(No Model.) 2 Sheets—Sheet 1.

J. B. F. FRÉDUREAU.

LIGHT GLOBE.

No. 538,193. Patented Apr. 23, 1895.

Fig. 1.

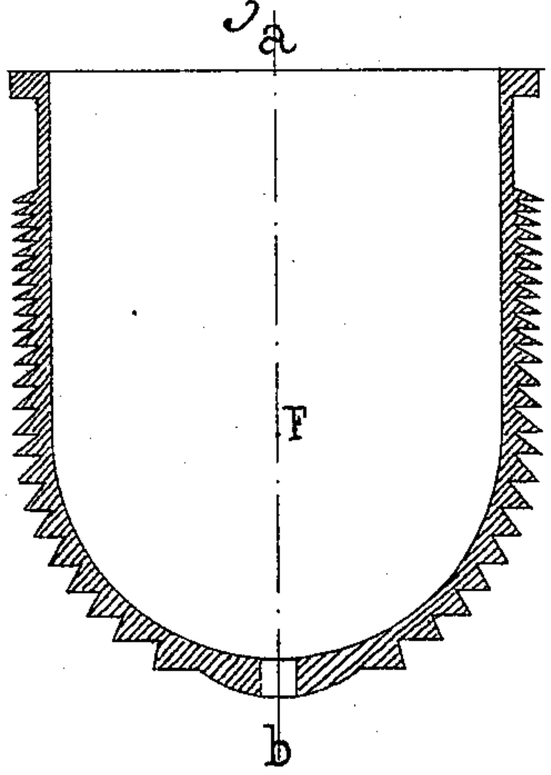


Fig. 5.

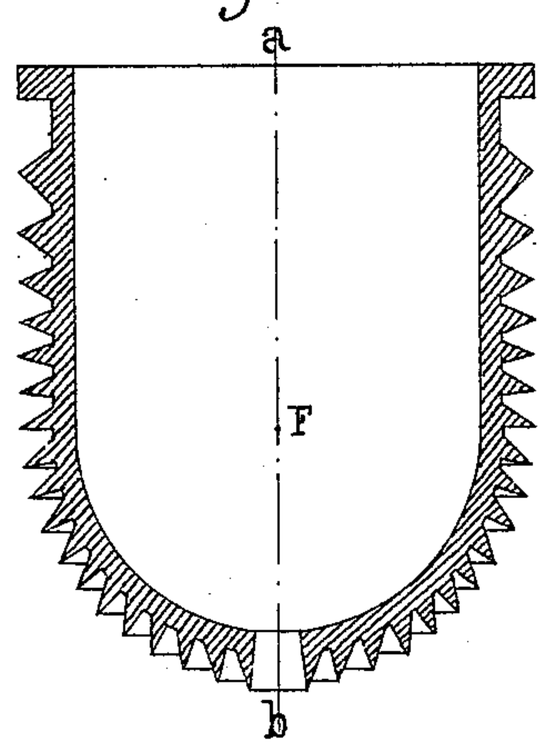


Fig. 3.

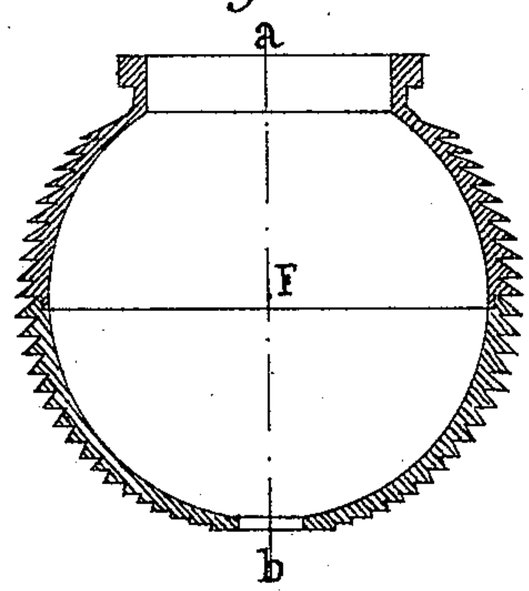


Fig. 2.

