# PATENT SPECIFICATION

Application Date: May 5, 1936. No. 12646/36. 470,522

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Complete Specification Accepted: Aug. 17, 1937.

## PROVISIONAL SPECIFICATION

## Improvements in Lenses

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:—

This invention relates to lenses of the kind comprising a pair of collective components enclosing a pair of compound dispersive meniscus components placed with their concave surfaces facing one another and enclosing a diaphragm between them; and its object is to provide a lens having an aperture not less than F/2 and having a flat field of greater angular extent than has hitherto been attained in such lenses.

We attain the object of our invention by making each of the dispersive components compounded of three elements, of which the outer elements adjacent to the diaphragm are collective menisci and each has a higher refractive index than has the inner element adjacent to it.

Dated the 2nd day of May, 1936.

ARTHUR WARMISHAM,
KAPELLA LIMITED,
The Common Seal of Kapella Limited was hereunto affixed in the presence of:—
J. RONALD TAYLOR, Director,
G. STAFFORD, Secretary.

## COMPLETE SPECIFICATION

## Improvements in Lenses

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:—

This invention relates to lenses of the kind comprising a pair of collective components enclosing a pair of compound dispersive meniscus components placed with their concave surfaces facing one another and enclosing a diaphragm between them; and its object is to provide a lens having an aperture not less than F/2 and having a flat field of greater angular extent than has hitherto been attained in such lenses.

We attain the object of our invention by making each of the dispersive components compounded of three elements, of which the outer elements adjacent to the diaphragm are collective menisci and each has a higher refractive index than has the inner element adjacent to it.

We now give data for the construction of two examples. 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 components by $S_1$, $S_2$, etc.

The material is defined in terms of the mean refractive index $^nD$, as conventionally employed. The Abbe V number also is given.

In Example I, in each of the dispersive compound components the outer element adjacent to the diaphragm is a collective meniscus. It has a higher refractive index and also a higher Abbe V number than the dispersive element adjacent to it.

In Example II, in each of the dispersive compound components the outer element adjacent to the diaphragm has a higher refractive index and a lower Abbe V number.

Relative Aperture F/2.

| Radii. | Thickness. |
|---|---|
| $R_1$ + .6921 | |
| | $D_1$ .082 |
| $R_2$ +2.632 | |
| $R_3$ + .3850 | |
| | $D_2$ .062 |
| $R_4$ + .6985 | |
| | $D_3$ .040 |
| $R_5$ + .2010 | |
| | $D_4$ .054 |
| $R_6$ + .2500 | |
| $R_7$ − .2890 | |
| | $D_5$ .054 |
| $R_8$ − .2132 | |
| | $D_6$ .040 |
| $R_9$ −5.0 | |
| | $D_7$ .045 |
| $R_{10}$ − .4071 | |
| $R_{11}$ +2.632 | |
| | $D_8$ .060 |
| $R_{12}$ − .8862 | |

Relative Aperture F/2.

| Radii. | Thickness. |
|---|---|
| $R_1$ + .6925 | |
| | $D_1$ .082 |
| $R_2$ +2.632 | |
| $R_3$ + .3697 | |
| | $D_2$ .062 |
| $R_4$ +1.429 | |
| | $D_3$ .040 |
| $R_5$ + .2012 | |
| | $D_4$ .054 |
| $R_6$ + .2439 | |
| $R_7$ − .2882 | |
| | $D_5$ .054 |
| $R_8$ − .2132 | |
| | $D_6$ .030 |
| $R_9$ +2.00 | |
| | $D_7$ .055 |
| $R_{10}$ − .387 | |
| $R_{11}$ +2.083 | |
| | $D_8$ .060 |
| $R_{12}$ −1.0012 | |

EXAMPLE I.

| Equivalent Separation. | Focal Length, $^nD$. | .9897. V. |
|---|---|---|
| | 1.613 | 59.3 |
| $S_1$ .001 | | |
| | 1.621 | 60.4 |
| | 1.576 | 41.4 |
| | 1.621 | 60.4 |
| $S_2$ .160 | | |
| | 1.621 | 60.4 |
| | 1.576 | 41.4 |
| | 1.623 | 56.4 |
| $S_3$ .001 | | |
| | 1.623 | 56.4 |

