

PATENT SPECIFICATION



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373,950

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COMPLETE SPECIFICATION.

Improvements in Photographic and Projection Lenses.

We, KAPELLA LIMITED, a British Company, of 104, Stoughton Street, Leicester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to photographic and projection lenses of the kind consisting of a pair of compound dispersive members with their concave surfaces facing one another, placed between outer collective members, and the object of the invention is to provide an improved objective of large aperture and field of view.

A lens system of this kind was described in the Specification of British Letters Patent No. 157,040, having an aperture of $F/2$ and field of view of 50° or more, and in which each of the collective members was a simple lens. The aperture of that system was limited to about $f/2$ by reason of the depth of curvature of the dispersive members, this curvature being necessary in order to secure substantial flatness of field and correction of spherical aberration.

We attain the object of the present invention by making one of the collective members of two separate collective components, each of which has its outer surfaces of unequal curvature, and we use shallower curves for the dispersive members. By these means we are enabled to enlarge the aperture of the system while securing equal flatness of field and correction of spherical aberration.

Either the front or the rear collective member may be divided, and the front member, that is the member nearest to

the longer conjugate, if so divided, should consist of two meniscus collective components with their more deeply curved surfaces facing outward from the lens system. But we prefer to divide the rear collective member, to give one exterior surface of each component a radius of curvature at least three times that of its other surface, and to place the two components with their more deeply curved surfaces facing one another. Either or both of the collective components may be compounded, but we generally prefer to make them simple elements.

The annexed drawing is a sectional drawing through the axis of a lens made according to the present invention, with the rear collective member divided, having an aperture of $f/1.4$, and being corrected for spherical and chromatic aberrations, coma, astigmatism and distortion.

We now give data for the construction of the example illustrated in the accompanying drawing. The notation is that the successive radii of curvature, counting from the front, are called R_1, R_2 , etc., the sign + denoting that the curve is convex toward the incident light, and - that it is concave toward the same. The axial thicknesses of the elements are denoted by D_1, D_2 , etc., and the separations of the members by S_1, S_2 , etc.

The material is defined in terms of the mean refractive index "D, as conveniently employed, followed by the Abbe V number and by the type number in Messrs. Chance Brothers' optical glass catalogue.

	Equivalent focal length 1". Radii	Thickness	Separation	Aperture F/1.4. "D	Flat field V	40° No.
	R ₁ + 0.9					
5	R ₂ + 6.1	D ₁ .15		1.6135	59.4	8065
	R ₃ + 0.44		S ₁ .005			
	R ₄ - 1.65	D ₂ .175		1.6135	59.4	8065
10	R ₅ + 0.307	D ₃ .02		1.579	40.4	407
	R ₆ - 0.350		S ₂ .195			
	R ₇ + 3.8	D ₄ .02		1.579	40.4	407
15	R ₈ - 0.523	D ₅ .21		1.6437	48.3	*
	R ₉ ∞		S ₃ .005			
20	R ₁₀ - 1.12	D ₆ .08		1.6135	59.4	8065
	R ₁₁ + 1.74		S ₄ .005			
25	R ₁₂ ∞	D ₇ .06		1.6135	59.4	8065

* Does not yet appear in the catalogue.

30 Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

35 1. A photographic or projection lens of the kind referred to, in which one of the collective members consists of two separate collective components each of which has its exterior surfaces of unequal curvature.

40 2. A lens as claimed in claim 1, in which the collective member nearest to the shorter conjugate consists of two separate collective components each having one of its exterior surfaces of a radius of curvature at least three times that of the other surface.

3. A lens as claimed in claim 1, or 45 claim 2, in which the more deeply curved exterior surfaces of the collective components are placed facing one another.

4. A lens as claimed in any of the preceding claims, in which the two separate 50 collective components are simple elements.

5. A lens constructed substantially as described and illustrated.

Dated the 22nd day of December, 1931.

KAPELLA LIMITED,

The Common Seal of Kapella Limited was hereunto affixed in the presence of:—

WM. TAYLOR,
Director,
C. STAFFORD,
Secretary.

[This Drawing is a full-size reproduction of the Original.]

