PATENT SPECIFICATION

Application Date: Oct. 12, 1927. No. 27,030/27. **299,983**

Complete Left: July 12, 1928.

Complete Accepted: Nov. 8, 1928.

PROVISIONAL SPECIFICATION.

Improvements in Lenses.

We, HORACE WILLIAM LEE, 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:—

It is well known that the type of lens known as the "Petzval" is the simplest type capable of forming a satisfactory image working at a large aperture, F/2 or thereabouts; but as the field is not flat, the angular extent of the circle of good definition is extremely limited. This type of lens consists of two separated doublets, either or both of which may be cemented.

In the present invention, in order to retain the excellent central definition of the "Petzval" lens and at the same time extend the field, the front doublet of the "Petzval" lens is replaced by a triplet anastigmat lens of the type, for example, specified in Letters Patent No. 155,640. The complete lens thus consists of a dispersive element placed between two spaced collective elements followed by a doublet collective component. Such a type will yield a good image of 30° angular extent at an aperture of F/1.8.

Dated the 11th day of October, 1927.

HORACE WILLIAM LEE,
KAPELLA LIMITED,
The common seal of Kapella Limited was hereunto affixed in the presence of:—
A. WARMISHAM.
WM. TAYLOR,
Directors.
T. E HUDSON.
Secretary.

COMPLETE SPECIFICATION.

Improvements in Lenses.

We, HORACE WILLIAM LEE, 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:—

It is well known that the type of lens known as the "Petzval" is the simplest type capable of forming a satisfactory image working at a large aperture, F/2 or thereabouts; but as the field is not flat, the angular extent of the circle of good definition is extremely limited. This type of lens consists of two separated doublets, either or both of which may be cemented.

In the present invention, in order to retain the excellent central definition of the "Petzval" lens and at the same time extend the field, the front doublet of the "Petzval" lens is replaced by a triplet anastigmat lens of the type, for example, specified in Letters Patent No. 155,640.

[*Price* 1/-]

The back doublet may be of the original Petzval form or of a modified form, e.g. with the flint component last, i.e., towards the focal plane. With suitable choice of glass it is possible to make the facing surfaces of equal curvature and so allow the elements to be cemented together. The curvatures and separations of the elements of the triplet may be modified to suit the correction of the system as a whole.

Better correction of distortion can be obtained by interchanging the two back components, namely the triplet back element and the Petzval back component; that is to say the Petzval doublet is placed inside the triplet between the dispersive element and the back collective element and close to the latter. In this case the Petzval doublet preferably takes the form of a cemented doublet with the flint element towards the dispersive element of the triplet.

In either case the dispersive element of the doublet is plano or double concave,

and the doublet is placed behind the dispersive element of the triplet (i.e. on the side remote from the object). The focal lengths of the two systems, the triplet anastigmat and the doublet, should not differ greatly, i.e., one should not be more than twice that of the other, because if the triplet is too weakly collective in power, the field will not be flattened effectively, and if the doublet is too weakly collective, the aperture will not be increased by a useful amount.

Two examples of the method of construction are given and illustrated in the drawing, both having an aperture of F/1.8, and a flat field of about 35°, corrected for spherical and chromatic aberrations, coma. astigmatism and distortion, suitable for use in photography, projection, microphotography and the like. In the specifications here given, the radii, thicknesses and separations are given in terms of the focal length of the system. The numbers after the specification of the optical properties of the glass used are those in the catalogue of Messrs. Chance Bros. & Co., Ltd.

EXAMPLE I.

Radii.	Thicknesses and Separations.	n_D	V	
R_1 + .735				
	D_1 .07	1.6118	59.	No. 4873
R_2 ∞				
	S_1 .25	1.		
R_3 − .64				
	D_2 .0135	1.6214	36.1	361
R_4 + .77				
	S_2 .225	1.		
R_5 + 4.47				
	D_3 .077	1.6135	59.	4873
R_6 − .615				
	S_3 .04	1.		
R_7 + .996				
	D_4 .077	1.6135	59.	4837
R_8 − .83				
	D_5 .0135	1.6501	33.6	5093
R_9 ∞				

EXAMPLE II.

R_1 + .66				
	D_1 .10	1.6134	56.3	2065
R_2 − 3.85				
	S_1 .25	1.		
R_3 − .59				
	D_2 .02	1.6214	36.1	361
R_4 + .69				
	S_2 .27	1.		
R_5 − 1.2				
	D_3 .02	1.6501	33.6	5093
R_6 + .916				
	D_4 .10	1.6135	59.	4873
R_7 − .55				
	S_3 .01	1.		
R_8 + .85				
	D_5 .06	1.6135	59.	4873
R_9 − 2.07				

The radius is reckoned positive when it is convex to the oncoming light.

