PATENT SPECIFICATION

Application Date: May 8, 1936. No. 12536/37. **474,815**

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PROVISIONAL SPECIFICATION

Improvements in and relating to Objectives

We, HORACE WILLIAM LEE, British Subject, of 52, Grove Park Gardens, Chiswick, London, W.4, and KAPELLA LIMITED, a Company registered under the Laws of Great Britain, of 104, Stoughton Street, Leicester, do hereby declare the nature of this invention to be as follows:—

This invention relates to lens systems corrected for spherical aberrations, coma and astigmatism, of the type comprising a simple dispersive component between two collective components; and it has for its object to improve the correction of the secondary spectrum.

According to the invention we employ glass in the dispersive element, which has an Abbé V number at least 20% less than that of the glass in either of the collective components, and we make the differences of the ratios of the partial dispersion to the mean dispersion of the glass of the dispersive element and collective components respectively not greater than 2½% for *b*—*d*; 1½% for *e*—F; 3% for F—*g*, and 5% for *g*—*h*.

In order that the monochromatic aberrations shall not, in the case of a lens comprising three simple elements, be excessive, we prefer to make the ratio of the power of the dispersive element to the power of the system not greater than seven to one.

By an element we mean a lens consisting of a single piece of glass.

By a component we mean a lens whether simple or compounded of two or more elements and forming a component part of the lens system.

Dated this 3rd day of May, 1937.

KILBURN & STRODE,
Agents for the Applicants.

COMPLETE SPECIFICATION

Improvements in and relating to Objectives

We, HORACE WILLIAM LEE, British Subject, of 52, Grove Park Gardens, Chiswick, London, W.4, and KAPELLA LIMITED, a Company registered under the Laws of Great Britain, 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 an objective consisting of a lens system corrected for spherical aberration, coma and astigmatism, of the type comprising a single dispersive component constituted by a simple element and located between two collective components. The term "element" is herein used to indicate a lens consisting of a single piece of glass, whilst the term "component" is used for a lens, whether simple or compounded of two or more elements, forming a component part of a lens system.

The present invention has for its object to improve the correction of the secondary spectrum in such an objective.

To this end according to the invention the glass employed for the dispersive element has an Abbé V number at least 20% less than that of the glass or glasses used in the collective components, and is such that the ratios of the partial dispersions to the mean dispersion differ from the corresponding ratios for the glass or glasses in the collective components by not more than 2½% for *b*—*d*, 1½% for *e*—F, 3% for F—*g*, and 5% for *g*—*h*.

In order that the monochromatic aberrations shall not, in the case of a lens comprising three simple elements, be excessive, the ratio of the power of the dispersive element to the power of the whole lens system is preferably not greater than seven to one.

The invention may be carried into practice in various ways, but numerical

[*Price* 1/-]

data for two convenient practical examples of objective according thereto, illustrated respectively in Figures 1 and 2 of the accompanying drawings, are given below.

In these examples, the successive radii of curvature, counting from the front, designated by R_1, R_2 . . . . . , the positive sign denoting that the surface is convex towards the incident light and the negative sign that it is concave thereto; the axial thicknesses of the elements are indicated by D_1, D_2 . . . . . ; and the axial air separations of the components from one another are indicated by S_1, S_2 . . . . . The glass of which each element is made is defined in terms of the mean refractive index n_D, in accordance with the usual convention, and by the Abbé V number.

The numerical data for the two examples are set out in the following tables:—

EXAMPLE I.

Relative Aperture F/10 — Equivalent Focal Length 1.000

Radii.	Thicknesses and Separations.	n_D.	V.	Relative Partial Dispersions. b—d C—F	C—e C—F	e—F C—F	F—g C—F	g—h C—F
R_1 + .1207								
	D_1 .0187	1.6129	55.8	.472	.541	.459	.551	.460
R_2 − .9333								
	S_1 .0085							
R_3 − .4839								
	D_2 .0062	1.6166	44.5	.469	.539	.461	.556	.471
R_4 + .1160								
	S_2 .0850							
R_5 + 3.393								
	D_3 .0155	1.6129	55.8	.472	.541	.459	.551	.460
R_6 − .5840								

EXAMPLE II.

Relative Aperture F/10 — Equivalent Focal Length 1.013

Radii.	Thicknesses and Separations	n_D.	V.	Relative Partial Dispersions. b—d C—F	C—e C—F	e—F C—F	F—g C—F	g—h C—F
R_1 + .1995								
	D_1 .0458	1.6133	59.3	.478	.543	.457	.544	.453
R_2 − 1.511								
	S_1 .0120							
R_3 − .4438								
	D_2 .0096	1.6166	44.5	.469	.539	.461	.556	.471
R_4 + .1852								
	S_2 .0446							
R_5 − .5362								
	D_3 .0096	1.5151	56.4	.475	.543	.457	.547	.462
R_6 + .1890								
	D_4 .0193	1.6133	59.3	.478	.543	.457	.544	.453
R_7 − .2788								

It will be noticed that in Example I the objective comprises three simple elements only and that the Abbé V number of the borate flint glass used for the dis-

persive element is just over 20% less than that of the dense barium crown glass used for each collective element. The power of the dispersive element is approximately 6.6 times the power of the whole lens system.

In Example II the objective comprises a simple front collective element, a simple dispersive element, and a compound back collective component. The same borate flint glass is used for the dispersive element as in Example I, whilst the collective components use a different dense barium crown glass in conjunction with a telescope flint glass. The power of the dispersive element is approximately 4.8 times the power of the whole lens system.

