of said sections to form a single open-ended hollow unitary refractor body, and said interconnecting means forming a part of exposed surface portions of said refractor body;
- (c) an aligned furrow provided in the outer surface of

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each of said joined sections to receive a retaining band;

- (d) a retaining band positioned in said furrow to hold said joined sections firmly together; and
  - (e) each of said sections having predetermined light-refracting properties with respect to light generated within the volume encompassed by said refractor body; whereby an additional section may be interchanged with any one of said sections to achieve a predetermined light-distribution pattern.
6. An illumination refractor for achieving a predetermined pattern of visible radiations, said refractor comprising:

- (a) a plurality of solid joined curved sections of predetermined limited thickness, each of said sections being substantially similar in size and shape and interchangeable with one another;
- (b) disengageable light-transmitting interconnecting means forming an integral part of oppositely disposed edge portions of each of said sections and substantially disposed within the thickness of said sections, said interconnecting means being complementally formed and alternately projecting from the inner surface and the outer surface of said edge portions and interfitting and joining together oppositely disposed edge portions of each of said sections to an edge portion of other of said sections to form a single open-ended hollow unitary refractor body; and
- (c) each of said sections having predetermined light-refracting properties with respect to light generated within the volume encompassed by said refractor body; whereby an additional section may be interchanged with any one of said sections to achieve a predetermined light-distribution pattern.

7. The refractor as specified in claim 6, wherein an aligned furrow is provided in the outer surface of each of said joined sections to receive a retaining band, and a retaining band is positioned in said furrow to hold said joined sections firmly together.

8. The refractor as specified in claim 6, wherein said interconnecting means comprises a plurality of light-transmitting tongues, each of said tongues interengaging with tongues of an adjacent section, and engaging tongues on adjacent sections forming a part of the surfaces of said refractor.

9. The refractor as specified in claim 6, wherein said interconnecting means comprises a plurality of light-transmitting tongues, a tongue-receiving groove provided adjacent each of said tongues, each of said tongues fitting into one of said grooves as provided on an adjacent section and engaging and interfitting with tongues of an adjacent section, and interfitting tongues on adjacent sections forming a part of the surfaces of said refractor.

10. A luminaire having a vertically disposed lamp, said luminaire comprising:

- (a) a reflector having a generally open bottom peripheral portion;
- (b) a refractor comprising,
  - (1) a plurality of solid joined curved sections of predetermined limited thickness, each of said sections being substantially similar in size and shape and interchangeable with one another,
  - (2) disengageable light-transmitting interconnecting means forming an integral part of oppositely disposed edge portions of each of said sections and substantially disposed within the thickness of said sections, said interconnecting means being complementally formed and interfittingly engaged and joining together oppositely disposed edge portions of each of said sections to an edge portion of other of said sections to form a single open-ended hollow unitary refractor body, said interconnecting means forming a part of exposed surface portions of said refractor body, and

## 7

(3) each of said sections having predetermined light-refracting properties with respect to light generated by said lamp within the volume encompassed by said refractor body, and		1,609,277
		1,894,915
		2,071,108
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(c) securing means joining the open bottom peripheral portion of said reflector to an open end of said refractor body.	5	2,281,524
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