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COMPLETE SPECIFICATION.

Improvements in Lenses.

We, TAYLOR, TAYLOR & HOBSON, LIMITED, of Stoughton Street Works, Leicester, Opticians, and HORACE WILLIAM LEE, B.A., of the same address, Optician, 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 telephoto-graphic objectives, i.e. those in which the focal length is considerably greater than the distance from the back glass to the focal plane (in the present case the former being twice the latter), and it consists in an improved telephotographic objective of simple construction, large aperture, and useful field of view, composed of only four lenses of which two are cemented together to form a front positive combination and two are cemented together to form a back negative combination, the two combinations being separated by an air space. The invention is directed to the attainment of good correction for spherical aberration, coma, astigmatism, chromatic aberration whether on or off the axis, and distortion, together with the use of such flat curves that the aperture-ratio may be as much as F/4.5 with the requisite approximation to such corrections.

According to the present invention this result is obtained by the use of glasses of high refractive index for the front positive combination, not less than 1.57 for

the D-line, wherein the refractive index for the D-line of the negative flint component is greater than that for the positive crown component, the difference being not less than .047 as ordinarily measured and more for the larger aperture lenses, and relative dispersions such as to allow of the separate achromatization of the front combination as is usual in this type of lens; together with glasses for the back negative combination, in which the refractive index of the positive component is equal to or greater than that for the negative component, and the relative dispersions are such as to allow of the separate achromatisation of the back combination.

Other means have been proposed for the correction of telephotographic lenses, as described for example in the Specification of Letters Patent No. 3096 of 1914, the correction of aberrations being facilitated by introducing an air-space in the front combination, or in the Specification of Letters Patent No. 19,580 of 1909, correction being obtained by the use, in the first combination, of flint glass of equal or less refractive index than that of the crown.

Two numerical examples of lenses made according to the improved construction of the present invention, will now be described with reference respectively to Figure 1 and Figure 2 of the accompanying drawings, the letters P/M. and C. referring to the catalogues of Parra-Mantois and Chance respectively.

EXAMPLE I (FIGURE 1).

Aperture ratio F/6. Equivalent focal length 12 inches.

	Radii	Thicknesses	n_D	nu -value	
40 Front	$(r_1) + 2.17$ inches	(d_1) .48 inches (d_2) .12 " diameters all 2.1 inches Separation (s) 2.62 inches	1.573	57.3	{ P.M. 5220. C. 9002. C. 361.
	$(r_2) - 4.4$ "				
	$(r_3) + 5.5$ "				
Back	$(r_4) - 1.36$ inches	(d_3) .06 inches (d_4) .20 " diameters all 1.5 inches	1.573	57.3	{ P.M. 5220 C. 9002 C. 410
	(r_5) flat				
	$(r_6) - 2.10$ "				

[Price 1/-]

EXAMPLE II (FIGURE 2)

Aperture ratio F/4.6. Equivalent focal length 12 inches.

	Radii	Thicknesses	n_D	nu -value.	
Front	$\left. \begin{array}{l} (r_1) + 1.933 \\ (r_2) - 3.90 \\ (r_3) + 5.67 \end{array} \right\}$ inches	,, (d_1) .60 inches	1.573	57.3	{P.M. 5220 C. 9002
			1.652	33.6	
			diameters all 2.65 inches		
Separation (s) 2.32 inches.					
Back	$\left. \begin{array}{l} (r_4) - 1.269 \\ (r_5) \text{ flat} \\ (r_6) - 2.07 \end{array} \right\}$ inches	,, (d_3) .04 inches	1.573	51	P.M. 6062 C. 361
			1.620	36	
			diameters all 1.5 inches		

10 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:—

15 1. A telephotographic objective composed of four lenses only, of which two are cemented together to form the front combination, and two are cemented together to form the back combination, each separately achromatised, and in which (a)
20 the refractive index for the D-line of the negative flint lens in the front combination is greater than that of the positive crown lens by an amount at least equal

to .047, neither being less than 1.57 and (b) the refractive index of the positive lens of the back combination is equal to or greater than that of the negative lens to which it is cemented, substantially as described.

1. A telephotographic objective formed according to the constructional data hereinbefore set forth with reference respectively to Example 1 or the Example 2.

Dated this 22nd day of September, 1919.

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Fig. 1.

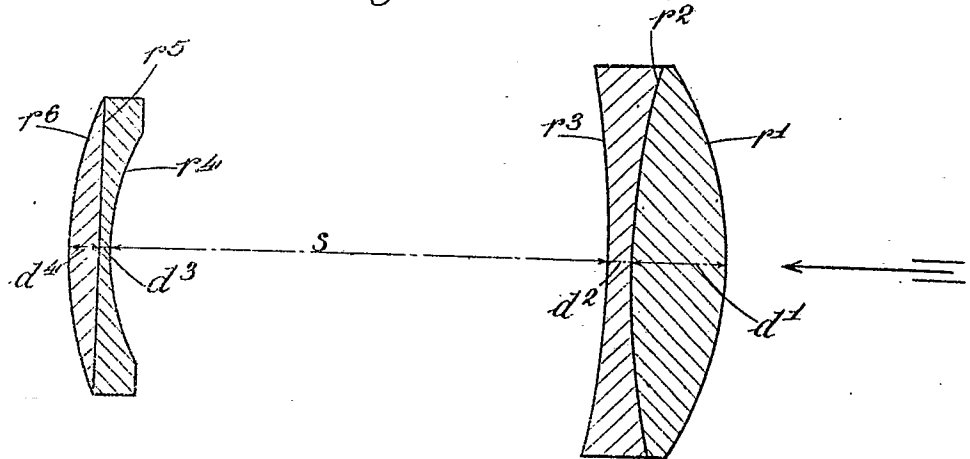


Fig. 2.

