

PATENT SPECIFICATION



Application Date: May 3, 1929. No. 13,777/29.

329,144

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PROVISIONAL SPECIFICATION.

Improvements in Photographic Objectives.

We, ARTHUR WARMISHAM, a British Subject, and KAPELLA LIMITED, a British Company, both of 104, Stoughton Street, Leicester, do hereby declare the nature of this invention to be as follows:—

5 This invention relates to photographic objectives, and especially those of wide aperture, suitable for cinematography, and its aim is to improve a known type of objective in respect of flatness of field, without sacrificing the keen central definition hitherto obtained.

10 The Petzval type of objective is pre-eminently adapted to give fine central definition at large aperture, such as F/2. The rather severe curvature of field limits the usefulness of this type of objective, but, on the other hand, in types of objective in which a closer approximation to anastigmatism is obtained in combination with wide aperture, the central definition is much inferior to that given by the Petzval type.

15 Now according to this invention we produce a novel modification of the Petzval type of objective in which we can effect substantial improvement in the approximation to anastigmatism without incurring the introduction of severe axial zonal spherical aberration, that is to say without substantial sacrifice of the central definition characteristic of the Petzval type.

20 Our novel modification consists in replacement of the conventional cemented doublet front glass of the Petzval type, in which the convergent member has a lower refractive index than the divergent

member, by a separated doublet in which the convergent member is double convex and made of Dense Barium Crown, and the divergent member is double concave and made of a Dense Flint glass. Simultaneously we replace the single dispersive member of the Petzval back pair by a cemented doublet dispersive member comprising a double convex component made of Dense Barium Crown having a refractive index greater than 1.600, and a double concave dispersive member made of a Light Flint having refractive index not exceeding 1.575.

25 In a particular construction made according to this invention, and of 1" equivalent focal length and relative aperture F/1.9, the Petzval curvature (i.e. $\Sigma \frac{1}{n.f.}$, the summation being taken over every component of the combination, f being the focal length calculated without regard to thickness of component, and n the corresponding refractive index) is 0.55, whereas in objectives of the conventional Petzval type, the corresponding figure is about 0.72.

Dated the Second day of May, 1929.

ARTHUR WARMISHAM,
KAPELLA LIMITED,
The Common Seal of Kapella Limited was hereunto affixed in the presence of:—

G. STAFFORD,
A. WARMISHAM,
Directors.

T. E. HUDSON,
Secretary.

COMPLETE SPECIFICATION.

Improvements in Photographic Objectives.

65 We, ARTHUR WARMISHAM, a British Subject, and KAPELLA 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:—

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This invention relates to photographic objectives, and especially those of wide aperture, suitable for cinematography, and its aim is to improve a known type of objective in respect of flatness of field, without sacrificing the keen central definition hitherto obtained.

The Petzval type of objective is pre-

eminently adapted to give fine central definition at large aperture, such as F/2. The rather severe curvature of field limits the usefulness of this type of objective, but, on the other hand, in other types of objective in which a closer approximation to anastigmatism is obtained in combination with wide aperture, the central definition is much inferior to that given by the Petzval type.

Now according to this invention we produce a novel modification of the Petzval type of objective in which we can effect substantial improvement in the approximation to anastigmatism without incurring the introduction of severe axial zonal spherical aberration, that is to say without substantial sacrifice of the central definition characteristic of the Petzval type.

Our novel modification consists in replacement of the conventional cemented doublet front glass of the Petzval type, in which the convergent member has a lower refractive index than the divergent member, by a separated doublet in which the convergent member is double convex and made of Dense Barium Crown, and the divergent member is double concave and made of a Dense Flint glass. Simul-

taneously we replace the single dispersive member of the Petzval back pair by a cemented doublet dispersive member comprising a double convex component made of Dense Barium Crown having a refractive index greater than 1.600, and a double concave dispersive member made of a Light Flint having refractive index not exceeding 1.575.

A numerical example of this improved construction is described and illustrated with reference to the accompanying drawing.

The notation of the example 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 front, and - that it is concave toward the front.

The thicknesses of the lenses are denoted by T_1, T_2 , etc., and the axial distances between the surfaces R_2 and R_3, R_4 and R_5 , and R_7 and R_8 , are denoted by D_1, D_2 and D_3 respectively.

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

	E.F.L.	1.074.	Clear aperture	.60 = F/1.8.	Messrs. Chance Brothers' Catalogue Type.
			"D	D - G ¹	
65	$R_1 + .5838$	$T_1 .132$	1.6130	.01305	8065
	$R_2 - 2.273$	$D_1 .032$			
	$R_3 - .9490$	$T_2 .046$	1.6052	.02107	5953
70	$R_4 + 2.800$	$D_2 .055$			
	$R_5 + 2.331$	$T_3 .129$	1.6134	.01397	2065
	$R_6 - .5251$	$T_4 .042$	1.5497	.01572	1018
75	$R_7 + .4740$	$D_3 .042$			
	$R_8 + 1.039$	$T_5 .125$	1.6130	.01305	8065
80	$R_9 - .8834$				

In this particular construction made according to our invention, the Petzval curvature (i.e. $\sum \frac{1}{n.f}$, the summation being taken over every component of the combination, f being the focal length calculated without regard to thickness of component, and n the corresponding refractive index), is 0.55, whereas in objectives of the conventional Petzval type, the corresponding figure is about 0.72.

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:—

Objectives comprising four members separated by air spaces, the two outer members being convergent, and the two inner ones divergent, characterised by the convergent members being simple and made of Dense Barium Crown anterior

divergent member being simple and made of Dense Flint and posterior divergent member being a cemented doublet, externally meniscus shaped, and having its convergent component double convex and of refractive index exceeding 1.600, and its divergent component double concave and of refractive index not exceeding 1.575.

ARTHUR WARMISHAM,
KAPELLA LIMITED,

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

WM. TAYLOR,
G. STAFFORD,

Directors.

G. STAFFORD,

Secretary.

Dated the Sixth day of January, 1930.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1930.

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