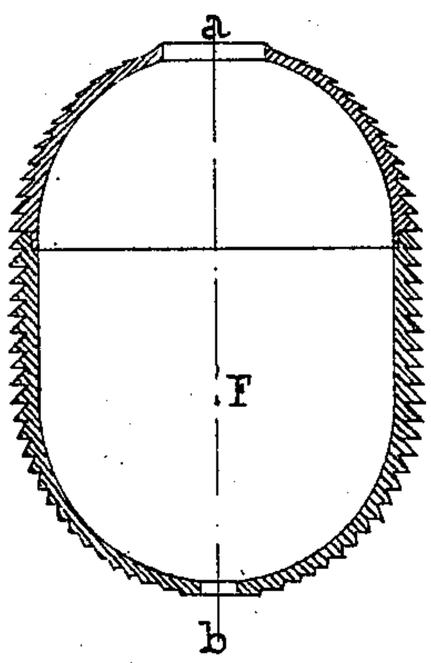
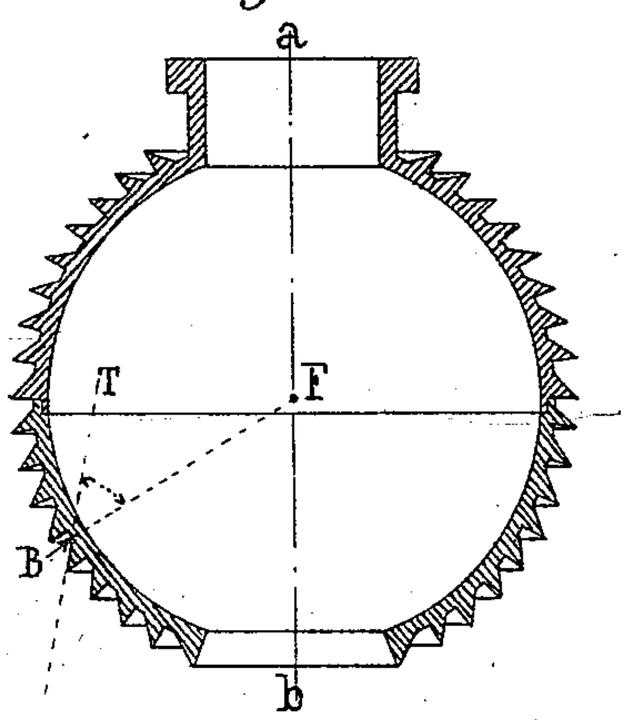


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

J. B. F. FRÉDUREAU.

LIGHT GLOBE.

No. 538,193. Patented Apr. 23, 1895.

Fig. 6.