EXAMPLE II.

| Equivalent Separation. | Focal Length, $^nD$. | 1.004. V. |
|---|---|---|
| | 1.613 | 59.3 |
| $S_1$ .001 | | |
| | 1.621 | 60.4 |
| | 1.605 | 38.2 |
| | 1.652 | 33.5 |
| $S_2$ .160 | | |
| | 1.652 | 33.5 |
| | 1.605 | 38.2 |
| | 1.621 | 60.4 |
| $S_3$ .001 | | |
| | 1.621 | 60.4 |

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. Lenses of the kind referred to comprisng a pair of collective components enclosing a pair of compound dispersive meniscus components placed with their outer concave surfaces facing one another and enclosing a diaphragm between them, in which each of the dispersive components is compounded of three elements of which the outer elements adjacent to the diaphragm are collective menisci, each of which has a refractive index higher than that of the inner element adjacent to it.

2. Lenses as claimed in claim 1, in which each of the dispersive components is compounded of three elements of which the outer elements adjacent to the

diaphragm are collective menisci, each of which has a higher refractive index and a lower Abbe V number than that of the inner member to which it is cemented.

3. Lenses as claimed in claim 1 or claim 2, and constructed substantially according to the examples herein.

Dated the 20th day of April, 1937.

ARTHUR WARMISHAM,
KAPELLA LIMITED,
The Common Seal of Kapella Limited was hereunto affixed in the presence of:—
J. RONALD TAYLOR, Director,
G. STAFFORD, Secretary.

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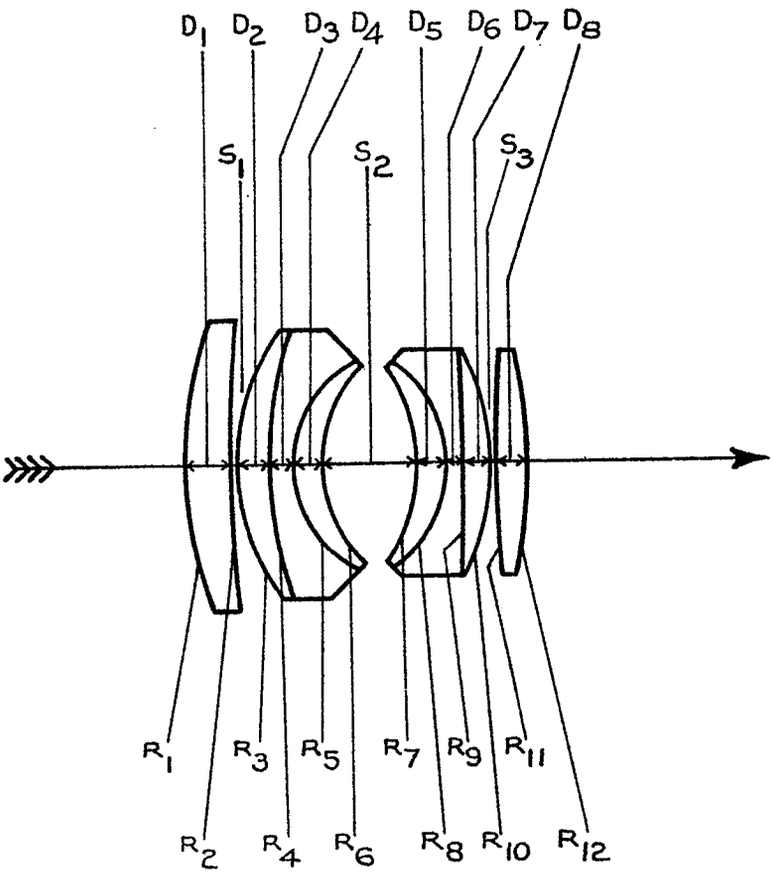


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