Fig. 1 is a plan view of the rear or light-incident face of a spotlight lens;

Fig. 2 is a plan view of a front or light-emergent face of a spotlight lens;

Fig. 3 is a partial cross-section of the lens of Figs. 1 and 2 taken along the section line 3—3 of Fig. 2; and

Fig. 4 is a view illustrating the operation of the lens of Figs. 1 and 2.

This embodiment of my invention comprises a single piece of cast glass 1 which is circular in outline and is generally flat. Fig. 1 represents the light-incident face 2 of the lens and will sometimes be referred to as the rear face. Fig. 2 represents the light-emergent face 3 of the lens and will sometimes be referred to as the front face. For purposes of orientation in the following description, I will designate the horizontal diameters indicated at 4 and 5 of Figs. 1 and 2, respectively, as the first diameters and the vertical diameters 6 and 7 of Figs. 1 and 2, respectively, as the second diameters.

To visualize the complete lens, the reader should imagine that Fig. 1 is placed back to back with Fig. 2. Then, viewing the combination along the section lines 3—3 of Fig. 2, one obtains a cross-section as shown in Fig. 3 in which the upper portion corresponds to the light-emergent face of the lens and the lower portion corresponds to the light-incident face. It will be further understood that this lens is symmetrical about the first diameter and it is also symmetrical about the second diameter.

Referring now to Figs. 1 and 3, the light-incident face 2 of the lens comprises a plurality of arcuate ridges 8 to the left and right respectively of the second or vertical diameter 6 of the lens. As seen in Fig. 1, the arcuate ridges are concave with respect to the second diameter and their radii of curvature are substantially greater than the radius of the lens itself. There is also on the light-incident face a substantially flat central section 10 extending generally along the second diameter 6 on which there are no ridges but which may be specially formed as will be explained below. This central section is bounded by the inmost edges of the arcuate ridges 8 immediately to the left and right of the second diameter.

Each of the ridges 8 on the light-incident face of the lens is a lens surface of negative or divergent refracting power and generally slopes outwardly and rearwardly of the lens. This can best be seen in the cross-section of Fig. 3. Generally, these ridges will not be of uniform width throughout their lengths nor of the same refracting power. Moreover, each ridge has a variable refracting power from its centermost edge to its outermost edge. In practice the optical characteristics of each ridge will be individually adjusted to produce the desired height to width ratio of the resultant light beam. In the particular embodiment being described the inmost ridges are the widest in a direction along the first diameter 4 of the rear face of lens 2 and the ridges further removed from the center of the lens are progressively narrower in the same direction.

To obtain an even diffusion of illumination from the light passing through the central section and the wider ridges I have found it advantageous to provide flutes 11 on the surfaces of these elements of the lens. These flutes are quite shallow and are concave in cross-section when viewed from the rear of the lens. The flutes in the central section of the lens may be generally parallel to the second diameter 6 of the lens and the flutes on the surfaces of innermost ridges follow the curvatures of the ridges. The necessity for these flutes is determined in a particular case by the uniformity of illumination produced in a given area of the beam.

The light-emergent face 3 of the lens, as illustrated in Figs. 2 and 3, is provided with annular ridges 12 which slope generally outwardly and rearwardly of the lens. The optically effective surfaces of the ridges are indicated at 13 and adjacent surfaces 13 are joined by surfaces 14 sloping outwardly and forwardly of the lens. These are preferably coated with an opaque, non-reflecting paint, as indicated at 15. These annular ridges are of progressively increasing refracting power, being positive or convergent spherical lens surfaces. The ridges on this light-emergent face of the lens constitute a conventional Fresnel lens surface.

An annular flange 16 is integrally cast with the lens body 1 and is used in conjunction with a conventional lens mounting means of any suitable type. So that the lens may be readily oriented in its mounting, I preferably provide a small notch 17 in the flange 16 at one extreme of either the first or second diameters of the lens.

With the foregoing description of the structure of my new lens in mind, its method of operation will be readily apparent to those skilled in the art. The arcuate ridges on the light-incident face of the lens tend to spread incident light by a greater amount in opposite directions parallel to the first diameter of the lens than they do in opposite directions parallel to the second diameter. On passing through the body of the lens and emerging through the surfaces of the annular ridges on the light-emergent side of the lens the light is further refracted and distributed to produce a resultant beam which is oval or substantially elliptical in cross-section. By properly proportioning the ridges on the light-incident and light-emergent faces of the lens and by proper adjustment of the respective refracting powers of the ridges, the distribution of light over the cross-section of the resultant beam may be made substantially uniform.

Referring now to Fig. 4, I have illustrated the operation of my new lens in conjunction with a light source 18 and a screen 20. The maximum uniformity of illumination produced with my new lens is obtained with so-called spotlight bulbs which have a series of upright and parallel filament coils arranged in either monoplane, biplane or barrelshaped construction. The lens may be used with other types of light sources and many advantages will still be realized.

With the bulb or light source relatively close to the light-incident face of the lens as indicated in solid outline at 21, and with the first diameters 4 and 5 of the light-incident and light-emergent faces 2 and 3, respectively, horizontal, the beam produced by the lens will have its greatest height and width at a given distance from the lens. In Fig. 4 it is clearly seen that the height of the beam projected on the panel is considerably less than the width of the beam. In any particular design of a lens incorporating my invention, the ratio of height to width of the beam may be given a desired value. For a given design, this ratio will remain substantially constant for any position of the light source with respect to the lens. I have illustrated at 22 in dotted outline the resultant beam produced by my new lens when the light source is relatively far from the lens. This relation of source to lens produces a beam whose absolute height and width are much less than before but retain the predetermined ratio. As the source of light is moved closer to the lens the absolute dimensions of the beam on a screen 20 at any given distance will increase, but the ratio of height to width will remain substantially uniform as previously stated.

My invention is defined in the following claims. The foregoing description of a particular embodiment is merely for purposes of illustration and the scope of the invention is not to be limited thereby.

I claim:

1. A spotlight for producing a beam of light having substantially uniform intensity throughout its cross-section and having greater divergence in opposite directions parallel to one diameter of the lens than the divergence in opposite directions parallel to another diameter perpendicular to said one diameter, the ratio of divergence in one direction to the divergence in the other direc-