

# PATENT SPECIFICATION



Application Date: March 9, 1944. No. 4440/44.

572,086

Complete Specification Left: Jan. 27, 1945.

Complete Specification Accepted: Sept. 21, 1945.

## PROVISIONAL SPECIFICATION

### Improvements in Lenses

We, J. H. DALLMEYER, LIMITED, a British Company, and BERTRAM LANGTON, a British Subject, both of Church End Works, Willesden, London, N.W.10, do hereby declare the nature of this invention to be as follows:—

This invention relates to lenses of the Brucke type consisting of an achromatic negative component separated from an achromatic positive component by a distance greater than the focal length of the latter. The lens is used with the negative component nearer the object when the image of this is to be reduced. In this position, the back focus is in excess of the focal length.

Lenses of this type have been employed for a long time, but usually suffer from considerable distortion, and have only a small angular field.

One object of the present invention is to remove these disadvantages, and so provide a lens with a greater sphere of usefulness. Another object is to provide a lens which may be used on existing cameras and projectors to embrace a larger angular field. In many cases a shorter focus lens cannot be used because the

mount of the lens fouls the mechanism between the lens and the focal plane. The present invention overcomes this difficulty by reason of the relatively very long back focus.

We attain these objects by making the negative component of a biconvex positive element followed by a meniscal negative element whose convex surface faces the preceding positive element, and for the positive component by employing a positive doublet followed by a single positive element. The contact surface of the doublet is convex to the dispersive or negative component. The single positive may be replaced by a doublet.

Both components are corrected approximately for colour and distortion, the residues in one component balancing those in the other. The lens as a whole is corrected for spherical aberration, coma, astigmatism and flatness of field over approximately 45°.

Dated the 18th day of February, 1944.

B. LANGTON,  
J. H. DALLMEYER, LTD.,  
N. A. CARTER,  
Managing Director.

## COMPLETE SPECIFICATION

### Improvements in Lenses

We, J. H. DALLMEYER, LIMITED, a British Company, and BERTRAM LANGTON, a British Subject, both of Church End Works, Willesden, London, N.W.10, 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 Brucke type consisting of an achromatic negative component separated from an achromatic positive component by a distance greater than the focal length of the latter. The lens is used with the negative component nearer the object when the image of this is to be reduced. In this position, the back focus is in excess of the focal length.

Lenses of this type have been employed for a long time, but usually suffer from

considerable distortion, and have only a small angular field.

To correct for this distortion it has been proposed to provide a lens of this type in which the front dispersive member comprises a front biconvex or plane convex positive element followed by a meniscus negative element and the rear collective member comprises either three or four separate elements two of which are compound.

The present invention aims at simplifying these prior constructions and at the same time obtaining high corrections, a large angular field and a high ratio of back focus to equivalent focal length, for example two to one.

In many cases a shorter focus lens cannot be used because the mount of the lens fouls the mechanism between the lens and the focal plane. The present inven-

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tion overcomes this difficulty by reason of the relatively very long back focus. We attain these objects by making the negative component of a positive element followed by a negative element and employing for the positive component two members only, comprising a positive doublet element followed by a positive single or doublet element. The contact surface of the doublet is preferably convex to the dispersive or negative component.

Both components are corrected approximately for colour and distortion, the residues in one component balancing those in the other. The lens as a whole is corrected for spherical aberration, coma, astigmatism and flatness of field over approximately  $45^\circ$ .

A convenient practical example of this type of lens system, according to the invention is illustrated in the accompany-

ing drawing, and numerical data, for this example is given in the following table in which  $R_1, R_2$  - - - indicate the radii of curvature of the individual surfaces counting from the front, the positive sign indicating that the surface is convex to the front and the negative sign that it is concave thereto, whilst  $T_1, T_2$  indicate the axial thickness of the elements and  $S_1-S_2$  indicate the axial separation between the elements all in inches. The glass is specified by the refraction index for the D line and the V value.

The equivalent focal length is 0.52" - - - the relative aperture F/2.8 and the distance from the last surface to the focal plane, i.e. the back focus is 1" .1.

The back focus is therefore approximately twice the equivalent focal length. This example is well corrected over a field of  $45^\circ$ .

	Radius.	Thickness or separation.	Refractive Index for D line.	Abbe C number
45	$R_1 + 1.3466$	$T_1$ .13	1.6512	33.6
	$R_2 - 2.7821$	$S_1$ .005		
	$R_3 + 9.8669$	$T_2$ .03	1.6072	59.3
	$R_4 + .37674$	$S_2$ 1.545		
50	$R_5$ 00	$T_3$ .02	1.6509	33.7
	$R_6 + .43393$	$T_4$ .14	1.6153	56.2
	$R_7 - 1.0579$	$S_3$ .005		
	$R_8 + 1.1201$	$T_5$ .10	1.6114	59.6
	$R_8 - 5.2621$			

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 lens of the type described in which the negative component consists of a single positive element followed by a single negative element and the air space between has the shape of a dispersive lens, and in which the positive component consists of two members only, comprising a positive doublet element followed by a positive single or doublet element.

2. A lens as claimed in Claim 1 in which the contact surfaces (or surfaces) of the positive component is (or are) convex to the negative component.

3. A lens system substantially as described with reference to the accompanying drawing.

Dated the 14th day of June, 1944.

J. H. DALLMEYER, LTD.;  
N. A. CARTER,  
Managing Director,  
B. LANGTON.

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

