

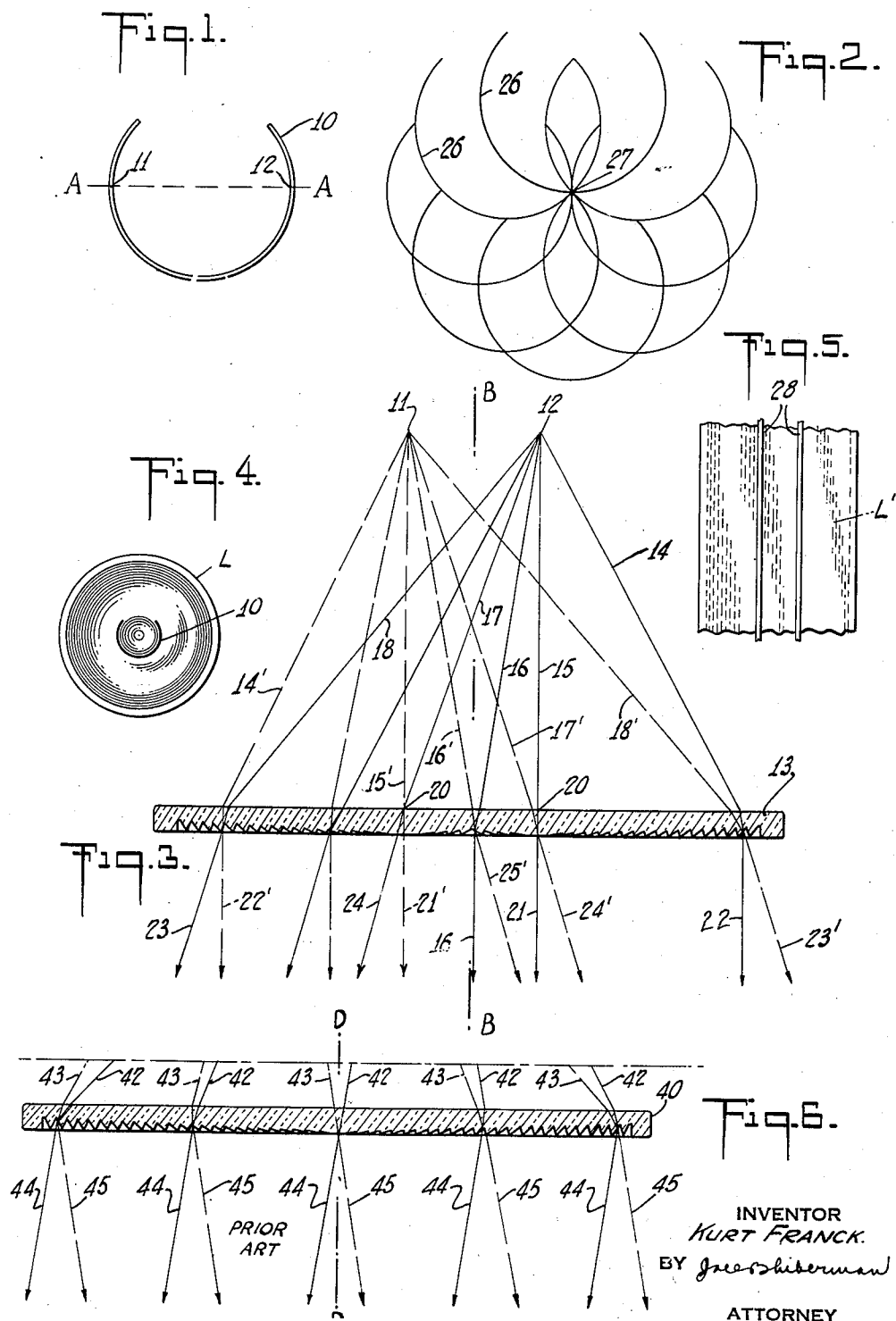
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LUMINAIRE

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LUMINAIRE

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The present invention is directed toward luminaires, and is more particularly directed toward luminaires with light concentrating lenses.

The typical Fresnel lens used for obtaining a concentrated light distribution is one designed to accept light diverging from a focal point and bend all the rays into parallelism with one another so as to produce a beam with minimum divergence. Owing to the physical size of the region occupied by the source, or a plurality of sources, all the rays emitted by the lens cannot be parallel to one another. Convergence of some rays and divergence of others is unavoidable. The divergent rays spread so that areas illuminated increase with the distance, but this does not substantially affect the uniform character of this illumination. The convergent rays, however, meet at numerous spots and bring about excessively bright streaks, or images of the source, or of the multiple source. Such images are particularly noticeable where a high wattage filament, such as 300 or 500 watt ring filament, is used behind the usual lens of a luminaire designed for medical examination. The filament images are very distinct and the examination and diagnosis correspondingly difficult. Even with such diffusion as can be obtained by light etching of the glass the filament image is distinctly visible with a definite dark spot in the center of the illumination pattern. These phenomena are also noticeably present where two tubular or fluorescent lamps are used back of a lens designed to give a concentrating distribution, as the two lamps produce two peaks in the candlepower curve close to the nadir. These peaks may be accentuated by color differences and an out of phase relation.