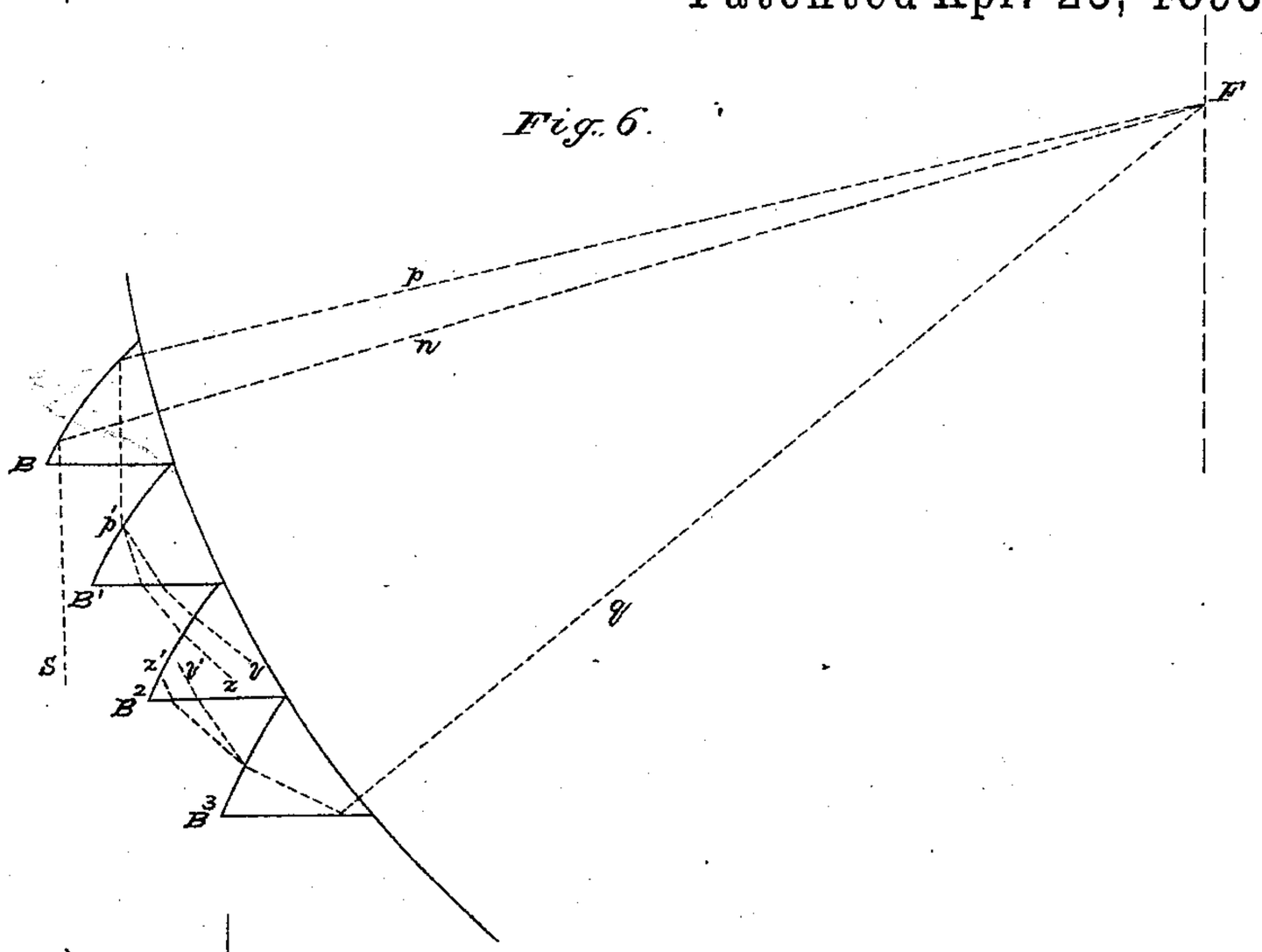
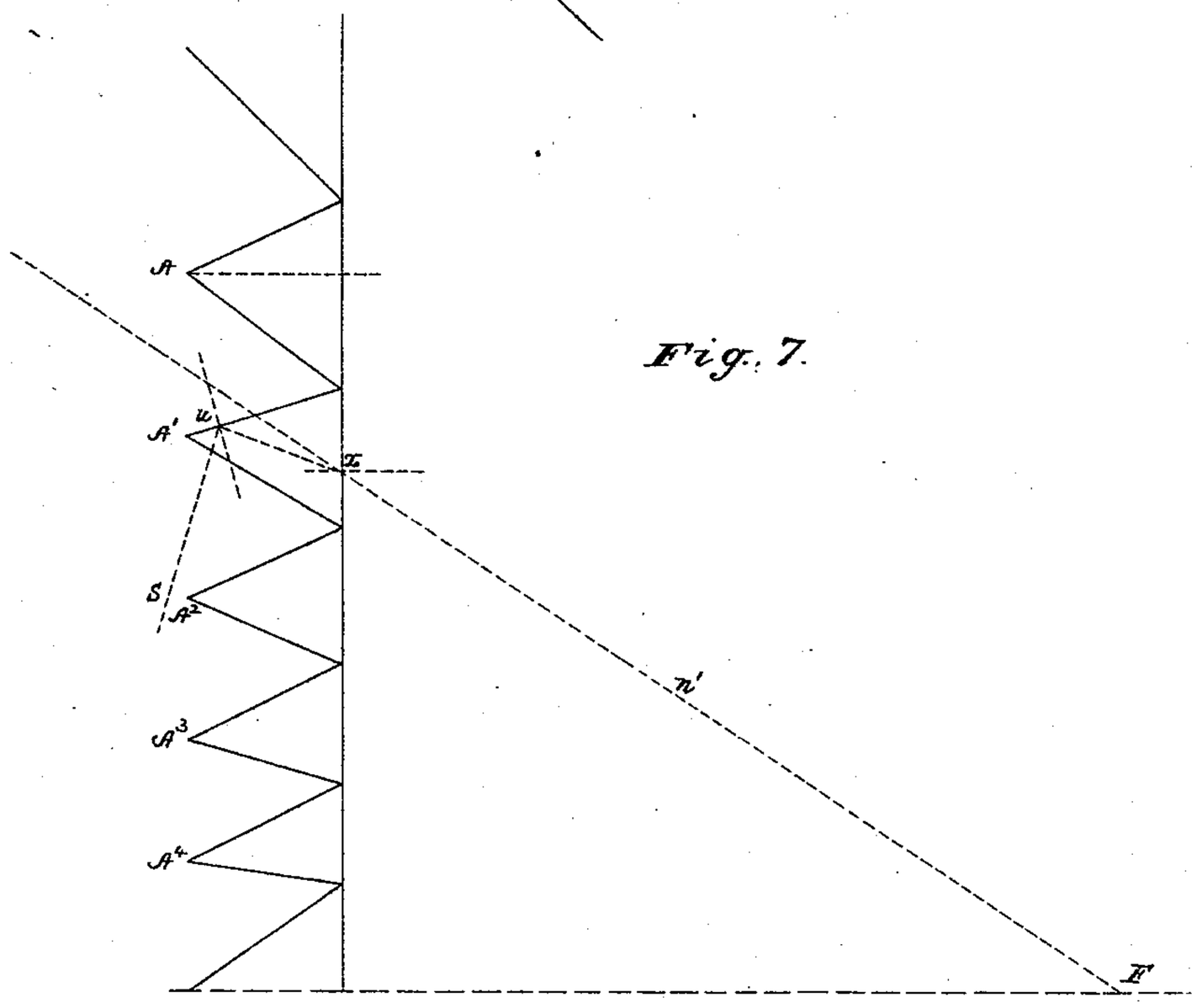


