

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

Improvements in or relating to Photographic Lenses.

We, OPTISCHE ANSTALT C. P. GOERZ AKTIENGESELLSCHAFT, 45/46, Rhein-strasse, Berlin-Friedenau, Germany, a German company, 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 spherically, chromatically, and astigmatically corrected photographic lenses having the diaphragm in front, of the class comprising a collective meniscus and a cemented dispersive meniscus separated from the former by an air space having the shape of a collective meniscus, the cemented surface being collective and convex towards the incident light, and has for its object to produce specially favourable correction conditions, more particularly as regards the coma errors, in order to enable the objective to be used as an interchangeable element of a so-called "convertible" lens.

It has already been attempted in various ways to obtain the most favourable correction conditions in three-lens objectives with the diaphragm in front, and a collective meniscus next to the diaphragm, by making this meniscus uncemented, so that the air space situated between it and the cemented components, could be utilised for correcting the errors. This was based on the assumption that it was desirable that the refractive index of the uncemented positive meniscus should be comparatively high—for instance greater than the refractive index of the cemented single lens next to the air-space on the other side thereof. Further investigation has however shown that the selection of such a comparatively high refractive index for the uncemented positive meniscus of the objective not only

did not lead to the best possible correction conditions, but on the contrary precluded the possibility of satisfactory corrections.

According to the present invention a considerable improvement of the correction conditions is obtained by reducing the refractive index of the uncemented positive meniscus, for instance by making this refractive index the same as that generally used for the said meniscus in the usual cemented three-lens systems of the well-known kind, the refractive index of the positive meniscus being smaller than that of the adjoining negative component.

This invention comprises accordingly a photographic lens of the above-mentioned class having a positive uncemented meniscus on the side towards the diaphragm, the refractive index of which is smaller than that of the next bi-concave lens.

An objective having these characteristics, can be obtained which is distinguished by specially accurate correction of the coma with very small intermediate errors. Moreover, the zonal aberration, even when the relative aperture is very great, can be kept very small; there is also the possibility of a very thorough correction of the chromatic aberration.

Finally, a substantial manufacturing advantage, as well as an increase in the value in use of the new object-glass, results from the fact that, owing to the reduction of the refractive index of the positive meniscus, the latter can be made of easily manufactured durable borosilicate crown glass which is highly transparent.

The accompanying drawing illustrates diagrammatically an object glass constructed according to this invention. L_1 indicates an uncemented collective

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meniscus, L_2 an air-space in the form of a collective meniscus, L_3 is a dispersive lens cemented to a collective lens L_4 .

In the following table of elements r_1, r_2, r_3 indicate the radii of curvature of the various surfaces from left to right in the drawing, d_1, d_2 indicate the thicknesses of the components L_1, L_2 , and n_D and n_G^1 indicate the refractive indices for the D and G¹ lines of the spectrum respectively. b_1 is the distance between the plane of the diaphragm and the centre of the first surface. The dimensions are appropriate for an equivalent focal length of 100 units.

	$b_1 = -1.80$	
	$r_1 = -15.00$	$d_1 = +1.17$
	$r_2 = -9.00$	$d_2 = +0.33$
	$r_3 = -8.38$	$d_3 = +0.73$
20	$r_4 = +63.33$	$d_4 = +3.00$
	$r_3 = -14.42$	

	$L_1 - n_D = 1.51220, n_G^1 = 1.52221$
	$L_2 - (\text{air})$
	$L_3 - n_D = 1.52320, n_G^1 = 1.53685$
25	$L_4 - n_D = 1.62140, n_G^1 = 1.63503$
	Diameter of full aperture = 8.00.

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 photographic lens of the class set forth, in which the refractive index for the line G¹ of the uncemented collective meniscus is smaller than that of the adjacent component of the cemented meniscus. 35
2. A double photographic lens comprising two similar or equal objectives as set forth in Claim 1. 40
3. A photographic lens as set forth in Claim 1, in which the collective meniscus is made of borosilicate crown glass. 40
4. The complete photographic lens substantially as described with reference to the accompanying drawings. 45

Dated this 8th day of February, 1921.

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