The present invention contemplates a luminaire having a source of luminosity of substantial dimension on opposite sides of an axis of symmetry, so that the original light rays come from a region larger than the conventional point light source. According to the present invention the luminaire also has a prismatic lens having symmetrical halves on opposite sides of said axis of symmetry and a focal length which equals the distance separating the source from the lens, each half having an optical axis parallel with the axis of symmetry and displaced therefrom in an amount equal to the maximum displacement of the source from the axis of symmetry, whereby overlapping images of the source are produced in regions adjacent to but on opposite sides of said axis of symmetry.

Other and further objects will hereinafter appear as the description proceeds.

The accompanying drawing shows for purposes of illustrating the invention embodiments of the same arranged for annular, or ring type, light sources and for parallel light sources, it being understood that the drawing is illustrative of the invention rather than limiting the same.

In the drawing:

Figure 1 illustrates the ring type filament of a commercial high wattage incandescent lamp;

Figure 2 illustrates the images of a ring type filament produced by the luminaire of the present invention;

Figure 3 is a cross sectional view through a lens profile illustrating the action of the lens prisms on light rays originating in two sources on opposite sides of a lens axis;

Figure 4 is a plan view illustrating an annular lens with ring type filament;

Figure 5 is a plan view illustrating a rectilinear lens with two rectilinear light sources; and

Figure 6 is a fragmentary sectional view indicating the action of a typical light concentrating lens when it receives light from two sources equally displaced from the axis.

The filament of a typical 500 watt incandescent lamp is illustrated at 10 in Figure 1 and occupies substantially a ring about 1 3/8" in diameter, and these filaments are known as ring type filaments. Each point on the filament becomes a light source and in analyzing the distribution of light in an axial plane, such as the plane A—A of Figure 1, it may be assumed that the light comes from two points 11 and 12.

In Figure 3 the two points 11 and 12 are illustrated as being on the opposite sides of a vertical axis of symmetry B—B. A prismatic lens is indicated at 13. Light rays from the source 12 to the right of axis B—B, such as indicated at 14, 15 and 16, fall on the side of the lens 13 to the right of the axis of symmetry B—B and do not cross the axis B—B, while other rays, such as 17 and 18 from source 12, cross the axis B—B and fall on the lens on the left of this axis. Similarly rays, such as 14', 15' and 16' from source 11, fall on the lens without crossing the axis, and rays, such as 17' and 18', cross the axis B—B and fall on the lens.

In Figure 3 of the drawing the rays 15 and 15' are drawn parallel to the axis B—B. Rays 15 and 15' strike the lens in two points 20, 20 opposite which the lower surface of the lens is plain, and these rays pass through without deviation as indicated at 21, 21'. The prisms outside

the points 20, 20 are of increasing refracting power, so that rays such as 14 and 14' are refracted so as to be parallel with one another and the axis B—B (and axis 15 or 15'), as indicated at 22, 22'. Between the points 20, 20 the lower surface of the lens has prisms of increasing refracting power to the center of the lens. These prisms are designed to have a profile so that a light ray such as 16 which fails to cross the axis B—B is refracted out parallel to the axis B—B. Rays such as 17 and 18 and 17' and 18' which cross the axis B—B are bent toward the axis B—B as indicated at 23 and 23' and 24 and 24'. A ray such as 16' which crosses the axis B—B is transmitted as indicated at 25'. Rays 23 and 24 are parallel with one another but diverge from the axis and similarly rays 23', 24' and 25' are parallel with one another but diverge from the axis B—B.

It will thus be seen that there is a balancing of light distribution on opposite sides of the axis of symmetry B—B with a very large portion of the light rays emitted in directions parallel with the axis of the system so as to build up high intensities adjacent the axis of symmetry, and that the remaining rays are emitted in directions of uniform divergence with respect to this axis so as to provide light fringes of gradually lesser intensity.

In the lens of Figure 3 the prisms are designed to have relatively low prismatic action at the periphery of the lens, and this means that the prism depth is small, thereby providing greater optical efficiency and better manufacturing conditions.

When the light source is in the form of the ring filament, as indicated in Figure 1, the lens may be in the form of a round plate, as indicated at L in Figure 4, or square, and the prisms will be of annular conformation. When the prism profile of Figure 3 is used, it will have an annular zone of zero refracting power opposite the points 20—20, an annular outer region of increasing refracting power and a central round area in which the refracting power increases toward its center.