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:—

1. An optical objective comprising a single dispersive component constituted by a simple element and located between two convergent components, in which the glass employed for the dispersive element has an Abbé V number at least 20% less than that of the glass or glasses used in the collective components, and is such that the ratios of the partial dispersions to the mean dispersion differ from the corresponding ratios for the glass or glasses in the collective components by not more than $2\frac{1}{2}$% for *b*—*d*, $1\frac{1}{2}$% for *e*—F, 3% for F—*g*, and 5% for *g*—*h*.

2. An optical objective as claimed in Claim 1 consisting of three simple elements, in which the ratio of the power of the dispersive element to the power of the whole lens system is not greater than seven to one.

3. The optical objective substantially as described with reference to Figure 1 or Figure 2 of the accompanying drawings.

Dated this 3rd day of May, 1937.

KILBURN & STRODE,
Agents for the Applicants.

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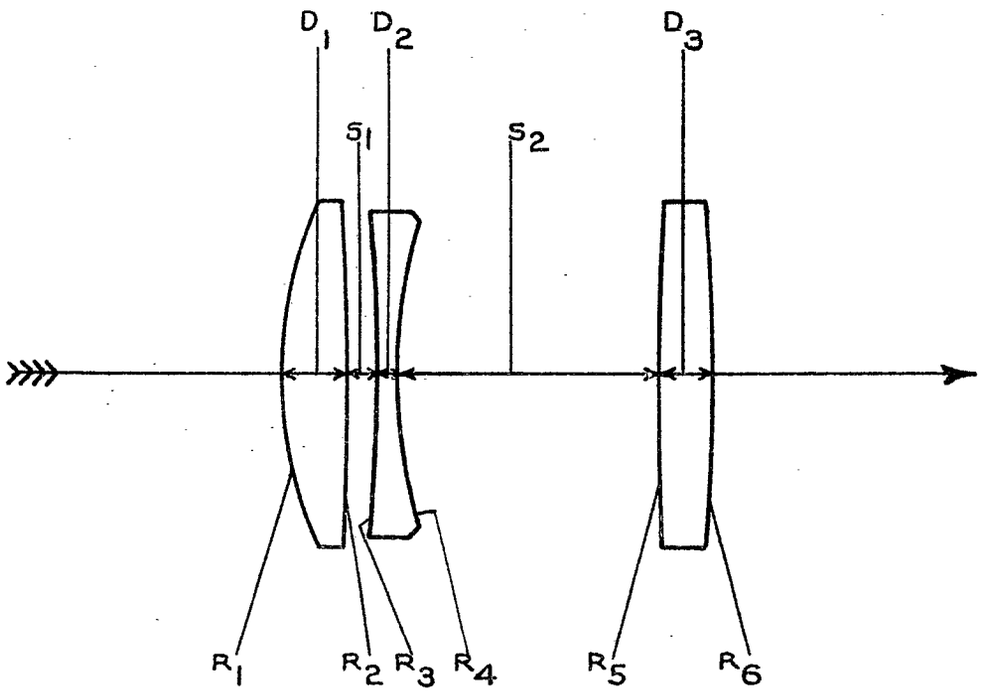

FIG. 1.

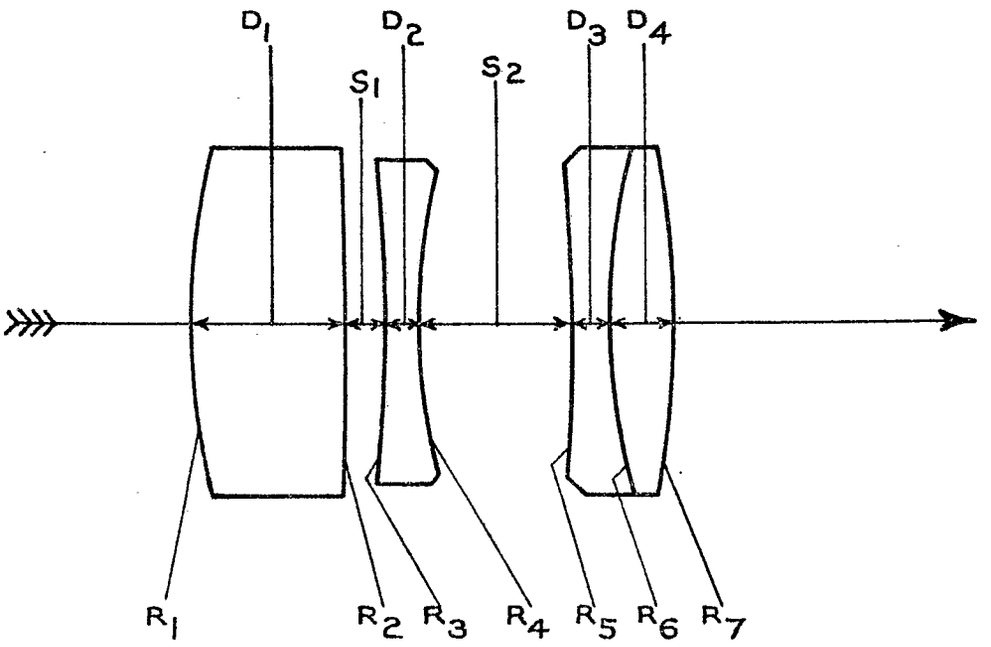

FIG. 2.

Malby & Sons, Photo-Litho.