Listing of Claims:

1. A Fresnel lens for use in an optical system including an image plane,

the Fresnel lens being constructed as a refractive optical element with respect to visible light, and comprising:

a plurality of annular zone lens surfaces disposed concentrically; and

a plurality of side wall surfaces each formed between adjacent annular zone lens surfaces, the side wall surfaces generating noise lights due to reflection and/or refraction of light incident at varying angles on the side wall surfaces,

wherein the side wall surfaces are modulated so as to spatially spread the noise lights in the image plane.

2. The Fresnel lens according to claim 1, wherein:

the side wall surfaces are modulated so that noise light attributed to diffraction does not spatially concentrate along a direction in the image plane.

3. The Fresnel lens according to claim 2, wherein:

an angle assumed by each said side wall surface relative to an optical axis is modulated in correspondence with position along a circumferential direction.

4. The Fresnel lens according to claim 2, wherein:

a position of each said side wall surface is modulated along a radial direction while maintaining a constant angle relative to an optical axis regardless of position along a circumferential direction.

5. The Fresnel lens according to claim 3, wherein:

the angle assumed by each said side wall surface relative to the optical axis is periodically modulated in correspondence with position along a circumferential direction, and

an inclination θ of each said side wall surface at a given position (P) is expressed by the following expression (1):

$$\theta(\varphi) = \alpha + \beta \times 1/2 \left[1 - \cos(f \times \varphi + \gamma)\right] \cdots (1)$$

where α, β, γ and f respectively represent a reference angle of inclination, an angular amplitude relative to the reference angle of inclination, an initial phase and a number of change cycles (frequency) occurring within a full circumference, and φ represents an angle formed by a half line (OP) starting from an end point at an origin point (O) and passing through the position (P) relative to a polar axis (OX) in a polar coordinate system having the origin point (O) set at a center of the Fresnel lens.

6. The Fresnel lens according to claim 4, wherein:

the position of each said side wall surface is periodically modulated along the radial direction, and

a distance (radius) rt between a given position (Pt) taken at a top portion of the side wall surface and a center of the Fresnel lens is expressed by the following expression (2), and a distance (radius) rb between a given position (Pb) taken at a bottom portion of the side wall surface and the center of the Fresnel lens is expressed by the following expression (3):

$$rt(\varphi) = Ct + At \times 1/2 \left[1 - \cos(f \times \varphi + \gamma) \right] \ldots (2)$$

$$rb(\varphi) = Cb + Ab \times 1/2 \left[1 - \cos(f \times \varphi + \gamma) \right] \ldots (3)$$

where Ct and Cb respectively represent reference radii of the top portion and the bottom portion, At and Ab respectively represent radius amplitudes relative to the reference radii at the top portion and the bottom portion, γ and f respectively represent an initial phase and a number of cycles (frequency) occurring through a full circumference, and φ represents an angle formed by a half line (OP) starting from an end point at an origin point (O) and passing through the position (Pt) or the position (Pb) relative to a polar axis (OX) in a polar coordinate system having the origin point (O) set at the center of the Fresnel lens.

7. The Fresnel lens according to claim 1, wherein:

the optical system is formed by an eyeglass lens with a human eye, the image plane is a retina of the human eye, the

plurality of zone lens surfaces and the plurality of side wall surfaces include zone lens surfaces and side wall surfaces formed on at least one side of the eyeglass lens, and

side wall surface modulation is optimized so that the noise light due to reflection and/or refraction at the side wall surfaces is minimized at the retina for various eye gaze angles.

8. The Fresnel lens according to claim 7, wherein:

the side wall surface modulation is adjusted so that noise light attributed to diffraction does not spatially concentrate on the retina after passing through an iris of the human eye.

9. An optical device, comprising:

an imaging lens for forming an image on an image plane;

an aperture that restricts light passing through the imaging lens; and

a Fresnel lens, wherein:

the Fresnel lens is constructed as a refractive optical element with respect to visible light, and includes a plurality of annular zone lens surfaces disposed concentrically and a plurality of side wall surfaces each formed between adjacent annular zone lens surfaces, the side wall surfaces generating noise lights due to reflection and/or

refraction of light incident at varying angles on the side wall surfaces,

wherein the side wall surfaces are modulated, and the modulation is optimized so as to minimize the noise lights in the image plane.

10. The optical device according to claim 9, wherein:

the side wall surface modulation is optimized to substantially prevent the noise light from passing through the aperture.

11. The optical device according to claim 9, wherein:

the side wall surface modulation is adjusted so that noise light attributed to diffraction does not spatially concentrate on the image plane after passing through the aperture.

12. The Fresnel lens according to claim 2, wherein:

each said side wall surface has a bottom portion in the form of circular contour centered on the optical axis and a top portion in the form of wavy circular counter constituted by a periodically modulated circle centered on the optical axis.

13. The Fresnel lens according to claim 2, wherein:

adjacent side wall surfaces are modulated by a same frequency and have different phases.

14. The Fresnel lens according to claim 13, wherein:

a phase difference between the adjacent side wall surfaces is at least 30 degrees.

15. The Fresnel lens according to claim 1, configured as a meniscus lens.

16. The Fresnel lens according to claim 15, wherein the zone lens surfaces and side wall surfaces are disposed on a concave surface of the meniscus lens.

17. The Fresnel lens according to claim 1, wherein the zone lens surfaces and side wall surfaces are disposed on at least one of a concave lens surface and a convex lens surface.