

# PATENT SPECIFICATION

198,958

Application Date: Oct. 7, 1922. No. 27,159 / 22.

Complete Accepted: June 14, 1923.



## COMPLETE SPECIFICATION.

### Improvement in Photographic Lenses.

5 We, HORACE WILLIAM LEE, a British subject, and KAPPELLA LIMITED, a British company, both 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:—

10 This invention relates to photographic lenses and particularly to that kind known as telephotographic lenses and comprising a collective system and a dispersive system separated by a considerable space, the focal length of the whole being substantially greater than 15 the distance from the back glass to the focal point of an infinitely distant object, the whole being corrected for spherical and chromatic aberrations, coma, astigmatism and curvature of field. Its object 20 is to provide such a lens having a relatively large aperture and at the same time being simple to manufacture; and this we accomplish by constructing the front or collective system of the special form and materials hereinafter described, 25 and at the same time constructing the rear or dispersive system of two pieces of glass only, as hereinafter described.

30 In Patent Specification No. 132,067 of 1918 is described a lens of the kind referred to, in which, in order to keep the Petzval term of suitable value with a system giving a magnification greater 35 than two, the dispersive system is composed of three glasses.

40 In the present invention we sacrifice magnification, to some extent, in order to secure the necessary flatness of field with a simple dispersive system of two

cemented lenses, whereas in the original invention three such lenses are required. By the present invention we are enabled to obtain a larger aperture, such for example as F/4.8, an aperture which 45 has not been attained hitherto in any lens of this kind having a flat field.

Lenses of the kind referred to have been constructed of four glasses only, cemented together in pairs, but with 50 none of these has it been possible to attain so large an aperture as we attain by our present invention.

In Specification No. 139,719 of 1919, it is required that the difference of 55 refractive indices, for the D line of the spectrum, of the components of the collective system, should lie between .03 and .07. In Specification No. 151,507 of 1919, it is required that this difference 60 should not be substantially less than .1; and in Specification No. 1185 of 1914, that it should be practically zero. In the present invention we assign to this difference a value which is neither 65 substantially less than .075 nor substantially greater than .095.

Our invention will be further illustrated with the aid of the subjoined 70 specifications and with reference to the accompanying drawings, Figs. 1 and 2, which illustrate diagrammatically two examples of telephotographic objectives constructed and arranged according to 75 our invention, and show the relative positions, curvatures, and thicknesses of the various lenses composing the objectives. Fig. 1 illustrates a lens of 12 inches focal length, magnification 2, and aperture F/6, of which the following 80 is a specification:—

[Price 1/-]

	Radii.	Thicknesses & separations.	Kinds of glass.	Glassmakers' Catalogue number.
5	$R_1 = +2.15''$	$D_1 = .42$	$n_D 1.5744 \vee 57.7$	C 9002.
	$R_2 = -6.22''$	$D_2 = .12$	$n_D 1.6515 \vee 33.4$	P.M. 6661.
	$R_3 = +5.65''$	$S = 2.73$		
10	$R_4 = -1.35''$	$D_3 = .08$	$n_D 1.5732 \vee 51.9$	P.M. 6062.
	$R_5 = \infty$	$D_4 = .20$	$n_D 1.6117 \vee 37.4$	P.M. 6695
	$R_6 = -2.13''$			
15	Diameter of front combination 2.05". Diameter of back combination 1.5". Fig. 2 illustrates a lens of focal length		10 inches, magnification two, and aperture F/4.8, of which the following is a specification:—	20
	Radii.	Thicknesses & separations.	Kinds of glass.	Glassmakers' catalogue number.
25	$R_1 = +1.993''$	$D_1 = .6$	$n_D 1.5744 \vee 57.7$	C 9002
	$R_2 = -3.90''$	$D_2 = .1$	$n_D 1.6515 \vee 33.4$	P.M. 6661
	$R_3 = +5.67''$	$S = 2.32$		
30	$R_4 = -1.25''$	$D_3 = .06$	$n_D 1.5732 \vee 51.9$	P.M. 6062
	$R_5 = \infty$	$D_4 = .17$	$n_D 1.6117 \vee 37.4$	P.M. 6675
	$R_6 = -2.04$			
35	Diameter of front combination, 2.15". Diameter of back combination, 1.5". "C" refers to the catalogue of Chance Bros. & Co. Ltd., Birmingham; "P. M." to that of Parra-Mantois & Cie of Paris.		to be performed, we declare that what we claim is:—	
40	In the above specifications we have chosen in each case, for the double convex component of the front system, a medium barium crown glass having the refractive index of 1.5744, such glass being suitable for a lens having a magnification approximately two (that is, within 10 per cent. of two). For this purpose we prefer a glass having this refractive index or one not less than 1.568 nor more than 1.578, but we do not limit ourselves to glass having its index within this range, and, provided the refractive index of the other component of the front system be at least .075 but not more than .095 greater than that of the said double convex component, the index of refraction of this latter component may be varied with the object of varying the magnification. A glass of lower refractive index is suitable for a lens of greater magnification.		1. A telephotographic lens of wide aperture and large useful field, free from astigmatism, spherical and chromatic aberrations, and curvature of the field, comprising two separated systems, each cemented and achromatised, the front system consisting of a double convex component and a double concave component, the index of refraction $n_D$ of the latter exceeding that of the former by an amount which is neither substantially less than .075 nor substantially greater than .095, and the back system consisting of a cemented doublet constructed substantially as described.	70
45			2. A telephotographic lens as claimed in Claim 1, and having a magnification approximately 2, in which the index of refraction of the double convex component of the front system is not less than 1.568 nor more than 1.578.	75
50			Dated the 6th day of October, 1922.	80
55			HORACE WILLIAM LEE. KAPELLA LIMITED.	85
60			The Common Seal of Kapella Limited was hereunto affixed in the presence of:—	90
65	Having now particularly described and ascertained the nature of our said invention and in what manner the same is		WM. TAYLOR, W. S. HOBSON, } Directors T. E. HUDSON, Secretary.	95

