W. CHURCHILL.

SIGNALING LENS.

APPLICATION FILED NOV. 26, 1907.

974,123. Patented Nov. 1, 1910.

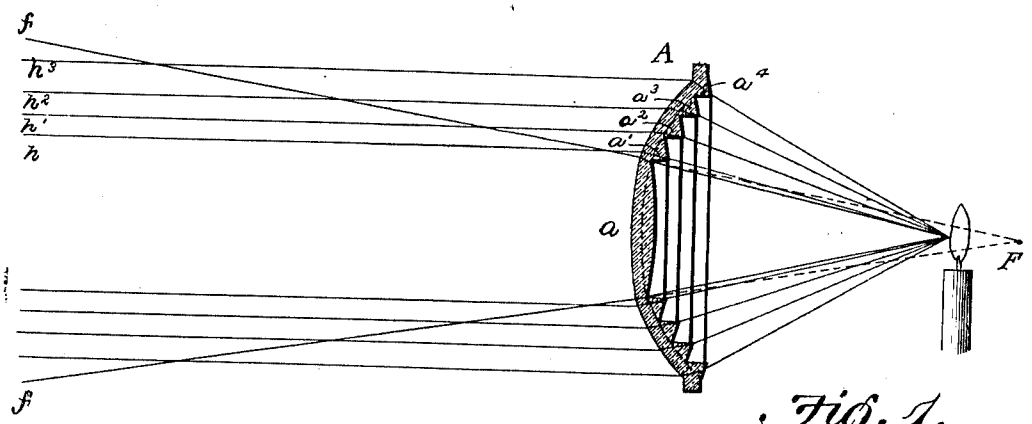

Fig. 1.

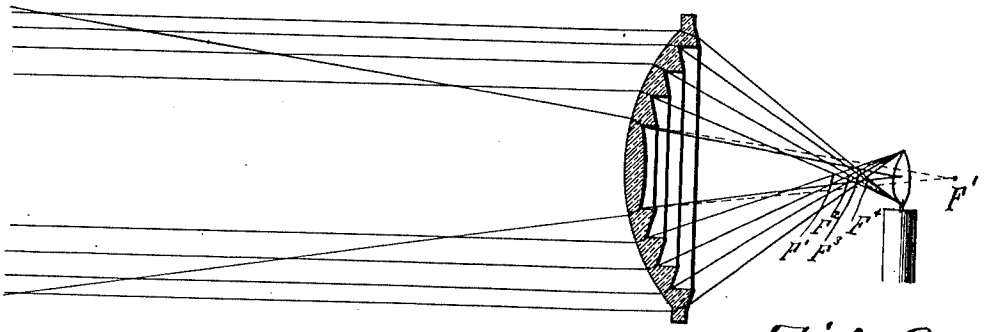

Fig. 2.

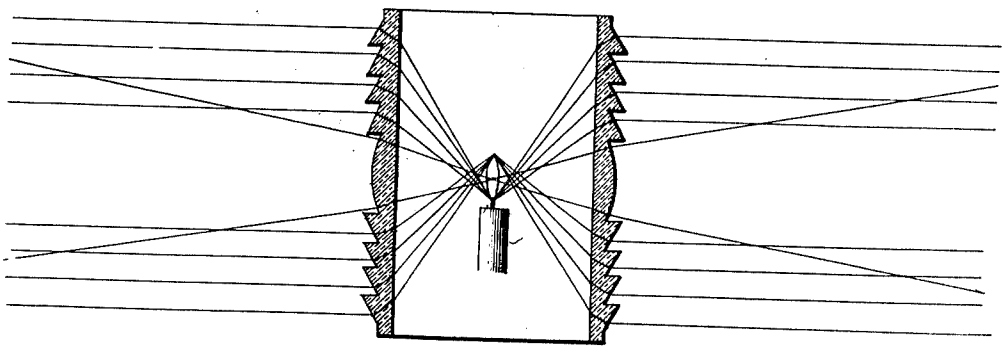

Fig. 3.

WITNESSES

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SIGNALING-LENS.

974,123. Specification of Letters Patent. Patented Nov. 1, 1910.

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To all whom it may concern:

Be it known that I, WILLIAM CHURCHILL, a citizen of the United States, residing at Corning, in the county of Steuben and State of New York, have invented new and useful Improvements in Signaling-Lenses, of which the following is a specification.

My invention relates to improvements in lenses, especially to that type thereof which are used in connection with signal lanterns, it being also applicable with advantage to lenses used on automobile or locomotive headlights. In such lenses it is desirable that a beam of light of great intensity and observable from a distance be provided, this necessitating that the lens project the rays more or less parallel, although in practice the difficulties of accurate alinement of the axis of the lens with the point or points from which the signal is to be observed renders it desirable to so design the lens that the beam thrown thereby is slightly divergent. This is accompanied by a reduction of the intensity of the illumination, which reduces the distance at which the signal is observable, if it be attempted to give a sufficient spread to cover a wide field, as is necessary when the signal is located adjacent to and is to be seen from the curve of a railway track.