Fig. 7.



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UNITED STATES PATENT OFFICE.

JEAN BAPTISTE FERDINAND FRÉDUREAU, OF PARIS, FRANCE.

LIGHT-GLOBE.

SPECIFICATION forming part of Letters Patent No. 538,193, dated April 23, 1895.

Application filed January 10, 1893. Serial No. 457,918. (No model.) Patented in France July 21, 1890, No. 207,096; in Belgium January 16, 1891, No. 93,452; in England January 16, 1891, No. 858, and June 24, 1892, No. 11,818; in Switzerland January 27, 1891, No. 3,070, and in Italy March 14, 1892, No. 31,453.

To all whom it may concern:

Be it known that I, JEAN BAPTISTE FERDINAND FRÉDUREAU, a citizen of the Republic of France, residing at Paris, France, have invented a certain new and useful Improvement in Light-Globes, (for which Letters Patent have been obtained as follows: in France, No. 207,096, dated July 21, 1890, and two patents of addition thereto; in Belgium, No. 93,452, dated January 16, 1891, and patent of addition thereto; in England, No. 858, dated January 16, 1891, and No. 11,818, dated June 24, 1892; in Switzerland, No. 3,070, dated January 27, 1891, and in Italy, No. 31,453, dated March 14, 1892, and patents of addition thereto,) which improvement is fully set forth in the following specification.

My invention relates to improvements in light globes and consists in a transparent glass or crystal globe presenting a surface of double curvature (*i. e.*, which cannot be developed in its entirety or cannot be spread out into a plane) such as a spherical, semi-spherical, ovoidal, &c., the exterior surface being provided with a series of parallel (horizontal) rings or annuli forming one piece with the globe, their common axis being arranged to coincide with that of the globe. These rings when cut by a vertical plane represent a prismatic section, the surfaces of which, whether straight or curved, are calculated to so reflect the rays, from a light placed in the center of the globe, by means of one of the surfaces of the transparent rings, as to form a cone diverging from the light and tangential with the globe, and to prevent appreciable dispersion of their passage through the other face of the ring, that is to say without forming a spectrum.

The object and effect of this invention are to distribute by the known laws of refraction and reflection the beams in the most desirable manner, such as concentrating the light downward (or forward as in the case of a light set on a side wall) and diffusing some of the luminous rays through their reflection from one ring to another. Moreover these globes modify the apparent light (especially that of the voltaic arc) through the slight refraction of the more highly refrangible rays (which ordinarily give the arc light its bluish hue). These rays after passing through one of the prismoidal rings, fall on the upper surface of the next ring and are thereby partially reflected and so diffused, and partially internally refracted, this latter portion being the more refrangible rays. In this manner the luminous point is transformed to appear to the eye as a large cluster of luminous rays filling the whole globe, and the loss of light usually attendant on the use of semi-opaque screens or of opalescent glass or other translucent material is avoided.

Having thus defined the objects and advantages of my invention, I shall describe the manner in which these results are effected and to this end show the principle of my invention applied to two common forms of globes, reference being made to the accompanying drawings, which form part of this specification.