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

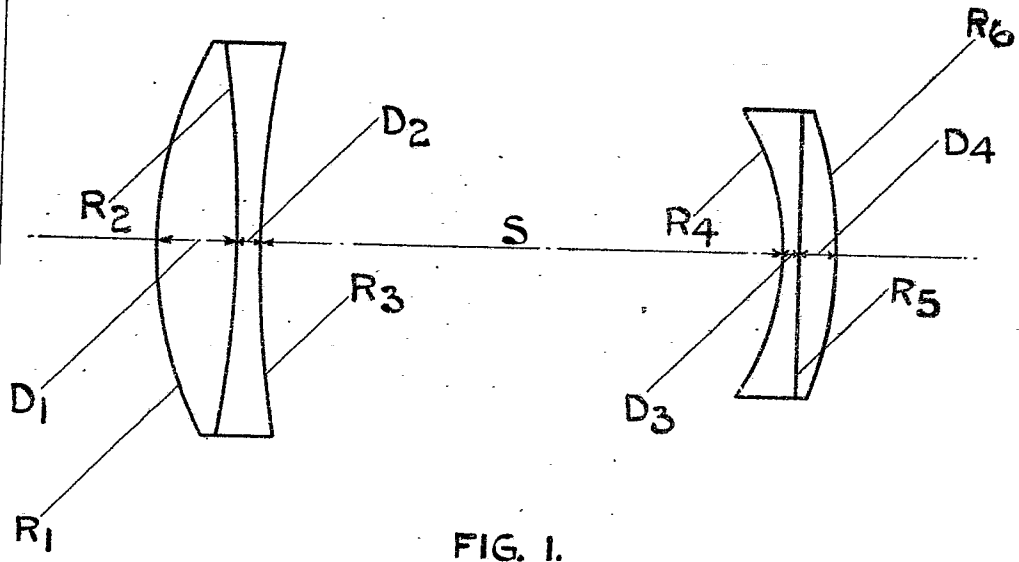


FIG. 1.

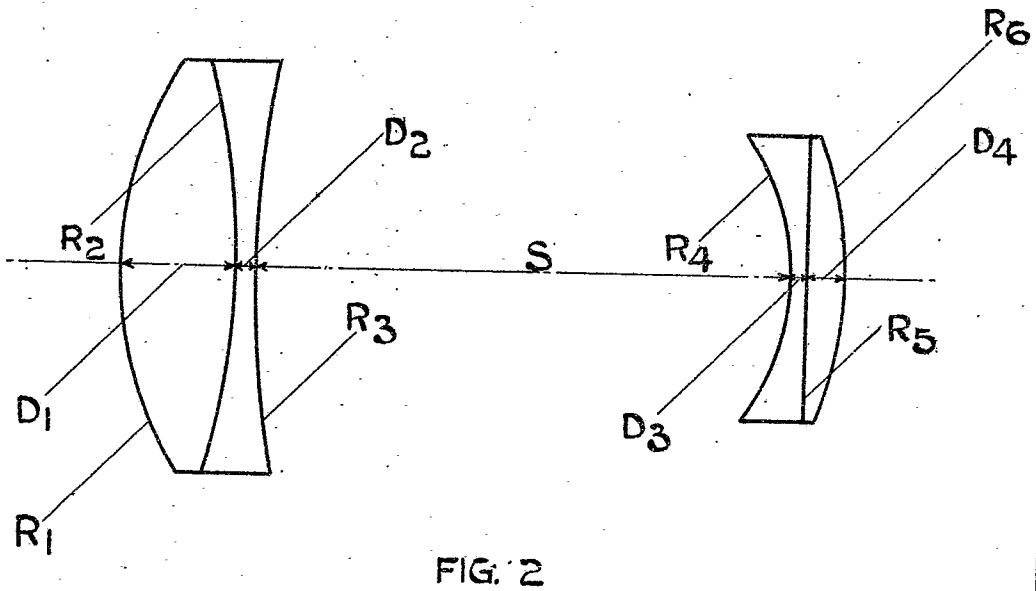


FIG. 2