To avoid as much as possible the defects above pointed out, my invention comprises a signal lens, a part of which is so calculated as to throw what is generally called a bundle of parallel rays (although as above pointed out the rays thereof are slightly divergent) and another part of which is so calculated as to project a bundle of divergent (or more exactly, of more greatly divergent) rays, the latter bundle being therefore observable from a greater distance from the axis of the lens than the first named; and in order to prevent the formation of a dark zone between the bundles of parallel and diverging rays, it further consists in using the central part of the lens to project the diverging rays and the outer portion of the lens to project the parallel bundles and it further consists in the design, construction and arrangement of the lens whereby these results are accomplished as will be hereinafter more fully described and claimed.

Referring to the accompanying drawings in which corresponding parts are designated by corresponding marks of reference:—Figure 1 is a diagram illustrating the application of my invention to a Fresnel lens. Fig. 2 is a diagram illustrating the application of my present invention to a lens of the character shown in U. S. Letters Patent No. 801,766 granted Oct. 10, 1905 to the Corning Glass Works, as assignee from myself. Fig. 3 is a sectional view of a lens, such as used in marine signals, and to which my invention may be applied.

My invention in its broader aspects is not confined to the general form of the lens and is thus applicable both to the round form shown in Fig. 1, and to various modifications thereof and to the marine form shown in Fig. 3.

The lens A to which the invention is applied is of the well known Fresnel type as applied to railroad signal lamps, that is to say, it consists as shown in Fig. 1, of a central convex portion a surrounded by zones a'—a^2—a^3—a^4. Instead, however, of so constructing the central portion and the zones that they all focus more or less approximately to a common point, which heretofore has in common practice been in the plane of the source of illumination, I so construct them that the central portion or bull's eye a, has its focus F as shown by dotted lines located behind the focus of the zones, whereby with a single source of illumination for all parts of the lens, the rays projected by the central bull's eye are rendered more divergent than those from the surrounding zones. With this arrangement the rays h—a', h'—a^2, h^2—a^3, h^3—a^4, etc., projected by the zones will be somewhat divergent. They may be considered as parallel as they would obviously be if the lens was optically perfect with the source of illumination situated at the principal focal point of the zones. The rays f—a, from the bull's eye will be divergent. While the amount of such divergence is obviously a matter of choice under the circumstances in which the lamp is to be used good results will be secured by making such angle of divergence measured from the axial line of the lens, about 8°. By using the bull's eye to project the divergent bundle of rays, the latter will be projected through the parallel rays, and thus a field will be produced having a strongly illuminated center surrounded by a less strongly illuminated zone. If on the other hand, the central part of the lens is

used to project the parallel rays and the zones to project the divergent rays, a field will be produced similar to the above but with the outer and inner portions separated by a dark annulus.

In Fig. 2 the application of my invention to a lens such as that shown in my Patent No. 801,766 before referred to is illustrated. In this construction instead of the zones having all the same or approximately the same point of focus, as is the case in the previous form, each zone has a separate and independent principal focal point F'—F^2—F^3, etc., located along the axis of the lens and between the lens and the source of illumination, whereby as explained in the said prior patent the effective area of illumination is that included within the projection of the lines joining such focal points and the corresponding zones and whereby at the same time the approximate parallelism of the rays projected by the zones is maintained. Indeed they are rendered less divergent than would otherwise be the case, for it must be remembered that the difficulties of manufacture of signal lenses by pressing, and spherical aberration, preclude mathematical parallelism of the rays. In this case as in the previous case, the central bull's eye has its principal focal point F' located behind the source of illumination which in this case is therefore intermediate of the several focal points of the lenses.

It is obvious that my invention is also applicable to a cylindrical lens, which instead of refracting in two directions as does a spherical lens like that shown in Figs. 1 and 2, refracts only in one direction. Such are the lenses commonly used for marine signals, the refraction taking place in the vertical plane. The manner of constructing such a lens with the different focal distances of the several parts will be readily understood from the above and from Fig. 3, it being remembered that such a lens will not produce a field having concentric strongly illuminated and less strongly illuminated parts such as will be produced by a lens of Fig. 1, but one having a central band of strong illumination and a portion less strongly illuminated on the top and bottom thereof.

It should be noted that the peculiar field of illumination produced by a railroad semaphore lens constructed as before described may be of assistance in rendering it distinctive, that is to say in permitting the observer to distinguish it from other sources of illumination which would otherwise, from their color and location, be liable to be confounded therewith. When viewed at a short range such a lens presents the appearance of a bright ring of light surrounding a dark central area in the middle of which is the erect image of the illuminating flame.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. The combination with a Fresnel lens, having different parts thereof focusing on different planes and a source of illumination located between the lens and the focal point of a part of the lens.

2. A Fresnel lens having the central part thereof of greater focal length than the zones.

3. The combination with a Fresnel lens having different parts thereof focusing on different planes and a source of illumination located intermediate of the said planes.

4. The combination with a Fresnel lens, having the central part thereof of greater focal length than the zones, and a source of illumination located intermediate of the several foci.

5. A lens consisting of a central bull's eye and concentric zones, the central bull's eye having a greater focal length than the zones.

6. A lens of the type described having a series of zones and a central bull's eye, each element of which is focused upon a different point in the axis of the lenses, the central bull's eye having the greatest focal length.

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