Figures 1, 2 and 3 represent globes of spherical and cylindro-spherical shape the rings of which form at their upper surfaces sections of paraboloids while the lower faces are made plane and parallel. Figs. 4 and 5 show spherical and cylindro-spherical globes in which the upper surfaces of the rings form portions of cones all of which have a common axis, but the apexes of which are variously placed on said axis, while the lower faces form portions of cones having their axis (*a b*) in common with the globe and a common apex in the center of the light F. Fig. 6 is a drawing of the outlines of the annuli or rings in the lower portion of Figs. 1, 2 and 3. Fig. 7 is a corresponding drawing of the annuli in the upper portion of Fig. 5.

The transparent globes are made of glass or transparent crystal and can be cast, ground, cut or produced by any known method of manufacture of glass, or crystal. The surfaces or faces of the rings are calculated on the principle that the upper surfaces or faces thereof entirely reflect the rays coming from the seat of light, as they are inclined at an angle equal to or less than the limiting angle of total reflection of the substance of which the globe is made. The lower surfaces are constructed to allow the reflected rays to pass

without any appreciable dispersion. For this purpose in the case illustrated in Figs. 1, 2 and 3 the upper surfaces are portions of paraboloids, all having one common focus in the center of the light and one common axis, *i. e.*, the axis of the rings. At any point in the paraboloids the angle formed with the incident rays is less than the limiting angle of total-reflection. As the globe presents at its interior surface a smooth figure of revolution, the luminous rays coming from the center of light F pass through the transparent envelope in nearly radial directions, and are then deflected downward by the upper surfaces in one direction as a result of the parabolic surface, *i. e.*, parallel to the axis of the globe. The lower surfaces are made plane, parallel and perpendicular to the axis of the paraboloids. Thus these reflected rays will pass through them without dispersion.

As shown in Fig. 6 the ray *n* coming from the center of light F, passes through the interior surface without refraction and is reflected by the upper surface in a direction parallel to the axis of the paraboloid, *i. e.*, in a vertical line. The ray *p* after passing out of the prism B falls on prism B′ at *p′*. It is there refracted. The more refrangible portion, taking the direction *v*, is lost in the interior of the globe, and the least refrangible is diffused in the prism B^2. The ray *q* first falls on the lower surface of the annuli B^3 and is refracted in the direction *v′* and *z′*.

In the second case (Figs. 4 and 5) the surfaces of the rays are conical instead of being parabolic or perpendicular to the axis. The inclination of the upper face of each ring is so calculated that the angle T B F formed by the incident ray and the surface, is equal to or less than the limiting angle of total reflection of the substance of which the globe is made. All the luminous rays coming from the center of light F, and falling on the upper surfaces of the hoops are entirely reflected by them. The lower surfaces form portions of cones described around the axis of the globe, and having their common apex in the center of light.

In the upper portion of the globe the ray *n′* (Fig. 7) may be refracted slightly at the point of contact *x* with the interior surface and it will take the direction *x u*. At the upper surface it is reflected in the direction *s* at an angle to the axis of the globe.

The two constructions become practically alike at the particular ring, which is at the level of the center of light.

It will be obvious that the first construction is more favorable for the lower than the upper parts of the globes, while the reverse is true in the second. I therefore do not limit my invention to globes made wholly by one of these methods but both may be used in different parts of the same globe. The globes may be in one piece, as in Figs. 1 and 5, or in two parts, an upper and a lower fitted together, Figs. 2, 3 and 4.

Having now described my invention and the manner of carrying it into practical operation, what I claim is—

1. A light globe of glass or other transparent substance, provided with a series of horizontal parallel, prismoidal, transparent annuli or rings, whose upper surfaces are determined substantially as shown and described so as to totally reflect the rays of light in the general direction of their common axis, and whose lower surfaces are constructed to emit the reflected rays without refraction, as set forth.

2. A light globe of glass or other transparent substance, the body of which is formed of an interior smooth surface of double curvature, and provided externally with a series of parallel prismoidal annuli or rings, whose upper surfaces are determined substantially as shown and described so as to totally reflect the rays of light in the general direction of their common axis, and whose lower surfaces are constructed to emit the reflected rays without refraction, as set forth.

In witness whereof I have hereto set my hand in the presence of the two subscribing witnesses.

JEAN BAPTISTE FERDINAND FRÉDUREAU.

Witnesses:
J. CASALIS,
ROBT. M. HOOPER.