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. A flat field lens for photography, projection, microphotography and the like, corrected for spherical and chromatic aberrations, coma, astigmatism and distortion, consisting of the combination of a triplet anastigmat lens of known type with a cemented or separated doublet of

collective power placed behind the dispersive component of the triplet (i.e. on the side remote from the object), in which the focal length of neither triplet nor doublet exceeds twice that of the other, whereby the focal length is decreased and the aperture correspondingly increased.

2. A lens as claimed in Claim 1 in which the negative element of the doublet component is plano or double concave.

3. A lens as claimed in Claims 1 and 2, formed according to the constructional data hereinbefore set forth with reference to Examples I or II.

Dated the 10th day of July, 1928.

HORACE WILLIAM LEE,
KAPELLA LIMITED,
The common seal of Kapella Limited was hereunto affixed in the presence of:—
A. WARMISHAM.
WM. TAYLOR.
Directors.
T. E. HUDSON.
Secretary.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1928.

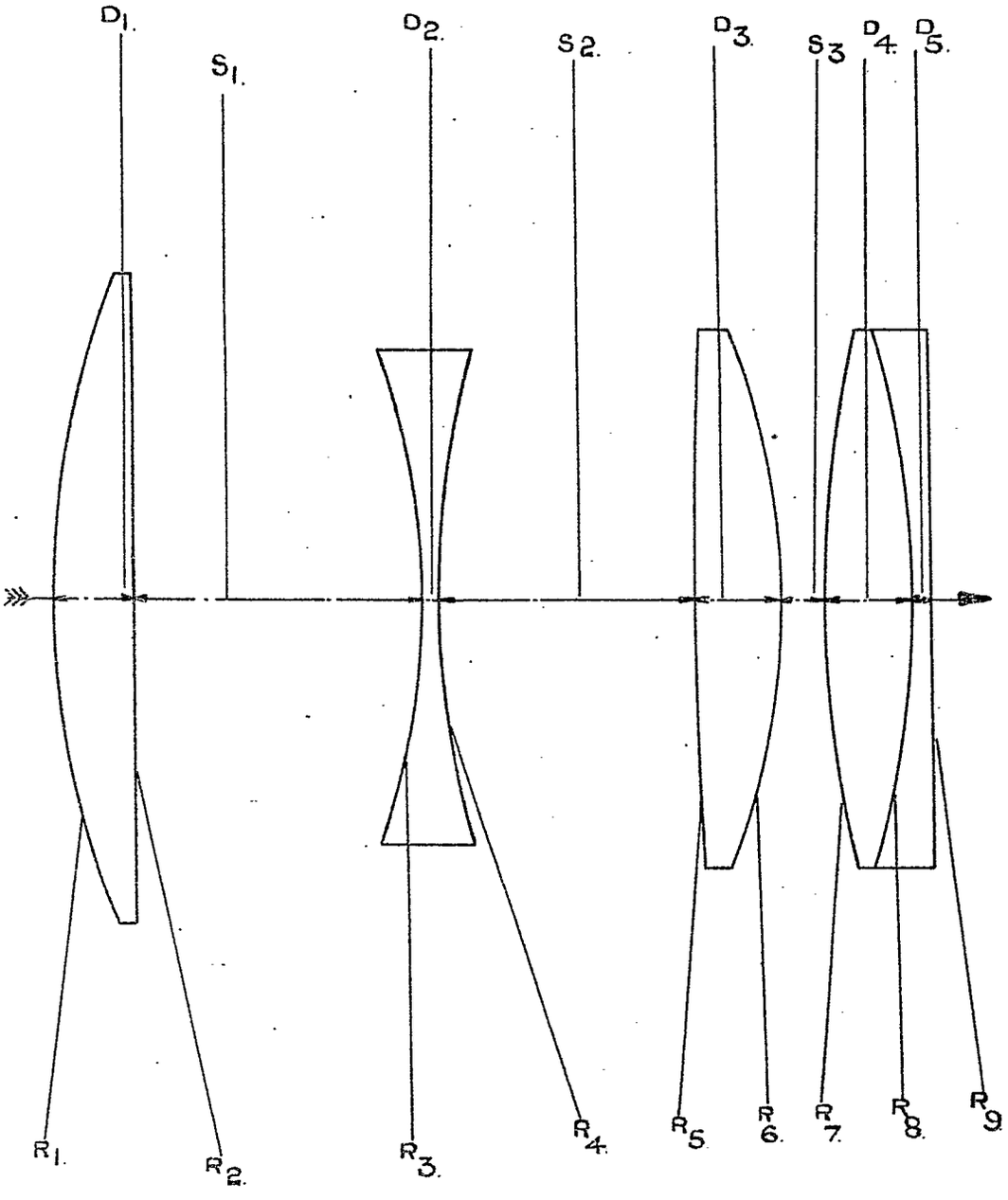

FIG. 1.