When one employs the round construction contemplated by Figure 3 the ring type filament will produce an infinite number of low contrast images such as illustrated by the arcs 26 in Figure 2, all these arcs intersecting at the center 27 of the illumination pattern, thereby producing an extremely high spot of illumination exactly at the center of the system. The filament images overlap so that a very even pattern of illumination is obtained around the very small, high central intensity spot 27.

In Figure 5 the lens L' is shown as having parallel prisms and the light sources are illustrated in the form of two fluorescent or tubular lamps 28—28. With a lens profile such as previously described it will be apparent that similar light directing is accomplished, the lamp images may be overlapped, and building up of regions of high intensity on opposite sides of and close to the nadir may be avoided.

Figure 6 illustrates a typical Fresnel type lens 40 whose prisms are primarily designed to accept light rays from a point source in an axis D—D and bring them into parallelism. When, however, such a lens is employed with a ring type filament of the type shown and described above, it does not produce a beam of strictly parallel rays, for example, rays fragmentarily illustrated by full lines 42 are considered as coming from

a source (such as 12) on the right-hand side of the lens axis D—D, and rays illustrated by the broken lines 43 are considered as coming from a source (such as 11) on the other side of the axis D—D. The incident rays 42 are concentrated into parallelism with one another as indicated at 44, but they all deviate to the left of the axis D—D, while the rays 43 are transmitted as indicated at 45 all parallel with one another, but they deviate from the axis D—D in the other direction. From an inspection of Figure 6 of the drawing it will be apparent that there is a mixture of diverging and converging rays, and, inasmuch as each point on the lens may be considered optically as a small aperture or pin-hole, there is projected a distinct image of the filament on the working plane. This image is definite in its outline and very high in intensity. This results in a central spot which is distinctly less brightly lighted than the filament image.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular forms shown are but a few of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. In a luminaire, the combination with an incandescent lamp having a ring type filament substantially annular about its axis so that light rays originate at substantial distances from the lamp axis, of a lens disposed transversely of said axis and having annular light concentrating prisms to produce non-centrally located, continuously and progressively overlapping images of the lamp filament, the refracting power of said prisms decreasing from the center of the lens to zero at a distance from the center equal to the radius of the filament ring and then increases toward the periphery of the lens, the refracting power being such that direct light falling on the lens without crossing the axis is concentrated into a cylindrical bundle of substantially parallel rays and the light rays which cross the said axis before reaching the lens are bent into an acute angle to said axis without again recrossing the same and form a peripheral fringe of divergent light.

2. A luminaire comprising a source of luminosity of substantial dimension and having its dominant light output coming from two regions on opposite sides of an axis of symmetry and equally spaced therefrom, and a lens whose profile is symmetrical on opposite sides of said axis of symmetry, each side of the lens having a system of prisms which accepts direct rays from the entire source of luminosity and produces non-centrally located, continuously and progressively displaced regions of luminosity and wherein the refracting power of the said prisms decreases for a finite distance from said axis to a region of zero refracting power and then increases but with the opposite sign beyond said zero region to a substantially greater amount than at said axis and being such that direct rays originating in the corresponding region of the source of luminosity and not crossing the axis of symmetry are concentrated into parallelism with one another and the axis of symmetry, and direct rays originating in the opposite remote region and crossing the axis of symmetry are concentrated into parallelism with one another and emitted in directions slightly divergent from the axis of symmetry,

whereby the light output of the luminaire is characterized by an absence of convergent light and consists of a bundle of substantially parallel rays of substantially the area of the lens for producing a very intensely lighted region adjacent the axis of symmetry and slightly divergent light rays providing light fringes of gradually lesser intensity; the zero regions of the lens being aligned substantially with the two regions of dominant light output of the source of luminosity.

3. A luminaire such as claimed in claim 2, wherein the source of luminosity is in the form of a substantially annular incandescent lamp filament and the prisms are annular with variant refracting power both inside of and outside of an annular region of the same diameter as the filament.

4. A luminaire such as claimed in claim 2, wherein the source of luminosity is rectilinear and prisms are rectilinear and parallel to it.

5. A light concentrating lens for use with a light source of generally annular configuration, said lens being symmetrical on opposite sides of its center, and having a plurality of light refracting elements to produce non-centrally located, continuously and progressively overlap-

ping images of the light source and having a refracting power which decreases for a finite distance from said center to a region of zero refracting power and then increases but with the opposite sign beyond said zero region to a substantially greater amount than at said center, said refracting powers being such as to bend into parallelism light originating in said source at a predetermined distance from the lens.

10 6. A light concentrating lens for use with two parallel spaced light sources, said lens being symmetrical on opposite sides of its median plane, and having a plurality of light refracting elements to produce non-centrally located, continuously and progressively displaced images of the
15 light source and having a refracting power which decreases for a finite distance from said median plane to a region of zero refracting power and then increases but with the opposite sign beyond
20 said zero region to a substantially greater amount than at said median plane, said refracting powers being such as to bend into parallelism light originating in said sources at a predetermined
25 distance from the lens.

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