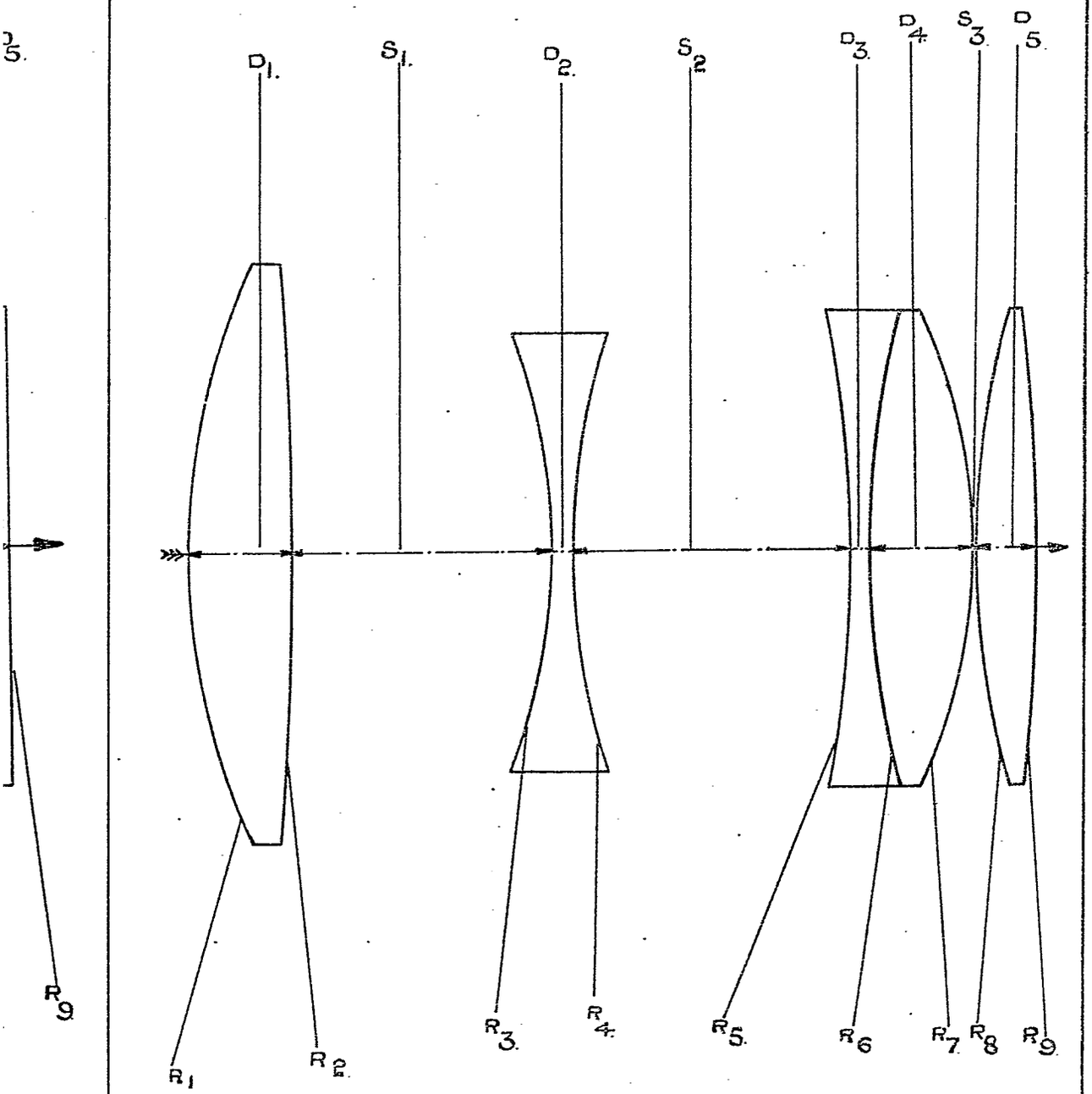

FIG 2.

Charles & Read Ltd. Photo Litho.

299,983 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

SHEET 2

[This Drawing is a reproduction of the Original on a reduced scale]

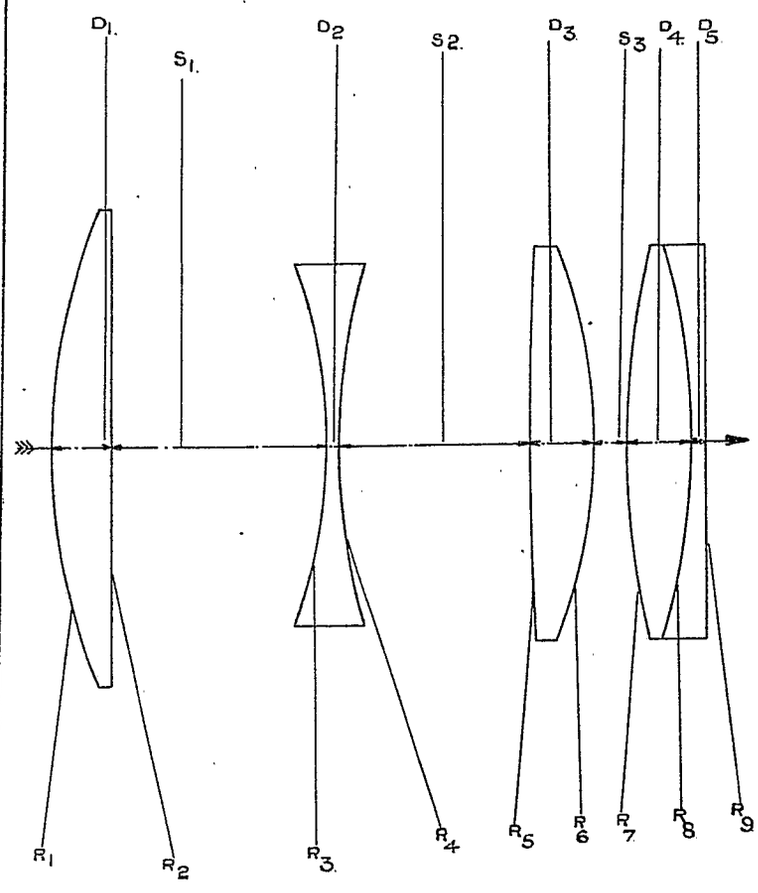

FIG 1.

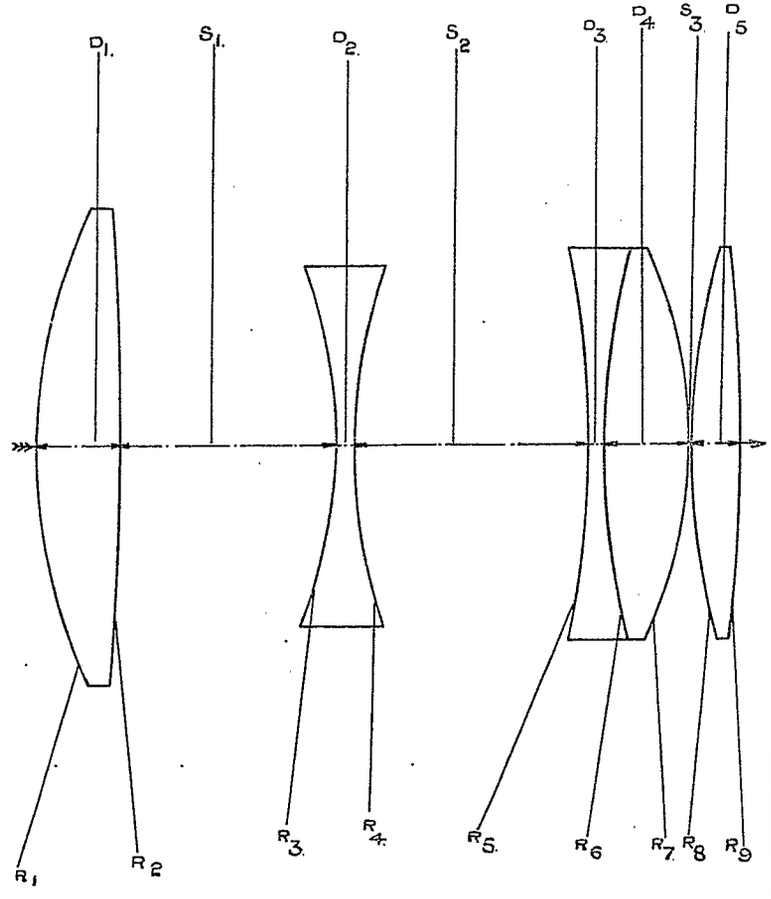

FIG 2.

Charles & Read Ltd Photo Litho.